DISCUSSION PAPER

Practical Issues Concerning Temporary Carbon Credits in the CDM

Michael Dutschke

Bernhard Schlamadinger

HWWA DISCUSSION PAPER

227

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)
Hamburg Institute of International Economics
2003
ISSN 1616-4814

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)
Hamburg Institute of International Economics
Neuer Jungfernstieg 21 - 20347 Hamburg, Germany
Telefon: 040/428 34 355
Telefax: 040/428 34 451
e-mail: hwwa@hwwa.de
Internet: http://www.hwwa.de

The HWWA is a member of:

- Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (WGL)
- Arbeitsgemeinschaft deutscher wirtschaftswissenschaftlicher Forschungsinstitute (ARGE)
- Association d'Instituts Européens de Conjoncture Economique (AIECE)

HWWA Discussion Paper

Practical Issues Concerning Temporary Carbon Credits in the CDM

Michael Dutschke*
Bernhard Schlamadinger**

HWWA Discussion Paper 227
http://www.hwwa.de

Hamburg Institute of International Economics (HWWA)
Neuer Jungfernstieg 21 - 20347 Hamburg, Germany
e-mail: hwwa@hwwa.de

* HWWA Hamburg Institute of Internationl Economics
** Johanneum Research, Graz, Austria

This paper has been prepared within the research programme International Climate Policy

Edited by the Department World Economy
Head: PD Dr. Carsten Hefeker

HWWA DISCUSSION PAPER 227
May 2003

Practical Issues Concerning Temporary Carbon Credits in the CDM

ABSTRACT

Afforestation and reforestation (AR) projects in the Clean Development Mechanism are able to create emission permits that can be accounted against the industrialized countries' commitments for limiting their greenhouse gas emissions, as agreed under the Kyoto Protocol. The discussion of how to treat credits from temporary carbon stocks is centering on the proposal for expiring emission credits from AR, which in the subsequent commitment period need to be replaced. While the basic methodological question is thus being solved, the practicalities arising from the solution have so far not been considered. The authors make new proposals on accounting modalities, define the tCER value as compared to a permanent CER, and forecast who will be the potential buyers for temporary offsets.

JEL-Classification: Q23, Q25, Q13

Keywords: Clean Development Mechanism, Forestry

Michael Dutschke
HWWA Hamburg Institute of International Economics
Research Programme International Climate Policy, Dutschke@hwwa.de

Bernhard Schlamadinger
JOANNEUM RESEARCH, A-8010 Graz, Austria
bernhard.schlamadinger@joanneum.at

1 Introduction

There is a broad consensus that emission permits created through afforestation and reforestation (AR) projects in the Kyoto Protocol's Clean Development Mechanism (CDM) are not necessarily a permanent offset to industrial emissions of greenhouse gases (GHGs). The positions of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), summarized in the Parties' submissions and a subsequent options paper by the Secretariat (UNFCCC 2002c), agree largely that certified emission reductions (CERs) from AR projects should reflect the temporary nature of carbon storage and therefore have a limited validity.

While during the Activities Implemented Jointly (AIJ) pilot phase credits from forestry modalities were granted "eternally", only few projects provided any kind of safeguards against unexpected losses of carbon stored in the respective project's vegetation and soils. Notably Costa Rica installed project buffers for a period of 20 years, while selling the rights to all expected credits upfront (they could not sell the credits themselves, because credits arise only once verification of actual stock changes has occurred). In the Costa Rican case, it was the host country government that took over the liability. The Mexican Scolel Té agro-forestry project holds the participating smallholder farmers liable for any carbon loss before the end of the 25-year project duration. It is however doubtful if in practice, this liability can be enforced.

