Climate Change Expert Group
Paper No. 2013(1)

Made to Measure: Options for Emissions Accounting under the UNFCCC

Andrew Prag (OECD), Christina Hood (IEA)
and Pedro Martins Barata (Get2C)

May 2013

OECD/IEA CLIMATE CHANGE EXPERT GROUP PAPERS

This series is designed to make available to a wider readership selected papers on climate change issues that have been prepared for the OECD/IEA Climate Change Expert Group (CCXG). The CCXG (formerly called the Annex I Expert Group) is a group of government delegates from OECD and other industrialised countries. The aim of the group is to promote dialogue and enhance understanding on technical issues in the international climate change negotiations. CCXG papers are developed in consultation with experts from a wide range of developed and developing countries, including those participating in CCXG Global Forums.

The full papers are generally available only in English.

The opinions expressed in these papers are the sole responsibility of the author(s) and do not necessarily reflect the views of the OECD, the IEA or their member countries, or the endorsement of any approach described herein.

Comments on the series are welcome, and should be sent to env.contact@oecd.org or the Environment Directorate, 2 rue André Pascal, 75775 PARIS CEDEX 16, France.

OECD/IEA Climate Change Expert Group Papers are published on
www.oecd.org/env/cc/ccxg.htm

Applications for permission to reproduce or translate all or part of this material should be made to: OECD Publishing, rights@oecd.org or fax 33 1 45 24 99 30.

This document has been produced with the financial assistance of the European Union. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

Copyright OECD/IEA, 2013

Applications for permission to reproduce or translate all or part of this material should be addressed to:
Head of Publications Service, OECD/IEA
2 rue André-Pascal, 75775 Paris Cedex 16, France
or
9 rue de la Fédération, 75739 Paris Cedex 15, France.

ABSTRACT

Mitigation pledges put forward by countries under the UNFCCC process are "made to measure" in that they are tailored to fit each country's individual circumstances. However, the pledges also need to be made to be measured so that we have a full understanding of how the various commitments add up to an aggregate global mitigation effort. The Kyoto Protocol provides the only existing international emissions accounting framework, but it applies only to developed countries with specific commitments. This paper assesses what would be required, in addition to existing reporting requirements, to build a robust emissions accounting framework under the UNFCCC applicable to a broad range of Parties.

The paper first identifies necessary building blocks for an emissions accounting framework and assesses progress made in agreeing international reporting processes. It then looks in detail at the two most challenging areas for emissions accounting. The first area is accounting for flows of tradable units from market-based mechanisms, including international flows between linked domestic trading systems as well as from offset crediting mechanisms. The second area is accounting for emissions and removals from the forestry and land-use sectors, which have characteristics that make emissions accounting challenging: the need to distinguish anthropogenic emissions from natural variations, to deal with long time-frames and to measure sinks as well as sources of emissions. Finally, options are presented for how these issues might be taken forward in the negotiations, and how negotiators can build on recent progress made on reporting formats.

JEL Classification: Q54, Q56, Q23, Q58
Keywords: Climate change; UNFCCC; emissions accounting; market-based mechanisms; land-use change; forestry

RÉSUMÉ

Options sur mesure pour comptabiliser les émissions dans le cadre de la CCNUCC

Établis « sur mesure » en ce sens qu'ils sont adaptés à la situation particulière de chaque pays, les engagements de réduction des émissions pris dans le cadre du processus de la CCNUCC doivent aussi se prêter *à la* mesure, pour permettre de comprendre pleinement les différents engagements qui concourent à l'effort mondial global de réduction des émissions. Le seul cadre international de comptabilisation des émissions qui existe est celui du Protocole de Kyoto, mais il vaut uniquement pour les pays développés ayant pris des engagements spécifiques. Ce document se propose d'évaluer quels éléments seraient nécessaires, en plus des obligations de notification existantes, pour constituer un cadre de comptabilisation des émissions solide et applicable à un large éventail de Parties dans le contexte de la CCNUCC.
Il commence par mettre en évidence les éléments de base nécessaires à un cadre de comptabilisation des émissions et analyse les progrès intervenus dans la définition de processus de notification internationaux. Ensuite, les deux aspects les plus délicats de la comptabilisation des émissions sont examinés en détail. Le premier est la comptabilisation des flux d'unités négociables issues des mécanismes fondés sur le jeu du marché, dont les flux internationaux entre systèmes d'échange nationaux couplés et les unités provenant de systèmes de crédits de compensation. Le second est la comptabilisation des émissions et des absorptions des secteurs de la foresterie et de l'utilisation des terres, dont les caractéristiques imposent de distinguer les émissions anthropiques des variations naturelles, de prendre en compte des horizons temporels longs et de mesurer les puits en plus des sources d'émission. Pour finir, le document présente des solutions envisageables pour faire avancer les négociations sur ces questions et permettre aux négociateurs de s'appuyer sur les progrès intervenus récemment dans le domaine des cadres de présentation.

Classification JEL: Q54, Q56, Q23, Q58
Mots-clés: Changement climatique; comptabilisation des émissions; mécanismes de marché; modification de l'affectation des sols; sylviculture

FOREWORD

This document was prepared by the OECD and IEA Secretariats in 2012-2013 in response to a request from the Climate Change Expert Group (CCXG) on the United Nations Framework Convention on Climate Change (UNFCCC). The CCXG 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 in a collaborative effort. 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.

Members of the CCXG are Annex I and OECD countries. The Annex I Parties or countries referred to in this document are those listed in Annex I of the UNFCCC (as amended by the Conference of the Parties in 1997 and 2010): Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, the European Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. As OECD member countries, Korea, Mexico, Chile, and Israel are also members of the CCXG. Where this document refers to "countries" or "governments", it is also intended to include "regional economic organisations", if appropriate.

ACKNOWLEDGEMENTS

This paper was prepared by Andrew Prag (OECD), Christina Hood (IEA) and Pedro Martins Barata (consultant for Get2C). Pedro Martins Barata was lead author for Section 4. The paper benefited from direct funding for the work of the CCXG programme in 2012-13, including from Australia, Denmark, the EC, Finland, Germany, Japan, Netherlands, New Zealand, Norway, Sweden, Switzerland, the UK and the US as well as the Children's Investment Fund Foundation, and in-kind support from the OECD, IEA and Denmark.

The authors would like to acknowledge valuable written comments from the delegations of Australia, Belgium, Canada, Japan, Norway, Spain, Sweden and the UK. The authors are also grateful for input and guidance from Alexia Kelly (US), Hayden Montgomery (New Zealand), Paulo Canaveira (Portugal) and Neta Meidav and Sekai Ngarize (UK). In addition, helpful comments on earlier drafts were received from OECD/IEA colleagues Anthony Cox and Philippe Benoit as well as Gregory Briner, Jane Ellis and Raphaël Jachnik. The paper also benefited from delegates' comments at the CCXG Global Forum event in March 2013, where a draft version of this paper was presented.

Questions and comments should be sent to:
Andrew Prag
OECD Environment Directorate
2, rue André-Pascal
75775 Paris Cedex 16
France
Email: andrew.prag@oecd.org

All OECD and IEA information papers for the Climate Change Expert Group on the UNFCCC can be downloaded from: http://www.oecd.org/env/cc/ccxg.htm.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **7**

1. INTRODUCTION **12**

2. WHAT IS AN EMISSIONS ACCOUNTING FRAMEWORK? **13**

2.1 What is an emissions accounting framework? 13
2.2 Components of an accounting framework 14
2.2.1 Understanding targets and goals ex ante 15
2.3 Reporting progress towards pledges: biennial (update) reports 18

3. ACCOUNTING FOR FLOWS OF TRADABLE GHG EMISSIONS UNITS **21**

3.1 Building blocks for understanding international unit accounting 22
3.2 Who is accountable? Addressing "double claiming" 23
3.3 What does the atmosphere see? Accounting for units against single-year targets 26
3.4 Following the units: accounting within different pledge types 29
3.4.1 Units from crediting mechanisms 29
3.4.2 Allowance units from domestic emissions trading systems 31
3.5 Do we need a centralised transaction log and/or standardised international unit types? 34
3.5.1 Conversion to a standardised international unit type 34
3.5.2 Centralised transaction log 35
3.6 Options for tracking and accounting for unit flows 36

4. ACCOUNTING FOR LAND-USE SOURCES AND SINKS UNDER A NEW AGREEMENT **39**

4.1 Starting from principles 39
4.2 Basic concepts in land-use sector reporting and accounting 40
4.3 One approach to accounting: the development of land-use reporting under the Convention 42
4.4 A second approach: LULUCF accounting rules under the Kyoto Protocol 43
4.4.1 Conclusion on the evolution of the Kyoto accounting approach 45
4.5 Experience with AFOLU accounting in developing countries 46
4.5.1 Forestry projects in the CDM 46
4.5.2 REDD+ and its implications for accounting 47
4.6 Options for moving forward on land-use sector accounting 47

5. CONCLUSIONS **51**

REFERENCES **54**

GLOSSARY **56**

LIST OF TABLES

Table 1: Extracts from CTF tables relevant to accounting 19
Table 2: Unit types that Parties could potentially count directly towards pledges 21
Table 3: Transactions of offset credits within different pledge types: information needed to understand impact on aggregate abatement 30
Table 4: AFOLU Accounting methodologies (non-exhaustive list) 42
Table 5: Activity-based accounting rules for Annex I Parties with KP commitments (non-exhaustive list). 44
Table 6: Pros and cons of options for AFOLU accounting 49

LIST OF FIGURES

Figure 1: An emissions accounting framework, showing *ex ante* and *ex post* elements 8
Figure 2: The different elements of unit accounting 9
Figure 3: Overview of an accounting framework, showing *ex ante* and *ex post* elements 15
Figure 4: Distinguishing between different elements of unit accounting 22
Figure 5: Transfer of units between ETS systems in two countries can affect pledge accounting 33
Figure 6: Options for unit accounting 38
Figure 7: Land-based versus activity-based accounting 41

Executive Summary

Under the United Nations Framework Convention on Climate Change (UNFCCC), many Parties have put forward emissions reductions targets and actions for the year 2020 (hereafter referred to as "pledges").[1] These pledges, covering both developed and developing countries, have been expressed in a variety of ways and so are not necessarily comparable. Many include the assumption that emissions units from market mechanisms will be transferred between countries. Understanding how these movements will impact on progress towards pledges can be difficult if the pledges themselves are not well understood. Pledges also use different approaches to measure emissions and removals in the land-use sector. A greenhouse gas (GHG) emissions accounting framework is therefore needed to provide full visibility and understanding about Parties' individual and joint efforts to reduce global emissions in line with the agreed goal of limiting warming to 2°C.

This paper identifies what is needed, in addition to existing UNFCCC reporting structures, to create an emissions accounting framework that could be applicable to all Parties. Such a framework could build on processes agreed for the period before 2020, with a view to informing a new agreement covering the post-2020 period. The paper benefited from discussions at the Climate Change Expert Group (CCXG) Global Forum held on 19-20 March 2013.

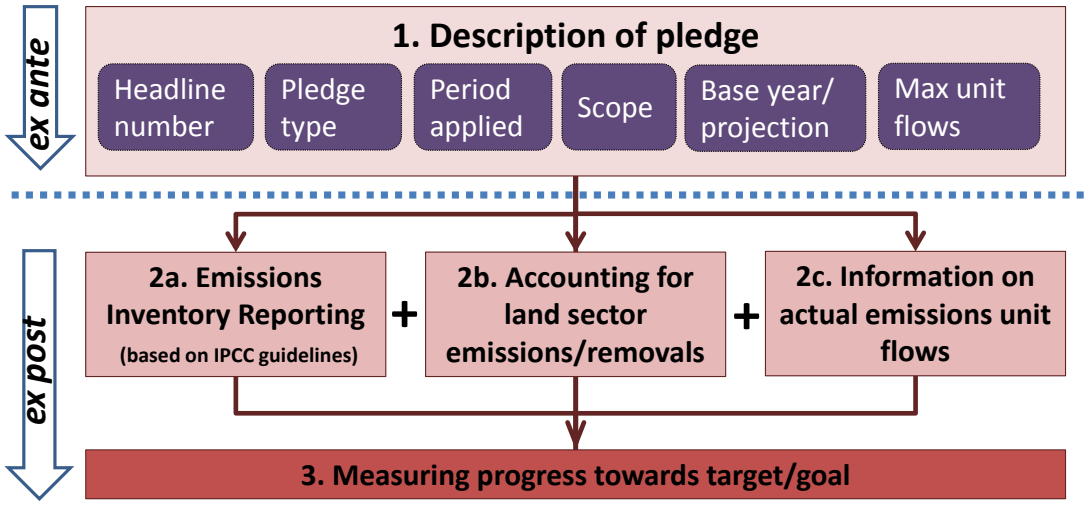
All Parties have existing reporting requirements under the UNFCCC. Requirements include provision of information on domestic emissions (i.e. GHG inventories) and stated emission reduction goals and targets. Developed countries must submit annual reports of their emissions inventory, as well as biennial reports detailing their mitigation commitments and progress towards those commitments. Developing countries are requested to submit biennial update reports, providing updates on their emissions inventory and mitigation actions, where appropriate. An accounting framework is needed in addition to the reporting provisions for domestic emissions and stated emissions targets or goals for two broad reasons. These are (i) to enhance understanding of the expected mitigation effects of country pledges *ex ante*, including any double claiming of abatement between pledges (such as through some types of international unit trades) and (ii) to accurately measure progress towards meeting those pledges.

An accounting framework can also influence the participation of countries in a new agreement. It could increase participation if designed to give recognition for actions taken by Parties that would not otherwise be captured (in particular for the land-use sector, where policy interventions can have impacts with significant time lags). An accounting framework could also decrease participation if seen by some Parties as not flexible enough to accommodate their circumstances, or too intrusive on their domestic processes and policies. Adoption of a universally-applied accounting framework would not, however, by itself increase overall mitigation ambition. Faced with more stringent accounting rules, Parties might choose to alter the headline numbers used to define their pledges (such as changing from X% to Y% reduction), resulting in limited or no net change of ambition.

An accounting framework could include requirements for *ex ante* information describing the pledge, including the headline number (% reduction), the type of pledge (e.g. absolute or relative reductions), as well as its scope and period of application. Furthermore, an accounting framework could also require *ex ante* information on the approach to be used to measure emissions/removals from the land-use sector and the maximum expected use of tradable emissions units from market-based mechanisms. *Ex post* information could then be required to measure and report progress towards pledges. Figure 1 shows possible *ex ante* and *ex post* elements of an accounting framework. The extent to which rules or internationally-agreed procedures could apply may vary between the three stages.

[1] The word "pledge" is used in this paper as a general term encompassing different possible types of GHG emissions-related target, commitment, action or goal put forward by Parties either pre- or post-2020

Figure 1: An emissions accounting framework, showing *ex ante* and *ex post* elements



Source: Authors

Existing UNFCCC reporting procedures already provide some of the necessary elements to bring into operation such a framework. For example, the common tabular format (CTF) tables that will form part of developed countries' biennial reports require detailed *ex ante* description of the pledge. The CTF tables also require *ex post* information relevant to measuring progress, including annual GHG emissions, net unit flows and specific information relating to annual changes in land-use sector emissions and removals.

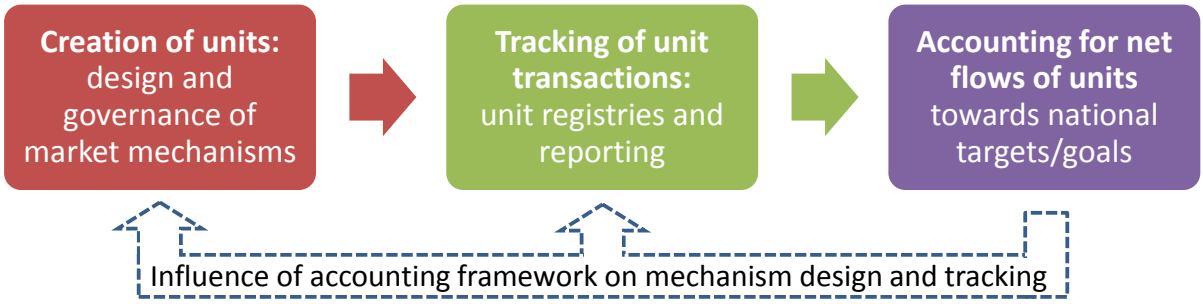
However, the CTF tables are not sufficient to provide a comprehensive accounting framework for developed countries, and do not cover reporting by developing countries. This paper therefore addresses two key areas for accounting, and highlights what would be needed to fill the accounting gaps. The two areas are: (i) how to account for international flows of GHG units given the diverse pledge types; and (ii) how to account for land-use emissions and removals, given the particular characteristics of that sector, such as the challenge of identifying human-induced emissions changes and the long-term nature of policy interventions.

Accounting for international flows of GHG units

Flows of GHG emissions units matter for UNFCCC accounting when units that originated outside of a Party's pledge boundary are counted as a direct contribution towards the achievement of that Party's pledge. This can occur from *international* transfers of units, from the use of *domestic* units that originated in sectors not covered by the national pledge (e.g. agriculture or soil carbon) or from the use of units generated in a *different time period* to the period of application of the pledge. Units transferred between linked domestic trading systems, or offsets purchased by entities covered by those systems, do not affect UNFCCC accounting unless one Party chooses to count those units as a direct contribution towards meeting a national pledge.

It is useful to distinguish three elements of the "life cycle" of emissions units as used under the UNFCCC**:** (i) **creation** of units (design and governance of market mechanisms), (ii) **tracking** of units, and (iii) **accounting** of unit flows towards national targets/goals. Figure 2 shows this distinction, noting that there are linkages between the three elements.

Figure 2: The different elements of unit accounting



Source: Authors

Creation of units covers the ensemble of design and governance processes that determine the quality of the emissions units created by market mechanisms, as well as the quantity of units generated for any particular mitigation action. Although these processes are crucial to the continued use of market mechanisms as a tool to increase ambition and cost-effectiveness of emissions mitigation, design and governance issues have been explored in previous CCXG work and are not the focus of this paper. If countries seek to use units arising from domestically-governed mechanisms to count towards targets under the UNFCCC, then the "framework for various approaches" (FVA) currently being elaborated under the UNFCCC could play an important role in ensuring transparency of the domestic processes used. The FVA could also serve to describe internationally-recognised standards for some design elements.

This paper focuses on the tracking and accounting aspects. **Tracking of unit transactions** includes the processes and systems necessary to track transactions and follow the ownership of emissions units as they change hands either domestically or internationally. This includes unit registries, tracking of units using unique serial numbers, and transaction logs for recording and reporting transactions. Whether domestic or international, the output of such tracking systems will be essential for the third element in Figure 2, **accounting for net flows of units towards national targets or goals**. The processes agreed for this accounting step may influence the other two elements. For example, domestic tracking systems may be designed to be compatible with international accounting requirements. Two important issues to consider for accounting for unit flows within national pledges are the potential overlap of pledges and their period of application.

Overlap of pledges and avoiding "double claiming"

"Double claiming" of units could arise if units are counted towards the pledges of both countries involved in a transfer of emissions units. To clarify the aggregate mitigation expected from country pledges, it is therefore important to distinguish between pledges that take into account net flows of unit movements and those that do not. It can be assumed that the economy-wide targets of developed countries account for net flows of emissions units, as biennial reports require reporting of unit totals (distinguishing units "under the Convention" from other units). For developing countries, it is not clear whether 2020 pledges account for net unit movements or not. A full understanding of global mitigation effort would require this to be clarified and made transparent, so that any double claiming is clearly attributed. In most cases, the decision to account for exported units will be a political one, but there are some instances where there are technical considerations. For some emissions sources, national emissions inventories may not be sufficiently detailed to notice emissions reductions resulting from projects that resulted in exported credits. In these specific cases, if the seller country were to account for the full unit flow then that country may end up further from meeting its emissions target than expected.

