ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Dutschke, Michael; Schlamadinger, Bernhard; Wong-Leung, Jenny P.; Rumberg, Michael

Working Paper

Value and Risks of Expiring Carbon Credits from CDM Afforestation and Reforestation

HWWA Discussion Paper, No. 290

Provided in Cooperation with:
Hamburgisches Welt-Wirtschafts-Archiv (HWWA)

Suggested Citation: Dutschke, Michael; Schlamadinger, Bernhard; Wong-Leung, Jenny P.; Rumberg, Michael (2004) : Value and Risks of Expiring Carbon Credits from CDM Afforestation and Reforestation, HWWA Discussion Paper, No. 290, Hamburg Institute of International Economics (HWWA), Hamburg

This Version is available at:
https://hdl.handle.net/10419/19262

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

HWWA HAMBURG

DISCUSSION PAPER

Value and Risks of Expiring Carbon Credits from CDM Afforestation and Reforestation

Michael Dutschke
Bernhard Schlamadinger
Jenny L. P. Wong
Michael Rumberg

HWWA DISCUSSION PAPER

290

Hamburgisches Welt-Wirtschafts-Archiv (HWWA)
Hamburg Institute of International Economics
2004
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

Value and Risks of Expiring Carbon Credits from CDM Afforestation and Reforestation

Michael Dutschke
Bernhard Schlamadinger
Jenny L. P. Wong
Michael Rumberg

HWWA Discussion Paper 290

http://www.hwwa.de

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

The work underlying this text has been supported by the EC funded Projects ENCOFOR (www.joanneum.at/encofor) – Contract B7-6200/2002/069-203/TPS, INSEA – Contract SSP1-CT-2003-503614 - INSEA, and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Contract AG Z III 6.

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

HWWA DISCUSSION PAPER 290
August 2004

Value and Risks of Expiring Carbon Credits from CDM Afforestation and Reforestation

Abstract

The Milan conference of the UN Framework Convention on Climate Change has established two types of emission offsets under the Clean Development Mechanism (CDM), valid for afforestation and reforestation activities. In order to account for the non-permanent nature of carbon storage in forests, these credits expire after a pre-defined periods, after which the buyer needs to replace them. The present article assesses their market value in relation to "permanent" credits, identifies their specific risks and proposes how to mitigate and manage them. It analyzes strengths and weaknesses of expiring credits for sellers and buyers. Taking the example of the EU emissions trading system, the authors discuss how expiring credits could reach fungibility with permanent emission allowances on domestic markets.

JEL-Classification: Q23, Q25, Q13

Keywords: CDM, afforestation, reforestation, permanence, insurance, lCER, tCER

Michael Dutschke
Hamburg Institute of International Economics (HWWA)
Michael.Dutschke@hwwa.de

Bernhard Schlamadinger
Joanneum Research, Graz/AT
bernhard.schlamadinger@joanneum.ac.at

Jenny L.P.Wong
Forest Research Institute Malaysia, Kuala Lumpur/MY
jlpwong@hotmail.com

Michael Rumberg
TÜV Süddeutschland, Munich/DE
Michael.Rumberg@tuev-sued.de

Introduction

The rules governing afforestation and reforestation (AR) activities under the CDM have been among the most controversial issues under the Kyoto Protocol. One major issue was the potential "non-permanence" of carbon stored in AR projects. In 2000, the delegation of Colombia proposed a scheme under which CERs were only granted temporarily and would need to be fully compensated upon the date of their expiration. This proposal rapidly quickly won support among the participating Parties. Though modified and revised by several Parties, the basic approach of temporary CERs has imposed itself onto the international discussion and was finally enacted in Decision 19 on "Afforestation and Reforestation Modalities and Procedures under the CDM" of the ninth Conference of the Parties to the UNFCCC in Milan.

First reactions to Decision 19/CP.9 revealed some confusion among the market participants. To date, no in-depth analysis has been carried out on the consequences of the modalities and procedures on issuance of, and accounting for, expiring credits. The authors try to answer pertinent questions on the value and risks attached to the two new types of expiring certified emission reductions (CERs) that emerged, namely "temporary CERs (tCERs)" and "long-term CERs (lCERs)". In this article, we subsume both types of CERs issued for afforestation and reforestation (AR) activities under the CDM – tCERs and lCERs – under the term *expiring CERs*. We will assess chances for fungibility between different permanent and expiring CER types and domestic trading units, as exemplified by the European Emission Allowances.

What is an expiring CER?

For both types of expiring CERs, there is the choice between one single crediting period,[1] with a non-renewable baseline of a maximum of 30 years on the one hand, and a baseline of a maximum of 20 years, which then can be revised and renewed up to two times. Thus, up to three consecutive crediting periods, summing up to a maximum of 60 years, are achievable for AR projects. The operational lifetime of the forestry activity can be no shorter than the chosen crediting period. Another common feature is the verification period of five years. The first verification is at any point in time during the crediting period, but afterwards the carbon stocks will need to be re-verified every five years. Proper project design needs to make sure that rotation length and verification cycles do not coincide in such a way that verification is taking place systematically at the point of time when carbon stocks are peaking (Decision 19/CP.9, Article 12 (d)). Upon re-verification, the liability for non-permanence moves to the credit owner, who can replace CERs upon expiration with any type of emission permits, AAUs, ERUs, RMUs, CERs, or with newly certified expiring CERs of the same type. Once a project has decided to use either lCERs or tCERs, it needs to stick to this decision until the end of the (last, in the case of baseline renewal) crediting period. On expiration, tCERs and lCERs can in no case replace each other.

There are two limitations imposed on expiring credits. One results from paragraph 14 of Marrakech Decision 11/CP.7, which stipulates that CERs from AR may not exceed one percent of each Annex-I Party's base year emissions annually. Due to the fact that forestry projects have long operational periods before the first expiring CERs are certified, this limitation is not seen to be critical for the first commitment

[1] Crediting period is the term used under the AR modalities for the period during which tCERs or lCERs can be certified.