In 2000, the delegation of Colombia proposed a scheme under which CERs are only granted temporarily and would need to be fully compensated upon their expiration. Though modified and revised by several Parties, this approach has successfully been established in the international discussion. The reason is that it is simple to understand and bookkeeping is manageable for national and international registries. After expiration of the temporary credits, the buyer is held liable to replace them, while there is no buyer liability during the validity period of the tCERs. If after expiration the forest is still in place, the tCERs from the same AR project can be re-issued. Obviously, the contract between investor and host partners can cover several credit validity periods. Any solution along these lines is a likely outcome of the negotiations, even though methodological details around accounting, credit duration, and the maximum frequency of re-issuance are still to be resolved.

TCERs will be a new type of carbon credit, which is not directly fungible with any other emission permits, AAUs, ERUs, RMUs and CERs. While other emission permits offset greenhouse gas (GHG) emissions once and forever, tCERs only allow for a break in liability for emissions. According to a proposal made by the EU, this break is fixed to the length of one commitment period. The effect of the break is that in the second commitment period the liability for emissions compensated through tCERs used in the first commitment period will arise anew.

The ongoing SBSTA negotiations focus on carbon accounting among governments. That is, tCERs would first become relevant for the government of the country where a CDM investor is located (the government itself can also be the investor). Any SBSTA decision on tCERs will likely regulate the issuance and expiry of tCERs in the registry of such government. How this government will then regulate the issue towards its "national entities" (for example companies) remains a sovereign decision to be taken by each individual government.

There are at least four ways how an investor country government could deal with CDM sinks project credits at the sub-national level:

1. It could exclude CDM sinks projects from crediting under a national emissions trading system

2. It could allow CDM sinks projects in such trading system, but treat such credits as equal to permanent credits. In such a case the government would "guarantee" the credits internationally (buyer government liability), and the private-sector entity would not have to replace its tCERs from the CDM sinks projects it invests in, should non-permanence occur.

3. It could allow CDM sinks projects in the trading system, and participating companies would earn tCERs in line with the tCERs accounted at the government level. In this case, the full risk of non-permanence would be with the company. Domestic commitments for individual companies may also be defined on an annual basis, in which case the value of tCERs for the government and companies would not be directly comparable, and regulatory adaptations would be of need.

4. Finally, the government itself could invest in CDM sinks projects, in which case it would have to assume full liability for any non-permanent projects.

For the purposes of this paper it is assumed that the government would include tCERs in its sub-national system and that the commitment periods for companies coincide with the Kyoto commitment periods (option 3 above). This means that any private-sector entity investing in CDM sinks projects would have to bear the full liability for non-permanent projects. We further assume that the tCER validity period would be five years and would be synchronous with the Kyoto commitment periods.

Finally, the fact that tCERs are not fungible with other emission permits raises at least three questions:

1) What will be the consequences for the project developer on the tCER production side?

2) What will be the price level of tCERs in relation to that of permanent permits?

3) Who will buy credits that only offset excess emissions for a limited period?

The present article tries to give simple and practical answers, and points to problems that need to be solved before rules and modalities for CDM AR projects are decided upon.

2 Options for implementing tCER accounting

Despite the discussions over temporary carbon accounting schemes since the year 2000, some basic practicalities have not been sufficiently considered so far. In the following, we propose down-to-earth solutions for tCER accounting procedures, for "permanent" project emissions, and for the baseline risk.

2.1 A hybrid accounting option based on average stocks and up-front tCER issuance

Of the three accounting options listed in the UNFCCC Secretariat's options paper (UNFCCC, 2002b), one allows generating a tCER on the basis of the full stocks measured at the moment of verification, while the two other options cover sequestration during periods that have already taken place (see also Box, p. 14, Schlamadinger et al, 2002). While the first option could be exploited by systematically claiming credits shortly before the end of the rotation period,[1] the disadvantage of the

[1] Normally, this will only work for one commitment period. The perverse incentive for shortening the eucalypt harvesting cycle from a minimum seven-year rotation to the length of a commitment period will depend on the trade-off between timber and carbon value.

other two options is that tCERs are only issued at the end of the commitment period, and thus cannot be traded before (derivatives could be traded, however). Therefore, we propose here a hybrid option.