Single-year versus multiple-year targets

The period of application to which pledges apply is important when considering how to account for use of transferable units. If a pledge is defined for a single year only, rather than applying to total or average emissions over a period, then the use of international emissions units (including offsets and units from trading systems) accrued over multiple years can be problematic. The problem is that what the atmosphere "sees" are cumulative emissions across all years, not just the emissions level in the target year, whereas emissions units have "vintages" depending on the year that the underlying reduction occurred.

Unit accounting would be made more robust if countries that wish to count tradable emissions units of any vintage towards their pledge were to express the pledge as applying across multiple years (an average or total emissions level over the period). With this approach, a country with a single-year pledge could still choose to count international units towards that pledge, but only using units with a vintage corresponding to the single target year.

Multiple-year pledges are therefore preferable for a number of reasons. They could improve the credibility of pledges by minimising the risk that emissions in a single target year be unrepresentative of underlying trends (due to abnormal weather in that year, for example), and by providing more frequent measuring of progress towards goals. Parties expressing multiple-year pledges would also be able to make greater use of international market mechanisms whilst maintaining a robust approach to accounting. Conversely, restricting the vintages that can be used by single-year pledges could distort emissions markets, due to strong demand in one particular year.

Options for tracking and accounting for unit flows

This paper puts forward three options for unit accounting under the UNFCCC. All options assume transparent *ex post* reporting of actual net unit flows by Parties intending to count units towards their pledges. Option A is the more rigorous accounting option and would aim to give a good level of *ex ante* clarity on how net unit flows are likely to impact the expected aggregate global mitigation expected from countries' pledges. This would require *ex ante* information on maximum permitted unit flows and also rules to prohibit double claiming and the use of international units for single-year targets. Option C is the most flexible option and would rely on periodic *ex post* reporting of international unit movements using domestic tracking systems only. Option B is a middle option that conserves flexibility regarding Parties' choice of pledge type, adding only sufficient constraints to get a reasonable *ex ante* estimate of aggregate abatement. This would require some extent of *ex ante* declaration to limit any potential double claiming, plus restrictions on eligible unit vintages for single-year target types and an international tracking system to which Parties can voluntarily opt-in.

Accounting approaches for land-use emissions and removals

More than any other sector, land-use emissions and removals highlight the need to distinguish between the differing objectives of emissions reporting versus accounting. The land sector emissions profile includes a complex mix of anthropogenic and non-anthropogenic emissions and removals, lagged emissions from historical events, effects from past management practices (age class structure of forests), natural disturbances and other factors beyond human control. Whilst inventory reporting provides a detailed record of both anthropogenic and natural GHG emissions and removals from land areas over time, accounting focuses only on anthropogenic emissions/removals or changes in carbon stock resulting from human interventions, including decisions taken as a result of the mitigation target or goal.

Discussion of land-use emissions and removals has often focused on two dichotomies. One is the distinction between reporting based on land areas (used for UNFCCC), and accounting based on specific land-use activities (as used for the KP). The second is between "net-net" accounting, where net emissions (emissions minus removals) in the target period are compared to net emissions in a base year, and "gross-net" accounting where net emissions from the target period are not compared to a historical period/year.

Negotiations on the KP second commitment period have shown some convergence and a move away from these two distinctions. Together, the discussions on KP accounting and those on accounting for Reduced Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+) in developing countries indicate use of some similar elements. There is increasing recognition of the need to provide flexibility in accounting approaches by moving away from a strict dichotomy between "gross-net" and "net-net" towards approaches that compare net emissions in the pledge period to projected, forward-looking baselines (e.g the forest management reference levels now introduced to the KP).

In addition to attracting the participation of a large number of Parties, it is important that any future UNFCCC accounting framework for land-use emissions and removals be designed to optimise the incentives provided. The framework should aim to avoid perverse incentives for land-use change where possible, while providing incentives and recognition for land-use mitigation actions. As an alternative to seeking a single comprehensive accounting system, an option would be to refocus the discussion not on a single, universal accounting framework, but rather on the need to ensure environmental integrity and provide transparency, credibility and flexibility across all different approaches. For example, the process could act to develop criteria under which it may be appropriate for a land-based approach to be taken by a specific Party, depending on that country's circumstances.

Building on biennial reporting

Agreeing CTF tables for developed countries' biennial reports in Doha was a step towards an integrated approach to unit accounting pre-2020 that can be built upon for a post-2020 agreement. The on-going work programme for countries to clarify their mitigation targets and goals is also an important ingredient in moving towards a universal accounting framework. However, the existing reporting processes are not in themselves sufficient to function as an emissions accounting framework.

The largest gap in the current reporting format is that the tables only apply to developed countries, and there are no current plans to develop such tables for developing countries. One problem arising from the application of detailed accounting to only a subset of Parties is that it can lead to "double claiming" of units by more than one Party. This could compromise the accounting for developed country targets if units are sourced in developing countries that also claim the reductions represented by the units. A common basis for accounting and reporting applicable to all Parties would therefore be advantageous for understanding flows and use of tradable units under a new agreement. Failing this, guidance for biennial update reporting could be developed to encourage developing country Parties to declare whether their mitigation goals account for unit flows.

A second gap is that the CTF tables do not provide for sufficient information on several other aspects relating to unit flows. These include the period for which a target applies, and the nature and traceability of emissions units, including assurance that they are issued and retired (used) only once (avoiding double-issuance and double-retirement). For land-use emissions and removals, the CTF tables currently allow developed country Parties to specify their accounting approach, and then to report emissions according to either the land-based or activity-based approach. At present, there is no guidance on which approach is preferred, or criteria for justification of particular approaches, and reporting provisions could be further developed in this regard.

In terms of further work building on this paper, an important issue to explore is how an accounting framework could be applied to a potential "spectrum of commitments" that countries may take on as part of a post-2020 agreement. Furthermore, it will be important to assess the transition of the pre-2020 to the post-2020 framework, including issues around the use of domestically-generated units issued pre-2020.

1. Introduction

Under the Cancun Agreements, adopted at the sixteenth meeting of the Conference of the Parties (COP) to the UNFCCC in 2010, Parties inscribed their pledged national mitigation targets and actions for the year 2020. Since 2010, an increasing number of Parties has clarified the scope and details of their targets and goals (hereafter referred to as pledges) through presentations and submissions to the UNFCCC. Being based on national circumstances rather than commonly-applied accounting rules, these pledges are different from one another in a number of ways including their scope, period of application, coverage of land-use emissions and removals and use of units from market mechanisms. Comparison of pledges is therefore difficult.

In 2011, Parties agreed to launch the Durban Platform negotiations, aiming to reach agreement by 2015 on a new "protocol, other legal instrument or agreed outcome with legal force" applicable to all Parties under the Convention, to enter into force from 2020. Clarity on Parties' pre-2020 objectives is therefore not only important for understanding the overall global mitigation effort to 2020, but also a factor in facilitating negotiation of the post-2020 agreement.

Given the diversity of existing pledges to 2020, Parties agreed at COP 18 in Doha in 2012 to establish work programmes to clarify developed country targets and to further the understanding of developing country actions and goals. At Doha (and previously at Durban), Parties also agreed to enhance reporting requirements under the UNFCCC, in particular by adopting guidelines for biennial reports from developed countries and biennial update reports from developing countries.

Reporting requirements exist for all Parties under the UNFCCC and include information on emissions, emissions objectives and emissions trends. These reporting provisions are different for developed and developing countries and do not constitute an emissions accounting framework. Only Annex I Parties with commitments under the KP are currently subject to a rules-based accounting framework.

The aim of this paper is to clarify what an accounting framework is, what it can and cannot achieve, and to assess what would be needed to develop an accounting framework that builds on and complements existing international reporting requirements. The paper also aims to improve understanding of the different types of target or pledge that have been proposed, and to explore how an accounting framework could be applied to those pledges. The analysis does not specifically address the pre- or post-2020 period, nor is it specifically aimed at developed or developing countries. The paper does not assume that an accounting framework will adopt a KP-style rules-based approach..

This analysis builds on other recent CCXG work in the areas of unit accounting (Prag *et al.*, 2011), market mechanism design and governance (Prag *et al.*, 2012) and measurement, reporting and verification (MRV) of emissions commitments and actions (Ellis *et al.*, 2011). The paper benefitted from discussions with delegates from a wide range of countries and organisations at the CCXG Global Forum in March 2013.

The paper is structured as follows. Section 2 assesses what an emissions accounting framework is trying to achieve, and categorises existing mitigation commitments and reporting requirements. Section 3 addresses issues surrounding accounting for transferable emissions units, and proposes some options for accounting. Section 4 looks at existing methods of reporting and accounting for emissions and removals from the land-use sector, and suggests options for a future agreement. Section 5 presents conclusions.

2. What is an emissions accounting framework?

Under the UNFCCC, Parties have already agreed to differentiated requirements for reporting and provision of information on mitigation targets/actions and emissions inventories. Annex I Parties with emissions commitments under the KP are also subject to an accounting framework that, *inter alia,* tracks use of tradable emissions units and characterises contributions from land use, land-use change and forestry (LULUCF) emissions and removals. This section explores the distinction between reporting and accounting, and what could be required of a new accounting framework that would be applicable to a wider group of Parties under the UNFCCC than the KP has been to date.

2.1 What is an emissions accounting framework?

An emissions accounting framework is defined here as the ensemble of systems and processes that are necessary to understand Parties' pledges under the Convention as well as progress made towards those pledges. The goal of such a framework is to provide visibility and understanding about Parties' individual and joint efforts to limit or reduce emissions to be in line with the global goal of limiting warming to below 2°C.

Some of the information required by such a framework is already captured by existing reporting requirements agreed under the UNFCCC. These include national communications, biennial reports for developed countries and biennial update reports for developing countries. This sub-section and those that follow analyse what further information is required in these reporting processes to create an emissions accounting framework under the UNFCCC.

Estimates of national emissions inventories, calculated by each country using IPCC guidelines, provide the bedrock for emissions reporting under the UNFCCC. The quality and breadth of emissions inventories has generally been improving over time, including improvements in the quality of underlying data and emissions factors, in both developed and developing countries. However, simple comparison of inventory estimates in different years is likely to be insufficient as a means to understand Parties' progress towards their emissions targets and goals. This is for two principal reasons:

i. Where the scope of pledges includes the land-use sector, complexity in accounting for emissions and removals from this sector means that the approach used to capture mitigation actions in the land-use sector may differ from information provided in national inventories. For example, changes in carbon stock over time, which may be caused by specific activities or interventions, may not be captured by comparing inventory emissions to a base year.

ii. The widespread use of market-based mechanisms, both under the KP and domestically, involves transfer of emissions units between countries. If such units are counted by Parties as a contribution towards their pledge, domestic inventory emissions can differ significantly from a reported state of progress towards a pledge, once the net flow of transacted emissions units has been taken into account.

It is important to clarify what functions an accounting framework can fulfil within the UNFCCC process, as well as those functions that are beyond the scope of accounting. An accounting framework **can** act to:

i. Enhance agreed reporting rules to improve quality and comparability of information through translation of emissions objectives into common formats, as well as reporting individual and collective progress.

ii. Facilitate the use of market mechanisms internationally, by providing a basis for seeing which units are counted towards which country pledges, and therefore understanding where unit movements lead to overlaps between pledges. To achieve this, the accounting framework needs to be supported by tracking systems, which could be international or domestic/bilateral.

iii. Influence participation in a new agreement. An accounting framework could potentially increase participation if designed in a way that it recognises positive actions taken by Parties (for example in the land sector, where the recognition or not of interventions that enhance the carbon stock over a time period is entirely down to the design of the accounting framework). However, the accounting framework could also decrease participation if some Parties see it as too inflexible to their circumstances, or too intrusive on their domestic processes and policies.

There are a number of functions that an accounting framework **cannot** fulfil, including the following:

i. An accounting framework cannot, in itself, guarantee or safeguard increased mitigation ambition. If a rigorous accounting framework is made applicable for emissions pledges of all Parties, some Parties may choose to change the overall reduction figure of their mitigation goal or target at the same time as they apply the accounting framework. Therefore overall mitigation would be neither more nor less ambitious, though a common accounting framework would help to clarify countries' relative progress.

ii. An accounting framework cannot serve to define the legal nature of Parties' targets or goals, or impose compliance or sanctions in relation to those pledges.

There are also ways that an internationally-agreed accounting framework can help Parties to make their domestic policies more manageable and/or cost-effective. Accounting can provide a basis by which Parties can choose to assign legal or other responsibility to emissions, as a means of providing incentives for mitigation. This could of course be done independently of any international accounting framework, but some countries may choose to take advantage of an agreed international framework in this regard. An example is the embedding of the EU Emissions Trading System (ETS) in the KP framework during the first commitment period. Another example is the use of CDM methodologies and procedures to generate carbon credits as part of China's domestic policy.[2]

2.2 Components of an accounting framework

At the heart of any emissions accounting framework are the emissions targets or other objectives put forward by participating jurisdictions. An accounting framework is often thought of only as the means for *ex post* measurement of progress towards objectives. However, the complexity of different pledge types, including their form and whether they account for international flows of emissions units, means that *ex ante* factors are also important for an accounting framework to function effectively.

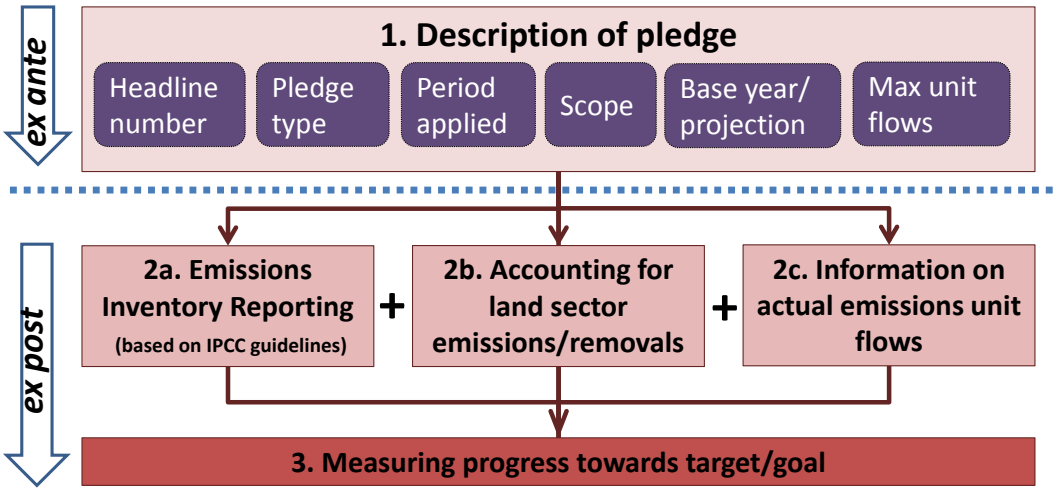
Figure 3 depicts the components of an accounting framework in stages. Stage 1 covers the *ex ante* description of the pledge itself, including the headline number (e.g. percentage reduction) as well as other defining characteristics (for example, whether the land-use sector is considered in the pledge, and if so which accounting approach that will be used). Stage 2 shows the separate components necessary to calculate progress towards the goal: reporting of specific information on emissions unit flows and land-use sector emissions/removals accounting. Stage 3 represents the use of the accounting information to report progress towards the pledge.

The three stages vary in the extent to which Parties are likely to agree rules or other procedures. For example, for stage 1 Parties have put forward pledges under the Cancun Agreements, according to their own scope, timeframe and other factors. These can vary considerably. The lack of common rules for defining these aspects of pledges means that understanding of Parties' commitments *ex ante* is patchy as it depends on information supplied voluntarily by Parties. Whilst the provisions agreed for biennial reports and CTF tables go some way towards providing a framework for stages 2 and 3, this paper explores where

[2] These "China Certified Emissions Reductions" (CCERs), although generated from processes originally designed for the UN Clean Development Mechanism, might be used as offsets for domestic emissions trading systems in China. See Partnership for Market Readiness, PMR (2013).

further information and agreement may be necessary to ensure full understanding of Parties' pledges and their progress towards them.

Figure 3: Overview of an accounting framework, showing *ex ante* and *ex post* elements



Source: Authors

2.2.1 Understanding targets and goals ex ante

The headline numbers of Parties' pledges tend to appear simple at first glance. Most pledges consist of a headline number (or a range of numbers), and a clarification for the metric or type of goal or target being used.[3] In general there are four types (UNFCCC 2011a and b):

i. absolute reduction or limitation of emissions measured against a historical base year emissions level, e.g. US in the range of 17% reduction on 2005 levels

ii. absolute reduction relative to a future, projected emissions level (usually "business as usual", BaU), e.g. Brazil 36-39% below BaU

iii. reduction or limitation of emissions intensity, such as GHG/unit of Gross Domestic Product (GDP) or other relative metric, e.g. China 40-45% reduction in CO_2/GDP

iv. reduction to a fixed net emissions level, e.g. Costa Rica aiming for carbon neutrality.

On closer analysis, the simple descriptions of pledge types hide complexities. Firstly, differences in form, metric and scope of the pledges hinders comparison of the associated emissions reduction. Different levels of mitigation ambition can be expressed in all four types of pledge, so relative metrics could be more or less ambitious than absolute ones. Secondly, pledges differ in their period of application. Some pledges cover only a single target year (point target) whereas others apply to emissions over multiple years.

Understanding headline numbers of pledges based on absolute reductions against a base year

Most developed country Parties have submitted quantified economy-wide targets for 2020 expressed as a percentage reduction against historical base year emissions. Parties have chosen different base years and different means of accounting for land-use emissions/removals, both factors that can have a strong effect on the target level of emissions (Levin *et al.*, 2010). Targets also differ in the time frame over which they

[3] Some developing countries have submitted qualitative pledges not directly based on a GHG metric; these are not considered here.

apply. A target expressed as a reduction in emissions for the year 2020 is different to a reduction target that covers each year in a multi-year period, such as 2013-2020. For example, the US has a target based on reduction in the year 2020 only. Whilst the EU and Australia have also stated targets for the year 2020 only, these have subsequently been converted to a multiple-year approach in order apply the rules of the KP second commitment period, which utilise a form of "carbon budget" approach.

For the KP, the various parts of stage 1 in Figure 3 are largely standardised through agreed rules. Although headline numbers amongst KP Parties vary, other factors are mostly common to all participants, with a few exceptions where Parties can choose from a limited number of options.[4] This means that KP headline numbers give a reasonable estimation of the relative magnitude of different commitments. Note however that the effort or burden of meeting a commitment in a particular country cannot be estimated by a reduction target alone. The total volume of emissions reduced is not necessarily a measure of relative effort between countries.

For stage 2 in Figure 3, Parties with KP commitments calculate total emissions permitted during the target period, and the total is converted into a stock of tradable emissions allowance units (note that for the KP this is effectively also an *ex ante* step). This means that flows of emissions units underpin the whole accounting framework (credits and debits for land-use emissions/removals, as well as market mechanisms). The carbon budget approach ensures that all targets can be compared and accounted for on the same basis, including transfer of units between countries.

