

## Forest Carbon Partnership Facility (FCPF)

### Valuing Emission Reductions

*Draft for Discussion - October 8, 2008*

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#### Executive Summary

Determining a fair carbon price for Reducing Emissions from Deforestation and Degradation (REDD) activities is rendered difficult by the fact that there is no readily available price reference for similar carbon assets. To fill this vacuum, the FCPF's Participants Committee will issue guidelines on how to set the price for emission reductions to be purchased by the Carbon Fund. The objective is to arrive at prices that:

1. Entice sellers to sell and buyers to purchase emission reductions from REDD;
2. Reflect the risks that derive from the current absence of a regulatory framework on REDD;
3. Recognize the risks and benefits of REDD relative to other carbon asset classes;
4. Allow risk and benefit sharing by sellers and buyers; and
5. Leave room for adjustments later on as the UNFCCC adopts rules on REDD and demand and supply for emission reductions from REDD activities evolve.

The objective of this note is to explore the options for setting the price for REDD assets in the FCPF to be discussed primarily with a small set of stakeholders and ultimately endorsed by the Participants Committee.

This pricing paper provides a number of options on how to proceed. It is expected that the regulatory risk will be reduced during the coming years, which might lead to significant price changes. As both sellers and buyers are sharing the risk for the success of the programs, both parties should also share future gains and losses from price increases (or decreases) in equal shares.

At an initial discussion held on April 2, 2008, countries and organizations expressed a preference for a combination of fixed and floating prices. The fixed price component is designed to guarantee a minimum revenue flow that is correlated with REDD production costs (both opportunity and implementation costs), while the floating price component is meant to allow seller and buyer to share the potential of price upsides in the future. An auctioning mechanism also met with favorable responses as it holds the potential for unbiased price discovery.

The pricing approach proposed below applies exclusively to the FCPF's Carbon Fund and should not be interpreted as an attempt to set the price for emission reductions from REDD in general.

## 1. Background: REDD and the FCPF

Deforestation and forest degradation together are the second leading cause of climate change, responsible for about 20% of global greenhouse gas (GHG) emissions (approximately 70% of Brazil's emissions and 80% of Indonesia's emissions). At CoP13 in Bali in December 2007, Reducing Emissions from Deforestation and Forest Degradation (REDD) was included in the so-called "Bali Action Plan," as an item to be discussed with a view to possible inclusion in a new climate regime starting in 2013.<sup>1</sup>

Reducing emissions in the forest sector demands complex approaches and structural interventions that have significant economic and social implications. Most developing countries have to prepare themselves to face these rather complex challenges if REDD is to succeed. For this reason the international community has taken steps to assist countries in this immense task. One of these steps is to establish the Forest Carbon Partnership Facility (FCPF). The FCPF will test and evaluate different approaches to REDD in tropical and subtropical countries and thus set the stage for a future system of positive incentives for REDD.<sup>2</sup> It is expected that the FCPF will become operational by mid-2008.

The FCPF will include two funds. The first one (Readiness Fund) will build capacity for REDD, in particular through the development of REDD strategies, methodologies for setting reference scenarios and monitoring activities, and the evaluation and dissemination of these experiences. The second one (Carbon Fund) will pilot REDD carbon transactions in a selected group of countries.

The Carbon Fund's strategic objective is to give the signal that the international community is willing to provide financial incentives to those tropical and subtropical countries that will have built their capacity for REDD, even before a post-2012 regime is decided upon and established. Payments will be made for high-quality emission reductions in countries that will have been deemed "ready" by the Participants Committee (PC) under the Readiness Fund.<sup>3</sup>

As the Carbon Fund's target capitalization (US\$200 million) is small relative to the REDD challenge worldwide, its direct objective is not to save the world's forests. Rather its demonstration transactions are designed to create the comfort necessary for much larger financial flows to follow suit. For the Carbon Fund to succeed in playing this catalytic role, it must induce the participation of the private sector whose financial resources as buyers of emission reductions will be needed to scale REDD up to the required level. One critical determinant of the private sector's participation in REDD (both in and beyond the Carbon Fund) will be the price to be paid per ton of emission reduction (ER).

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<sup>1</sup> Please see [http://unfccc.int/files/meetings/cop\\_13/application/pdf/cp\\_bali\\_action.pdf](http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf) and [http://unfccc.int/files/meetings/cop\\_13/application/pdf/cp\\_redd.pdf](http://unfccc.int/files/meetings/cop_13/application/pdf/cp_redd.pdf)

<sup>2</sup> More information on the FCPF can be obtained at [www.carbonfinance.org/fcpf](http://www.carbonfinance.org/fcpf)

<sup>3</sup> For more information on the Readiness business process, please refer to the FCPF's draft Information Memorandum at <http://carbonfinance.org/Router.cfm?Page=FCPF&FID=34267&ItemID=34267&ft=DocLib&CatalogID=37737>

## 2. Emission Reduction: Definition and Creation

The Carbon Fund intends to pay for ERs from REDD countries on behalf of the Carbon Fund Participants. The ERs are all the rights, titles, and interests attached to a metric ton of emission reduction of carbon dioxide equivalent (tCO<sub>2</sub>e) produced by a REDD activity referred to here as an Emission Reductions Program (ER Program). An ER Program is an activity that leads to measurable emission reductions, ranging from policy and regulatory changes to investment projects.

ER Programs can have national or sub-national boundaries. In case of sub-national activities, reference to a national accounting framework will be made to avoid leakage and double accounting. The decision on what kind of ER Program to adopt will depend on each country's needs and priorities.