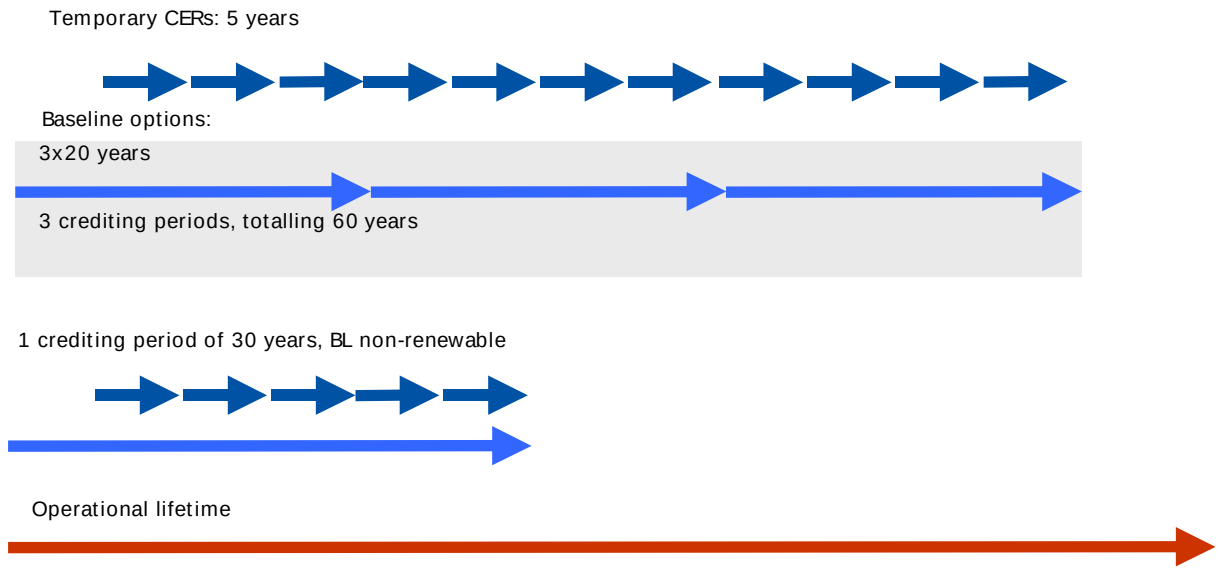
period. The rule on how to impose this limitation domestically is left to the individual Annex-I Parties.

Another limitation of AR CERs is that they cannot be carried over ("banked") to a subsequent commitment period (Decision 19/CP.9, paragraphs 41, 45). Consequently, the accepting Annex-I Party will first submit expiring CERs and bank AAUs instead. Given the limited amount of AR credits within the CDM, this rule is of no practical relevance to the value of expiring CERs.

Temporary CERs

TCERs assist Annex-I Parties to meet their GHG emission target for one commitment period only. These certificates expire before the end of the subsequent commitment period, during which the respective Party needs to over-comply with its target by the corresponding amount. With every successful re-verification, new tCERs are issued for the whole *net anthropogenic greenhouse gas removals by sinks* since the project start. As expired tCERs can be replaced by newly certified tCERs, it is most likely that a project developer will try to sell a succession of tCERs over the crediting period. Credit sales covering only one commitment period will increase transaction costs for both sides. The project risk is exclusively on the seller's side. After the termination of the (last) crediting period, tCERs can be replaced by tCERs from any other AR project. In our examples in Figure 1, the first tCERs are only produced five years after the start of the crediting period. It is unlikely that any AR project will yield relevant growth before this time, and will thus start verification earlier.

Figure 1: Terms and timeframes used in the context of temporary CERs



Long-term CERs

In contrast to tCERs, lCERs by default only expire at the end of the project's (last) crediting period, provided the carbon stocks are still in place. In case they are not, the respective lCERs expire upon the reception of the certification report detailing their non-permanence, and need to be replaced immediately. New lCERs can only replace expired lCERs if they stem from the same project activity. The validity of the different vintages differs. Assuming a non-renewable crediting period and the first verification in year five, the first lCERs may thus have a validity of 25 years. Upon the second verification, the increase in carbon stocks produces lCERs with 20 years of validity, and so on.

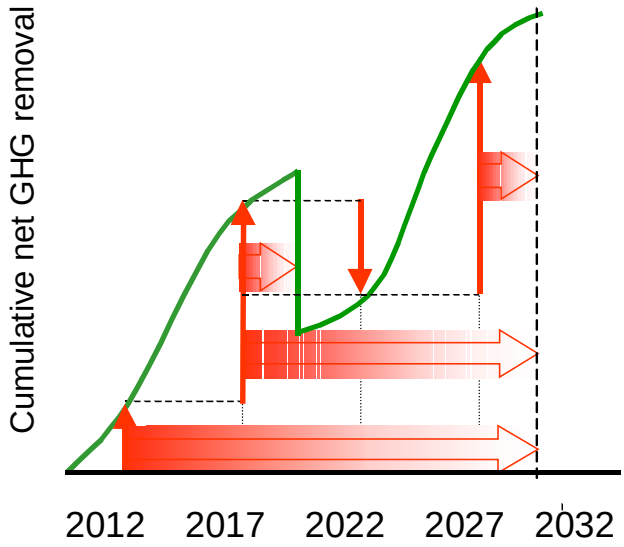
In case a due verification report is not provided after a notification period of 120 days, all lCERs ever produced will expire. Even though up to three crediting periods can be achieved with one activity, it would be misleading to believe that any lCER could have a validity of 60 years The start of activity determines the start of the

crediting period, not the time of the first verification. As stated above, project developers will probably not seek verification during the first five years. As carbon stocks increase, there will be additions in five-year increments of lCERs with a shorter lifetime. Figure 2 shows how the regular validity of lCER can even be limited to one verification period, if there is a net decrease in the sequestration level due to harvesting. Either these "short-term lCERs" are not sold, or they are sold for a price that compares to the one of single tCERs.

An lCERs may be used for compliance only during the commitment period in which it was issued. Environmental NGOs could choose to buy lCERs without using them, in order to achieve the climate benefit while avoiding additional emissions within the Annex I countries. In that case, no replacement on expiration is necessary. Only if the owner submits lCERs for compliance, replacement is due at the end of the (last) crediting period of the project.