However, defining a carbon budget for the LULUCF sector is complex and the KP accounting rules have a number of weaknesses in this regard, covered in Section 4. Previous CCXG work highlighted that whilst the budget approach could be the most logical accounting option for all countries under a new agreement, it is unlikely that all Parties would adopt a system based on an internationally-governed carbon budget (Prag *et al.*, 2011). Also, it can be difficult to translate some pledge types into carbon budgets. For example, pledges based on an intensity metric, such as emissions per unit of GDP, would be difficult to convert into a budget *ex ante*.

Although simpler for accounting, a carbon budget approach does not necessarily lead to greater mitigation ambition. Box 1 highlights some specific examples of KP Parties converting nationally-defined headline targets into the format required by KP accounting rules. The difference between single-year and multiple-year targets will remain an issue for future accounting under the UNFCCC. In particular, single-year targets can make international accounting difficult if Parties engage in international transfers of units from market-based mechanisms. This issue of accounting for different "vintages" of carbon units is discussed in Section 3.

[4] These include base year for all (EITs) or some (non-EIT Annex I countries) gases, and LULUCF activities, described in detail in Section 4.

Box 1: Accounting rules and ambition are separate issues

A mitigation target may be expressed differently depending on the accounting approach used. An example is the conversion of developed country targets into Assigned Amounts for the Kyoto Protocol second commitment period. The Assigned Amount is a carbon budget covering every year of the period (a type of multi-year target). Effectively, a Party must meet its inscribed target for each year of the commitment period, not just the final year, with the flexibility that the total emissions for the eight years of the second commitment period should be equal to eight times the inscribed value. Further flexibility comes the ability to trade units internationally through the flexible mechanisms.

Australia's unconditional target for 2020 has long been defined as a reduction of 5% from 2000 levels (a single-year target for 2020). To convert to a "Quantified Emissions Limitation or Reduction Commitment" (QELRC) under the KP, the percentage target needs to be adjusted both for change of base year and to switch from single-year to multiple-year target (as well as other factors, such as land-use rules). Numerically, the overall headline figure has changed from 5% (from 2000 levels, for single-year 2020), to 0.5% (from 1990, each year of commitment period) (UNFCCC, 2013a). The smaller figure is not due to a decrease in ambition, but represents a two-stage conversion to the KP accounting framework.

In the case of the EU, the figure inscribed as a QELRC for 2013-2020 is nominally the same as the EU's single-year 2020 target described in European legislation (the Climate and Energy Package), i.e. a 20% reduction from 1990 levels by 2020. However, the QELRC has in fact been calculated to take into account the 8 years of the commitment period, as well as differences in KP base-years for EU members, updates to Global Warming Potential (GWP) figures and the exclusion of aviation. It is coincidental that all these changes result in the headline figure itself being unchanged (EU, 2012).

Understanding headline numbers of other pledge types

Developing countries have put forward a range of pledges, including all four of the categories listed above (UNFCCC 2011a). The key accounting challenge for reduction from BaU and for emissions intensity pledges is that they rely on assumptions about future developments in order to calculate *ex ante* the total net volume of emissions that will be released if the pledges are attained. Mitigation goals defined against BaU scenarios usually state a percentage emissions reduction from a future expected emissions scenario. To define this scenario requires a projection of emissions into the future to act as a baseline against which to measure reductions. Developing projected baseline scenarios of this sort is challenging, involving a number of economic, social and other assumptions (see Clapp and Prag, 2012, and DEA, OECD and UNEP, 2013).

Mitigation pledges defined as a reduction in emissions intensity state reductions in most cases as a percentage decrease in emissions per unit of GDP (or other output metric). In accounting terms, these pledge types are also difficult to characterise because the reliance on an economic forecast means that the magnitude of emissions allowed under this type of pledge also cannot be known precisely *ex ante.* However, in this case there is only one unknown variable (GDP growth), and some of the complexity of characterising BAU pledges is therefore avoided.

Pledges defined as reduction in emissions relative to a fixed future level, such as to be "carbon neutral", appear simple but nevertheless highlight the importance of defining clear accounting rules. Since most countries, however small, will expect to have significant energy- and industry-related emissions as part of their emissions inventory for the foreseeable future, carbon-neutral pledges rely on removals from the LULUCF sector and, potentially, transfer of units from other countries. Both of these factors require a clear accounting framework in order to understand progress towards the pledge. The issue of whether pledges or targets apply to a single target year or average emissions remains important.

Understanding other *ex ante* aspects of pledge descriptions

The other factors needed to fully understand pledges *ex ante* are easier to characterise. Also listed in Figure 3, they include the scope of the pledge (sectors and gases), as well as the Global Warming Potentials to be used for each gas. Although national circumstances may lead to different choices between countries, IPCC reference documents can be used to transparently clarify *ex ante* which choices and values have been used (IPCC, 2006).

If the pledge is not economy-wide, then the sectoral scope of the pledge needs to be also clearly defined. Most countries have estimated their national emissions profile in their emissions inventory reports. In most cases these inventories follow IPCC guidelines (either 1996 or 2006 version), including identification of key categories in order to provide a detailed break-down of emissions for the more important source categories. However, translating a portion of the emissions inventory into a pledge covering certain economic sectors is not necessarily an easy task, as economic sectors do not map simply with IPCC inventory categories. This means that the pledge may not directly match to data reported in the national inventory. Nevertheless, careful definition of the scope of pledge, including detailed mapping to IPCC categories, can help to clarify this problem.

2.3 Reporting progress towards pledges: biennial (update) reports

Stage 3 in Figure 3 represents the output of an accounting framework: provision of information on progress made towards pledges. At present, only countries with on-going KP commitments are subject to an accounting framework that stipulates target types and reconciles unit transfers and domestic emissions in order to assess progress towards those targets. However, Parties have agreed to reporting requirements that are applicable to all countries, albeit in different ways. Reporting requirements for all developed countries include national communications (which cover a broad range of topics, and with different frequency requirements for different groups of countries), and mandatory annual inventory reports (see, for example, Ellis *et al.*, 2011).

In order to increase transparency and understanding of all countries' pledges for 2020, Parties agreed at COP17 in 2011 on guidelines for biennial reports from developed countries, and separate guidance on biennial update reports from developing countries (UNFCCC, 2012a). Box 2 shows some key extracts from the biennial reporting guidelines relevant to accounting (for developed countries). At COP18 in Doha, the guidelines were supplemented with the CTF tables, which developed country Parties will use for reporting of numerical data, including on progress towards emissions reduction targets (UNFCCC, 2013b). The tables do not apply to developing country Parties.

Only a limited number of the CTF tables are directly relevant to emissions accounting and understanding targets, and these are summarised in Table 1 below. The other tables are less relevant to the description and reporting of targets, though they are important for building international understanding of emissions trajectories, specific policies or other actions and climate finance commitments.

All the CTF tables currently contain the following footnote (UNFCCC, 2013b): "Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets". The language used is not very clear. The usual interpretation is that units reported in the tables do not prejudge future decisions over which units may or may not be valid, for example under the "framework for various approaches". However, the text could also be interpreted as suggesting that the existing CTF tables do not seek to address the issue of double counting of emissions units, in that if one Party reports use of units, that does not prejudge what another party may wish to do with those same units.

Box 2: Extracts from biennial reporting guidelines relevant to accounting

***Ex ante* description of targets**: "The description of the Party's economy-wide emission reduction target shall include the following information taking into consideration any relevant decisions of the Conference of Parties (COP):

(a) Base year; (b) Gases and sectors covered; (c) Global warming potential values as established by the relevant decisions adopted by the COP; (d) Approach to counting emissions and removals from the land use, land-use change and forestry (LULUCF) sector, taking into consideration any relevant decisions adopted by the COP; (e) Use of international market-based mechanisms in achieving its emission reduction target, taking into consideration any relevant decisions adopted by the COP, including a description of each source of international units and/or allowances from market-based mechanisms and the possible scale of the contributions of each; (f) Any other information, including relevant accounting rules, taking into consideration any relevant decisions of the COP, where appropriate;"

Estimates of emission reductions and removals and the use of units from the market-based mechanisms and LULUCF activities

"9. For the base year, information reported on the emission reduction target shall include the following: (a) Total GHG emissions, excluding emissions and removals from the LULUCF sector; (b) Emissions and/or removals from the LULUCF sector based on the accounting approach applied taking into consideration any relevant decisions of the COP and the activities and/or lands that will be accounted for; (c) Total GHG emissions, including emissions and removals from the LULUCF sector;

10. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraph 9(a–c) above, **information on the use of units from market-based mechanisms."**

Although a useful step forward for understanding the targets put forward by developed country Parties under the UNFCCC, the CTF tables cannot alone function as a means to reliably account for the achievement or otherwise of pledges. In particular, this is due to complexity concerning accounting for flows of emissions units and accounting for the land-use sector.

For flows of emissions units, there are a number of specific accounting challenges which are not covered sufficiently by the tables. These include: i) accounting differences when considering both point year targets and period targets; ii) challenges regarding reporting of total unit quantities "used" on an annual basis, given that governments (and entities covered by cap-and-trade) may not declare full unit-use until the final year of the pledge; and iii) lack of clarity on how transfers of units may be accounted for in the national accounts of transacting Parties, particularly if one is a developing country without a quantified target being reported using CTF. Section 3 explores these and other issues related to unit flows.

For the land-use sector[5], whilst the IPCC inventory guidelines describe a means to estimate emissions and removals according to net emissions per defined land areas (a land-based approach), this might not be sufficient for an accounting framework to assess progress towards emissions pledges. Unlike in other sectors, the land sector emissions profile includes a complex mix of anthropogenic and non-anthropogenic emissions, lagged emissions from historical events, natural disturbance and many other factors beyond immediate human control. Section 4 of this paper explores options for accounting for land-use emissions and removals.

[5] Whether defined as LULUCF, or with agriculture also included, as defined in the 2006 IPCC guidelines: Agriculture, Forestry and Other Land-Use (AFOLU)

Table 1: Extracts from CTF tables relevant to accounting

Sub-table	Purpose	Relevance to accounting
2(a)	Inscribe headline emissions reduction target as a percentage of base-year/period	Includes line on "period of application" without specifying the meaning
2(b) and 2(c)	Describe gases covered and GWPs used	Straightforward information, making reference to detailed guidance from IPCC
2(d)	Provide basic information on LULUCF accounting approach	Inclusion of LULUCF in base year and target calculations and choice of accounting approach (land-based vs. activity-based accounting)
2(e)I and 2(e)II	Expected use of units from market-based mechanisms "under the Convention" (2(e)I) and "other market-based mechanisms"(2(e)II)	To describe a reduction target *ex ante*, this table refers to the "possible scale of contribution" of units (reflecting language from biennial reporting guidelines). The tables distinguish between units "under the convention" and "other market-based mechanisms", without specifying further this distinction.
4	Overall reporting of progress	Headline figures for emissions for each year in the reporting period, including LULUCF and the use of units. Unit types are again distinguished between "under the Convention" and "other", with a single total required for each category per year. The reporting of units per year is sensitive to the period covered by the target (point versus period) and the use of cap-and-trade involving private sector (as discussed below).
4(a)I	Progress in LULUCF if using land-based accounting	Reporting on base year emissions, contribution from each land category (according to land categories in IPCC Reporting Guidelines)
4(a)II	Progress in LULUCF according to activity-based accounting under KP	Reporting on base year emissions, contribution from each activity (following the breakdown in Article 3.3 and Article 3.4 of the Kyoto Protocol, with the exception of wetland drainage and rewetting)
4(b)	Detailed reporting of emissions unit-types, per year but only for three years and two years prior to the reporting year (20XX-3 and 20XX-2).	Information included by Parties "if relevant to their targets", implying that units should be reported here only if they are being directly counted as a contribution to a national target. Yearly reporting of units within a target period can be difficult or mis-representative, given that governments (and entities covered by cap-and-trade) may not declare full unit-use until the final year of the pledge.

3. Accounting for flows of tradable GHG emissions units

At Durban in 2011 Parties agreed on a number of principles for the creation, trading, tracking and use of emissions units that are traded internationally in the context of the UNFCCC. These principles, building on decisions taken at Cancun in 2010, include that market approaches "must meet standards that deliver real, permanent, additional and verified mitigation outcomes, avoid double counting of effort, and achieve a net decrease and/or avoidance of greenhouse gas emissions" (UNFCCC, 2012a). Subsequent decisions at Doha in 2012 launched two work programmes based on these principles: to elaborate modalities and procedures of a new market-based mechanism and also to elaborate a "framework for various approaches, including opportunities for using markets" (FVA).

This section assesses how an accounting framework can help facilitate the fulfilment of these principles whilst respecting the diversity of pledges put forward by Parties under the UNFCCC. To be robust, an accounting framework must be able to account for any type of tradable unit that Parties declare as making a direct contribution to meeting its stated pledge under the UNFCCC. Such units could arise from internationally-governed mechanisms (crediting or trading), or units issued through market mechanisms under domestic governance. Issues surrounding the creation and use of this increasing diversity of unit types have been described in previous CCXG work (Prag *et al.*, 2011). Table 2 gives an overview of some unit types that Parties could potentially count towards their national targets/goals.

Table 2: Unit types that Parties could potentially count directly towards pledges

	Domestic governance	**International governance**
Domestic unit flow	Domestic offset credits Domestic trading system allowance units	International credits surrendered by entities within a domestic trading system (e.g. CERs by EU ETS entities) KP Removal Units (RMUs)
International unit flow	Bilateral crediting agreements (e.g. Japan Joint Crediting Mechanism credits) Linked domestic trading system allowance units	Credits from KP project-based mechanisms (CDM, JI), potentially credits from a new market mechanism under the UNFCCC Allowances under KP (Assigned Amount Units, AAUs); potentially allowances under UNFCCC sectoral trading

For an accounting framework to facilitate meaningful international transfer of units, it must at the very least allow for *ex post* reporting of aggregate totals of units used. This would mean that an international true-up exercise would be feasible, should international stakeholders choose to do this. However, the complexity of unit movements means that a more rigorous accounting framework, that allows both *ex ante* visibility over possible maximum unit movements, and visible tracking of those movements using a central tracking system, is desirable.

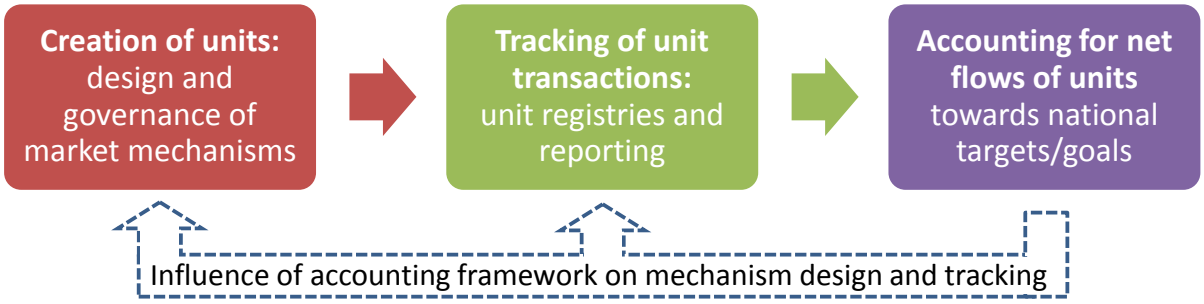
Here, the term "tradable emissions units" refers to any emissions units created with the intention of being transferable from one country to another, regardless of whether a specific market-oriented policy was used to provide incentive to private sector or other emitters to achieve emissions reductions. This is the definition generally recognised in the UNFCCC process (UNFCCC, 2012b).[6]

[6] An alternative definition would be that "market-based mechanism" only applies to the application of incentives based on market forces within countries, which would mean that transfers in emissions units would be possible between governments, not necessarily related to a market-based policy (e.g., an agreement to transfer a block of emissions units in return for general funding/ODA).

3.1 Building blocks for understanding international unit accounting

The overall "life-cycle" of emissions units can be divided into three distinct categories charting the life of a unit from creation (issuance) to use (surrender as part of an emissions target or goal), as depicted in Figure 4. It is when units are surrendered as counting directly towards a target that they become of interest to international accounting.

Figure 4: Distinguishing between different elements of unit accounting



Source: Authors

Creation of units covers the ensemble of design and governance processes that determine the quality of the emissions units created by market mechanisms, as well as the quantity of units generated for any particular mitigation action (as this depends on decisions on baselines or crediting thresholds).[7] Mechanisms relevant to international accounting could include a large number of different mechanism types, including trading systems and crediting mechanisms, and could be governed either by domestic bodies or through UNFCCC-created authorities, as for the KP mechanisms (Prag *et al.*, 2012). It is the design and governance processes that ensure units represent "real, permanent, additional and verified mitigation outcomes", and that baselines or reference levels used to set caps or calculate credits are credible and represent real emissions reductions.

Whilst crucial to the continued use of market mechanisms as a tool to increase the ambition and cost-effectiveness of emissions mitigation, these design and governance issues are covered elsewhere and are not the focus of this paper. If countries seek to use units arising from domestically-governed mechanisms to count towards targets under the UNFCCC, then the FVA could play an important role in ensuring full transparency of the domestic processes used, as well as potentially describing internationally-recognised standards for design elements. The procedures under the FVA could also require that Parties demonstrate that units are of comparable quality with other international units (see Prag *et al.*., 2012; CEPS, 2012; UNFCCC, 2012c).

Tracking of unit transactions includes the processes and systems necessary to track transactions and follow the ownership of emissions units as they change hands either domestically within a market mechanism, or internationally (including secondary trading between entities). This includes unit registries, tracking of units using unique serial numbers and transaction logs for recording and reporting transactions. Most domestically-governed trading systems are likely to employ such infrastructure in order to ensure that domestic regulators have good visibility of the compliance of covered entities (e.g. the EU ETS, and the California scheme that uses a Western Climate Initiative common transaction log). Important questions include whether such systems could also serve to report unit flows relevant to the UNFCCC, or whether an international transaction log is required. These are explored in Section 3.4.

[7] "Quality" of an emissions unit is difficult to define. It is often taken to mean that a unit has environmental integrity, though even this phrase can be interpreted in numerous ways (see discussion in Prag *et al.*, 2012). In many cases, it can be taken to mean that the unit represents a real emission reduction.

Accounting for net flows of units towards national targets or goals is perhaps the least explored of the three elements, in part because most experience to date has been through the KP flexible mechanisms, which are embedded in the KP "carbon budget" framework and only account for movements of emissions units between Parties with KP commitments. Furthermore, the nature of Parties' targets and goals to 2020 and beyond has only gradually become clearer through submissions and workshops under the UNFCCC (e.g., for the case of the US, see Pershing, 2012). Many countries have now stated an intention to use tradable emissions units either through the new market-based mechanism operating under the UNFCCC or the FVA. It is therefore important that the broader accounting framework can deliver the clarity needed to ensure that the continued use of market-based mechanisms is a cost-effective tool to stimulate real and on-going emissions reductions internationally.

The three categories shown in Figure 4 above are not, in reality, independent of one another (as shown by the feedback arrow). For example, decisions made on how units are accounted for within national targets/goals can influence the design of mechanisms to create units in the first place. One role of the FVA could be to define which units are deemed as valid for counting towards pledges put forward under the UNFCCC. In this case, decisions made through the FVA may depend on how transacting countries elect to account for units within their pledges. If a developing country with a BAU pledge states that units transferred out of the country will not have any impact on the reporting of its emissions position (i.e. the pledge does not account for unit flows), then the credibility of the units generated may be questioned internationally. Another example is that domestic tracking and registry systems might be designed to be compatible with any emerging requirements of an international accounting framework.