The following steps will be taken to guarantee the quality of the ERs:

1. The Facility Management Team (FMT) of the FCPF will develop, for the PC's approval, proposed eligibility criteria and portfolio preferences for ER Programs from which ERs would be purchased by the Carbon Fund as well as guidelines on setting reference scenarios and monitoring ERs;
2. The FMT will establish Ad Hoc Technical Advisory Panels (TAPs) and request them to review each proposed ER Program and help the Carbon Fund Participants Committee decide whether to select the ER Program into the Carbon Fund;
3. The relevant World Bank regional unit will perform its due diligence, including to confirm that the ER Program complies with the Bank's applicable environmental and social safeguard policies;
4. An independent reviewer, possibly a TAP, will perform an *ex ante* assessment of the ER Program to confirm that it is consistent with the FCPF's eligibility criteria and guidelines noted above;
5. The REDD Participant Country will implement its ER Program and report on implementation on an annual basis according to agreed monitoring standards and the provisions set forth in the Emission Reductions Payment Agreement (ERPA);
6. An independent reviewer, possibly a TAP or another independent organization, will perform an *ex post* (e.g., annual) assessment of the ER Program to verify the level of ERs claimed by the REDD Participant Country or its approved entity;
7. The World Bank regional unit will check that the ER Program remains in compliance with the applicable environmental and social safeguard policies;
8. Based on the independent reviewer's verification report, and subject to the ERPA provisions and to compliance with the applicable environmental and social safeguard policies, the Trustee of the Carbon Fund will make a payment to the entity designated by the REDD Participant Country in the ERPA;
9. The Trustee of the Carbon Fund will account for the ERs delivered to the Carbon Fund and allocate a *pro rata* share of ERs to each Carbon Fund Participant through the internal registry.

It is important to emphasize that the FCPF or the Bank will not attempt to suggest what, if any, value the ERs from ER Programs should have in respect of the present or a future climate change regime, let alone whether REDD should be linked to the carbon market. Those are decisions for the Parties to the UNFCCC to make. Nevertheless it may be necessary to refer to the units used in the context of the present or a future regime when determining the pricing structure for the ERs that would be purchased by the Carbon Fund.

### 3. Valuation Principles

Determining a fair value per tCO<sub>2</sub>e saved through REDD is rendered difficult by the fact that there is no readily available reference for this kind of carbon. There are transactions taking place on the voluntary market, including through the BioCarbon Fund<sup>4</sup> administered by the World Bank, but a regulated market does not exist since there is no regulatory framework in place under the UNFCCC or other schemes, nor are there standardized assets defined on the voluntary market.<sup>5</sup>

The voluntary market for land-based carbon, including REDD, is characterized by:

- A large number of transactions but fairly small volumes;
- Pre-compliance speculation;
- Voluntary commitments and philanthropy;
- Several different certification standards in existence or in preparation; and
- Prices that vary widely as a function of the motivations of the buyers and sellers.

These characteristics limit the usefulness of the voluntary market price observations for price setting under the FCPF's Carbon Fund.

The existing carbon funds administered by the World Bank mainly purchase Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs). They use a pricing approach whereby a reference price ("benchmark") is adjusted upwards or downwards according to the specific set of risks inherent in the underlying project and the agreed allocation of risks between buyers and sellers. Other factors, such as advance payments, the degree of competition for a project, and buyers' willingness to pay a premium for specific project attributes, are also factored into the recommended price for a specific transaction. That price is used as the basis for negotiating the ERPA with the seller. The final price is then a result of the negotiations with the seller.

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<sup>4</sup> See [www.biocarbonfund.org](http://www.biocarbonfund.org)

<sup>5</sup> There is scope for forest management under the Joint Implementation (JI) mechanism of the Kyoto Protocol. However, the many regulatory uncertainties associated with JI as well as more technical hassles specific to forestry activities (notably the compatibility of national inventories and registries with the International Transaction Log in this respect) may in the end drastically limit the number of REDD projects implemented under JI. So far no REDD projects have been undertaken or are under development under JI.

Average Prices for Forest Carbon in 2007  
(US\$ per tCO<sub>2e</sub>)<sup>6</sup>

Project type	Price <sup>7</sup>
Afforestation (plantation) on voluntary market	8.2 (2 - 40)
Project-level avoided deforestation on voluntary market	4.8 (2 - 30)
BioCarbon Fund (avoided deforestation)	3 (2.5 - 3.5)
Agroforestry and other assets traded on the Chicago Climate Exchange	3.15 (1.62 - 4.20)
BioCarbon Fund (reforestation)	4.15 (3.75 - 4.40)
Afforestation (restoration) on voluntary market	6.8 (4 - 50)

Note: Numbers in parentheses show the ranges

The absence of a readily available and relevant price reference for REDD makes the existing pricing approach difficult to apply to the FCPF's Carbon Fund. To fill in this vacuum, it has been agreed that the FCPF's PC would issue pricing guidelines for the ERPAs to be signed under the Carbon Finance Mechanism. The objective of the pricing guidelines is to:

- (i) Give sufficient comfort to sellers and buyers at the present stage to commit to selling and purchasing, respectively, ERs from REDD through the FCPF's Carbon Fund;
- (ii) Reflect the risks that derive from the current absence of a regulatory framework on REDD;
- (iii) Recognize the risks and benefits of REDD relative to other carbon asset classes;
- (iv) Allow risk and benefit sharing by sellers and buyers; and
- (v) Leave room for adjustment later on as the UNFCCC adopts rules on REDD and demand and supply for ERs from REDD activities evolve.

The pricing approach proposed below applies exclusively to the FCPF's Carbon Fund and should not be interpreted as an attempt to set the price for REDD in general.

<sup>6</sup> Sources: BioCarbon Fund; Chicago Climate Exchange and K. Hamilton, M. Sjardin, T. Marcello and G. Xu. 2008. *Forging a Frontier: State of the Voluntary Carbon Markets 2008*. Ecosystem Marketplace  
[http://www.ecosystemmarketplace.com/documents/cms\\_documents/2008\\_StateofVoluntaryCarbonMarket2.pdf](http://www.ecosystemmarketplace.com/documents/cms_documents/2008_StateofVoluntaryCarbonMarket2.pdf).

<sup>7</sup> Some data are aggregated values from the supply chain. According to Hamilton *et al.* (2008, op. cit.), the average price for direct purchase from a project developer on the over-the-counter market (all sectors) was \$5/tCO<sub>2e</sub> compared with \$11.30 from the end retailer.