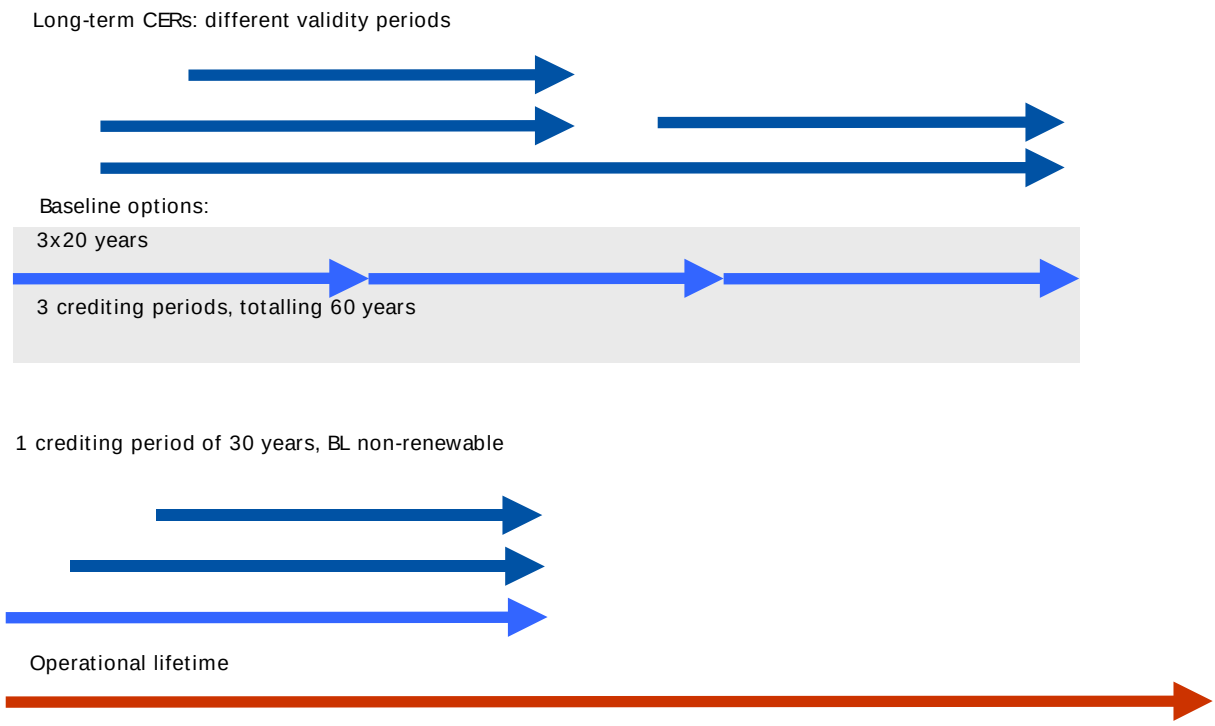
There is a clause in the rules for lCERs, that in case of losses or failure to provide the verification report, one lCER shall be replaced by "one AAU, CER, ERU, RMU or lCER *from the same project activity*" (Decision 19/CP.9, paragraphs 49 (d) and 50 (c)). This rule might not be applied to actual projects as under-achievement of net carbon removal will not result in a need for replacement during the growth phase and as long as the overall carbon stocks remain at least constant. If growth is negative however, there will be no newly certified lCERs from the same activity to replace losses. The same is true in case no certification report (ibid. paragraph 50) is submitted, because in that case, no replacement by "lCERs from the same project activity" is possible, as all lCERs ever certified for this project will expire.

Figure 2: Different lifetimes of lCERs from one activity



(Source:Bird, Dutschke et al. 2004)

Figure 3: Terms and timeframes used in the context of long-term CERs



What is the value of expiring certificates?

For an investor, the effect of buying expiring credits is equivalent to deferring his or her compliance to a future commitment period. The decision to buy expiring CERs depends on the expected price of replacement credits. In case the buyer does not expect a second commitment period to occur (i.e. no replacement is necessary), the value of expiring credits from AR would be identical to that of non-expiring CERs from GHG reduction projects. However, if the future price of credit replacement is expected to increase, the discount rate could be lower than the price increase of credits. In this case, the present value of lCERs would be negative, and it would be a better option to buy non-expiring CERs. Nevertheless, it is rather difficult to expect either investor preferences or the discount rate to remain constant over crediting periods between 20 and 60 years. The investor's horizon is much shorter than this; the institutions themselves seldom reach this age (consider that the UN system itself has not yet celebrated its 60th birthday). Costs that occur beyond the investor's horizon are usually assigned a much lower net present value. Additionally, most of today's host countries may have taken on some kind of reduction commitment by the middle of this century. All these expectations lead to the consequence that the individual buyer's discount rate does not remain constant over time.

The actual net value of deferring compliance is calculated as follows:

$$V_{\exp.CER} = 1 - (1 - i)^n$$

Where *i* is the discount rate, and *n* being the number of years compliance is deferred. Table 1 gives an overview over expected values of lCERs or a succession of tCERs, assuming costs and risks were equivalent to permanent CERs (Dutschke & Schlamadinger 2003; Subak 2003).

Below we will further differentiate risk assesment.

Table 1: Net value of expiring CERs and economic equivalence period under different discount rates

Assumed discount rate	Value after ... years			
	5	**20**	**30**	**60**
3%	14%	46%	60%	84%
4%	18%	56%	71%	91%
5%	23%	64%	79%	95%
6%	27%	71%	84%	98%
7%	30%	77%	89%	99%
8%	34%	81%	92%	99%
9%	38%	85%	94%	100%

A tCERs with a fixed validity period of 5 years will be worth between 14 and 38 percent of a permanent CER. An lCER with a validity period of 60 years, on the other hand, would nearly reach the value of a CER. [2]

Specific risks for AR projects

In this section, we refer to risks that are generic to CDM. However, due to the non-permanent nature of AR CERs, these risks not only affect credits to be produced after their incidence, but also those that have been generated before.

As the issue of liability only arises on verification, expiring CERs are risk-free during the commitment period in which they are issued. Subsequently, for each additional verification period, a certain percentage of the values referred in Table 1 above needs to be discounted in order to cover the costs of re-verification and risk management.

[2] As stated above, this is a hypothetical case. In practice, maximum lCER validity periods will not be superior to 55 years.