In order to deliver on the overall objectives of emissions accounting as described in Section 2, the accounting framework will need to ensure that units from market-based mechanisms, once issued and verified as high quality according to the "creation of units" element in Figure 4, are clearly accounted for. There are two important areas that an accounting framework should address. The first is double counting of emissions reductions, including "double claiming" of units as counting towards more than one country pledge and "double issuance" of two or more units for a single emission reduction (the same or different units types; see for example UNFCCC 2012b and VCS 2012). The second area is rationalising the impact that the period of application of pledges can have on the use of international units. These two areas are explored in the following sections.

3.2 Who is accountable? Addressing "double claiming"

Double claiming of units is a sub-category of double counting. Double claiming is currently not possible for Annex I Parties with KP commitments because any emissions unit transferred between the KP accounts of these Parties is automatically deducted from the seller's account, and added to the buyer's account, via the International Transaction Log (ITL). Emissions reduction credits arising from CDM projects are credited to the buyer account, but cannot be debited from the seller account because developing countries do not have emissions reduction targets under the KP. However, some developing countries which are Parties to the KP have stated emission reduction pledges under the Convention, and this means that there is a risk that emissions reductions from CDM projects might be double claimed between developed and developing countries.

One way to address double claiming would be to require that any if country has stated a quantified national emissions pledge, then any units generated in and exported from that country should be debited from the seller's "account" under the UNFCCC. There are both political and technical reasons why this approach could be challenging. Politically, all Parties participating in international unit flows would need to recognise that their emissions pledges will account for international flows of units. This is not straightforward as some developing country Party have stated that pledges are conditional on financial and

other support, and they consider that funding provided through the purchase of emissions units is part of that support.[8]

On the technical front, the diversity of pledge types described in Section 2 means that defining like-for-like accounting for emissions transfers is not easy, because of the difficulty of defining carbon budget approaches for some types of pledge. Also, the only unit accounts that exist currently for developing countries in the UNFCCC process are holding accounts in the CDM registry. These are not designed to hold carbon budget units and therefore not as a means to measure progress towards pledges.[9] A further issue concerns the "visibility" of credit emissions reductions with the national emission inventory, as in some cases inventory methodologies will not be of sufficient detail and granularity to pick up credited reductions, which could be problematic if exported units are accounted for (see Box 3).

Box 3: "Now you see me, now you don't": reconciling GHG unit flows with national emissions inventories

Most GHG market mechanisms employ quantification and monitoring methodologies that aim to measure emissions reductions to a high degree of accuracy. It would be logical to assume that the volume of reductions achieved, as recorded under the market mechanism, should be reflected by a commensurate decrease in the national emissions inventory of the country concerned, calculated according to IPCC guidelines.

The reality is less simple. GHG inventories are estimates of national emissions, compiled through estimations of emissions sources. Different source categories are estimated according to different methodologies, and with different levels of accuracy (tiers). The way that specific emissions reductions can be reconciled with national inventories therefore varies depending on sources, which can be grouped into three different cases:

i) In only a few specific sectors will it likely be possible to match specific interventions to particular reductions recorded in the emissions inventory – for example where there are only a few emissions sources in a particular category in a country, such as N_2O from nitric acid production.

ii) In other cases, whilst emissions reductions should have an impact on reducing the inventory, it will be very difficult to attribute particular interventions to particular reductions, even where the most stringent inventory tier is utilised. An example would be an intervention to reduce use of road transport fuel through modal switching. In the national inventory, road transport emissions are usually calculated through estimates of total fuel sold in the country, so all reductions should theoretically contribute to lower inventory emissions, even though the large and disparate dataset makes it very difficult to attribute particular reductions to particular interventions.

iii) The third example includes cases where emissions reductions arising from specific interventions will not have any impact at all on the emissions inventory estimate, because the estimation methodology for those emissions sources is not accurate enough to show project-based emissions. For example, cases where inventory emissions are estimated by multiplying a non-emissions variable (e.g. land area or number of livestock) by a standard emissions factor. In theory a country could choose to specifically invest in improving its inventory estimation methodology for a particular emissions category, in order that it will be of high enough resolution to "see" specific reductions from interventions. In reality this may be prohibitively costly for some countries.

These different cases can have implications where countries wish to reconcile flows of GHG units with changes in the national GHG inventory. The issue is not new. Several Annex I countries grappled with this problem during the first commitment period of the KP, such as New Zealand, where domestic JI projects would only be

[8] In reality this argument cuts both ways, as there is an on-going debate as to whether funds provided in return for usable carbon credits should count towards the goal of mobilising $100bn of climate finance to support the needs of developing countries. For an overview of this issue see Clapp et al, 2012

[9] They are temporary holding accounts for subsequent transfer of Certified Emission Reductions (CERs), which are CDM credits

considered for emissions sources that would be reflected in changes in the national emissions inventory; for example, energy and waste projects.[10]

To assess implications of inventory accuracy for unit accounting pre- and post-2020, it is important to distinguish between ETS allowance units and credit units. For **ETS units traded internationally between linked systems,** all covered sectors (and entities within those sectors) will be measuring and reporting total annual emissions based on the MRV requirements of the linked ETSs. In many cases, ETS sectors are likely to be those for which emissions can be accurately measured for the whole sector (such as electricity generation). Cumulatively, the reported data from each entity can be aggregated to form a picture for the whole sector, and changes in annual emissions reported to the ETS should represent changes in total inventory emissions at the national level in those sectors. In cases where a national ETS is broadened to sectors where total emissions are harder to reconcile it is likely that governments will have ensured that measurement in those sectors will align with accounting nationally (such as the NZ ETS including forestry on the basis that it follows KP accounting rules). Therefore, it is likely that if a net flow of ETS units crossing national borders is reported along with the national emissions inventory, this will give an accurate picture of total abatement.

Offsets or other credit units traded internationally and used to meet a national goal/target are likely to arise from diverse emissions sources in many different sectors. In some cases, emissions reductions documented by project-level or other methodologies stipulated by market mechanisms will not be reflected in the emissions inventory of the host country, as per the third case described above. When a buyer country retires those units as a contribution towards its national target or goal and reports the net unit flow, accounting logic would suggest that the host country should report a positive flow of the same quantity of units. However, some host governments may be concerned about being "short-changed" in cases where the credited reductions do not (or do not fully) appear as a commensurate reduction in the emissions inventory estimate.

The partial lack of visibility of reductions in emissions inventories underlines that reporting of unit flows should be maintained separately to inventory reporting, so that countries report their emissions inventory as well as additional information on net unit flows (rather than adjusting the inventory itself to account for unit movements). Furthermore, to maintain the environmental integrity of the international system, it will be important in general that unit flows are reported by both seller and buyer countries. For credited reductions falling under the second category above, the reductions should theoretically show up in the national inventory so the decision to report unit flows is purely a political one by the "seller" government – there is not technically any "short changing" if exported units are accounted for. However, for credited reductions in the third category, further information may be needed to decide how the sold credits should be reported to ensure a fair outcome for the seller country.

Overall, this issue of inventory visibility raises questions for future research regarding what incentives unit accounting rules might present for countries to improve their inventory processes for key categories, and ensuring that such rules are not a disincentive for developing countries to adopt targets and participate in market mechanisms.

It is therefore too simplistic to conclude that the only possible solution is a KP-style accounting framework, with all unit transfers being deducted from the seller-party account, even if this remains an ideal solution in theory. Nevertheless, it is important that double claiming between country pledges (geographic double counting) is minimised and made fully transparent, as it otherwise remains a serious danger to the credibility of both existing and new market mechanisms. One study estimated that global mitigation could be weakened by up to 1.6bn tCO_2 if all credits issued in developing countries were counted towards both developing and developed country pledges (Erickson and Lazarus, 2011).

If some Parties insist that their emissions reduction pledges do not account for net international unit flows, then this could present a risk of double claiming. UNFCCC reporting provisions could be developed to request that all Parties clearly stipulate whether they account for net unit flows within their pledges. This would allow "buyer" countries to make discretional choices about which other Parties they choose to enter

[10] The NZ JI programme states "*Projects must … result in a reduction in the total GHG emissions that will be reported by NZ in its GHG inventory."* http://www.mfe.govt.nz/issues/climate/policies-initiatives/projects/

unit transactions with, and could therefore exert some influence over how or whether other countries account for unit flows. This distinction would also provide the opportunity to build in a clear incentive for countries with quantified emissions mitigation pledges to move towards accounting for unit flows (e.g. through quantitative restriction on use of units generated in countries with pledges that do not account for unit transfers). Section 3.6 explores options for how this might be achieved.

3.3 What does the atmosphere see? Accounting for units against single-year targets

Emissions targets or pledges can be defined as a target emissions level for a single year, with no regard to emissions in years preceding or following the target year. Alternatively, they can be defined as covering emissions over a period leading up to the target year (see Section 2). The KP carbon budget approach is one way to achieve this sort of multiple-year target. However, targets that measure total (or average) emissions over a number of years can be defined without using a binding carbon budget. Such multiple-year targets can be desirable to enhance understanding of both how Parties are progressing and for ensuring robust accounting of unit movements.

Climate change is caused by the build-up of GHGs in the atmosphere over time. This build up is affected by the on-going emissions trajectories of countries, not their emissions or removal positions in any single year. Thus, the impact a country has on atmospheric GHG concentrations will be the accumulation of emissions over time, rather than emissions levels in a single year. Since emission levels can fluctuate significantly, a single year's emissions may not be representative.

Even if Parties do not engage in international trading of emissions units, then the choice of either a single or multiple year target can still be important for understanding the aggregate impact of Parties' pledges on global emissions. This is because unexpected and non-policy-related emissions fluctuations can occur in particular years, which may cause a target to be met in a particular year but not in the following or subsequent years. Such fluctuations can be caused by unexpected economic changes or other factors such as availability of hydro-electric power due to weather changes that cause a temporary drop (or rise) in emissions. Also, a government could decide that in order to meet a single year target, it will issue command-and-control regulation to decrease production of energy-intensive or other sectors during that year. In many cases emissions would revert towards their previous level in the year following the target year, which could be misrepresentative for understanding that country's contribution to global mitigation.

If Parties do engage in international trading of emissions units, then defining targets as applicable to a single year only can be particularly problematic for unit accounting. Emissions units, whether credits or trading system allowances, have "vintages" corresponding to the year that the emissions reductions actually occurred. For credits issued against a baseline, the vintage corresponds to the year in which the reduction occurred.[11] For a unit from a trading system, the vintage usually represents the year in which the allowance was issued. In most trading systems, allowances can be banked forward, so earlier vintages are fully fungible for later use (EU, 2003; RGGI, 2006).

Counting previous years' offsets can affect the integrity of a stated national pledge, depending on whether pledges are defined as a single-year or multiple-year basis. Box 4 demonstrates how the use of international units can have a different effect on the overall global mitigation stimulated by a pledge, depending on whether a pledge is defined for a single year target (e.g. 2030), for two single-year targets (e.g. 2025 and 2030) or continuous average/total emissions over a number of years. The same country, with the same assumed emissions trajectory, would purchase a greater number of units if the target is defined for more than one year (assuming that the environmental quality of the units is constant).

[11] For example, a CDM project implemented and registered in 2011 may produce credits of 2011, 2012 and 2013 vintage (and so on), with the credits distinguishable between years (and in this case, 2013 vintages are also distinguished as being credits from the second commitment period).

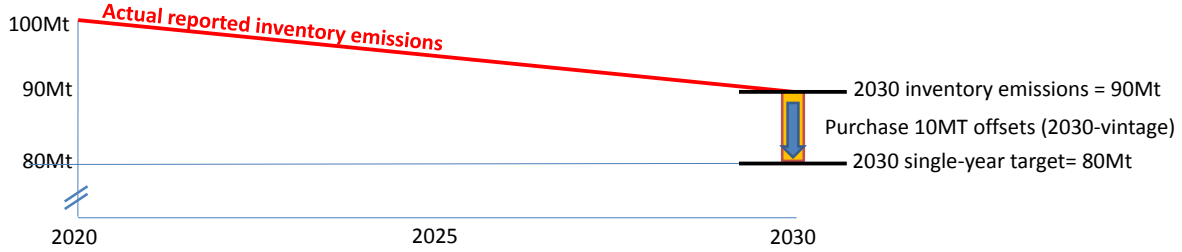
One robust principle for unit accounting under a new agreement should be that if countries wish to count tradable emissions units of multiple vintages towards their pledge then the pledge itself should also be expressed as a multiple-year target using an average (or total) emissions commitment over a time period (e.g. from the current year to the stated target year).[12] Under this principle, other factors such as base years could still be different according to national circumstances without impacting the integrity of the accounting framework (no need to standardise base-years to 1990, for example). If a country has a single-year target, it could still elect to use international units, but only those whose vintage corresponds to the single target year (see Box 4). Whilst this would maintain the overall integrity of international unit transfers, it could have a distorting effect on offset markets due to strong demand in one particular year.

Countries would therefore have an incentive to express their pledges as multiple-year targets, in order to make greater use of international market mechanisms. Such a principle would also be in the interest of maintaining comparability, and assessing progress towards goals of the Convention (*vis-à-vis* the various objectives for an accounting framework). Countries that do not count emissions units towards their target would of course be free to define a single-year point target, and report on progress towards that target via inventory emissions reporting.

Box 4: Use of international units in single-year and multiple-year targets

Consider a country with emissions in 2020 of 100Mt CO_2e, and a single-year target for 2030 of 80Mt CO_2e. Inventory emissions decline linearly, reaching 95Mt in 2025 and 90Mt in 2030. The country purchases and retires 10Mt of 2030-vintage offsets and reports that its 2030 target was achieved (Figure A). The total emissions impact of this trajectory relates to emissions across the entire time period, not just in the target year. Across the 11 years, inventory emissions less purchased offsets equal 1045Mt – 10Mt = 1035Mt.

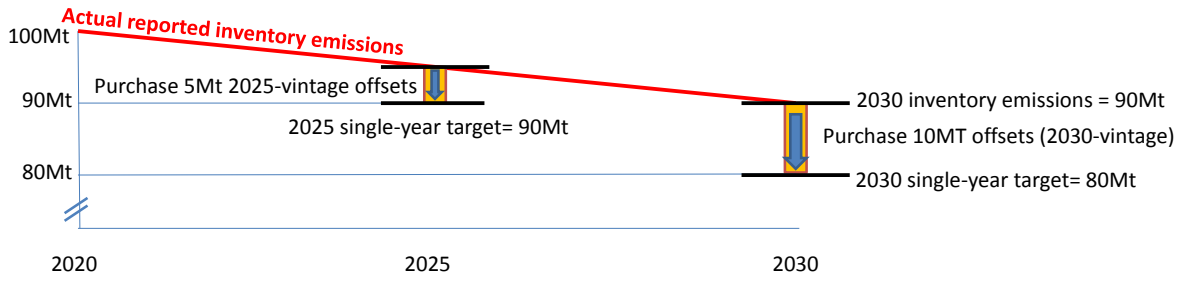
Figure A: Single year point target for 2030, achieved by purchasing 2030 offsets



If the same country also adopts an interim target of 90Mt in 2025 and purchases 5Mt of 2025-vintage offsets to achieve this interim target (Figure B), then the country has now bought 15Mt of units over 11 years. Total net emissions (including units) are 1045Mt-15Mt=1030Mt.

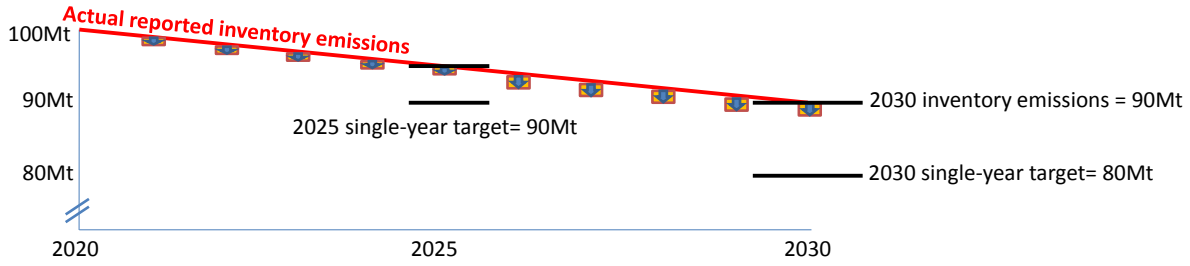
Figure B: Two single-year targets

[12] There could even be some entitlement to use vintages from before the start of the target period. Under the KP, the CDM had a fast-start facility, whereby projects could begin to generate valid credits from the year 2000, even though the KP target period did not begin until 2008. This was a particular case because i) at the time there were no existing international emissions commitments in either developing or developed countries, and so any early action to implement emission reduction technology was considered beneficial; and ii) the developed country targets for which CERs would later contribute were defined under the KP carbon budget approach.



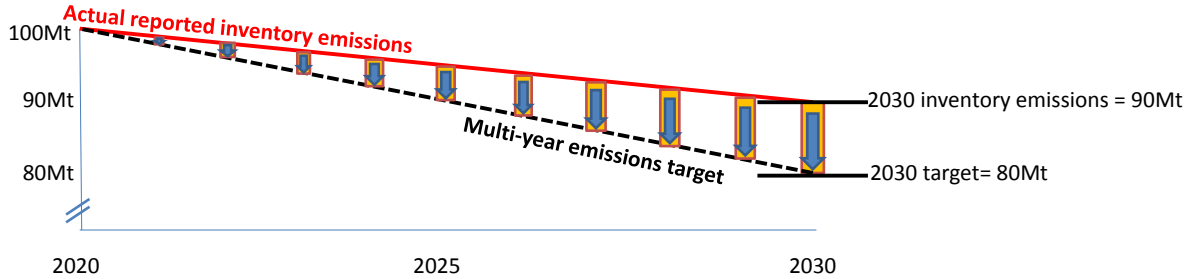
The situation is more complex if units of non-target-year vintages are allowed. For the same 2025 and 2030 single-year targets, if the country spreads unit purchases over time, on average it would need to purchase 1Mt per year 2021-2025, and 2Mt per year 2026-2030 (Figure C). Total net emissions are 1045Mt-15Mt=1030Mt. While this is the same net emissions as the case shown in Figure B, the logical link between emissions levels, units, and the target is lost. If the "spirit" of a single-year target is to show a snapshot of emissions in that single year, then it makes sense to restrict unit use to the single vintage-year (the situation is more complex where units are retired as part of on-going commitments under a domestic ETS – here some use of earlier vintages may be appropriate as discussed in Section 3.4.2).

Figure C: Single-year targets for 2025 and 2030, with annual purchases of emissions units



Finally, if the country adopts annual targets declining linearly to its 2030 goal of 80Mt (Figure D), this would require unit purchases every year. Net emissions (including units) in this case are 1045Mt-55Mt=990Mt.

Figure D: Multi-year target, with annual purchases of emissions units



These four cases show that for the same 2030 end point, total net emissions could be 1035Mt, 1030Mt or 990Mt depending on the frequency of target years chosen, and therefore the frequency (and total) of offsets purchased. This is a significant variance: approximately half of one year's emissions.