Proposed approach for tCER accounting

Assumptions: the validity period of tCERs is 5 years, and synchronous with contiguous, 5-year commitment periods. The tCERs that are valid in the first commitment period are referred to as $tCER_1$, tCERs valid in the second commitment period are termed $tCER_2$, and so on. Monitoring of AR project is carried out according to the IPCC's Good Practice Guidelines for LULUCF Inventories (chapter 4.3), which are currently in preparation. Measurements of carbon stocks or stock changes can take place at any time, but are a precondition for verification and certification to occur.

Example. An AR project is initiated on 1 Jan 2000, and carbon stocks in the project increase by 1000 tons C every year for 20 years. Thus, carbon stocks at the start of the first commitment period are 8000 tC, at the end of the first commitment period 13000 tC, at the end of the second commitment period 18000 tC, and so on.

Proposal: Generally, the average carbon stocks (over and above those in the baseline scenario) during a commitment period are used as a calculation basis for the issuance of tCERs (this automatically considers the early crediting of CDM projects starting in the year 2000). In the example, 10,500 $tCER_1$s would be issued for the first commitment period. However, the average carbon stock will only be known at the end of the commitment period. To avoid a delay in the trading of tCERs until then, an attempt is made here to provide for early issuance of $tCER_1$s as follows: At any time during the commitment period, a project can be verified in terms of the level of carbon stocks at the beginning of the commitment period. In the example, this would be 8,000 tons C. The corresponding 8,000 $tCER_1$s could be issued up-front (right after certification), with a validity period over the first commitment period. There is a type I and a type II error involved in this: The type I error means that the 8,000 tons may be an underestimation of the average C stock over the commitment period as the forest continues to grow, and thus the project's performance is underestimated. The type II error lies in the fact that the project might fail during the commitment period (part of the 8,000 tons C might be lost due to natural or human-induced disturbance), while the tCERs that were issued would "survive" – albeit only for the first commitment period. We assume that over a large enough number of projects these errors will probably cancel out. That is, more carbon will be stored that is unaccounted for, than will be lost from failing projects.

At the end of the commitment period, the project can undergo another verification of carbon stocks, now allowing an estimate to be made of the average carbon stocks during the entire commitment period (at the same time this second verification would be the basis for the upfront-issuance of $tCER_2$s). If the above example project goes according to plan, then another 2,500 $tCER_1$s could be issued and traded for compliance with first commitment period targets. This number is calculated as the difference between the average stock (10,500 tC) and the stock that was already credited (8,000 tC). In a sense, the 2,500 $tCER_1$s serve as a buffer to guarantee project performance during the commitment period. Should the carbon stocks turn out to be still at 8,000 tC or to have dropped below that level, then no further $tCER_1$s can be issued[2]. The same procedure would apply for $tCER_2$ credits: Initial issuance would be based on the certification at the beginning of 2013 or later (this could at the same time be the final certification for $tCER_1$s).

Table 1 below summarizes the issuance of tCERs for the example project as a function of time. The table can be expanded in horizontal and vertical directions for further commitment periods, and for tCERs issued in these future commitment periods.

Table 1: Example for measured C stocks and certified tCERs over two commitment periods

Time of measurement	Measurement	$tCER_1$	$tCER_2$
C stocks at start of CP1[3]	8,000	8,000	0
C stocks at end of CP1	13,000	2,500	13000
C stocks at end of CP2	18,000	0	2500

One could argue that the hybrid average-upfront crediting approach would open the door for projects issuing the 8,000 $tCER_1$s (this example) at the beginning of the commitment period, in order to be able to harvest the trees during the same commitment period. However, we believe that this will not occur on a large scale

[2] Should a decline of carbon stocks after the start of the commitment period already be obvious during the first certification, we suggest that a discount factor be applied to the up-front issuance of tCERs. For example, the 8000 $tCER_1$s in this example could be reduced to a lower number, depending on the prediction of carbon stock changes in the monitoring plan, and an independent assessment of that number by the certifying entity.