We distinguish three types of risks for AR projects: baseline, commercial, and institutional risks. In the following paragraphs, we will describe them in detail, and propose manners to mitigate and manage them.

Baseline risks

The baseline is the sum of carbon stock changes on the project area in the project's absence and subject to external influences. These may be price variations of timber or alternative land use products, like meat, corn or soy beans, the subsidy level for different activities, and long-term financing conditions. In addition, migration patterns can play a role, if increasing population pressure acts on the area, or if depopulation leads to the formation of natural succession forest in the project's absence. The project's additionality is at risk, in the event the baseline carbon stocks at any point in time are higher than the verified actual net removals. The project design document should explore the likelihood of occurrence of baseline-related risks, but the longer the baseline validity, the more they are difficult to assess.

Decision 19/CP.9 offers the option to use control plots for a dynamic baseline determination, as described by the Good Practice Guidance (IPCC 2003 p. 4.96). There are however practical difficulties in installing these control plots. They should be inside the project area but not subject to the influence of the AR activity, or located outside the project boundaries. In the first case, it will be contested, whether they represent "business as usual". In the latter case, direct measurement may be difficult, and it will be questionable to establish whether they really represent the project area. Furthermore, there is little incentive for the project developer to incur high costs for control plots and losses due to baseline dynamics if static 30-year baselines are also acceptable to the Executive Board. Additionally, a static baseline secures first-mover advantages.

In spite of a theoretical chance of achieving a maximum crediting period of 60 years, there is a risk in choosing a renewable baseline. We therefore expect most project developers to select a non-renewable crediting period of 30 years.

Commercial risks

Commercial risks are the ones that are under control of the project developer. Before thinking of managing risks, it is imperative for a project developer to mitigate them. Besides the choice of a low-risk host country, risk mitigation should be guided by standards and criteria for good practice in the forestry sector. The higher initial costs may be recovered by increased project permanence and credibility, both of which will result in lower commercial risks. Additionally, project design should be aware of the creation of long-term benefits, in order to foster self-interest of local populations in ensuring the permanence of the afforested areas.

Failure of the operating company in the host country

Failure of the local project operator may or need not to have repercussions on the verifiable sequestration level. The project will go on if the new owners continue the management of the project. Continued management implies the implementation of the measures outlined in the monitoring plans if during the take-over negotiations monitoring does not fall behind, thus affecting the next verification by the DOE (see "Interruption of monitoring and verification" below). Community schemes may be less likely to fail, as single dropouts will not necessarily endanger the whole project. The risk of failure of the operating company can be mitigated by conservatively checking the project's financial and economic feasibility.

Partial losses

Fires, winds, earthquakes, pests, animals, or theft of timber may lead to a decreasing sequestration level (Cottle & Crosthwaite-Eyre 2002). This risk is lower during the afforestation phase of the first 10 – 20 years, when stocks are building up by regular increase of the planted area. A slower-than-expected increase will only become a risk for the project's expiring CERs that were already issued, if it leads to economic project failure. The sequestration level may also decrease due to a selection of non-suitable sites, species, and management practices. The same may happen if changing climate leads to deteriorating growth conditions. Fire risks depend on the climate zone and the species selected, and fire damages differ depending on the age of the stand; often they are higher if they occur in young stands. A management plan needs to include the delimitation of fire breaks, installing watch towers, and building competency among the employees in fire prevention and extinguishment. Risks of over-exploitation can be adequately mitigated if sustainable management criteria are followed.

Interruption of monitoring and verification cycle

There is the risk that the project operator loses interest in monitoring and verification. The ceasing of project monitoring and verification (M&V) will lead to the project becoming a defunct CDM project. This risk is differentiated between tCERs and lCERs. As tCERs are paid on delivery, there is always an incentive to go on with M&V, as long as the returns at least cover both activities. Where the lCERs paid on delivery after selling all potential credits, there would be no longer an incentive for M&V continuation. It is clear that monitoring will only go on if this activity is adequately funded by a compliance fund. Therefore, after the initial phase of stock build-up, a fraction of the carbon proceeds needs to be withheld in an escrow and partially

disbursed on every successful re-verification. Part of this amount could be contracted with the designated operational entity (DOE), the certifier, while another part needs to be transferred to the company that does regular project monitoring, in most cases the proper project operator.

Credit replacement risk

There is no simple or direct way to estimate the costs for replacement of the expired CERs. In the moment that replacement is due, prices may be higher or lower than at the time of initial project investment. As a mitigation strategy, expiring CERs can be replaced at any time during their validity. The buyer has the chance to choose a favorable moment, when certificate prices are low. If tCERs are replaced by the buyer before the end of delivery contract, the remaining stream of tCERs can be sold again. In contrast, lCERs once used for compliance cannot be used again, even though they were replaced by permanent credits before expiration.

For verification, DOEs may come up with package offers over the whole baseline validity period.[3] The credit replacement risk may be reduced by financial instruments like options and forwards on allowances once certain market liquidity is reached. These options may cover periods of up to 10 years, provided international climate policy becomes more entrenched in the future.

Eyre and Mundy (1999) name the following interests that are commercially insurable:

- *"carbon offsets per se*
- *(agreed) value of the carbon offsets per tonne*
- *start-up capital (investment costs)*
- *annual management budget*
- *forest timber itself*
- *amenity value of the forest for eco-tourism*
- *replacement value of amenities and equipment destroyed by an insured peril*
- *costs of restoration of the project following a destructive event*
- *amortised cost of the project carbon credits per tonne over the life of the project*
- *net present value of the sales of carbon credits over the next 30 years*
- *direct fire fighting costs (over and above the annual protection budget)"*

[3] The authors do not expect prices to be fixed upfront for a time longer than one commitment period.

There is a variety of options to secure carbon investment, which we subsume under "insurance", but which can be granted by any actor within the finance sector. Carbon insurance against commercial project failure will only be achieved if the project operator is backed by a credible investor country company or bank. It is more realistic that the investor keeps various types of carbon projects in the portfolio, in order to spread the failure risk across several projects. Where fire insurance for the timber value of the plantation is being offered, it will be relatively easy to piggyback an insurance against losses of carbon stocks within one five-year period. Fire insurance usually costs around 1 and 2 percent of the timber value annually (Subak 2003), and it takes into account the fire risks of every particular project. Five years however, is at the upper margin of insurance coverage and usually is issued over one or two-year terms (Wong & Dutschke 2003).