3.4 Following the units: accounting within different pledge types

This section considers what information would be needed from unit transactions in order to understand unit movements between different pledge types. The analysis first considers credits (units issued *ex post* for reduction against an agreed baseline), and then looks at cases concerning allowance units from linked emissions trading systems. Note that it is possible for some countries to have an ETS in place for some sectors, but have no quantified cap or target on other sectors. In such cases, the analysis below on ETS units is still relevant for the ETS sectors.

3.4.1 Units from crediting mechanisms

In general, credits will be easier to account for than ETS units because distinct "buyer" and "seller" countries can be identified for each type of transaction, which is not the case for units from mutually-linked ETSs.[13] This analysis assumes that the buyer country will accept to account for in-coming internationally-transferred credits as a contribution towards meeting its pledge, because if the opposite were true the country would be unlikely to have engaged in unit purchases in the first place. However, given the nature of pledges currently stated by major developing countries, the question of whether the seller country will account for unit flows when reporting its pledge position is less certain.

It is important to consider how flows of credits between different pledge types may be measured through existing reporting structures, and where these structures could be enhanced. Table 3 considers what information is needed to understand how flows of offset credits would impact overall global mitigation efforts in four distinct hypothetical cases. The four cases depend on i) whether the seller country accounts for unit flows within its pledge or not and ii) whether the buyer country has a single-year or multiple-year target. In cases where the seller accounts for unit flows, there is less risk of double claiming so *ex ante* information on expected unit flows is less important, assuming that all transacting Parties clearly declare unit flows *ex post*. However, in cases where the buyer has a single-year target, *ex ante* declaration of the maximum expected credit use would still be useful. In cases where the seller country does NOT account for unit flows, *ex ante* information is critical to understand in advance the extent of possible double claiming.

[13] "Type of transaction" refers here to the recognition by a government or regulator of a particular type of credit or offset. For example, if the regulator of a domestic ETS in country X states that a particular type of credit from country Y will be recognised in the ETS, then that type of credit is likely to only flow *from* entities in country Y (seller country) *to* entities in country X (buyer). This would not be the case for linked ETSs, where allowance units will flow in both directions.

Table 3: Transactions of offset credits within different pledge types: information needed to understand impact on aggregate abatement

	Buyer has multiple-year target	**Buyer has single-year target**
Seller accounts for net flows of units	***Ex ante* information required:** none essential as double claiming likely to be avoided. **Tracking / *ex post* reporting:** When international transaction occurs, seller counts deduction of unit sale in vintage year of issuance, and the buyer reports the same unit in the year that the credit is retired (i.e. when the buyer decides to count the unit towards its pledge). **Vintage restrictions:** Eligible vintages should be limited to years of buyer's continuous commitment (which can include a previous KP target), potentially with agreed additional "early action" allowance.	***Ex ante* information required:** Desirable for countries with single-year target to stipulate a supplementarity limit *ex ante*. A specified limit on the use of crediting units would allow better estimate of inventory emissions, and so *ex ante* understanding of how the target contributes to global mitigation.[14] **Tracking / *ex post* reporting:** same as for multiple-year target. **Vintage restrictions:** Important that there is a requirement for credits to be from the same vintage year as the year of commitment, otherwise difficult to understand meaning of buyer pledge, as described in Box 4.[14]
Seller does NOT account for net flows of units	***Ex ante* information required:** Essential to understand potential extent of double claiming. Buyer countries should **specify *ex ante* quantitative limit** on total purchase of credits from countries that do not account for units (**or** an internationally-agreed common limit). **Tracking/ *ex post* reporting:** both **buyers** and **sellers** need to report information**.** **Buyers** declare the totals of each unit type that they have retired and also report information on whether the seller is accounting for those same credits in its pledge. **Sellers** would need to report (i) net units ISSUED (on the assumption that units will be eventually retired) if they want these to be valid to meeting buyers' targets under UNFCCC and (ii) whether or not these units are excluded from their own national pledge (i.e. declare whether they are "accounting for" these particular units).[15] **Vintage restriction:** Limit vintages to period of continuous commitment (possible early action allowance).	***Ex ante* information required:** To understand the extent of double claiming, buyer countries should **specify *ex ante* quantitative limit** on total purchase of credits from countries that do not account for units (**or** an internationally-agreed common limit). In addition, it would be desirable for countries with a single-year target to stipulate a clear supplementarity limit for all use of units, as this would allow a better *ex ante* estimate of inventory emissions, and hence an *ex ante* understanding of the contribution of the target to global mitigation. **Tracking / *ex post* reporting:** same as for multiple-year target **Vintage restriction:** as above, to fully understand buyer pledge, vintages should be restricted to target year only.

[14] As described in Section 3.4.2, the situation is more complex where units are retired as part of on-going commitments under a domestic ETS. In this case there is less likely to be a mismatch in the quantity of credit units surrendered between the target year and non-target years, so quantity restrictions may not be necessary.

[15] In some specific cases there may be technical reasons for not declaring net export of units from certain emissions sources for which changes will not be noticed in the emissions inventory, as described in Box 3.

3.4.2 Allowance units from domestic emissions trading systems

This section analyses the impacts of international transfers of domestic ETS units on accounting for national pledges. Note that units from domestic ETS units will only be relevant to international accounting (for example under the UNFCCC), under certain conditions (see Box 5). If these conditions are not met then the ETS would be a purely domestic policy instrument reducing domestic inventory emissions, and its units are not relevant to international accounting.

Box 5: Do units issued under domestic systems matter for international accounting?

Allowance units from domestic ETSs become relevant to international accounting under two circumstances. The first is where there is an international transfer of ETS units out of the country, for example due to direct linking of the ETS with a system in another country, and that the government of the other country chooses to use those imported units as a direct contribution towards achievement of their national pledge. The second circumstance is that units from an ETS are counted as a future direct contribution toward the national goal or target of the country of origin, having been banked between trading periods.

The linking of ETSs is already occurring (for example EU ETS linking with Australia), and use of the traded allowances toward international targets is likely to occur once ETSs are fully linked. This is because at the end of a UNFCCC reporting period, there may have been a large net flow of ETS units from one of the linked systems to the other; the net flow of units between countries cannot be known precisely in advance (as it is the result of independent trading decisions by entities covered by the ETS). In this case the government of the importing country may have a significant and unexpected shortfall in progress towards meeting its national mitigation pledge, because each unit imported represents a tonne of emissions *not* reduced from the inventory in the destination country. There would therefore be a strong incentive for the government to seek to count the net total of imported ETS units as a direct contribution towards achieving the national pledge put forward under the UNFCCC (these units would be the total of those retired by covered entities during the pledge period). See also Prag *et al.*, 2011.

If one of the circumstances outlined in Box 5 occurs then it will be important to understand unit flows related to ETSs. Firstly, Parties with linked ETSs could declare in advance whether they are intending to count ETS units as a direct contribution to their pledge. In practice, however, it may be difficult for governments to know in advance whether the volume of international unit flows will be significant, given that the net aggregate flow of units between countries will depend on decisions taken by individual trading entities covered by the ETS. The government has control only over the upper limits allowed for international unit purchases (offsets as well as allowances from linked schemes), as these can be defined in the rules of the ETS.

This section considers the implications on international accounting for different permutations of linked ETSs, in similar format to the discussion on credits above. The first case considers ETSs that are linked between countries that both have multi-year national targets, and where both Parties account for unit flows towards those international targets. Suggestions are then made for "work-around" solutions in less simple situations, namely where one or both countries has a single-year target; and where one of the countries has a mitigation pledge but decides that this pledge does not account for international unit flows. Given the inherent two-way flow of allowance units in linked systems, the section refers to "Party A" and "Party B" rather than "buyer" and "seller".

ETS unit accounting where both Parties have multi-year targets

In the first case described (where both Parties with linked ETSs account for international unit flows and have multi-year national targets), it initially appears straightforward to understand the accounting implications if a Party decides to declare "imported" ETS units as being a direct contribution towards meeting its national target. The country with a net import would declare this total, and the other Party with a net export of units would be obliged to declare the same amount as a positive unit flow when reporting its

pledge position. Given that the actions of one Party are therefore dependent on another, an important part of the bilateral ETS linking agreement could be to stipulate whether ETS units will be counted towards either Party's UNFCCC target or not. The reporting itself could be based on outputs from either the domestic/bilateral registry system being used, or from an international transaction log if applicable.

However, the picture is likely to be more complex because a further characteristic of ETSs is that allowance units issued in different years can be swapped between entities and often, depending on the rules of the scheme, can be banked for use in future phases (e.g. EU, 2003; RGGI, 2006). Banking means that ETS units reported by a Party as counting directly towards achievement of its pledge may not correspond to an emission reduction in the same time period as the pledge. If these banked allowances are not accounted for, emissions in the current pledge period could be under- or over- stated. To take into account both international flows of allowance units and banking provisions, there are three distinct ways that countries could report flows of ETS units from linked systems, each of which could in theory lead to a robust international accounting framework:

1. **Report retirement of imported units, export of own allowances, and banking**. This system would require Parties with linked ETSs to report on the following unit totals when reporting to the UNFCCC: a) retired credits and allowances from overseas linked ETSs, b) net export of allowances from own ETS during the period, c) total of banked ETS allowances from the Party's own system at the end of the period, d) total retirement of previously-banked allowances from own ETS. Reporting could be made based on either domestic/bilateral registry systems or from an international transaction log.

2. **Report all issuances and retirement of domestic allowance units.** This gets around the banking issue by requiring reporting of all units created/issued AND retired under domestic ETSs where there is a stated intention to count units towards national targets. This would mirror the approach already taken at the national level under the KP (where allowance units are AAUs) and could also function with domestically-created units. It would be important that Parties agree to report on all issuance and retirement transactions from their bilaterally-linked registries, or that those registries were linked through an international transaction log. The use of common serial numbers could facilitate the reporting of issuance and retirement.

3. **Convert exported allowances into an international unit type.** When ETS units are purchased by an entity in a linked system in another country (and therefore exported), they would be converted to an "international unit". Countries would report a) units converted to international units (i.e. own ETS units exported for the first time), b) international units retired, c) own ETS units banked at the end of the period, d) retirement of previously-banked allowances from own ETS. If the ETS compliance period doesn't match the biennial reporting cycle then there won't be an exact match with the target in each biennial period, but this can be explained in the reporting. There are specific challenges associated with converting to international units, discussed in the next section.

Some ETSs are sub-national in scope and may be governed by sub-national laws that are not under full control of the national governments. All of the options considered here assume that the national government has full access to information concerning emissions units issued sub-nationally within the country. For national governments to adopt the options present here, they would need to be sure of having access to the relevant information.

Issues for ETS unit accounting if one Party has a single year target

If a Party has a single-year target, the same information on ETS unit flows would still need to be reported (biennially or otherwise), and the same three options listed above apply. This information is necessary to understand the global picture of where and when emissions are being reduced, to avoid double claiming and understand aggregate global effort. This information would help to build confidence internationally

that the Party is making progress towards its single-year target by demonstrating that ETS units are being retired continuously by covered entities, thereby building confidence that imported ETS units declared in the target year as counting towards the national pledge represent real abatement.

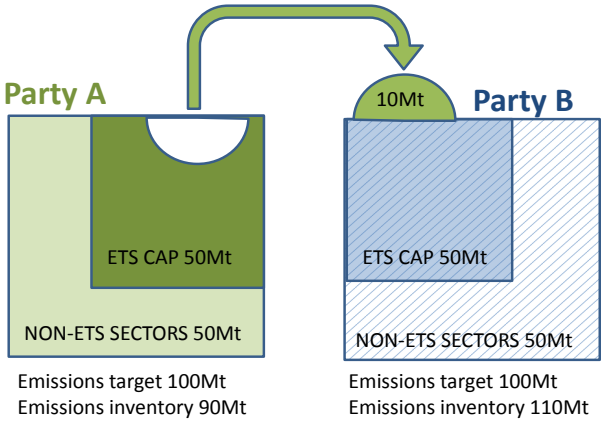
For a Party with a single-year target, unit retirements in the target year could be of multiple vintages. This would not pose the same accounting problem as credit units from multiple vintages, because retired ETS units would not represent "summing up" allowances from the non-target years, but are likely to be a reflection of on-going annual surrender by covered entities. Note that the same logic applies to CERs or other offset credits that have been purchased and surrendered by entities in the ETS. These will be of multiple vintages, but covered by the rules of the ETS and therefore considered part of the multiple-year target represented by the ETS, and therefore should not pose an international accounting problem.

Issues for ETS unit accounting if one Party does not account for unit flows

As with the discussion of credits above, if there is a net export of allowances from an ETS located in a country that does not account for international unit flows in its pledge, there is a significant risk of double claiming of abatement. In Figure 5 below, if Party B accounts for unit flows and Party A does not, Party A would report inventory emissions of 90Mt and Party B would report net emissions of 100Mt, and the apparent total of 190Mt would reflect double claiming of the transferred 10Mt.

On the other hand, if there is net import of allowances by the Party that is not accounting for unit flows within its pledge, then there is "zero counting" of the transferred units. In Figure 5, if Party A accounts for unit flows and Party B does not, Party A would report net emissions of 100Mt and Party B would report inventory emissions of 110Mt. The apparent total of 210Mt would actually overstate emissions by 10Mt. Party B would need to make a further 10Mt of emissions reductions to meet its 100Mt inventory target, a bonus for the atmosphere.

Figure 5: Transfer of units between ETS systems in two countries can affect pledge accounting



Source: Authors

If UNFCCC reporting provisions were to require both Parties A and B to report units issued, retired, exported and banked according to one of the three options discussed above, then any double claiming would be clearly identified on an *ex post* basis by analysis of reports submitted to UNFCCC. Analogous to the discussion of credits, if Parties wish to have increased *ex ante* confidence that the potential risk of double claiming will be minimised, this would entail further requirements. For example, a UNFCCC decision could explicitly make ineligible imported ETS units from countries that do not account for unit flows in their pledges. Alternatively, countries could decide unilaterally to avoid linking with an ETS in a country that does not account for international unit flows, or voluntarily impose limits on the volume of units allowed from ETS schemes in countries that do not account for units. A conservative calculation could then be made assuming this quantitative limit is met, allowing the maximum potential level of double claiming to be quantified *ex ante*.

3.5 Do we need a centralised transaction log and/or standardised international unit types?

The above analysis on accounting issues for credits and allowances raises two important questions about the systems necessary to ensure robust unit accounting in a non-KP world. The first is whether a standardised international unit type is necessary for any transaction of units that will subsequently be counted as a direct contribution to a country's pledge under the UNFCCC. The second is whether a central international transaction log is necessary, or if robust unit accounting can be obtained through reporting based on domestic or bilaterally-linked registry systems.

This section addresses both of these questions, by analysing options and assessing them against a number of properties that must be delivered for the international community to have confidence that the global mitigation effort is not weakened by counting towards national pledges units originating in domestically-generated systems. The properties include: (i) that the units issued are for credible emissions reductions (the first element in Figure 4, not covered in this paper); (ii) that not more than one unit is issued for a single emission reduction (avoiding double issuance); (iii) that units retired count towards only one country's pledge, or if not, that any double claiming is fully transparent; and (iv) that a unit cannot be resold or reused once it has been retired and used towards achievement of a pledge.

3.5.1 Conversion to a standardised international unit type

The KP is built around a set of standardised unit types: AAUs, RMUs and credits from the project-based mechanisms. All of these are issued through the ITL, with full visibility and accountability to regulatory bodies UNFCCC. Outside of the KP, the only units currently foreseen to be issued through UNFCCC bodies are those from the "new market-based mechanism". Given the discussion above on the relevance of domestic trading systems and domestically-created offset credits, it is very likely that units originating in domestic systems will be relevant under a new system. Although the FVA (or other UNFCCC-agreed process) could act to specify which units are "recognised" and which are not, there is not yet clarity on whether this recognition would entail subsequent "creation" of a new standardised international unit type through conversion of domestically-generated units that Parties wish to declare towards their total.

It is not clear whether requiring that domestic units are converted into international units would improve accountability based on the four properties listed at the start of this section. Although the purposes of the FVA are not yet decided, during negotiations in 2012 it became clear that if the FVA is to involve a UNFCCC body adjudicating on the validity of Parties' approaches, it is likely that this role would be a one-off "mechanism approval" role rather than case-by-case project assessment. Alternatively, some Parties see the purpose of the FVA as setting standards but without a direct governance role. In either case, the conversion of domestic units to an international unit would not aid in strengthening the integrity of the system.

Furthermore, it is important to consider the case whereby a crediting mechanism or domestic ETS recognised under the FVA undergoes a change (e.g. to its procedures, principles or domestic governance arrangement) that means it is no longer recognised under the UNFCCC. With an international unit approach, the consequence would presumably be to discontinue the conversion of domestic units to the international type. For crediting mechanisms, this would be straightforward; any credits issued after a certain date would no longer be converted. For a linked ETS, the situation is more complex. Due to trading of units between years within a period, as well as banking outside of the period, it would be difficult to know which units remain valid for conversion and which are not. A solution would be to discontinue all conversion of ETS allowances after a certain date, regardless of when they were issued. However, such a rule is likely to seriously affect the viability of ETSs linking in the first place; if linking was established on the understanding that a country can count a net import of units towards its pledge, any change in the authority to convert units may disrupt the linking arrangements.

In summary, a requirement for a standard international unit type is therefore not necessarily a useful feature of the FVA. What matters are the standards adopted for creation of units deemed to be eligible, and not the name or type of the unit itself. Therefore, for domestically-generated unit types to be declared as counting towards pledges without conversion to an international unit, the requirements for unit tracking, including registries and transaction logs, become very important.

3.5.2 Centralised transaction log

For tracking unit flows, an important question is whether the UNFCCC needs to maintain a centralised transaction log through which all units are transacted if they are to be subsequently counted as a contribution towards a national pledge. This requirement would mean that domestic registries are designed according to internationally-agreed specifications, and that any international linking of such registries would involve connection to the central log. Domestic registries would therefore essentially report all international unit transactions via the log (in real-time or with standard delays).

The existing ITL acts as a hub for national registries established under the KP (including the CDM registry). For each proposed transaction, the ITL carries out both technical checks (e.g. are the registries connected, and are transacting accounts active?), as well as policy-based checks to ensure that certain KP accounting rules are not infringed (see Prag *et al.*, 2011). The ITL also acts to assign unique serial numbers to all KP units, thereby facilitating tracking. Other domestic, sub-national or independent registries established for ETSs and for offset credits usually perform similar functions, based on individual system rules.

Parties choosing to account for unit movements when reporting their pledges would need to commit to transparently report the unit types and quantities counting towards their national target/goal. This would be an important prerequisite of the accounting framework. For developed countries, this is in line with the principles in biennial reporting guidelines (but is not yet specified for developing countries). This reporting of unit flows could be done, if appropriate, through outputs of domestic registries or tracking systems, which could be used to inform the relevant CTF tables. Countries reporting in this way would essentially be independent of any international tracking system, with international transparency depending on the reporting outputs of those domestic systems.

Given the complexity of different unit types, an international tracking system, similar to the existing ITL, would provide a single hub and a "real-time" tracking process for all unit types that Parties wish to count towards pledges. Parties could choose to connect their domestic registry system to the central system, through the use of standardised communication protocols and data exchange specifications (Prag *et al.* 2011). Advantages of a centralised log include: full and instantaneous reporting; internationally-developed specifications that may simplify registry development for Parties new to trading; better visibility of double issuance and double claiming; and the possibility to assign unique serial-numbers that could facilitate tracking of when units are declared as retired. Disadvantages include security concerns, in that some Parties may fear security breaches in a single common system for all linked mechanisms. The burden of needing to connect to the international system could be seen as a disincentive for Parties seeking to develop and link ETSs bilaterally.