#### **4. Drivers of REDD Values**

In general carbon prices, including those of land-based carbon (Land Use, Land-Use Change and Forestry - LULUCF; Reducing Emissions from Deforestation and Forest Degradation - REDD; and Reforestation and Afforestation - A/R), have varied widely across different markets due to the heterogeneous nature of carbon assets, different transaction profiles, diverging buyers' needs and preferences, and very limited transparency of information on the structure and terms of specific deals.

In general the price drivers for any ER asset are the level of supply and demand, the eligibility under formal climate regime and trading schemes, and the risk allocation between buyer and seller. In the case of REDD, some of the main risk factors include:

- The technical design of the ER Programs, where credibility is of the essence;
- The governance framework in the REDD Country Participant, in particular as it relates to the forest sector;
- Management of permanence of forest carbon in the face of natural and man-made disturbances which can cause the carbon to be released back to the atmosphere;
- Leakage;
- Definition of additionality criteria, which may disqualify certain activities considered to be part of the business-as-usual scenario;
- Monitoring requirements, which may impose constraints on how many ERs can be claimed from a given ER Program;
- The stringency of any future ER regimes and the regulatory uncertainty about the future value of REDD-based ERs;
- Reputational risks associated with doing business in the forest sector, especially in certain countries with forest dwellers and indigenous peoples and poor communities;

The offered price for Emission Reductions from REDD will also depend on the opportunity costs of standing forests. Developing countries would include lost economic gains in their price calculations, as we discuss below.

##### **4.1 Costs as a Price Determinant**

By reducing deforestation and forest degradation rates, developing countries potentially have to compromise financial and economic gains from agriculture, forestry, energy, transportation, urbanization, etc. The corresponding opportunity costs typically differ from country to country and also within a single country. In addition to the opportunity costs, implementation and transaction costs also have to be considered in order to assess the total costs of reducing emissions in the forest sector. These costs may influence the willingness to sell or, more precisely, to develop, implement and maintain programs that will reduce emissions at a given price. A country will have to identify where, when and how incentives for REDD have sufficient impact to reduce deforestation and degradation rates, taking into account these various costs.

The costs of REDD can be broken down into opportunity costs, implementation costs and transaction costs.

- (i) **Opportunity costs.** Deforestation, for all its negative impacts, can also bring benefits. Timber can be used for construction, and cleared land can be used for crops or as pasture. Reducing deforestation means foregoing these benefits. The cost of foregone benefits is known as *opportunity costs* and is usually the single most important category of costs a country would incur if it reduced its rate of forest loss to secure REDD payments. Estimating these opportunity costs is thus the central problem in estimating the costs of REDD. Estimating opportunity costs is also critical to understanding the causes of deforestation. Most economic agents do not cut down forests out of malice - they do so because they expect to benefit from it. Estimating the magnitude of opportunity costs gives a fair estimate of the pressures for deforestation. Understanding how opportunity costs are distributed across society groups tells us who would gain and would lose from REDD, which is important both from a moral/ethical perspective (if losses would be borne by vulnerable groups) and from a practical one (if losses would be borne by politically powerful groups able to prevent adoption of REDD policies or resist their implementation). Estimates of the opportunity costs thus provide inputs not only into the costs the country would bear from avoided deforestation, but also the cause and distributional implications of deforestation and, hence, the types of interventions needed to actually reduce deforestation and the potential need for mechanisms to avoid adverse social consequences.
- (ii) **Implementation costs.** In addition to opportunity costs, there is also a cost involved in implementing a REDD program. This is the cost directly associated with the action leading to the reduction of emissions, e.g., the guarding of a forest to prevent illegal logging, the relocation of a timber harvesting activity away from a natural forest to degraded land scheduled for reforestation, the intensification of agriculture or cattle ranching so that less forest land is necessary for food production, the re-routing of a road project so that less forest land is destroyed as a result of opening the road, the relocation of a hydroelectric production project away from a natural forest, the delineation and/or titling of land to traditional and indigenous communities so that they receive an incentive to keep protecting the forest against conversion, etc. All of these measures incur investment and recurring costs for the public and/or the private sectors, which need to be assessed and financed.
- (iii) **Transaction costs.** Over and above opportunity costs and implementation costs, REDD also involves specific transaction costs, which are the costs that are necessary to establish for the parties to a transaction involving a REDD payment (the buyer and seller, or donor and recipient) and also external parties such as a market regulator or payment system administrator that the REDD program has indeed achieved a certain number of tons of emission reductions. The costs are incurred in the process of identifying the REDD program, negotiating the transaction, and monitoring, reporting and verifying the tons of emission reductions. They are incurred by the implementers of the REDD program and third parties such as verifiers and certifiers, lawyers, etc. These costs are separate from implementation

costs as they are not incurred in the process of reducing deforestation or forest degradation but they come after that. They are nevertheless necessary to the transparency and credibility of the REDD program and thus add value to the whole process.

Priority should be given to the implementation of strategies that describe how the deforestation problem can be most cost-effectively addressed. Giving priority to low-cost solutions such as policy changes and the removal of perverse incentives seems to be an interesting strategy, as long as the basic condition for REDD is met, namely that there be the reduction of a pressure to deforest or degrade.

Some numerical estimates of the costs of REDD are available. In a recent survey, Boucher (2008) reviewed the calculations of opportunity costs of REDD produced by different analysts using different approaches.<sup>8</sup> Boucher distinguishes among three classes of approaches: (i) empirical estimates based on detailed studies in a particular area; (ii) per area estimates, which is a combination of regional approaches to costs but simplified to take into account only one global average carbon content per ha; and (iii) global partial equilibrium models.