[3] This does not necessarily have to take place at the start of the commitment period – it can take place at any time during the commitment period, but the objective is to estimate the C stocks on 1 Jan 2008.

because (1) in forestry projects, not all stands are harvested at the same time, because the objective is rather to maintain an even flow of timber and biomass fuels, requiring a certain amount of harvest each year (this is referred to as a “normal forest system”), and because (2) the project developers have the incentive to claim the other 2,500 $tCER_1$s as well as the 13,000 + 2,500 $tCER_2$s, etc. Further, the contract between investor and project host could include additional safeguards against premature forest loss.

2.2 Permanent project emissions

It is commonly understood that AR projects (and their baselines) will have to account for project emissions from land clearing, nitrous oxide emissions from fertilizing, and methane emissions from changes in the water regime. If the project area would have been used for agricultural purposes, it is likely and in many cases arguable that draining, fertilization and machine use would have caused higher emissions than under the forestry project case. If however the area would have been under-used or completely abandoned, these permanent project emissions can be higher than the ones under the baseline scenario. Under the aspect of permanence, these emissions need to be separated into permanent and non-permanent emissions. Initial land clearing or site preparation can cause a non-permanent project emission that will be offset by subtracting the respective amount from the carbon fixation achieved during the first validity period, and will thus be considered in calculating tCERs. Fossil fuel related CO_2 emissions, methane or nitrous oxide emissions on the other hand are irreversible and can thus not be offset by the temporary carbon uptake of the project. However, creating “CER debits” for CDM projects would most likely not be accepted by developing country Parties. The only possible safeguard in this case is to subtract the totality of permanent project emissions from every tranche of tCERs that is issued from the project over time.

2.3 The baseline risk

Natural succession in the baseline scenario can lead to a gradual loss of project benefits over time, as the baseline scenario approaches the project scenario. A dynamic baseline can thus lead to a premature end of the crediting period, because tCERs are calculated based on the carbon stocks present in the project, over and above the carbon stocks in the baseline scenario. For example, natural reclamation can occur with structural changes that lead to a decreased demand for arable lands. These changes are not always predictable. Baseline reassessment could result in the non-renewal of tCERs. If there is no time preference expressed in carbon accounting, any baseline change can be as much a risk to CDM projects as actual project vegetation losses (Meinshausen and Hare 2000). This risk is external to the project participants given that project additionality was assured at the project start. Planning periods in forestry are extremely long, and there is nothing that a project owner can do in case of baseline loss. In order to enhance investment security, the baseline validity should be renewed no sooner than at the time of harvesting.[4] This procedure would increase planning security and give forest restoration projects a much-needed incentive, as these would benefit from a static baseline over their entire crediting period.

3 What is the value of a tCER?

After the end of the tCER "rental" period the tCER needs to be replaced in full. The associated future costs can be discounted to calculate their present value (Table 2). For an investor the purchase of tCERs is equivalent to borrowing emission permits from a subsequent commitment period. While borrowing is generally ruled out under the Kyoto Protocol[5], this type of carbon credit is backed by real CO_2 mitigation over the respective commitment period.

The perceived project risks need not necessarily increase over time. With project lifetimes between 30 and 60 or more years most host countries are likely to have taken over some kind of emission limitation commitment and may thus be liable for future carbon losses on their territory.[6]

Table 2 analyzes the attractiveness of tCERs for discount rates between 3 and 9 percent. The table shows the relative value of tCERs compared to CERs depending on the duration of the CDM project over which it is able to generate tCERs. It assumes that at time 0 one ton of carbon is sequestered in a CDM reforestation project.

---

[4] For multi-species plantations with different rotation (not thinning!) periods, the species with the shortest rotation cycle should determine the frequency of baseline reassessment.

[5] One may see the non-compliance deduction of AAUs (amount of overshooting multiplied by a factor of 1.3) from the following commitment period as implicit acceptance of borrowing.