An option to encourage development of an international tracking system without it necessarily being mandatory could be for Parties to agree common specifications for registries (and subsequent ITL-style link up) that are voluntary for Parties to adopt. In this way the tracking system would exist as an option for countries to connect to if they declare in advance that they are intending to retire internationally-traded units as valid towards pledges. If Parties not opting-in to this system still wish to declare domestically-generated units as a direct contribution towards meeting their pledge, they would need to provide equally comprehensive reporting of unit movements (through biennial reports, or through specific annual reporting requirements), based on outputs from domestic registries. This requirement may provide an incentive for countries to opt-in to the central tracking system, though a key challenge would be to develop a system allowing consistent assignment of unique serial numbers.

3.6 Options for tracking and accounting for unit flows

In terms of unit flows, an accounting framework needs to provide sufficient visibility on unit movements so that all stakeholders can clearly see which units are moving where, and what impact those movements will have on the overall global mitigation effort. The minimum required to deliver this aim is an accounting framework based on transparency and disclosure, so that stakeholders can understand what units movements have occurred *ex post*, and how those movements affect the positions of participating countries. Without even this, it would be difficult for Parties to be sure of the contribution that internationally-traded units would be making towards achievement of targets or goals stated under the UNFCCC. In addition, a robust accounting framework will also provide an accurate picture of the maximum extent of potential unit movements *ex ante* in order to give good visibility of what is expected to be achieved collectively through national emissions pledges. If some countries choose not to participate in the accounting framework – with pledges not accounting for net unit flows – then the extent of the risk of potential double claiming would be made clear by this system.

Three options are presented in Figure 6 and described below: option A is the most rigorous option and is aimed at understanding the potential impacts of unit movements *ex ante*, as well as *ex post* accounting of actual movements. Option C is the most flexible and aims at achieving transparency of unit movements *ex post* but without *ex ante* understanding of the possible impacts of unit movements. Option B is a middle option that incorporates some *ex ante* information provision but remains more flexible than option A. These options could be considered concurrently, with different countries taking on different approaches, or could be considered as a phased approach moving towards greater *ex ante* understanding over time.

OPTION A: If, in addition to understanding unit movements once they have happened, Parties wish to have a good level of *ex ante* clarity on how net unit flows are likely to impact the expected aggregate global mitigation expected from countries' pledges, then a number of rules would need to be adopted. These would include provisions that essentially prohibit any double claiming, prohibit use of offsets against single-year targets, and require tracking of international flows of allowance units from linked ETSs, to avoid the discrepancies described in Section 3.4. A centralised tracking system, applicable to any Party wanting to declare domestically-generated units as retired towards their pledge, would facilitate these aims. This option would provide good clarity on the contribution of units towards the aggregate expected outcome of mitigation pledges *ex ante*, but would require national targets/goals to be put forward in a common format that allows for accounting of international flows of emissions units.

Under this option, rules to prohibit double claiming would place an increased onus on countries expecting a net outflow of units. In the case of crediting mechanisms, this would mean that countries selling units would be required to account for the exported units (reporting a positive unit flow in the vintage year of the credit), if they wish those units to be recognised as valid to be retired as a contribution to another country's pledge.[16] This requirement may result in some developing countries changing the headline numbers of their national pledges to deduct exported units, and so might not directly lead to increased ambition. In the case of linked domestic ETSs, given the likelihood that units will be retired as counting towards national pledges, this option would require tracking and reporting of units according to one of the three options in Section 3.4.2. Under option A, countries with single-year target/goals would report these only on an inventory basis, without any use of offset credits or linked ETS units allowed. This would allow easier *ex ante* estimation of the likely emissions path, and greater (though still not complete) confidence that aggregate effort would be consistent with the stated mitigation pledges.

OPTION B: If Parties only wish to have a moderate degree of *ex ante* clarity on the potential impact of unit movements on aggregate pledges, then some restrictions on double claiming and use of units for single-year targets would still be required. This option preserves countries' ability to choose their own type of pledge, adding only sufficient constraints to get a reasonable *ex ante* estimate of aggregate abatement.

[16] There may be some cases where net export of units from certain emissions sources is not reported for technical reasons to do with the level of detail of the emissions inventory; see Box 3

For example, countries buying units for use towards their national targets/goals could specify in advance a quantitative limit for purchase of offsets from countries that have not opted to account for unit out-flows. *Ex ante* calculations of aggregate global abatement would then be able to deduct any double claiming (using a conservative estimate based on maximum offset use). These quantitative limits would act to a strong reputational incentive for countries to avoid double claiming, and could also affect negotiating positions on access to finance and other issues.

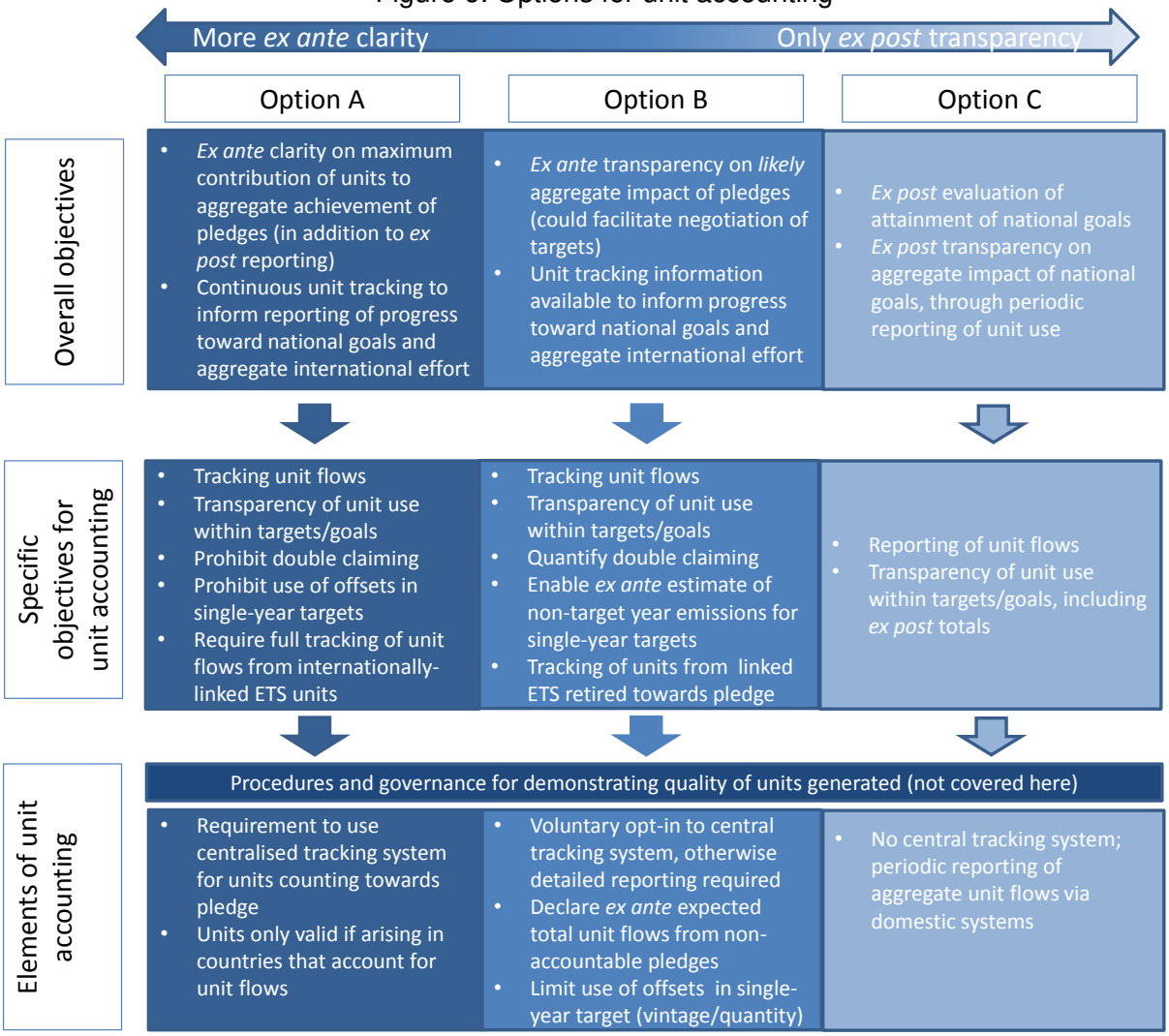
Under this option, countries with single-year targets would be required to restrict use of international offsets to those from the same vintage-year as the target (to respect the nature of these pledges as a "snapshot" of emissions and abatement in that calendar year). However, to estimate *ex ante* whether the aggregate impact is consistent with 2°C still requires an estimate of emissions in the non-target years. This estimate could be improved if countries were to specify a quantitative limit on offset use in the target year: again making the conservative assumption of full offset use, this would allow emissions in the target year (and the emissions trajectory over time) to be better estimated in advance, based on the assumed future use of units. [17]

Option B could include a centralised tracking system, but with countries voluntarily opting-in to the system (by adopting necessary registry standards, and agreeing to make all international unit movements available). Countries not opting-in to this system, but who still wish to retire units as counting directly towards their pledge, would be required to justify the unit use with detailed reporting.

OPTION C: Finally, in a pure transparency approach, countries would be required to report the use of offset credits (including information on vintage years) and use of imported ETS units when they report on delivery of their pledge. *Ex post*, this information would allow the aggregate impact of the national goals to be calculated, but it would be more difficult to have a good estimate of likely abatement *ex ante*. This is because the quantity of double claiming of offsets would be unknown ex-ante, and if countries with single-year targets use a significant quantity of offsets to comply in the target year, inventory emissions in the non-target years would also be significantly higher than anticipated. The problem is that "what the atmosphere sees" is the total quantity across all years, not just the emissions level in the target year. This approach relies more on reviewing pledges based on the *ex post* evaluations, rather than on *ex ante* estimation.

[17] The situation is more complex where units are retired as part of on-going commitments under a domestic ETS. In this case there is less likely to be a mismatch in the quantity of credit units surrendered between the target year and non-target years, so these vintage or total quantity restrictions may not be necessary in order to understand the impact of the pledge/target ex-ante (see Section 3.4.2).

Figure 6: Options for unit accounting



Source: Authors

4. Accounting for land-use sources and sinks under a new agreement

As emerging economies and developing nations increasingly take on mitigation commitments, the environmental, social and economic contexts under which activities in the land-use and forestry sectors take place will be increasingly diverse. Environmental, social and economic considerations, such as issues of land tenure, indigenous peoples' rights or economic development priorities are likely to be much more prominent. Also, the diversity of environmental, social and economic contexts is further mirrored in the diversity of agricultural and forestry systems involved, for which the availability of relevant data such as emission factors or activity data may be poorer.

Furthermore, accounting for commitments in this sector is likely to be of increasing importance in future as some of the developing countries that have made pledges under the UNFCCC feature land-use emissions as a major component of their emissions profile. This sector may therefore represent a cost-effective aspect of their mitigation actions (for example, Brazil and Indonesia have actions on reducing deforestation). Therefore, as more emerging countries take on commitments, the preservation of forests in particular from deforestation and degradation will take on an increasing role in assisting global mitigation efforts towards a trajectory consistent with the global goal of 2ºC.

In many cases these developing countries will be characterised by far less technical capacity and expertise in monitoring, measuring, reporting and verification of carbon flows than that available in Annex I countries (though there may be exceptions, such as Brazil). Any MRV system suitable to developing countries will need to be adaptable to such situations.

To build on existing experience, the accounting framework for the land-use sector can draw on three separate political-technical processes: the IPCC process on establishing guidelines for national inventory estimates; the Kyoto Protocol accounting framework and related supplemental inventory guidelines; and the discussions on reduced emissions from deforestation and forest degradation and enhanced forest management (REDD+) in the context of the post-2020 UNFCCC regime.

This chapter mostly refers to LULUCF rather than the term used in the IPCC 2006 guidelines, AFOLU (Agriculture, Forestry and Other Land-Use). The inclusion of agriculture into the inventory guidelines reflects the increasing interest in mitigation in this sector. To date however, the KP LULUCF approach has largely excluded agriculture, apart from very specific activities leading to changes in carbon stocks in croplands and grasslands. Nevertheless, it is expected that agriculture-related activities will need to be part of the policy mix in the future, especially in light of the increased participation in the mitigation regime of countries with large agricultural sectors, and the important linkage between forestry and agriculture.

4.1 Starting from principles

The fundamental principles for reporting in the land-use sector under a new agreement are analogous to the principles established by the IPCC 2006 guidelines on emissions inventories. These include: transparency; accuracy; consistency; completeness in coverage of all significant sources of emissions and sinks as determined by the UNFCCC; and providing comparability among Parties.

Similarly, principles for an accounting system can be derived from these principles of reporting. The difficulty in understanding and addressing the drivers of land-use change, including complex socio-political factors in many countries, means that another principle could be added to a future accounting framework: **to provide the right incentives for sustainable management of land resources, and to encourage increased participation in a future climate regime**. This additional principle relates the role of the accounting framework not only to the passive assessment of progress towards emissions pledges but indeed to the stimulus of actions required to address climate change, in particular if leading to the potential creation of an asset class. This last potential role of an accounting system is particularly crucial in the land-use sector: the predominance of a carbon pricing signal may in many cases clash with other policy goals or

lead to perverse incentives, even from a climate mitigation perspective (e.g. controversy over the role of bioenergy and associated crops).

4.2 Basic concepts in land-use sector reporting and accounting

"Anthropogeneicity"

The main specificity of this sector as compared to emissions from other sectors relates to the issue of "anthropogeneicity". Whereas in sectors such as energy or transportation emission levels are in most cases clearly dictated by human activity, emissions and removals from lands are subject to a variety of natural factors and are only to a limited extent attributable to human interference. An important issue is therefore how to ascertain whether a particular emission/removal was derived from human activity.[18] The IPCC inventory guidelines address the anthropogeneicity issue through the use of a "managed land proxy": if a land area is deemed to have significant human interference through land-use practices, it is classed as "managed" and emissions/removals arising from its use are to be reported. Whilst the IPCC guidelines suggest that reporting on "non-managed lands" as well should be considered good practice, it is often not technically feasible to measure the full carbon cycle on all lands.

Land-based versus activity-based accounting

The two main approaches developed for reporting and accounting emission and removals from managed lands are as follows:

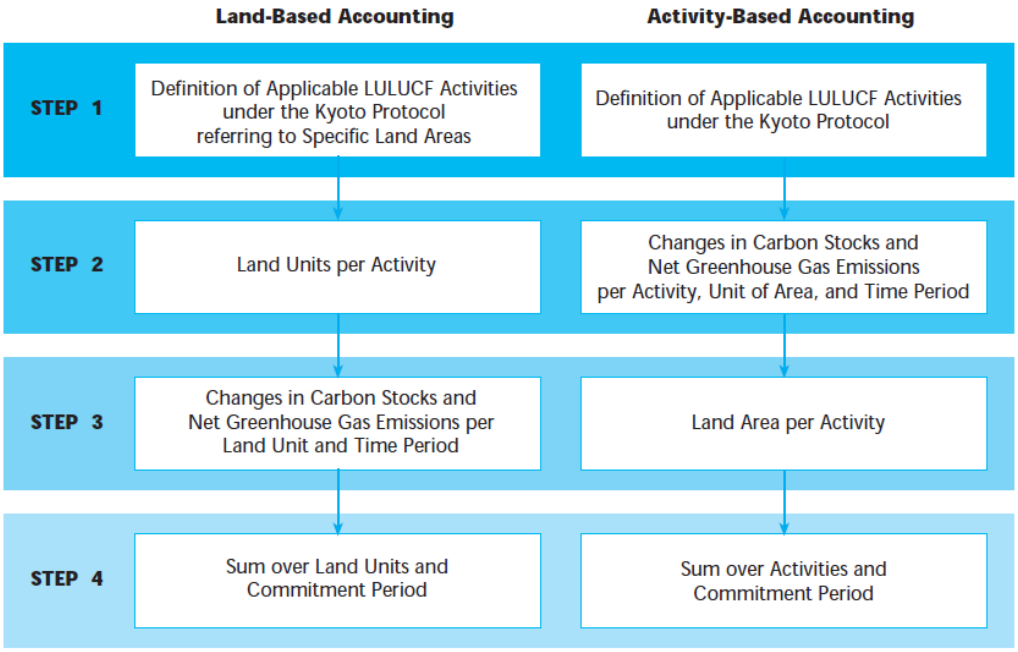
- Under a "land-based" approach, managed lands are classified according to the IPCC land classification system (forests, wetlands, grasslands, croplands, settlements and other lands). For each type of land and for each land conversion (change from one category to another) default methodologies and protocols for emission estimates are provided by the IPCC.

- Under an "activity-based" approach, lands are classified according to the predominant activity exercised on the particular land unit, with hierarchy applied where various activities may coexist on the same unit. Activities include forest management, cropland management, grazing land management, afforestation, reforestation, deforestation and wetland drainage and rewetting. For each activity, default emission/removal factors are calculated and multiplied by the area.

Much discussion has ensued over the relative merits of "land-based" over "activity-based" systems (e.g. Cowie *et al.*, 2007). If the ideal of carbon accounting is taken to be accounting for all relevant human-induced net emissions/removals, either approach could at least in theory realise that goal; Figure 7 shows that in essence the issue is simply one of stratification. Both approaches are vulnerable to exclusion of either land areas or activity types.

[18] It could be argued that non-human events influence emissions in other sectors, such as impact of heatwaves on air conditioning use. These are not considered here as they are likely to be secondary to human influence

Figure 7: Land-based versus activity-based accounting



Source: IPCC (2000) special Report on LULUCF

Net-net, gross-net and baseline accounting

Another major accounting issue unique to the land-use sector is the need to factor out the relationship between the long time-scales in most forestry-related activities and the provision of correct incentives to sustainable forest management and land-use change. The forestry industry has long lead times between plantation and harvesting, and the typical carbon sequestration curve through the growth cycle of forests is also long. Therefore emissions and removals in any one year may reflect decisions taken years before and be unrelated to the particular mitigation goal and current pledge period. This creates what could be construed as a perverse incentive for Parties to adjust the accounting cycle to the growth cycle of forests and get credit for the BaU natural cycle of forests. It can however be counter-argued that rewarding such legacy is in fact recognition for "early action".

At least three accounting methodologies can be found in the literature and in Parties' submissions (see Table 4 for explanation of concepts, pros and cons). Gross-net and net-net approaches are both used in KP accounting, for different activities. Further, baseline accounting based on forward-looking projections has been brought into the KP for the second commitment period, in relation to forest management.