In his review of 29 regional empirical estimates, Boucher found that the mean opportunity cost was US\$2.51/tCO<sub>2</sub>, with 18 out of the 29 estimates at less than US\$2/tCO<sub>2</sub>, and 28 out of 29 at less than US\$10/tCO<sub>2</sub>. The mean opportunity costs for Africa, the Americas and Asia were US\$2.22/tCO<sub>2</sub>, US\$2.37/tCO<sub>2</sub> and US\$2.90/tCO<sub>2</sub>, respectively, though Boucher found the differences across the continents not to be statistically significant. Boucher also found that traditional agriculture tends to be less profitable, therefore to have a lower opportunity cost than modern agriculture. As suggested by the numbers reproduced above, the opportunity cost increases as the demand for REDD increases because it costs increasingly more at the margin to protect one more ha of forest.

The Stern Review is the per area estimate identified by Boucher. Using a global average carbon stock of 390 tCO<sub>2</sub>/ha, Boucher assesses an opportunity cost range of US\$2.76/tCO<sub>2</sub>, to US\$8.28/tCO<sub>2</sub> (with a midpoint of US\$5.52/tCO<sub>2</sub>) which corresponds to the range of US\$5 to 15 billion per year the Stern Review estimates is necessary to reduce deforestation by 46 percent. As Boucher suggests, the fact that the Stern Review's estimates are higher than the empirical regional ones may be due the Stern estimates' being higher on the supply curve than the various point estimates of the 29 empirical studies, simply because the Stern review assumes that it would halt as much as 46 percent of deforestation, i.e. it would be situated about half way up the supply curve.

Finally, a number of models have attempted to estimate the aggregate cost, to the global economy, of reducing emissions from deforestation. Kindermann et al. (2008) estimate that to reduce emissions from deforestation by half between 2005 and 2030 (which would correspond to could a reduction in emissions of 1.7 to 2.5 billion tons of carbon dioxide) would require financial flows of US\$ 17 to 28 billion per year to the developing countries responsible for these emission reductions. This would amount to a payment of US\$ 10-21 per ton of carbon dioxide (tCO<sub>2</sub>). A 10 percent reduction over

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<sup>8</sup> Boucher, D. 2008. What REDD Can Do: The Economics and Development of Reducing Emissions from Deforestation and Forest Degradation. Washington: Union of Concerned Scientists. <http://siteresources.worldbank.org/INTCC/Resources/whatREDDcando.pdf>



the same period would cost between US\$ 0.4 and 1.7 billion annually and US\$ 2-5/tCO<sub>2</sub>. These numbers were derived using three global models assessing the opportunity costs of reducing deforestation.<sup>9</sup>

As far as the other costs of REDD are concerned, Boucher estimates that they may be on the order of US\$1/tCO<sub>2</sub>, thus opportunity costs seem to be the largest cost component of REDD.

## 4.2 Risks Associated with the Supply of REDD Carbon

The parties involved in a purchase transaction face several risks that can potentially affect the overall performance of the Carbon Fund. At least three major risks should be considered:

- (i) *Regulatory Risk:* REDD activities developed under the FCPF's Carbon Fund are exposed to substantial regulatory risks. It is not certain whether and how a future climate regime will integrate positive incentives (market or non-market instruments) for emission reductions from deforestation and forest degradation, what procedures and methods would be adopted if that were the case, and when this would start. Experience shows that regulatory risks are a key determinant of carbon prices. It is expected that there will be changes to the prices paid (upwards or downwards) for emission reductions from REDD as the UNFCCC process defines the approaches and uncertainties are reduced and eventually eliminated.
  - By way of mitigating this risk, the FCPF will closely monitor and strive to align with the regulatory developments on REDD.
- (ii) *Delivery Risk:* To a large extent, the success of the Carbon Fund will depend on the performance of the ER Programs from which it will acquire emission reductions. If the ER Programs do not perform, the Carbon Fund will not disburse its capital according to plan. The credibility and coherence of the strategy and policies that each country puts in place will be crucial to attract long-term finance and close long-term purchase agreements which will help to increase the bankability of those ER programs.
  - In many countries improving governance will mitigate the delivery risk. Improving governance could entail the following: (i) clarifying institutional responsibilities; (ii) improving the legal framework; and (iii) developing institutions that can deliver on the REDD-specific management and reporting functions (e.g., management of leakage, monitoring and reporting, coordination of REDD strategies, distribution of REDD revenues, etc.);
  - Broad consultation and participation of stakeholders in a meaningful and repeated manner when designing the national REDD strategies can

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<sup>9</sup> Kindermann G., Michael Obersteiner, Brent Sohngen, Jayant Sathaye, Kenneth Andrasko, Ewald Rametsteiner, Bernhard Schlamadinger, Sven Wunder, and Robert Beach. 2008. "Global cost estimates of reducing carbon emissions through avoided deforestation." *Proceedings of the National Academy of Sciences*, vol. 105, no.30, July 29, 2008, pp.10302-10307. <http://www.pnas.org/content/105/30/10302.full>

also play an important role in reducing delivery risk. The more the strategy is owned by civil society, including forest-dependent Indigenous Peoples and other forest dwellers, and the private sector, and the more equitably the benefits are shared among the various social groups, the higher the probability of success and sustainability will be;

- Risks can be further reduced by (i) applying tight selection procedures so that only the most promising and credible ER Programs are selected into the portfolio; (ii) conservatively estimating the ER potential of any ER Program; and (iii) purchasing only a fraction of the ERs generated by any ER Program.
- (iii) *Permanence Risk*: Even after the Carbon Fund receives delivery of the ERs and pays for them, a risk remains that the carbon would be released to the atmosphere due to natural and human disturbances.
- This risk could be (i) reduced by selecting credible ER Programs with a high likelihood of delivering ERs over a long period of time, and (ii) managed by setting aside a portion of the ERs generated in a buffer or reserve account to compensate for possible future losses. This could be done at a country/program level and/or at the Carbon Fund level. An in-country management of such buffers would require a secure institutional environment and a legal framework that guarantees effective coordination.

### 4.3 Additional Benefits

To the same extent that risks may justify a price discount, benefits may justify a price premium paid to the seller of an ER Program deemed qualitatively and/or quantitatively superior to other ER Programs.