Insurance for expiring CERs will look very much like a capitalized life insurance. If the insured risks do not occur, an end-of-contract payment will enable the insurance taker to replace expired CERs. In the actual pre-market phase, insurance will not be able to cover the price risk at credit replacement, not even over five years (Cottle & Crosthwaite-Eyre 2002). The insurance policy will thus stipulate a maximum restitution, and most likely a deductible. Additionally, a contract clause could make sure that the insurance may at any moment partially or in total replace the expiring CERs, without interrupting the contract. In this case, regular M&V payment could be left to the finance institution in order for it to weigh between project M&V and CER replacement costs.

In case the losses cannot be replaced from new growth within the same project, the insurance would replace tCERs by tCERs from another project until the end of the insured project's crediting period. Alternatively, the insurance company has the choice to replace expiring CERs with permanent allowances, thereby putting an

end to liability. This would be the only choice in the case of lCERs lost, as no replacement with other expiring CERs would be admitted. Depending on the insurance conditions, replacement of prematurely expired CERs would be done in one of the following manners:

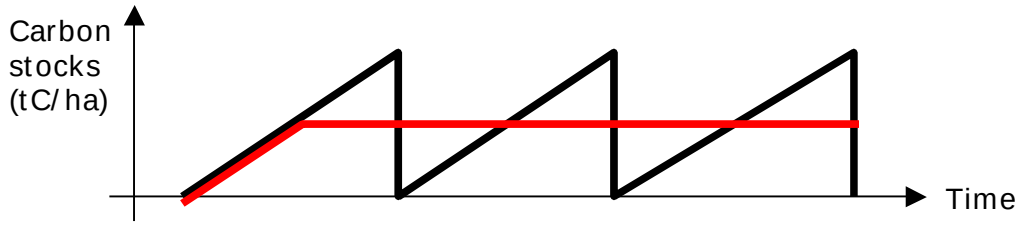
- For contracts that include end-of-term replacement, the lCER owner needs to compensate the insurance for the difference in value between the planned and the actual lCER lifetime. This amount would be calculated like in Table 1 above.

- For contracts that do not include end-of-term replacement, the insurance mechanism would only disburse the value of the above temporal difference and leave the acquisition of replacement units to the owner of the expired lCER.

Unlike in the early AR projects of the "activities implemented jointly" pilot phase, the current AR rules make self-insurance on the project level obsolete. This is so, because from the moment of verification on, and until the next verification, there is no risk to be covered. Neither buyer nor seller has an interest to refrain from using the credit stream over the expiring CERs complete lifetime. The buyer will only pay on delivery in the case of tCERs and on prolongation, in the case of lCERs.

As a simplification for small-scale projects, it was suggested that while monitoring should determine the actual time-path of carbon stocks, the issuance of lCERs should be based on the time-average carbon stock, shown with the red line in Figure 4. This line follows the actual growth of the project until the average carbon stock has been reached; subsequently it stays constant at the level of the average carbon stock. For further details see Schlamadinger et al. 2004.

Figure 4: Average carbon accounting



(Source: Schlamadinger, Bird et al. 2004)

Given the actual market size for AR projects, the design of specialized insurance contracts will certainly take a while. In the meantime, funds like the World Bank's BioCarbon Fund are already developing their own insurance schemes, in order to make expiring CER marketable.

Institutional risks

Annex-I company default

The Annex-I company using the expiring CER for compliance within a national emissions trading system for example, fails. If the risk of expiring CERs was internalized within this company, lCER or tCER replacement at the end of the crediting period will not be given. In any event, at the national level, the Annex I country holding the expiring CER in its registry must take over liability. Therefore, it is likely to ask the company for some sort of external insurance or other coverage.

Unplanned events in host-country

The host country may retroactively disapprove the project: Radical changes in government may lead to a risk for all types of foreign direct investment. The only possible risk mitigation is an appropriate choice of the host country. Social unrest

leading to invasion and sequestration losses can be partially prevented through a social impact assessment.

The risk of host countries being subject to secession or annexation can be mitigated if the investor country issues a blacklist of countries whose institutional risks will not be covered by the investor country. There will be consensus between investor and its government in most cases because CDM projects in high-risk countries are unlikely to be financed. Commercial host country risk insurance is in the range of five percent annually (Eyre and Mundy 1999), which may become prohibitive for long-term projects.

Host country takes over commitment in the land use sector

The host country may undergo a change in status within the climate regime. In subsequent commitment periods, the host country may take over climate change mitigation responsibilities for all or parts of the land-use sector. Either the effect on AR projects is a conversion of the expiring CERs issued to permanent emission reduction units with the subsequent risk of the release of sequestered carbon residing with the host country, or the appropriation of present or future removal units by the government. While a memorandum of understanding (MoU) between investor and host country is not a precondition under Kyoto Protocol regulations, it is highly recommended for AR projects. It elevates the approval from a matter of international private law to public law. The MoU should stipulate the fate of credits certified under the CDM in case the host country takes over own commitments. In this case, two options will apply. Either the afforested area becomes a part of AR under Kyoto Protocol Articles 3.3 or 3.4 or comparable future regulations, in which case the expiring CERs would be counted as removal units (RMUs), or alternatively the CDM

AR project turns to a JI project, in which case the expiring CERs would be canceled, and the holder would receive ERUs. In this latter case, a MoU may stipulate a compensation payment by the holders of expiring CERs, whose credits become upgraded as consequence of a future host-country transition regime.

Due project diligence will consist of selecting an appropriate project type with high social benefits within a stable political environment. However, as the Kyoto Protocol is a contract under international jurisdiction, the ultimate country risk lies with the investor country (i.e. the country that takes expiring CERs into its registry).

As it stands, commercial finance institutions will not be willing to cover these institutional risks. Before taking over institutional risks, the investor country needs to make sure if the project's commercial risks are covered by the investor. Risk management will form an important share of the expiring CER's emission compliance value but once in place it will create conditions for making them fungible with any other GHG allowance.