[6] Provided that land use, land-use change and forestry is included in the future country commitment.

Table 2: Discount rates, value of a succession of temporary credits, and "economic equivalence period" between temporary and permanent CERs

Discount rate	Value of temporary credits compared to permanent ones			"Economic equivalence period"
	Over 5 years	**15 years**	**30 years**	
3%	14%	37%	60%	**151,2**
4%	18%	46%	71%	**112,8**
5%	23%	54%	79%	**89,8**
6%	27%	60%	84%	**74,4**
7%	30%	66%	89%	**63,5**
8%	34%	71%	92%	**55,2**
9%	38%	76%	94%	**48,8**

The table shows the relative value of the resulting tCERs compared to that of CERs, depending on the duration over which the CDM generates tCERs from this sequestration of one ton of carbon. It is further assumed, for simplicity, that tCERs are always issued in 5-year increments. "Over 5 years" means that the project issues one tCER for this ton carbon only once, "over 15 years" means that the project issues tCERs for this ton carbon 3 times, and so on. For example, in the case of "15 years" the percentage shown (37% in the case of 3% discount) represents the total, discounted value of the stream of 3 tCERs issued over a period of 15 years, and linked to the same ton of carbon, relative to the value of a CER. The discount rate expresses price expectations of the market participants. It is influenced by the interest rate as well as expectations on the stringency of future emission-limitation commitments. If the commitments are expected to increase at a higher rate than the inflation rate, tCERs will not be attractive.[7] On the other hand, if the market participants do not expect a further commitment period, the tCER value will be nearly as high as for a permanent one, because there will be no future liability.

The difference in value of the tCERs compared to CERs will be below 1 percent after 49 to 151 years, depending on the discount rate applied. We call this the "economic equivalence period" between a CER and a tCER. If a stream of tCERs can be granted for this duration, the difference between the tCERs and a CER does not matter economically. A tCER that is only renewed once will be worth between 14 and 38 percent of a CER, and a stream of six consecutive tCERs over 30 years is worth

[7] To make things even more complex, the penalty for non-compliance on the international level is an 30 percent above the missing AAUs, which is equivalent to a 5 percent interest rate over five years. It is however not likely for most Annex I Parties to deliberately risk compliance speculating on the implicit low rate for borrowing.

between 60 and 94% of a CER. It is noteworthy that even with a tCER duration of only five years as assumed in Table 1, the project partners can contractually agree guarantees (such as insurance, buffer etc.) so that a stream of 5-year tCERs will be guaranteed and provided for at least 15, 30 or any other number of years (preferable a multiple of 5).

4 Who will be interested in buying tCERs?

In the context of the buyer’s interest for tCER, it will be important to distinguish between bilateral and unilateral CDM projects. In the bilateral case, an investor commits to a forestry operation and will tend to have long-term contracts over several Kyoto commitment periods, thus purchasing an entire “stream” of tCERs. The investor may in this case try to reduce his risk through contractual measures, such as insurance. For example, if the second issuance of tCERs does not materialize due to project failure, then a private insurance policy could provide for replacement credits.

In the case that tCERs are offered on the market (unilateral case), they only apply to a 5-year window of a project. There is no uncertainty for the investor, because investor knows what he is buying – a tCER that is valid for only one commitment period. As tCERs create debits immediately after expiration, but that is known to the investor and is the reason why they are cheaper than CERs (see Table 1). This option could be interesting for investors that are foreseeing important reduction potentials in the next commitment period, which could then be used to over-compensate the emissions of the actual commitment period. This is unlikely to be interesting for governments, but individual companies that plan for a change in technology may thereby hedge the emissions of the actual equipment until the end of its economic lifecycle. The other option for the buyer of tCERs from unilateral CDM projects is to buy these credits with the main objective of covering the risk of non-compliance. This individual “compliance reserve” fixes little capital stock and creates liabilities for the investor only if it is used for compliance. This can as well be an option for governments that do not support AF projects in the CDM in order to force their private sector to engage in emission avoidance measures, but see the multiple benefits of forestry in developing countries. While being invariable in their negotiation position, they could still build up an “emergency break” against falling out of compliance.