ERs from REDD will not be created equal. In most cases they will feature, in addition to climate change mitigation benefits, a range of 'additional benefits', in particular for local people and the local environment. For example, REDD activities could enhance biological diversity by protecting and restoring natural habitat by concentrating ER Programs on biodiversity hot spots, or preserve or improve livelihoods for local communities by securing customary property or user rights to their forest land and the land's timber and non-timber forest products. Some analysts have argued that REDD needs to be 'pro-poor' to succeed, in particular by using REDD revenues to lift people out of poverty. People would therefore not only be compensated for their foregone income, but they would be made better off through the REDD system. REDD may also create synergy between the climate change mitigation and adaptation agendas by improving the resilience of communities and ecosystems to climate change.

How the FCPF may help create, monitor and value these additional social and environmental benefits is a matter for the FCPF Participants to determine. Especially in the early days of incentive payments for REDD, the resources available will be limited, so there may be ways of directing these limited resources to ER Programs that exhibit strong additional benefits for only a marginal increase in costs, if any at all. In this respect, some ER Programs may achieve cost-effective ERs while also creating additional livelihood and biodiversity benefits.

The Readiness Mechanism will help countries test methods and tools for increasing additional benefits and reducing possible trade-offs between climate change mitigation and policy objectives of socioeconomic development and biodiversity conservation.

Furthermore, the question of the valuation of these additional benefits will be addressed. At this point in time it is not yet clear how to proceed. Should tons of carbon dioxide equivalent with relatively higher additional benefits receive a higher price than those with lower benefits? Or should different buyers pay for different services - practically, can distinct sources of financing for the different services embodied in a REDD ER (carbon, water, biodiversity and poverty reduction) be bundled together? It has to be remembered that livelihood improvements, consultations with local stakeholders and the inclusion of social groups in ER Programs represent risk mitigation measures to the delivery risks and, as such, may also be financially rewarded.

## **5. Potential Demand for REDD**

So far the creation and use of ERs from REDD have not been regulated by the UNFCCC, and it is not clear whether and how REDD will enter a post-2012 carbon market regime. On the one hand, REDD could remain under the UNFCCC but be kept out of international tradable mechanisms. If so, ERs from REDD would not be tradable for compliance purposes against any reduction target or commitment. Still, they could be assigned a value and could also continue to be exchanged on the voluntary market. On the other hand and at the other extreme, REDD could be declared fully eligible and fully fungible with other carbon asset classes on the market. The decisions of the Parties to the UNFCCC on how to treat REDD will have huge implications on the type and size of future demands for REDD assets.

If the future climate regime allows ERs from REDD to be traded for compliance purposes, the level of ER commitments from industrialized countries would most likely become the driving force. A range of factors, such as future Annex I Country targets, the number of countries adopting reduction targets, the capability of REDD to deliver significant ER volumes, the share of compliance-grade ERs reserved for REDD, and overall CDM performance would influence the demand for, and price of, REDD carbon assets. The supply of REDD ERs would be determined by the actual reductions in deforestation and degradation rates achieved in participating countries.

If REDD were to remain without compliance value, the voluntary market would need to expand significantly to satisfy the estimated large volume of potential REDD supply. Additional voluntary commitments from the private sector would be needed. Alternative financing sources are being discussed, such as the use of Official Development Assistance (as in the Brazilian proposal), possible voluntary user-fees on emissions from air and sea transport, emission compliance fees from auctioning off emission allowances, tax on oil and coal consumption, and the use of resources from reducing energy subsidies.

To date the compliance market has dominated the carbon market. In 2007, the global compliance carbon market is estimated to have grown to about US\$60 billion (about double the level of 2006). Within this, the allowance market (mostly the European Union Emissions Trading Scheme) accounted for about US\$42 billion, while the project-based market (mostly the Kyoto Protocol's Clean Development Mechanism) was

estimated at US\$10 billion. The balance was made up of a secondary market for guaranteed compliance assets and the voluntary market. The voluntary market, at about US\$200 million and 50 million tCO<sub>2</sub>e, itself doubled from the 2006 levels. Mid-2007, analysts expected a steady growth of the voluntary market to 400 million tCO<sub>2</sub>e by 2010 (of which 60% from the USA).<sup>10</sup>

In stark contrast to the CDM, forestry activities have received much stronger interest in the voluntary market (with 36% and 18% market shares in 2006 and 2007, respectively, as opposed to much less than 1% in the CDM).<sup>11</sup>

Voluntary carbon transactions encompass all purchases of ERs by entities that voluntarily decide to limit their carbon footprint. This includes private companies (for public relations reasons or to familiarize themselves with the management of ERs in anticipation of regulation), goods and services providers (offering carbon-free goods and services to their customers), individuals (wanting to offset emissions linked to their way of life), brokers and traders, and also governments that intend to contribute beyond their agreed target under the Kyoto Protocol or other agreements. The voluntary market thus caters to the demand from entities not subject to any internationally enforced compliance scheme to limit their greenhouse gas emissions, and to the extent that emission reductions offered in this marketplace are additional, the voluntary carbon market contributes to the global mitigation effort.

There are very few references yet to large-scale operations focusing on REDD but there are some signs that the future demand for REDD might be much larger than the current voluntary market volumes reported above. Norway announced that it will allocate about US\$500 million per year to the fight against tropical deforestation. Financial and service companies have also suggested they are willing to invest large sums in REDD, and a few deals have recently been announced.<sup>12</sup> If additional demand is created by user fees on emissions from air and sea transport, emission compliance fees from auctioning off emission allowances, or taxes on oil and coal consumption, the demand (voluntary or regulated) for REDD might increase significantly.

## 6. Valuation Proposals

The participants in the FCPF are primarily interested in testing approaches and demonstrating first-of-a-kind carbon transactions for REDD. The capital expected to be available in the FCPF's Carbon Fund, namely US\$200 million, is a small amount compared to the expected volumes of REDD ERs that could be generated by developing

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<sup>10</sup> M. Trexler. 2007. "US Demand?", presentation at the Point Carbon Carbon Market Insights 2007, Copenhagen, March 13-15, 2007.