Project quality and permanence

As pointed out above, the long-term liability of lCERs will lead investors to look for projects with a high chance of surviving their crediting period. Unsustainable projects will hardly be insurable (Eyre & Mundy 1999; Subak 2003), as their risk of failure is to be borne by the buyer. This would be all the more true if there were financial mechanisms to insure project failure and end-of-contract repayment. Obviously, guidance on criteria and indicators is needed in order to determine how permanence can be enhanced inherently within project design and implementation.

- The Forestry Stewardship Council or the Pan European Forest Certification System (PEFC) offer internationally recognized certification for sustainable forest management.

- The Intergovernmental Panel on Climate Change has published its "Good Practice Guidance for Land Use, Land-Use Change and Forestry" (IPCC 2004), with instructions on good practice in project monitoring within chapter 4.
- A "Triple Standard" for the design of forestry projects related to climate change mitigation, drafted by an international endeavor called "Climate, Community & Biodiversity Alliance" will become applicable by the end of 2004. An implementation standard will follow in 2005 (CCBA 2004).

While the use of the IPCC guidance is "recommended" in Decision 19/CP.9, compliance with FSC forest certification and CCBA standards is purely voluntary. Transaction costs linked to certification result less from the certification process itself, but rather from the additional considerations necessary in the design phase. Therefore, it is sensible for project developers to seek good practice certification early in the project design phase, rather than to retrospectively adapt the design during implementation. If investors additionally wish to convert lCERs into EUAs or other permits, insurance against commercial risk will become compulsory. In case commercial insurers enter this still very limited market segment, it is likely that they will go for an agreed standard to make sure that a project is inherently permanent. It took 10 years to impose the FSC, yet the supporting environmental NGOs have refrained from adding a climate component. As exemplified in the case of the CDM GoldStandard[4], developed by the Worldwide Fund for Nature (WWF), it is easier to develop new standards than to promote them (Michaelowa 2004).

High-standard AR projects compete with low-standard projects on the international market. Where trading systems as the EU ETS avoid a direct import of AR carbon credits by companies, they may still enter the system. As governments become competitors with companies in CER acquisition (Buen 2004a), member states could

[4] GoldStandard is a quality standard for certain types of non-sinks CDM projects (see www.goldcdm.net).

buy up expiring CERs and trade AAUs. Yet, in most cases, there will be a discount for low-quality projects.

If a government wants to provide additional incentives for specific project types (e.g. small-scale or combined afforestation and energy projects) (Schnurr, Dutschke et al. 2004), or in specific regions (like LDCs), the following measures can be applied:

1. Financially: A state guarantee can help finance and insure the project. There is a role to play for export credit insurance. The monetary value of this guarantee may possibly be accounted as financial development assistance. Another example is the IBRD Partial Risk Guarantees (PRGs) that can help manage risks (Eyre and Mundy 1999).
2. Mitigate replacement risk: As pointed out above, the price risk at the moment of replacement at the regular end of the project 's crediting period will be a major disincentive against AR projects. Replacement could thus be granted by the investor country. In this case, for the lCER owner no end-of-term payment would be due, and commercial insurance would be less costly.
3. Institutionally: Provide or subsidize supra-national insurance schemes for expiring CERs. Similar to the experience of the Prototype Carbon Fund, these schemes could be located at the World Bank before the private sector moves in. For its own purposes, the World Bank carbon finance unit is already developing instruments for risk management.[5]

Considerations on the use of expiring CERs by governments can be found in the following section on fungibility.

[5] Personal communication Benoit Bosquet, 25.03.2004

Making expiring CERs fungible with other credits

In order to discuss fungibility issues, we take the example of the EU Emissions Trading System (EU ETS) (Schlamadinger & Dutschke 2004). The results of this section are however valid for any domestic emissions trading system, whose allowances do not expire.

One of the main reasons for excluding sinks credits in the first EU trading period from 2005 to 2007 was the perceived incompatibility of expiring CERs with other CERs and EU allowances, due the fact of their limited lifetime. While the Kyoto Protocol is an international agreement between governments, individual companies only enter the picture under the provisions of domestic policies. For example, the EU has established an emissions trading system that will start operating on January 1, 2005. It puts a ceiling on the emissions of a few thousand companies of the sectors energy activities, production and processing of ferrous metals, minerals, and pulp and paper. Companies can either reduce emissions themselves, or purchase emission credits from other companies. They can also invest in CDM or JI projects (the latter only from 2008) to obtain credits. Credits from CDM AR projects will most likely be included in the system from 2008 onward. The European Commission, on the occasion of its review scheduled in 2006, will in this case establish modalities for the “linking” of AR credits in the second EU trading period (which is identical to the first Kyoto commitment period).

There is no need to regulate the import of tCERs into the system if member state governments will accept them. For the company using tCERs for domestic compliance, the member state government will decrease its target in the subsequent trading period. This does however not result in the conversion of tCERs into EU emission allowances.

In order to achieve full fungibility between non-expiring and expiring CERs however, insurance, credit replacement after expiration, and investor state acceptance are needed. An Annex-I government will hardly accept a chain of successive tCERs in exchange for a permanent emission allowance. The tCER supply contract between project owner and credit buyer does not have the legal quality required for long-term fungibility with state-backed emission allowances. In this section on fungibility, we will thus concentrate on lCERs.

There are two main situations of lCER use:

1) Governments buying lCERs for their compliance with Kyoto Protocol targets, and

2) Companies that are subject to domestic emission limits (e.g., as part of a national emissions trading system) buying lCERs.

When a government purchases lCERs for compliance with Kyoto Protocol targets, it retains the liability due to the risks of unplanned release and is liable for replacing the credits at the end of the project's crediting period, even if the carbon stocks stored in the project remain intact (case 1, see Table 1). The purchasing government can in turn hedge against the risk of project failure through insurance (case 2). It may however, turn out to be costly to internalize lCER replacement costs at the end of the project-crediting period, depending on market expectations.

If a national government were to allow companies to use lCERs towards their compliance, the government would then simultaneously use the lCERs in its national Kyoto accounts. In other words, the government would accept a liability at the international level. At the domestic level, there are now several possibilities of assigning the risk and liability of credit expiry. In all these cases, lCERs will be fungible with

domestic allowances, like European emission allowances in the case of the EU emissions trading system.