5 Conclusions

1. There are ways of linking tCERs to the average carbon stock during a commitment period, issuing a share of tCERs at the beginning or during the commitment period (with the remainder being issued at the end of the commitment period), while preserving the environmental integrity of the system.

2. Permanent project emissions above the baseline cannot be deduced only once from non-permanent CERs. They will have to be deduced from the tCER amount every time these are re-issued.

3. For project developers, certainty over the crediting period and baseline validity is of vital importance. Sinks under the CDM will only be encouraged if the political environment is adequate for this type of long-term investment. Also, certainty over only short periods could favor fast growing plantations over native species that grow over longer periods. The baseline reassessment periods need to be adapted to growth cycles.

4. The real value of non-permanent carbon credits depends on two parameters, namely future carbon price expectations and the investor's discount rate. As the first variable is pure speculation to date, this article has focused on estimating the crediting period necessary to obtain parity between a stream of tCERs and CERs from emission reductions on the basis of a discount rates ranging from 3 to 9 percent. In the best of these cases (i.e. with a discount factor in the range of 9 percent), tCERs will need to be re-issued to cover a total crediting period of 50 years in order for the entire stream of tCERs to become equivalent to a CER.

5. This period of 50 or more years could be denominated a market-driven equivalence period. It is unrealistic to expect market-based instruments to assure permanence indefinitely.

6. Given the temporary nature of tCERs, they could also serve as a reserve to cover unexpected emission increases that will be mobilized (and subsequently replaced) only in exceptional cases.

Acknowledgements

B. Schlamadinger was supported by the European Commission through the project CarboInvent (contract number EVK2-CT-2002-00157), which is part of the CarboEurope Cluster of projects.

The authors want to thank Jenny Wong from the Forest Research Institute of Kuala Lumpur for her helpful suggestions.

References

Dutschke, M. (2001). Permanence of CDM forests or non-permanence of land use related carbon credits? Hamburg, Hamburg Institute of International Economics HWWA Discussion Paper. No. 134, Hamburg

Meinshausen, M. and B. Hare (2000). Temporary sinks do not cause permanent climatic benefits: Achieving short-term emission reduction targets at the future's expense, Greenpeace, Hamburg

Moura-Costa, P. and C. Wilson (2000). "An equivalence factor between CO2 avoided emissions and sequestration - description and applications in forestry." Mitigation and Adaptation Strategies for Global Change **5**(1): 51 - 60.

Schlamadinger B., L. Aukland, S. Berg, D. Bradley, L. Ciccarese, V. Dameron, A. Faaij, M. Jackson, G. Marland, R. Sikkema, Forest-based carbon mitigation projects: Options for carbon accounting and for dealing with non-permanence, prepared for the UNFCCC (http://unfccc.int/resource/webdocs/2002/12.pdf, pp. 6-21)

UNFCCC (2002a). Land use, land-use change and forestry: Definitions and modalities for including afforestation and reforestation activities under Article 12 of the Kyoto Protocol in the first commitment period: Options paper on modalities for addressing baselines, additionality and leakage **FCCC/SBSTA/2003/6,** Bonn.

UNFCCC (2002b). Land use, land-use change and forestry: Definitions and modalities for including afforestation and reforestation activities under Article 12 of the Kyoto Protocol in the first commitment period: Options paper on modalities for addressing non-permanence **FCCC/SBSTA/2003/5,** Bonn.

UNFCCC (2002c). Land use, land-use change and forestry: Definitions and modalities for including afforestation and reforestation activities under Article 12 of the Kyoto Protocol in the first commitment period: Options paper on modalities for addressing socio-economic and environmental impacts, including impacts on biodiversity and natural ecosystems **FCCC/SBSTA/2003/7,** Bonn.