<sup>11</sup> K. Hamilton, M. Sjardin, T. Marcello and G. Xu. 2008. *Forging a Frontier: State of the Voluntary Carbon Markets 2008*. Ecosystem Marketplace  
[http://www.ecosystemmarketplace.com/documents/cms\\_documents/2008\\_StateofVoluntaryCarbonMarket2.pdf](http://www.ecosystemmarketplace.com/documents/cms_documents/2008_StateofVoluntaryCarbonMarket2.pdf)

<sup>12</sup> Merrill Lynch has announced that it would invest US\$9 million in the Ulu Masen project in the province of Aceh, Indonesia, which includes the purchase of 2 million tCO<sub>2</sub> at the price of US\$4/tCO<sub>2</sub>, and the payment of a premium for an option to purchase an extra 1 million tCO<sub>2</sub>. Marriott International has signed a US\$2 million forest-based offset agreement with the Brazilian state of Amazonas. Canopy Capital has announced it would buy carbon from the Iwokrama forest in Guyana.

countries. It is currently expected that the Carbon Fund will engage in approximately five carbon transactions only. For the FCPF to meet its demonstration goal, it is important that the Carbon Fund's proceeds be used strategically. On the other hand, the payments promised by the Carbon Fund will have to be sufficient to provide comfort to sellers that they can count on a certain financial incentive in the future subject to their generating the expected ERs. As well, the buyers (Carbon Fund Participants) need to know what their maximum financial liability is, and if the prices they are expected to pay are competitive relative to other opportunities they have within and outside the carbon market.

In line with the principle of providing comfort to the sellers, the Carbon Fund would likely enter into forward purchases. ERPAs would provide for the long-term sale and purchase of ERs. The chief benefit of long-term ERPAs is to mitigate the risk of price volatility. Below we discuss several pricing alternatives.

## 6.1 Fixed Prices

In fixed-price contracts, the price is set at the signature of the contract and remains unchanged until the end of the contract.

- *Pros:*
  - Fixed prices protect the sellers and the buyers from market movements. They guarantee sellers against price drops and buyers against price increases.
  - Fixed prices offer stability and may help the bankability of activities by enabling sellers to monetize future flows from ERPAs.
  - Fixed prices have been the most common option in forward project-based contracts in the carbon market.<sup>13</sup>
- *Cons:*
  - Due to price fluctuations, fixed-price contracts may fall out of line with market trends and thus lead to perceptions of unfairness over time (even if fixed contract prices were indexed to inflation and currency fluctuations).
  - In the case of REDD, it is expected that regulatory uncertainties will be reduced over time, as the eligibility of REDD under a regulated carbon regime is defined and methodological guidance is issued. If REDD ERs were to become eligible under a future market mechanism, this would trigger higher demand, and most likely higher prices, for REDD ERs, in which case fixed-price contracts may no longer be in line with market trends. On the other hand, if REDD does not lead to tradable rights under a future market, the price for REDD ERs may remain low, in which case a fixed-price may look more attractive.

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<sup>13</sup> Fixed ER revenue streams are required for financial institutions to lend against ERPAs. ERPAs with flexible prices and volumes contracted, but with a fixed pre-defined value (i.e., price times volume) may provide the same benefit. This will be further explained in the context of variable prices.

## 6.2 Floating Prices (Indexation)

Given the extreme variation of carbon prices (especially in the voluntary market) and the uncertainties surrounding supply and demand in a future climate regime, indexation or 'benchmarking' has been on the mind of the sellers of forward project-based ERs. REDD ER contract prices could be left floating or fully indexed to the price of another asset deemed appropriate.

- *Pros:*
  - Indexation is an attractive option to ensure transparent adjustments in long-term contracts.
- *Cons:*
  - Unless a fixed-price component or a cap on variation is agreed upon, both parties could be fully exposed to price fluctuations.
  - There is currently no obvious benchmark to which ERs from REDD could be pegged, and it is unlikely that a single benchmark will develop due to the heterogeneity of carbon asset classes, risks and other attributes. Identifying the right index and/or benchmark is therefore a serious challenge, as the classification of ERs from REDD is in many ways different from current voluntary and compliance assets. Carbon assets currently traded (EU Allowances, CERs and voluntary ERs traded on the Chicago Climate Exchange) are essentially different from REDD:
    - EUAs traded for compliance purposes under the EU Emissions Trading Scheme (ETS) are risk-free in so far as they are permits to pollute issued by the European Commission, the ETS regulator. Their prices vary as a function of very particular supply and demand patterns, including (political) allowance allocations, European weather conditions and price developments in the coal and gas sector. These variables are not relevant for most other carbon asset classes, including REDD. On the other hand, in certain countries, REDD ERs may in due course acquire a common feature with EUAs, namely that the government takes on a commitment to reduce emissions from deforestation and degradation and issues a number of emission quotas not to be exceeded, subject to fines. However, such capping does not exist at the moment;
    - Besides the compliance value, another important difference between ERs from REDD and CERs is that CERs are project-based transactions while ERs from REDD would in some cases not be traceable to a particular of project on the ground but result from national policies accounted for at the national level.
    - CER prices are based on bilateral negotiations, the terms of which are not publicly disclosed, except for some secondary market CERs;

- The Chicago Climate Exchange (CCX) is the only exchange that lists voluntary carbon assets, including but not exclusively those from forestry and REDD, but volumes traded are still rather small and are based on specific projects.<sup>14</sup>

There are different options for indexing the REDD price to an external market price. Indexation can (i) be based on a 1:1 relation; or (ii) risk-adjusted.

(i) *Full indexation (1:1)*

- *Pros:* No need to select an arbitrary ratio;
- *Cons:* Carbon assets under REDD and the market prices do have different characteristics (see discussion above).

(ii) *Risk-adjusted indexation*

- *Pros:* The price index reflects the risks identified for each ER Program;
- *Cons:* Buyers and sellers have different perceptions of the riskiness of a given ER Program, making the selection of the index controversial.