Table 4: AFOLU Accounting methodologies (non-exhaustive list)

	Pros	Cons
Net-net: Compares the net emissions (emissions minus removals) in the accounting period with net emissions from a historical base year or period.	- Creates a signal for mitigation relative to historical emissions - Consistent with mitigation goals based on historical base years or periods - Consistent with the treatment of other sectors	- Long-term trends in non-anthropogenic emissions may obscure impacts of anthropogenic mitigation and may result in perversities in accounting - Requires historical data
Gross-net: Net emissions over the accounting period, not compared to a historical base year or period	- Accountable net emissions are "what the atmosphere sees" - Relatively easy to calculate	- Credits may be earned for the simple existence of C stocks - Depending on the size of the sink, accounting in the land-use sector could overwhelm the mitigation goal
Forward looking baseline: Compares net emissions in the accounting period with an *ex ante* estimation of net business-as-usual emissions for the same period.	- Removes anticipated non-anthropogenic emissions and removals from accounting - Creates a strong marginal signal for changes in land-use management that reduce emissions relative to BaU - Maximizes the likelihood that accountable emissions reductions or increases in removals are additional to those expected with a BaU scenario.	- Highly complex and data-intensive to calculate - High uncertainty and variability in land-use sector emissions and removals may lead to baselines that are not accurate representations of BaU, resulting in undeserved credits or debits

Source: adapted from WRI (forthcoming)

4.3 One approach to accounting: the development of land-use reporting under the Convention

The UNFCCC established in its Article 4 the commitment by all Parties to report on "emissions by sources and removals by sinks" which implied therefore from the outset that national inventory guidelines under the UNFCCC would necessarily deal with emissions and removals from agriculture, forestry and other sectors. Box 6 provides a brief overview of the history of land-use sector reporting under the Convention, highlighting the complexity of the issue.

Some essential principles underpin AFOLU reporting. Reporting guidelines aimed to be comprehensive, i.e. covering all land-use change and forestry-related emissions and removals. As a consequence of this comprehensive approach, and the complex interactions of natural and human influences within each source category and their lagged effects over time, land-based Convention reporting includes many emissions which are effectively very difficult, or impossible, to control through mitigation policies or measures. Calls for comprehensive land-based reporting to form the basis for future accounting should therefore be considered in light of both the capacity of countries to implement such accounting frameworks, as well as the practical mitigation value of doing so, given that most reported emissions sources will be immaterial and beyond effective policy influence.

The IPCC guidelines assume that changes in carbon stocks are an acceptable measure of carbon flows. In national inventories, managed lands are classified into different categories, and conversions of land from one category to another are assessed. Emissions and removals are estimated by taking sizes of areas converted or remaining in each category over time and multiplying such areas by default factors or country specific factors, if available.

The later guidelines define six categories of land (IPCC, 2006): forests, cropland, grassland, wetlands, settlements and other land. Each land-use category is further subdivided into land remaining in that category (e.g., forest land *remaining* forest land) and land converted from one category to another (e.g., forest land *converted to* cropland). Parties may choose to further stratify land in each category according to climatic or other ecological regions, depending on the choice of the method and its requirements. GHG emissions and removals determined for each specific land-use include CO_2 from living biomass, dead organic matter and soils (as carbon stock changes), non-CO_2 emissions from biomass burning and, depending on the land-use category, emissions caused by some practices, such as fertilisation, drainage, etc.

Box 6 History of IPCC Reporting on LULUCF

The IPCC developed its Guidelines for National Greenhouse Gas Inventories in 1995 to enable all Parties to estimate national inventories of anthropogenic emissions. After minor revisions these guidelines became the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, which were incorporated into the UNFCCC and KP (Article 5.2). Under these guidelines, Parties were requested to report on Agriculture and Land Use Change and Forestry. Additional specific guidelines on supplementary information related to the KP were then added.

The specific treatment of the LULUCF sector under Kyoto led to the need for consideration on how activities under Articles 3.3 and 3.4 (KP articles dealing with the inclusion and treatment of LULUCF in the overall mitigation commitments of Parties) would be reported. In response to a request from Parties, the IPCC published a Special Report on LULUCF in 2000 and looked at issues regarding implementation of these KP articles, including recommendations on KP reporting guidelines. In 2001, upon the adoption of the Marrakesh Accords, the IPCC was invited to provide Good Practice Guidance for LULUCF, finalised in 2003. Finally, the original inventory guidelines were substantially revised in 2006, including a new chapter on AFOLU that does not include guidance on KP reporting for LULUCF activities. The main consequence of the change from LULUCF to AFOLU has been that former chapters 4 (agriculture) and 5 (LULUCF) have been merged, in order to avoid potential double counting and gaps, and to improve consistency across Parties.

In Durban, the UNFCCC COP requested the IPCC to revise the good practice guidance for supplementary information of LULUCF activities under the KP, to incorporate any necessary change resulting from the adoption of the 2CP. It is expected that this supplementary guidance will be adopted in 2013.

Reporting guidelines under the UNFCCC do not *per se* constitute an accounting framework. The reporting guidelines are based on scientific sound methodologies provided by the IPCC, while accounting is based on negotiations by Parties. In order to build on the land-based approach of the inventory to develop an accounting framework for any future commitments, choices are required on issues such as commitment type, baselines and base year. However, compatibility of any accounting framework to the classification and methodology under which emissions and removals are reported in this sector will facilitate convergence and comparability.

4.4 A second approach: LULUCF accounting rules under the Kyoto Protocol

KP reporting and accounting rules are markedly different from the Convention approach. Departing from a land-based approach, and in line with the broader KP unit accounting framework, Parties with KP commitments can generate credits from LULUCF removals, and have to cancel units for debits (emissions) based on a distinct set of choices and a limited range of activities. The KP approach aims to provide incentives for action in relation to different types of activities, as defined in its Articles 3.3 and 3.4. Therefore not all emissions or removals covered by the IPCC "managed lands" concept are recognised under the KP activity-based approach. Furthermore, for specific negotiating reasons and in order to address identified perverse incentives, several exceptions and particularities of the accounting rules were devised. A simplified overview of the activities and rules is provided in Table 5, including evolution of accounting rules from the first to the second commitment period.

Table 5: Activity-based accounting rules for Annex I Parties with KP commitments (non-exhaustive list).

<table>
<tr><th></th><th>First CP rules</th><th>Second CP rules</th></tr>
<tr><td>Afforestation</td><td rowspan="3">Mandatory.
Based on “gross-net”</td><td rowspan="6">No change</td></tr>
<tr><td>Reforestation</td></tr>
<tr><td>Deforestation</td></tr>
<tr><td>Grassland management</td><td rowspan="3">Voluntary. Net-net accounting</td></tr>
<tr><td>Revegetation</td></tr>
<tr><td>Cropland management</td></tr>
<tr><td>Forest management</td><td>Voluntary. Gross-net accounting, with absolute cap on credits and debits</td><td>Mandatory. Forest management reference levels, with new cap on credits related to base-year emissions</td></tr>
<tr><td>Wetland drainage and rewetting</td><td>Not included</td><td>Voluntary. Net-net accounting</td></tr>
<tr><td>Harvested wood products</td><td>Not included</td><td>Mandatory, (use of specific methodologies); included under the FM cap.</td></tr>
</table>

There are four notable features of this approach. The first is that the approach leaves out potential emissions and removals from activities not considered under either Article 3.3 or 3.4. These are reputed to be small, as the accounting system has targeted the most significantly reported sources in Annex I countries, and those activities likely to be generating the largest changes in carbon stocks. Secondly, it provides for an opt-in of additional activities, thus providing flexibility, albeit at the cost of less than perfect comparability between Parties with different coverage of activities. Thirdly, the need to accommodate a reference year of 1990 as a base year for Article 3.3. (the so-called “gross-net approach”) resulted in a different approach to that used for optional Article 3.4 activities, in which the reference approach is “net-net” (i.e. comparing changes in the commitment period with changes in the reference year). Fourthly, the rules imply that countries might need to carefully avoid double counting of emissions or removals resulting from the same land areas being covered by different activities under Articles 3.3 and 3.4. The Marrakesh Accords give primacy to Article 3.3 whenever that occurs.

In addition, an odd effect of the definition of “forest” assumed under the Marrakech rules[19] based on minimum threshold of vegetation cover is that all action that would increase vegetation cover but not cross the threshold into “forests” is listed under “revegetation” rather than afforestation. The different treatment of afforestation/reforestation (gross-net accounting) and revegetation (net-net accounting) creates a discontinuity in accounting when crossing the threshold between non-forest and forest land.

Rule changes for the second commitment period

There were major changes to the rules for the KP second commitment period. These were negotiated in parallel to agreeing targets in order to avoid the experience of the first period where accounting rules were negotiated after having agreed headline reduction targets, with potentially significant impact on the effort required to meet targets. The revisions were also informed by the experience in the actual implementation of the earlier rules.

[19] “Forest” is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest

Potentially the most important and structural rule change was the decision to make accounting for forest management mandatory. In deciding between "net-net" and "gross-net" approaches, Parties came to a compromise around a flexible notion of "forest management reference levels" (FMRL) – a generalised approach that encompasses both forward looking projections, extrapolation, and averaging.[20] FMRL use different, country specific approaches to adapt historical baselines and trend progressions to expected developments in forest management for each Annex I Party. The process of arriving at such indicators involved Party submissions and a centralised expert review team coordinated by the UNFCCC Secretariat. The process was intended to be transparent in identifying key assumptions and modelling parameters used. As such, the FRML have the potential to be more adaptable to particular country circumstances. They have also the potential to address the issue of "additionality" present in the earlier rules, i.e. the notion that Parties may receive credits for essentially "business as usual" emissions/removals (Grassi, 2012).

The use of FMRL is not however without issues. The technical complexities involved in providing meaningful reference levels given the uncertainty involved in economic driver analysis may make international agreement on levels difficult. In addition, the link between projected reference levels and general macroeconomic activity may result in unforeseen deviations, in a similar fashion to perceived over-allocation issues in emission trading systems in time of reduced economic activity. Finally, forest management credits are capped at 3.5% of base year emissions per annum. For critics of the lack of incentives for forest management in the first commitment period, this cap is considered likely to provide on-going incentives for forest management (Grassi, 2012: Ellison, 2012).

Overall, FMRL provide a more generalised and flexible framework than either gross-net or net-net accounting. Perhaps more significantly, they also provide an important common point of overlap with REDD+, and more generally, provide a potential solution for how to create accounting incentives for other sectors and activities, where a gross-net or net-net approach may be inappropriate.

Another change from first to second commitment period is the addition of "wetland drainage and rewetting" to the basket of voluntary activities in Article 3.4 to be reported under "net-net" provisions. Also, a further change involved the establishment of "natural disturbances" provisions to accommodate potential large and unexpected deviations from trends in forest management due to events or circumstances beyond the control of Parties. These could include *force majeure* events, such as wildlife fires or pests. In the event of large deviations from the baseline trend, Parties may exclude emission from forest management and afforestation/reforestation above certain "background" level, (plus a margin where needed). Finally, harvested wood products are now also included in the accounting system, with Parties either choosing "instantaneous oxidation" (the previous reporting rule), a new "production" methodology with default half-lives and decay functions for a variety of wood products, and the possibility to develop country-specific half-lives.

4.4.1 Conclusion on the evolution of the Kyoto accounting approach

The overall result of the recent evolution would indicate that the Kyoto system is firmly rooted in the activity-based system and will not move towards an "all land" reporting as proposed by many (e.g. Cowie *et al.*., 2007; Wetlands, 2010). However, the increased coverage of the Kyoto provisions, in particular

[20] The negotiating process under the AWG KP led to the development of technical proposals for FRML for 40 KP Parties and the European Union. These followed different methods:

- BAU Projections (32 countries + EU: (Most EU Member States, Australia, Canada, Croatia, Iceland, NZ, Switzerland, Ukraine)
- FMRL equal to LULUCF emissions and removals in 1990 (RU, NO, Belarus) (akin to net-net approach)
- Extrapolation: some smaller EU member states
- FMRL set at zero (Japan) (akin to gross-net approach)
- FMRL set at the average of the period 1990-2009

through the more flexible and comprehensive approach to forest management, and the end of the compensation for countries for which afforestation, reforestation and deforestation result in net emissions and other quirks in the accounting rules result in an improved and clearer system.

The Kyoto Protocol LULUCF accounting approach includes elements to be considered in devising a new regime. The activity-based approach lends itself better to the establishment and measurement of impacts of policies and measures. The opt-in approach reflected in the mandatory vs. voluntary nature of Article 3.3, and forest management versus other Article 3.4 activities may be appropriate in developing an accounting system for a much more varied set of national circumstances.

It is unlikely that the KP approach can be taken wholesale into a new regime applicable to developed and developing country situations, especially given capacity constraints and the focus on other land-use management priorities. Nevertheless, the recent developments show that it is an adaptive framework and may serve as a reference point for future accounting frameworks, in its range of flexibilities and overall approach, in particular in light of recent developments related to use of reference levels. Since Durban, Parties have engaged on a further work programme on a more comprehensive accounting system for LULUCF.

4.5 Experience with AFOLU accounting in developing countries

To date, experience with land-use accounting in developing countries has been mostly limited to generation of offsets, primarily through CDM. Forestry-based offsets present particular accounting problems, because of the “anthropogeneicity” issue and because the permanence of emission reductions is always at risk from either natural disturbances or deforestation.

4.5.1 Forestry projects in the CDM

The only land-based projects allowed in CDM are afforestation and reforestation activities, and these projects are issued with non-permanent units, designed to specifically address the risk of non-permanence of carbon sequestration in projects. These temporary (tCER) and long-term CERs (lCERs) were adopted because agreement was not reached on other solutions such as insurance buffers or discounts, or other risk-pooling measures.

From an accounting perspective, the fact that CDM forestry credits are temporary whereas Annex I LULUCF credits are permanent suggests that the Annex I/Non-annex I divide is replicated in a different treatment of afforestation and reforestation. While these CDM credits may be added to national Annex I totals for compliance with KP targets, they carry with them a liability that is carried forward into future commitment periods. This implies an assumption of risk that most Annex I Parties have chosen not to carry, and has translated into the decision not to allow these unit types into most emission trading systems to date, notably the EU ETS (EU, 2004). It has also implied that deforestation in developing countries is not addressed in any way by the Kyoto framework, despite being one of the major sources of emissions worldwide. This lacuna is what negotiations on REDD+ aim to fill (next section).

In the meantime, other offset protocols such as the Verified Carbon Standard and American Carbon Registry have been successful in including land-use sector operations, including experimenting with the development of REDD methodologies through the use of buffer accounts. However, these methodologies have had to grapple with the issue of leakage, usually through recourse to nationally- or regionally-defined reference levels and with constraints to the governance systems under which projects can be developed. Such "nested approaches", whereby a national or regional authority provides the backbone of a national reference level and a suitable liability coverage and governance system, may yet find their way into the official negotiations.

4.5.2 REDD+ and its implications for accounting

Addressing deforestation has been prominent in negotiations since 2007 and is particularly important given the potential contribution to mitigating climate change. While the role and scale of the endeavour are not disputed, there is much less agreement between Parties on modalities to address deforestation. In particular in the initial years, concerns were expressed by Parties in relation to the potential moral hazard of rewarding actions to address deforestation if these implied an implicit payment for inaction, i.e. for leaving forests standing. From the Convention perspective, this resulted in the need to find approaches to deal with deforestation that addressed the drivers of deforestation and decoupled any payments on performance from direct reward of conservation activities *per se*. From an accounting perspective, this led to approaches that focused on how best to address leakage and attribution issues. The discussion has centred on the use of forward-looking baselines, not unlike the KP forest management reference levels discussed above.

The moral hazard issue has further implications into the particular types of action envisaged for REDD+. Advocates have sought to have REDD+ included in the existing or future market-based mechanisms or otherwise financed through results-based payments. These in turn would require the construction of a baseline-and-credit system (similar to the CDM or JI). The use of national baselines has been proposed (similar to the FMRL approach devised for the KP). These baselines would need to be carefully constructed to correctly reflect the trends in drivers of deforestation, avoid perverse incentive and leakage issues, and should ideally not be based on pure inference or projection of past trends in deforested areas. Whereas some of the issues related to leakage could be partly dealt with through the use of national reference levels serving as crediting thresholds, the construction of such baselines has so far proved too difficult for an outright inclusion of REDD+ into the more advanced stages of mitigation strategies and carbon finance.

Together with evolution of the KP accounting framework reviewed above, Parties have reached some agreement on the need for a staged approach to the development of REDD+ and its inclusion in mitigation strategies. The Cancun decision on REDD+ therefore called for the development of national strategies on REDD+, including development of national reference levels for deforestation, and reporting on the appropriate safeguards needed to avoid perverse incentives both from a carbon and a forest management perspective.

In this regard, REDD+ is still far from having an accounting or even reporting framework, in stark contrast to the KP activity approach. However, the extent to which REDD+ is included in a future climate regime, and the flexibility of the framework to be agreed, will fundamentally determine the level and inclusiveness of participation by developing countries. Also, non-carbon benefits and considerations have taken a much larger role in the debate on the inclusion of REDD+ than with previous debates on forestry under the KP. Whether or in what way such non-carbon benefits might impact any future accounting regime is as yet unforeseeable.

4.6 Options for moving forward on land-use sector accounting

To be applicable to all Parties, a new AFOLU accounting regime will need to reflect the negotiating priorities of a wider and more diverse group of countries. It can be expected that such a regime will allow more flexibility for some of the accounting rules. For example, through the introduction of more streamlined estimation methods, with lower requirements on data availability for some countries (while fully recognising that even for developing countries data has grown substantially in recent years). Such flexibility needs to be designed so that it does not hamper comparability of similar situations.

A future regime could build on either the land-based system already used under the Convention and in national GHG inventories or through development and expansion of the KP activity-based system. Many developing country Parties already are using the Convention approach either in the context of producing national GHG inventories and national communications or in preparations for reporting under the Cancun REDD+ decisions. A case can be made that an evolution of the KP system may eventually lead to a similar level of coverage and comprehensiveness of reporting and accounting as a land-based system.

A potential drawback of extending the KP accounting approach to a comprehensive land-based approach in line with UNFCCC reporting is the potential for increased complexity (although that may be offset by the fact that it would align the two current systems of reporting). The additional benefit in terms of extra emissions coverage is likely to be small in relation to the accounting framework for the second commitment period, where the mandatory nature of forest management has increased coverage to most of the emissions and removals of the land-use sector. A land-based approach can also lead to increased risk of perverse incentives in land sector management. A key point is that greater emissions coverage does not necessarily equate to greater mitigation, although greater coverage does provide more flexibility and mitigation *potential*. However, requiring increased coverage may discourage developing countries from participating in the accounting framework – thereby reducing participation in the global mitigation response overall.

Several proposals have been made in relation to improvements in the KP rules and/or the development of a new accounting framework for the post-Kyoto period. Most of these have revolved around three concepts, summarised in Table 6:

a. Maintaining and enlarging the KP activity-based framework

b. Using the UNFCCC reporting system and its land categories to base a new land-based accounting framework

c. Using "full carbon accounting"

Table 6: Pros and cons of options for AFOLU accounting

Description	Pros	Cons
Expanding Kyoto: Using activity-based approach; potential shift to net-net accounting and reference levels for activities over time	- builds on an existing system - use of reference levels in second period may be prove to be more adequate for developing countries - more closely related to the management priorities and structures of countries	- predicated on a unit-based system that may discourage participation - political negotiability to "cherry pick" activities - difficult to reach agreement on range of activities and their nature - limited comparability, because of voluntary nature of some activities
UNFCCC-based: Use land-based approach as per UNFCCC 2006 inventory guidelines	- builds on experience with national inventories - increases comparability amongst Parties	- is only a reporting process, so need to devise new accounting rules - not as closely related to land-use management structures within countries - methodological uncertainties can be significant
"Full carbon accounting": Account for all lands and all carbon flows	- comprehensive approach - more related to the full carbon cycle and scientific assessments - comparability ensured	- complexity may lead to lower participation - increases the risk of compliance for Parties with low emissions in other sectors, due to the variability of emissions and removals in LULUCF sector
"Standard of standards": Developing generalised criteria for the development of baselines/reference levels, for use in either land- or activity-based approaches	- more generic framework - could be seen as transitional step - flexibility of choice between land-based and activity-based approaches	- embedding of higher-level flexibility may require trade-off with lower level flexibility (more prescriptive at lower levels)

An advantage of the KP activity-based system is that it provides for flexibility of the choices of activities covered, which renders possible the participation of countries which find it easier to commit to specific activity types rather than land-based accounting. Broadening the KP approach to all Parties would however require extensive agreement on the mandatory/voluntary nature of activity accounting and further definition of activities at a more specific level than the broad categories used so far. Overall, the KP approach is not easily adaptable to countries with lower management capacities in the land-use sectors. However, it can be argued that an evolution of the KP system may eventually lead to a similar level of coverage and comprehensiveness of reporting and accounting as a land-based system.