Case 1: The government assumes the liability upon project failure as well as project termination. This option would however be a subsidy that fails to provide incentives for good project design and implementation.

Case 2: The government assumes the liability upon project termination, but leaves the liability upon project failure to the company, which submitted the lCER for compensation. In that case, risk management will look for ways to increase project-inherent permanence. Engaging the local community in project design and implementation and creating local benefits minimizes the risks of project failure. Only once such safeguards are taken, will financial risk management come into effect. The governmental guarantee for credit replacement upon successful termination of the crediting period could be perceived as a premium for sustainable management of the project.

Case 3: The government assumes no liability at all, while the submitting company assumes liability for project failure and termination. However, because the acquiring Annex-I company may not exist at the end of the crediting period, the government would most likely ask the company to provide a life-insurance type contract or an allowance purchase option due at the end of the lCER validity. Essentially, the risk of project failure and the cost of future replacement will be internalized in the present value of the credit, in turn adding to its cost. With this, the cost of the credit that the company uses to comply with the domestic emissions trading system will consist of a) the price of the lCER, b) the price of insuring against non-permanence, and c) the cost of the future replacement by permanent credits.

Case 4: The government discounts the lCERs according to their estimated risks, which will depend on host country, project type, hazards to permanence of projects, etc. It is helpful here to think of a project portfolio, because individual projects might be subject to complete failure while the failure of the entire portfolio is not likely. A European member state would thus convert one lCERs into e.g., 0.6 EUAs, assuming that 60 percent of the projects' certificates are considered "risk free". Nevertheless, the government can still use the full amount of lCERs from the CDM afforestation and reforestation projects for compliance with the Kyoto targets, so that a surplus arises to the government in that commitment period. This surplus can be banked into the next and subsequent commitment periods in the form of AAUs. As more carbon is stored, this banked amount would increase from commitment period to commitment period and would serve as an "insurance buffer" in case of unplanned release of carbon from the project. At the end of the crediting period, all the remaining lCERs are due to be replaced. If the project has gone according to plan, there will be an amount of banked AAUs available so that the ultimate debit to the government would only be as high as the amount of risk-free carbon sequestered by the project. If the project has produced only the risk-free portion of carbon sequestration, then part of the lCERs already will have been retired, and only the remainder is retired at the end of the crediting period, insomuch as no AAUs are left. The net result is the same.

By converting lCERs into e.g. EU Emission Allowances (EUA), it comes upon the converting member state to decide upon its risk management strategy (see Table 2).

Table 2: Options for addressing non-permanence and credit expiry at the project end. Two main cases are distinguished (governments or companies purchasing lCERs).

		Who carries liability of non-permanence	**Who takes debits for expiry**
Government purchase of lCERs	Case 1: no additional measures	Government	Government
	Case 2: Insurance against non-permanence	Insurance	Government
Company purchase of lCERs for compliance in regional emissions trading system	Case 1: lCERs can be converted into local currency, e.g., EUAs, without additional measures.	Government	Government
	Case 2: lCERs can be converted into local currency if company insures against non-permanence.	Insurance	Government
	Case 3: lCERs can be converted into local currency if company insures against non permanence and has futures credits for the time of project termination.	Insurance	Company (has to buy future credits)
	Case 4: The government exchanges each lCER against a discounted amount of x (e.g., 0.6) "local currency (e.g., EUAs). For each lCER the government uses for Kyoto compliance, it banks (1 – x) AAUs into future commitment periods in order to protect against future risks of the project. This approach works better if applied to a whole portfolio of projects funded by companies within a country.	Risk is internalized into the price of EUAs by means of discounting.	Government, but only up to the "risk free" share of every lCER.

(Source: Schlamadinger, Dutschke et al. 2004)

Expiring CERs and interests of market participants

Long-term liability and complex modalities will be the main impediments against buying expiring CERs. On the other hand, they have a short-term price advantage over permanent CERs. In Table 3, a SWOT analysis for the buyer side of expiring CERs is carried out.

Table 3: SWOT analysis for buyers of expiring CERs

	Strengths	Weaknesses	Opportunities	Threats
Prices	Low-cost	Liability management as a cost factor.	Use as a compliance reserve. If not used for compliance, no replacement due.	CER futures as a competing instrument.
Project liability	Demonstrates high commitment, if the lCER user is project participant (not necessarily true for tCERs)	Project quality control and search for insurance mechanism increases transaction costs.	Specialized agencies will offer package deals for quality control, monitoring and verification in the future.	Small market niche, if CER prices remain low. Development of markets will take time.
Replacement costs	If beyond planning horizon, costs when they occur may not be due any longer.	Present costs may be higher than today's CERs.	Investor state may guarantee replacement at fixed costs.	Depending on domestic accounting rules may result in long-term liability to be accounted at current CER prices.
Flexibility	Little actual capital fixation.	Only limited amount can be used for compliance cap of 1% of investor country 1990 emissions).	Individual company not responsible for compliance with 1% cap.	National allocation rules for acceptance of expiring CER.

In most cases, certain amounts of expiring CERs have their place in larger carbon credit portfolios, whereby their use for compliance will free permanent CERs for sale or banking. Institutional buyers will capture secondary benefits, like a positive public image for biodiversity conservation and social benefits for the host country. Accounting rules for emission allowances, and especially expiring CERs, may turn out to be a challenge to Annex-I domestic legislation with implications for flexible mechanisms in general, and long-term CERs in particular: Where expiring CERs in the company balance were to be accounted for as liabilities under their present value, companies would have little incentive for their acquisition. National fiscal legislation could thus threaten a complete activity type under the CDM.

A SWOT analysis for the seller side (Table 4), including the host country government, shows that the limited host liability will be reflected in lower demand as well as in contractual agreements imposed by the potential buyers that try to partially rule

out Annex-I liability for project risks. It is thus likely that projects seeking for certification would proceed anyway, due to domestic incentives and internal profitability. Truly additional projects will need to go for co-financing, be it with voluntary compliance schemes, offering environmental services like watershed protection or biodiversity conservation on parallel markets. Another source of co-funding would be official development assistance (ODA), the eligibility of which under the CDM remains contested (Dutschke & Michaelowa 2004).