Indexation could be combined with a ceiling price to limit the exposure of the buyer and with a floor price to provide protection to the seller.

### 6.3 Fixed and Floating Prices

This pricing structure would combine a minimum fixed price component and a variable price component. The fixed price component guarantees a minimum carbon revenue as long as the ERs are delivered, and may be linked to the cost of generating ERs, meaning that the fixed price component would be sufficient to cover a range of the costs associated with REDD.<sup>15</sup> The floating price component, which would be indexed to some other appropriate price, would enable buyers and sellers to take advantage of future price rises equally and share the corresponding upside. Under this structure, the combined prices will always be equal to, or lower than, market prices.

- *Pros:*
  - This alternative is suitable for situations where ER Programs require minimum carbon revenues to become viable, but sellers still want to partially benefit from pricing upside potentials.
  - The structure also enhances the ERPA bankability by guaranteeing a minimum contract value.
- *Cons:* This proposal entails some of the same disadvantages as the previous structures, namely:
  - A limited flexibility to adjust to the law of supply and demand;

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<sup>14</sup> More precisely, CCX prices are publicly accessible at <http://www.chicagoclimateexchange.com/> and are applicable to all carbon asset classes, including forestry and REDD.

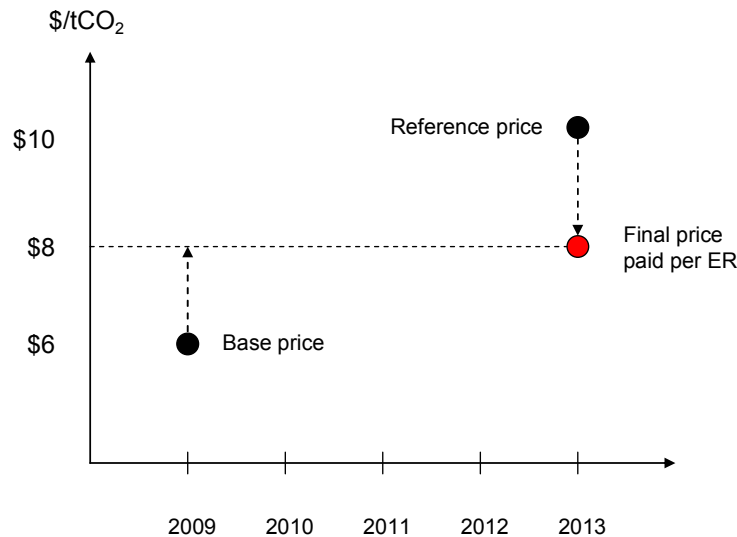
<sup>15</sup> By definition, a fixed price component cannot cover the production costs of all REDD assets, since these vary tremendously across and even within countries.

- Some exposure to price fluctuations; and
- The difficulty of finding the right index.

#### 6.4 Price References with Sharing of Upside and Downside

Under this structure, a price reference is selected before the first ERPA is signed. The price reference can be adjusted periodically so that it remains current. In case of price increases or decreases over the period of the ERPA, i.e. between the time of contract signature and the delivery of ERs, a mechanism can be agreed to share the upside (and downside) of the price fluctuations compared to the initial reference point. An example is given in the chart and text box below.

By sharing the benefits of price upsides and risks of price downsides, this mechanism allows the seller and buyer to benefit from price fluctuations but with limited exposure compared to full indexation or full flexibility.



#### Illustrative example of the pricing formula in item 6.4

The buyer and seller agree on a base price (for example, \$6 per emission reduction) before they sign the contract in 2010 and agree to share, say 50% of the price difference at the time the carbon asset is delivered. For carbon assets delivered in 2013, should the selected reference price be \$10 at that time and the agreement was to compare the selected reference price to the base price, the sellers and buyers would equally share the \$4 upside, and the final price would be \$8 [= reference price of \$6 + (\$10 - \$6)/2]. The buyer would pay \$2 less than the selected prevailing reference price as compensation for being an early mover and to guarantee to the seller a minimum quantity of ERs to be purchased. Should the reference price have fallen to \$4 at the time of the ER delivery, the final price would be \$5 [= reference price of \$6 + (\$4 - \$6)/2], thereby limiting the seller's exposure to the downside risk.



In the absence of transparent market prices, an indicative price reference could be set either through an independent market survey or through an independent price evaluation. A hypothetical REDD program could be created and used as the basis for the consultation process or a survey could be conducted to investigate recent transaction prices in the voluntary market for similar asset classes.

- (i) *A market survey* would evaluate how similar asset classes are currently being priced in the market.
  - *Pros:* The reference is based on real transactions;
  - *Cons:* Asset classes available as reference might be very different with respect to type, size and design, and thus not relevant to the REDD transaction at hand.
- (ii) Instead of a market survey, *price quotations* could be provided to the FCPF by external brokers, based on a real or hypothetical REDD transaction. These quotations would identify the willingness to pay at the present stage. Independent think tanks, carbon brokers and financial intermediaries would be asked to provide quotations to the FCPF to arrive at the indicative reference price.<sup>16</sup>
  - *Pros:* Price quotations would be based on a transaction description that would get the closest to the characteristics of REDD.
  - *Cons:*
    - A hypothetically designed transaction would represent the current thinking on REDD. However this is likely to change significantly over time;
    - This approach also favors the buyers, as it would reflect the willingness to pay for the REDD asset, not the willingness to sell.
- (iii) Hypothetically, an *auction* could be used to set the reference price.
  - *Pros:* An auction may be the most neutral way to discover the real willingness to pay of the buyers' community.
  - *Cons:*
    - Auctions demand that markets be mature (liquid) and efficient (many buyers and no collusion among them), which cannot be said of REDD in these early days.
    - An auction may be unwieldy in the context of the FCPF (see below).

It is possible to limit the price upsides and downsides to levels that are comfortable for buyers and sellers by placing caps on variations.