Using the UNFCCC reporting framework, on the other hand, would build on the inventory capacity already existing in many countries. For some large non-Annex I countries it provides a recognisable framework and is more easily embedded in their national inventory. Focusing on more intensively-managed land or on key categories of the sector are some options that could be considered in this scenario. Nevertheless, the UNFCCC reporting system is only a starting point for the accounting framework. Choices would have to be made on the issues of how to translate the reported emissions and removals under the Convention into accountable units, including choices regarding reference levels/baselines.

A third option would be to move towards a "full carbon accounting" system, tracking all lands and all activities, including non-managed lands. While this represents a scientific ideal, it is likely beyond the

current stage in development of any future framework, given the inadequacies of our current reporting to underpin such system, in particular not accounting for unmanaged lands, and heavily simplifying assumptions on cross-effects between managed and unmanaged land.

From a methodological perspective, developments under both KP accounting rules and REDD+ provide a reference point for discussions on a new framework. There is increasing recognition of the need to provide transparent flexibility to address issues of age-class legacy and perverse incentives by moving away from a strict dichotomy of "gross-net" and "net-net" towards what could be more generalised approaches under "forward looking baselines" (similar to some forest management reference levels) for some/all activities and/or land uses.

This overall improvement in different methodological approaches leaves open a fourth way: to refocus the discussion not on a single, universal, accounting framework, but rather on the need to ensure environmental integrity and provide flexibility *across* all different approaches. In other words, rather than choosing strictly between land-based vs. activity-based systems or gross-net vs. net-net, developing criteria under which it may be acceptable for all Parties that a land-based approach be taken by a specific Party. Such criteria relate obviously primarily to the relevance of the carbon flows covered in each case.

The reality of the negotiations and of Parties' interests implies that whatever the basis for the system, substantial flexibility will need to be provided for in the shape of possible opt-ins of particular activities or land categories, if the system is to have wider appeal. Aiming for the widest possible coverage, in a context of engaging countries with much more diverse social and economic conditions than heretofore, should still be possible.

5. Conclusions

An emissions accounting framework complements, but differs from, processes for reporting emissions and emissions reduction objectives. Reporting provides a detailed record of domestic emissions (and removals) across the economy, as well as information on countries' emissions targets or goals. An accounting framework can provide a means to understand and therefore compare emissions pledges, and measuring progress towards them. An accounting framework can also provide a consistent basis to assign responsibility for certain emissions sources covered by a country's pledge. Accounting is particularly important to understand and correctly attribute international transfers of emissions units between countries, and to consistently identify and assess the contribution of changes to emissions and removals in the land-use sector.

All Parties have existing reporting obligations under the UNFCCC, but only countries with on-going KP commitments are subject to an accounting framework that reconciles unit transfers and domestic emissions with international emissions commitments. For the post-2020 agreement, it is important that a more broadly-applicable framework is developed, with incentives for a broader range of Parties to participate, in order to understand countries mitigation objectives, and to measure individual and aggregate progress towards those objectives. The accounting framework will need to be flexible enough to reflect the diversity of mitigation commitments and pledges that Parties put forward, in order to attract the widest possible participation.

The accounting framework can build on the existing provisions for reporting, including biennial reports for developed countries (including CTF tables agreed at Doha) and biennial update reports for developing countries. The pre-2020 reporting provisions can therefore serve to inform not only progress on countries' pre-2020 targets, but also design of a post-2020 accounting framework.

An accounting framework can be applied *ex ante*, allowing for enhanced understanding of different countries' pledges. *Ex ante* information includes key parameters such as the type of pledge, its period of application (whether it applies to a single year or is a multiple-year commitment) and the type of baseline projection used (if applicable). It is also important to understand *ex ante* what approach will be used for estimating net emissions and removals in the land-use sector and the anticipated maximum net flows of international emissions units from market mechanisms. Accounting can also be applied *ex post*, to measure progress towards achievement of pledges. *Ex post* accounting information will include, in addition to information on domestic emissions, information on net aggregate actual import and export of emissions units, and totals of land-use credits and debits accountable for each reporting period.

Use of market mechanisms internationally means that units representing emissions reductions will be traded across national boundaries. Such units could arise from internationally-governed mechanisms (crediting or trading), or units issued through market mechanisms under domestic governance. An accounting framework needs to provide sufficient visibility on unit movements so that all stakeholders can clearly see which units are moving where, and what impact those movements will have on the overall global mitigation effort. In particular, it is important that any double claiming of units is minimised and made fully transparent, in order to maintain the credibility of existing and new market mechanisms.

The accounting framework needs to provide assurance of a number of properties relating to emissions units. These include: (i) that the units issued are for credible emissions reductions (not covered in this paper); (ii) that not more than one unit is issued for a single emission reduction (avoiding double issuance); (iii) that units retired count towards only one country's pledge, or if not, that any double claiming is fully transparent; and (iv) that a unit cannot be resold or reused once it has been retired and counted towards achievement of a pledge.

To achieve these aims, information would be required from a detailed unit tracking system (or systems). These monitor information on individual unit flows, which can be subsequently aggregated into totals of

net unit flows at the national level. As most domestic or bilateral market mechanisms will have their own tracking systems, the necessary information could be provided either directly through detailed reporting via those domestic systems, or by requiring connection to a central international system. If a single central system is not used, a key challenge will be whether an international convention for using unique serial numbers for emissions units can be implemented with a decentralised network of domestic or bilaterally-linked unit registries.

This paper assessed what elements of unit accounting would be necessary to achieve different levels of confidence in the use of international market-based units as contributions towards meeting pledges. All options assume that Parties report *ex post* on the volume and types of units being counted towards targets. However, the options range from a more rules-based approach that aims to provide clarity *ex ante* of the maximum impact of unit flows (which impacts on expected aggregate global abatement), to an approach based only on *ex post* transparency, with a middle option combining elements of both.

For **land-use emissions and removals,** a key accounting issue is the relationship between the long timescales in most forestry-related activities and the provision of correct incentives for sustainable forestry management and land use. Emissions and removals in any one year may reflect decisions taken years before and be unrelated to the current mitigation goal. This, combined with the challenge of identifying which emissions changes are due to human intervention, means that a consistent accounting framework is particularly important for this sector.

This paper assessed developments in both the KP LULUCF accounting framework and the UNFCCC "land-based" reporting provisions. Some convergence has occurred between the two, including extension of the KP activities and the use of forward-looking baselines in the KP (forest management reference levels). Options put forward in the paper examine how to build on the KP activity-based accounting rules and the UNFCCC land-based reporting processes to develop an accounting framework that has flexibility to encourage participation of countries, and that acts as an incentive to increased mitigation actions in the land-use sector.

Building on biennial reports and Common Tabular Format (CTF) tables

In Doha, Parties took a step towards integrating accounting into the UNFCCC reporting structures by agreeing the CTF tables as part of biennial reports for developed countries. Although a useful step forward for understanding the targets put forward by developed country Parties under the UNFCCC, the CTF tables cannot alone function as a means to reliably account for the achievement or otherwise of targets. Important outstanding issues include to what extent this reporting process could be further developed into an accounting framework, and what other systems would be necessary to support it.

Firstly, the CTF tables only apply to developed countries. This means that whilst they may provide a good reporting picture for selected individual countries, they cannot be relied on to create an accurate picture at a global level. This is related to a second key issue, which is that the accounting system needs to clearly delineate which Parties have pledges that account for net flows of units, and which Parties have pledges against which net exports of emissions units are not accounted. It would be too simplistic to make this distinction between those countries covered by CTF and those not, as pledge types are not necessarily divided into the developed and developing country groupings. A common basis for accounting and reporting would facilitate understanding of flows and use of tradable units. Failing this, guidance for biennial update reporting for developing countries could be enhanced to specify that Parties should declare whether or not their mitigation goals account for unit flows.

For the CTF tables to better inform a future accounting framework, more detailed reporting categories would be required, both for reporting of *ex ante* estimates of unit use and *ex post* accounting of actual transactions. *Ex ante* information is important to understand the expected or maximum potential unit flows, including any risk of double counting. New categories could include detailed listing by unit type, including an indication of origin of units, in order to determine whether they originate in countries that do or do not

account for unit flows in their pledges. The tables would also need to include the period of application of targets (single versus multiple year), and any voluntary restrictions Parties choose to impose on the origin of credits. It would also be beneficial for Parties to state if their domestic systems, ETS or otherwise, are linked to systems in other countries, and whether they anticipate to count retired ETS allowances as a contribution towards their pledge.

In addition, information would be required *ex post* on the actual net unit flows occurring. This could include detailing the vintages of offset credits retired and information on import and banking of linked ETS units. Further, if Parties declare net totals of units imported from countries that do not account for units in their pledges, this would highlight any potential double claiming. For declaring flows from linked ETSs, three options are put forward in this paper: to declare net flows crossing borders (plus totals of banked units), to declare all units issued and retired (thereby avoiding the need to declare banked units) or converting exported units into an international unit type.

For emissions and removals from land-use, the CTF tables currently allow Parties to specify their accounting approach, and then to report emissions according to either the land-based or activity-based approach. The tables or reporting guidelines do not yet provide guidance on which approach is preferred, nor criteria for justification of particular approaches, and guidelines could be developed in this area.

Parties have made progress in improving emissions reporting requirements applicable to Parties that do not have emissions commitments in the KP. This paper has assessed how reporting can be further developed to form an accounting framework that allows measurement and improved consistency of the reporting of national pledges. As the accounting framework begins to take shape, further analytical work would be useful in several areas.

An important characteristic of an accounting framework is the extent to which it allows efforts to reduce emissions (or enhance removals) to be fungible across different sectors and sources. The KP has near-complete fungibility, with all covered GHGs converted to CO_2-eq and with land sector emissions and removals equivalent to all other emissions sources (with some exceptions described in this paper). There are at least two broad reasons why a future accounting framework could challenge this mantra. The first is that different GHGs affect the atmosphere over different time-scales, so that the benefits of eliminating short-term forcers are different to reducing build-up of longer-term forcers. The second reason is that drivers leading to emissions changes in the land-use sector are often very different to those affecting the energy sector or other emissions sources. Land sector emissions, including those related to deforestation, are strongly linked to policy areas such as agricultural development and long-term management of forest resources. Addressing these drivers often requires very different policy responses to those targeted for other sectors. Future work could investigate pros and cons of fungible versus separate accounting frameworks.

Another important issue to explore is how an accounting framework could be applied to a potential "spectrum of commitments" that countries make take on as part of a post-2020 agreement. Further work could build on the analysis put forward in this paper, applying it to different types of commitment. Furthermore, it will be important to assess the transition of the pre-2020 to the post-2020 framework, notably issues around the use of domestically-generated units issued pre-2020.

References

CEPS (2012), "A Framework for Various Approaches under the UNFCCC: Necessity or Luxury?", Submission to the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA), 5 October 2012. http://www.ceps.eu/files/MM_FVADoha%20Final.pdf

Clapp, C., et al. (2012), "Tracking Climate Finance: What and How?", *OECD/IEA Climate Change Expert Group Papers*, No. 2012/01, OECD Publishing. http://dx.doi.org/10.1787/5k44xwtk9tvk-en

Cowie, A.L., M.U.F. Kirschbaum and M. Ward (2007), "Options for including all lands in a future greenhouse gas accounting framework", *Environmental Science & Policy*, Vol. 10, Issue 4, June 2007.

Ellis, J., et al. (2011), "Design Options for International Assessment and Review (IAR) and International Consultations and Analysis (ICA)", *OECD/IEA Climate Change Expert Group Papers*, No. 2011/04, OECD Publishing. http://dx.doi.org/10.1787/5k44zc5rx644-en

Ellison, D., H. Petersson, M. Lundblad and P.-E. Wikberg (2012), "The incentive gap: LULUCF and the Kyoto mechanism before and after Durban". *GCB Bioenergy*. doi: 10.1111/gcbb.12034.

Erickson, P., M. Lazarus and J. Larsen (2011), *The Implications of International Greenhouse Gas Offsets on Global Climate Mitigation*, SEI Working Paper WP-US-1106. http://sei-us.org/publications/id/380

European Commission (2012), *Preparing the EU's Quantified Emission Limitation or Reduction Objective (QELRO) based on the EU Climate and Energy Package.* http://ec.europa.eu/clima/policies/international/negotiations/docs/swd_13022012_en.pdf

DEA, OECD, UNEP (2013), National Greenhouse Gas Emissions Baseline Scenarios: Learning from Experiences in Developing Countries. http://www.uneprisoe.org/News/All%20News%20Items.aspx?guid=%7BE70063E8-D88C-4445-A1DC-9DF866303A8C%7D#.UbW_6-QvajU.gmail

EU (2003), Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:en:PDF

EU (2004), Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0018:0023:EN:PDF

Grassi (2012), "LULUCF: Major Step in Durban", EFI News, Vol.20, No 1, April 2012. http://www.efi.int/files/attachments/publications/efi_news_final_1_12_net.pdf

IPCC (1996), Revised 1996 Guidelines for the Preparation of National Inventories. Intergovernmental Panel on Climate Change

IPCC (2000), Special Report on Land Use, Land-use Change and Forestry. Intergovernmental Panel on Climate Change. http://www.ipcc.ch/pdf/special-reports/spm/srl-en.pdf

IPCC (2003), Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC National. http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_contents.html

IPCC (2006), 2006 IPCC Guidelines for National Inventories. Intergovernmental Panel on Climate Change

Levin K., et al. (2010), "Remedying Discord in the Accord: Accounting Rules for Annex I Pledges in a Post-2012 Climate Agreement", WRI Working Paper http://pdf.wri.org/working_papers/remedying_discord_in_the_accord.pdf

PMR (2013, draft), "Draft Technical Note 6: Overview of Carbon Offset Programs: Similarities and Differences", World Bank, http://www.thepmr.org/system/files/documents/PMR%20Draft%20Technical%20Note%206_Offset%20Standards.pdf

Pershing, J. (2012), "Clarification of the U.S. Economy-Wide Target", UNFCCC Workshop (17 May 2012, Bonn, Germany). http://unfccc.int/files/bodies/awg-lca/application/pdf/20120517_usa_0940.pdf

Prag, A., et al. (2011), "Tracking and Trading: Expanding on Options for International Greenhouse Gas Unit Accouting after 2012", *OECD/IEA Climate Change Expert Group Papers*, No. 2011/05, OECD Publishing. http://dx.doi.org/10.1787/5k44xwtzm1zw-en

Prag, A., G. Briner, and C. Hood (2012), "Making Markets: Unpacking Design and Governance of Carbon Market Mechanisms", *OECD/IEA Information Paper.* http://oecd.org/env/cc/(2012)4%20-%20Market%20Mechanisms_AE%20(2).pdf

RGGI (2006), Regional Greenhouse Gas Initiative Model Rule 12/31/08 final with corrections – Part XX CO2 Budget Trading Program. http://www.rggi.org/docs/Model%20Rule%20Revised%2012.31.08.pdf

UNFCCC (2011a), "Compilation of information on nationally appropriate mitigation actions to be implemented by Parties not included in Annex I to the Convention - Note by the secretariat", paper discussed in the context of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention. http://unfccc.int/resource/docs/2011/awglca14/eng/inf01.pdf

UNFCCC (2011b),"Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention - Revised note by the secretariat", paper discussed in the context of the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation. http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf

UNFCCC (2012a), "Decisions adopted by the Conference of the Parties", *in* Report of the COP on the Seventeenth Session. http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf

UNFCCC (2012b), Various approaches, including opportunities for using markets, to enhance the cost-effectiveness of, and to promote, mitigation actions, bearing in mind different circumstances of developed and developing countries – Technical Paper. http://unfccc.int/resource/docs/2012/tp/04.pdf

UNFCCC (2012c), "Views on a framework for various approaches: Submissions from Parties", paper discussed in the context of the AWG-LCA: Various approaches, including opportunities for using markets, to enhance the cost-effectiveness of, and to promote, mitigation actions. http://unfccc.int/resource/docs/2012/awglca15/eng/misc04.pdf

UNFCCC (2013a), "Decisions adopted by the conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol", *in* Report of the COP serving as the meeting of the Parties to the Kyoto Protocol on its eighth session. http://unfccc.int/resource/docs/2012/cmp8/eng/13a01.pdf

UNFCCC (2013b), "Decisions adopted by the Conference of the Parties", *in* Report of the COP on its eighteenth session. http://unfccc.int/resource/docs/2012/cop18/eng/08a03.pdf

Verified Carbon Standard (2012), *Double Counting: Clarification Rules*, VCS Policy Brief, 1 February 2012

http://v-c-s.org/sites/v-c-s.org/files/VCS%20Policy%20Brief,%20Double%20Counting.pdf

Wetlands (2010), On AFOLU, wetlands and the road to land-based accounting. Wetlands International and University of Greifswald. Greifswald

WRI (forthcoming), Greenhouse Gas Protocol. Mitigation Goals Accounting and Reporting Standard. World Resources Institute, Washington, D.C.

Glossary

AAU	Assigned Amount Unit
ACR	American Carbon Registry
AFOLU	Agriculture, Forestry and Other Land-use
AI	Developed countries listed in Annex I of the UNFCCC
BAU	Business As Usual
BR	Biennial Reporting
BUR	Biennial Update Reporting
CCXG	OECD/IEA Climate Change Expert Group
CDM	Clean Development Mechanism
CER	Certified Emission Reduction from CDM (also lCER - long-term CER, tCER - temporary CER)
COP	Conference of the Parties to the UNFCCC
CP	Commitment Period (of the Kyoto Protocol)
EB	Executive Board (of the CDM)
EC	European Commission
ERU	Emission Reduction Unit (from JI projects)
EU ETS	European Union Emissions Trading System
EUA	EU Allowance Unit
EUTL	European Union Transaction Log (new name for CITL from 2012)
FVA	Framework for Various Approaches
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWP	Global Warming Potential
ITL	International Transaction Log
JI	Joint Implementation
KP	Kyoto Protocol
LULUCF	Land Use, Land-use Change and Forestry
MRV	Measurable, Reportable and Verifiable
N_2O	Nitrous Oxide
NAI	Developing countries that are not listed in Annex I of the UNFCCC
NAMA	Nationally Appropriate Mitigation Action
NC	National Communication
NIR	National Inventory Report
NZU	New Zealand Unit
QELRC	Quantified Emission Limitation or Reduction Commitment
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	REDD projects including measures for conservation, sustainable management of forests and
RGGI	Regional Greenhouse Gas Initiative (ETS in the north-eastern US states)
RMU	Removal Unit
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEF	Standard Electronic Format
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
WCI	Western Climate Initiative

www.oecd.org/env/cc/ccxg.htm

www.iea.org



With the financial assistance
of the European Union