Table 4: SWOT analysis for the seller side of expiring CERs

	Strengths	Weaknesses	Opportunities	Threats
Prices	Will be attractive on demand peaks, shortly before end of commitment period.	Small market segment	There is willingness to pay for projects that offer additional environmental services, like biodiversity conservation.	Low prices may not sustain truly additional projects.
Project liability	Increases chances for high-quality projects.	May increase project development and contracting costs.	Procedures related to insurance mechanism are left over to the buyer.	Investors may try to channel back liability to the host country
Flexibility	Host government is free of sovereignty concerns; no infinite foreign control over project area.	Limited fungibility of credits lowers demand.	Use of lCERs as early domestic action under future compliance regime.	Future treatment of expiring CERs is uncertain.

In an article for Carbon Finance, Carbosur consultants calculated the revenue of expiring CERs for two single cohorts of exemplary plantations (Martino & Reali 2004). In their example, only 20 – 25 percent of the total carbon would be fixed in the first commitment period. They compare numbers of tCERs to those of lCERs credited and find the projects receive more tCERs, which is a tautology, given the difference in validity between tCERs and lCERs. Given the actual uncertainty over future commitment periods, they see a tendency for buyers to favor tCERs, while project developers for the same reasons might prefer lCERs. Another reason why this conflict of interests may arise is that in the tCER case, insomuch that after tCER expiry project

risks fall back to the project owner (Buen 2004b).

Many brokers see expiring CERs as being too complex to become operational. If the market occurs anyway, its actors will be a specialized minority, at least in the starting phase. As sellers will try to combine project benefits, tCER/lCER prices will reflect the willingness to pay for side-benefits specific to AR projects.

Conclusions

This article has attempted to assess the value and market opportunities of expiring CERs. It has noted high uncertainties, not only due to the ongoing buyers' liability for AR projects, but also to the uncertain future of international climate policy. This latter uncertainty has higher repercussions on expiring CERs than on CERs from other GHG mitigation activities under the CDM. This is so because the integrity of an AR project's CERs remains at risk until the end of the crediting period. We show that there are indeed ways to mitigate most project risks. As the option for one-off baselines for up to 30 years has been agreed upon by the Parties, most projects will refrain from using baselines that are renewed after a maximum of 20 years, even while promising a 60-year total crediting period. They are also likely to refrain from the option to use control plots for a dynamic baseline, as it will increase baseline risks, without bringing added benefits for the project. Commercial risks strongly relate to project quality. It will be in the interest of finance institutions providing insurance to ask for a certification of high-quality project implementation. We have shown that insurance is more likely to cover risks related to lCERs than those of a succession of tCERs. Mitigating the price risk for credit replacement is an interesting leverage governments can use for encouraging high-quality project development and implementation. Finally, a part of the failure risk for the Annex-I company and diverse host-country risks need to be covered by the investor country that ac-

cepts expiring CERs for compliance. Prudent selection of host country Parties will help mitigate these risks, which on the other hand means that least developed countries will tend to be systematically disfavored. Having AR projects in LDCs will require additional host country risk taking, which could possibly be reported as ODA. A SWOT analysis for the market of expiring CERs has shown that the complex AR modalities and procedures will lead to a specialist's market niche, where credit valuation will be subject to the one of the projects' added sustainability benefits. Ultimately, opportunities for AR projects under the CDM depend on factors external to the sector. As the climate regime will consolidate, so will the opportunities for long-term project investment.

References

Bird, D. N., M. Dutschke, et al. (2004). Should one trade tCERs or lCERs? Leuven, ENCOFOR.

Buen, J. (2004a). Competition for CERs. 15.04.2004, 4

Buen, J. (2004b). ViewPoint: Temporary or long-term? 15 January, 2004, 1

CCBA (2004). Climate, Community & Biodiversity Project Design Standards (Draft 1.0). Washington DC, Climate, Community & Biodiversity Alliance (CCBA).

Cottle, P. and C. Crosthwaite-Eyre (2002). Insuring Forest Sinks. Sellling forest environmental services: market-based mechanisms for conservation and development. S. Pagiola, J. Bisop and N. Landell-Mills. London.

Dutschke, M. and A. Michaelowa (2004). "Development assistance and the CDM - how to interpret "financial additionality"." Environment and Development Economics (upcoming).

Dutschke, M. and B. Schlamadinger (2003). "Practical Issues Concerning Temporary Carbon Credits in the CDM." HWWA Discussion Paper **227**: 12.

Eyre, J. and C. Mundy (1999). Risik Mitigation in Forestry: Linkages with Kyoto and Sustainable Forestry Management. Washington D.C., Forest Trends.

IPCC (2003). Good Practice Guidance for Land Use, Land-Use Change and Forestry (Task 1). Kamiyamaguchi, Hayama, Kanagawa, Japan, Intergovernamental Panel on Climate Change.

IPCC (2004). Good Practice Guidance for Land Use, Land-Use Change and Forestry (Task 1).

Martino, D. and P. Reali (2004). "Long-term or temporary." Carbon Finance(May 2004): 10-11.

Michaelowa, A. (2004). Stakeholders' Comment: Going for gold? 14 July 2004, 6

Schlamadinger, B., D. N. Bird, et al. (2004). The average carbon-stock approach for small-scale CDM AR projects. ENCOFOR Policy Brief. Graz.

Schlamadinger, B. and M. Dutschke (2004). Linking terrestrial carbon sequestration to the EU ETS. February 27, 2004, 2

Schlamadinger, B., M. Dutschke, et al. (2004). "How Can Carbon Credits from CDM Afforestation and Reforestation Projects be Used by Annex I Governments and Companies?" CDM Investment Newsletter **3**: 4-7.

Schnurr, J., M. Dutschke, et al. (2004). "Waiting for the green light." Carbon Finance: 14-15.

Subak, S. (2003). "Replacing carbon lost from forests: an assessment of insurance, reserves, and expiring credits." Climate Policy **3**: 107 - 122.

Wong, J. and M. Dutschke (2003). "Can Permanence be Insured? Consideration of some Technical and Practical Issues of Insuring Carbon Credits from Afforestation and Reforestation." HWWA Discussion Paper **235**: 17.