- *Pros:*
  - Upside caps potentially mitigate the buyers' exposure to price fluctuations beyond desirable/acceptable levels. They can be beneficial to buyers who are not prepared to incur an upside price risk beyond

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<sup>16</sup> To achieve balance in selecting the brokers, sellers and buyers could each designate two agents to provide price quotations; one more broker would be selected by the World Bank.

certain levels and still allow both buyers and sellers to bet on future carbon prices.

- Limits to downside variations mitigate sellers' exposure to extreme downside fluctuations and facilitate the trustee's administration of the funds. The cap will ensure a minimum price per ER, which helps program viability, but still allows both buyers and sellers to speculate on future carbon prices.
- *Cons:*
  - The definition of ceiling and floor prices derives from negotiations between sellers and buyers. It may be difficult for the Participants Committee to agree on the limits.

## 6.5 Auction

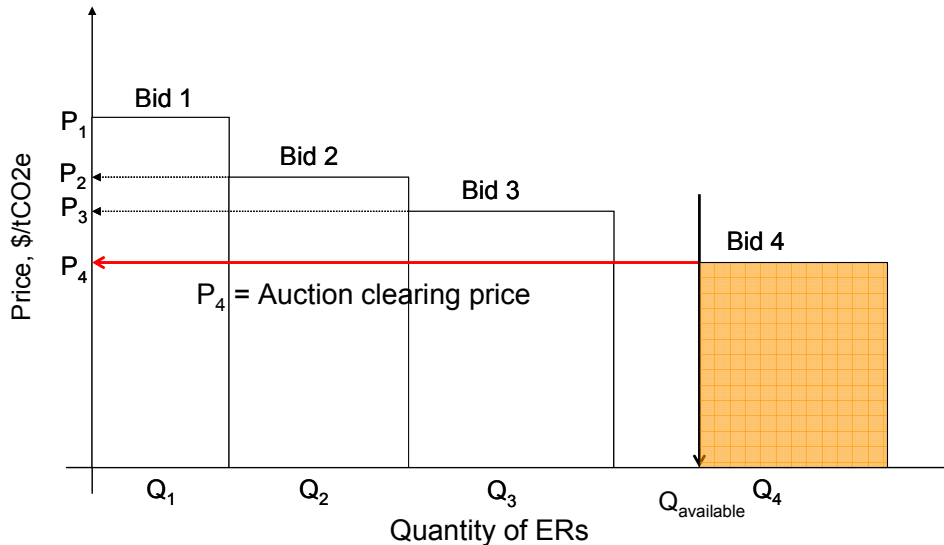
An auction mechanism, whereby a certain quantity of ERs are offered for sale and the buyers' compete for these ERs is thought to be an efficient way to discover the buyers' true willingness to pay.

An auction mechanism for the sale of future REDD ERs could be an option in a mature market when: (i) the expected demand for a certain ER Program is expected to exceed the volume guaranteed by the Carbon Fund; (ii) the delivery risk of future ERs is relatively small or the expected volume for potential ERs is very large; and (iii) the ERs are homogeneous, either because they come from one large program or from different programs with a similar risk profile.

- *Pros:*
  - Auctions represent a good option for price discovery as they let the market forces transparently determine the price for a batch of ERs with a given profile;
  - Auctions may become a very interesting option when larger quantities are put for sale and there is a large enough competition and demand from a larger number of interested buyers.
- *Cons:*
  - As REDD is still an emerging concept, there may not be sufficient market forces to allow an auction to take place in the immediate future, leading to very low, or even no bids, or collusion among bidders. This question deserves further thinking;
  - Carbon Fund Participants may not find an auction interesting as it would give them no advantage relative to any other potential buyer who could simply participate in an auction to buy from the FCPF's REDD ER Programs. This disadvantage can be mitigated by offering the Carbon Fund Participants a first right of refusal for a given quantity of ERs at the auction clearing price minus a price discount;
  - The auction clearing price may be lower than what the seller(s) expected, in which case they may not want to sell. This problem can be managed by announcing a reservation price, below which the seller(s)

would not sell. The reservation price may be set in agreement between the seller(s) and the Carbon Fund Participants such that the Carbon Fund Participants would agree to pay the reservation price in case the auction clearing price does not rise above that level due to lack of competition.

The chart below shows a so-called Dutch auction, in which the auction clearing price paid by every bidder ( $P_4$ ) is the price offered for the last available ER, in this case by the fourth bidder. In this particular case, the fourth bidder does not obtain the full quantity of ERs bid for. The Dutch auction is thought to be one of the most efficient auction types.



## 7. Additional Questions

In addition to the choice of pricing structure among the alternatives described in the previous sections, choices will have to be made among the following possibilities:

- (i) *One-off payment vs stream of payments*: Should a single payment be made in the hope that the cause of deforestation or degradation will be eliminated for ever, or are recurrent payments necessary to provide a recurrent incentive?
- (ii) *Forward contracts vs spot contracts*: Should contracts be signed in advance and provide for a long-term sale and purchase of ERs, or could contracts be signed when the ERs have been generated?
- (iii) *Upfront payment vs payment on delivery*: Should the ERs be paid for in advance upon contract signature or only when they are generated and delivered?
- (iv) *Uniform vs differentiated prices*: Within the same pricing structure, should the prices of two contracts differ to account for difference in perceived risks and benefits, or should these prices be the same? In case of differentiation, should it be purely formulaic or negotiated?

## **8. Conclusions and Next Steps**

An earlier draft of this pricing note dated March 24, 2008 was circulated and discussed with a number of FCPF stakeholders, representing potential sellers and buyers, on April 2, 2008.

On that occasion, the participants in the discussion overwhelmingly expressed a preference for a pricing structure that would include a fixed price component and a floating price component. This combination would offer security but also flexibility. The participants also expressed an interest in testing the auction mechanism as an interesting price discovery mechanism.

The participants requested the World Bank to improve its understanding of opportunity costs and to simulate what ER prices could be depending on the pricing structure that is selected. Work is ongoing in these areas, which will feed in to the discussion on pricing structures. A revised note will be circulated in the near future, followed by another meeting.