Moving Beyond the First Generation of Reductions
Background Paper for LAC Flagship Report, World Bank 2009

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Despite the various uncertainties involved in estimating the costs and benefits of mitigating climate change, the available scientific evidence underscores the urgent need for stepping up current climate mitigation efforts. Indeed, if current emission trends are maintained, there is a significant downside risk of high rates of global warming during the present century, which could in turn lead to potentially catastrophic impacts on human and natural systems. As argued in chapter 1, in order for climate change mitigation efforts to be both effective and efficient, they would necessarily have to encompass reductions in GHG emissions in industrialized *and* developing countries. In addition, a global deal on climate change would have to explicitly incorporate equity considerations both with respect to the territorial origin of emission reductions, as well as their payment.

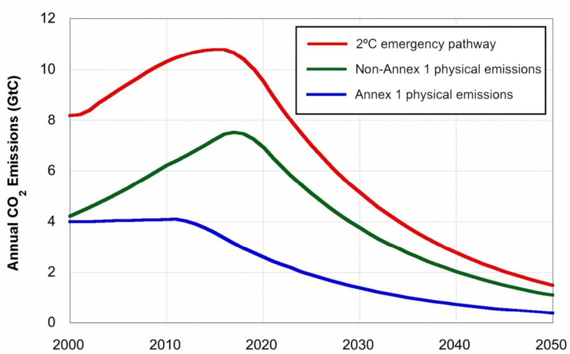
This chapter reviews these various challenges. In particular, we first discuss the equity and efficiency challenges of the climate regime, and highlight the role of climate finance in facing these challenges. We then examine the possibility of employing a gradual approach to developing countries' participation in global mitigation commitments. We review LAC's participation in the CDM over the past nine years and argue that a second generation of mitigation efforts which is policy based and sector wide may require additional financial instruments. Finally we point to the inclusion of reduction of emissions from deforestation and degradation, and incentives for the transformation of the energy and transportation sectors as being crucial to fully realize the mitigation potential of LAC.

4.1. The need for a truly global agreement

Because of the scale of the emission reductions that are required, an effective global agreement to mitigate climate change will necessarily have to involve both industrialized and developing countries. This is the result of the simple arithmetic of the situation. To illustrate this, consider for example an aggressive emission reduction scenario that allows for maintaining a low likelihood of global temperature increases above the 2ºC threshold. The Stockholm Environment Institute (SEI 2007) calls this scenario the "2º emergency pathway". The expected emission reductions that would be needed in order to stay within this scenario are illustrated in Figure 4.1, for the world as a whole as well as for industrialized (Annex I) and developing countries (non-Annex I).

The red line shows the trajectory for global CO2 emissions, which would peak by 2015 and then drop by 80% below 1990 levels by 2050. This would allow for CO2 concentrations to peak at about 470 CO2e ppm. The blue line in Figure 4.1 shows a possible emission trajectory for industrialized countries in which their emissions would peak by 2010 and then decrease by 6% annually, thus dropping to 90% below 1990 levels by 2050. The trajectory is much more stringent than the mitigation proposals that are currently being considered by several industrialized countries – e.g. in June 2007, the G8 countries agreed to reduce their GHG emissions by 50 percent by 2050 – so it is deemed "just barely" politically plausible by the Stockholm Institute. The green line is the arithmetical difference between the global maximum global emissions that would be needed to meet this target (red line) and the emissions that would be generated by industrialized countries (blue line). That is to say, it would be the remaining emission "budget" faced by developing countries. Thus, in addition to current development challenges – e.g. 1.5 billion people without electricity, one billion without access to fresh water, and 800 million chronically undernourished – poor countries would face the additional daunting task of having their GHG emissions peak before 2020 and to drastically reduce them thereafter, not only in per capita but also in absolute terms.[1]

Figure 4.1.Climate Stabilization Paths



Source: Stockholm Environment Institute, "The Right to Development in a Climate Constrained World", 2007.

One could argue that the above scenario is perhaps too stringent. Consider, thus, the more conservative hypothetical target of stabilizing GHG concentrations between 535 and 590 CO2e ppm, which would be associated with temperature increases of about 3ºC with respect pre-industrial levels.[2] What would it take to meet this kind of stabilization target? IPCC estimates that by 2050 global emissions would have to fall to a range from 30 percent below to 5 percent above their 2000 level. On a per capita basis, and for the world as a whole, emissions would have to be reduced from about 6.9 tCO2e in 2000 to

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[1] The trajectory shown covers CO_2 emissions only, including approximately 1.5 GtC of emissions from land use in non-Annex 1 countries in 2000 (note that each tone of carbon corresponds to about 3.7 tons of CO2). The radiative forcing from non-CO2 gases is assumed to decline by about 50% by mid-century.

[2] Note however, that even for this relatively conservative target higher rates of warming cannot be excluded. The level of expected warming in the hypothesis of meeting this target rises from 3ºC to 4.9ºC when using high end – instead of mode – estimates for the so-called "climate sensitivity" parameter, which measures the expected warming associated with a doubling of GHG concentrations. Stern (2008), for instance, using a very similar target of 550 co2e ppm, reports a 7 percent probability of temperature increases above 5ºC, which could potentially lead to the melting of most of the world's ice and snow, as well as to sea level rises of 10 meters or more, and losses of more than 50 percent of current species.

between 3.2 and 4.8 tCO2e in 2050. For developing countries, which in 2000 emitted 5 tCO2e p/c, converging to the average global level of per capita emissions required to meet this target would imply stabilizing at about their current level of emissions per capita or, in a worst case scenario, reducing their emissions by about 36 percent by 2050. Moreover, to the extent that the developing world's share in the world's population would increase from about 80 to 90 percent during this period, the emissions reductions that would be required in developing countries would be largely independent of the stringency of the emission reduction targets taken on by industrialized countries. Thus, for example, even if rich countries were to reduce their emissions to zero – from their current 14.3 tCO2e p/c – developing countries would still need to reduce their own emissions by as much as 28 percent by 2050.[3]

4.2. The equity challenge

Would a self-funded substantial contribution of developing countries to global efforts to mitigate climate change be compatible with equity considerations? Clearly not, for three reasons. First, industrialized countries carry a much larger historical responsibility for the existing atmospheric stocks of GHGs that are causing climate change. Second, developing countries have the right to develop without restraint, just as the current developed nations have done over the last one hundred years. did. Third, developing countries must first face the challenge of poverty reduction,are the most vulnerable and the least able to adapt to the adverse effects of climate change. They can hardly be expected to shoulder the additional burden of reducing their GHG emissions.

The lower level of responsibility of developing countries can be illustrated by the fact that the cumulative energy related emissions of rich countries from 1850 to 2004 are, on a per capita basis, more than 12 times higher than those of developing countries – respectively 664 and 52 tCO2 p/c.[4] Thus, even though their share of the world's population is only about 20 percent, industrialized countries are responsible for 75 percent of the world's cumulative energy related CO2 emissions since 1850. The difference between both groups of countries is smaller but still significant when not only emissions from energy but also from land use change are considered for the shorter 1950-2000 period – land use change emissions are not available for previous periods. In this case the cumulative emissions of industrialized countries would be 457 tCO2 p/c compared to 103 tCO2 p/c for developing countries. It is thus natural to expect rich countries to assume a much larger share of the cost that will be associated with reducing global GHG emissions.

In addition, developing countries face the overarching challenge of achieving and maintaining the high rates of economic growth that are needed to eradicate poverty and

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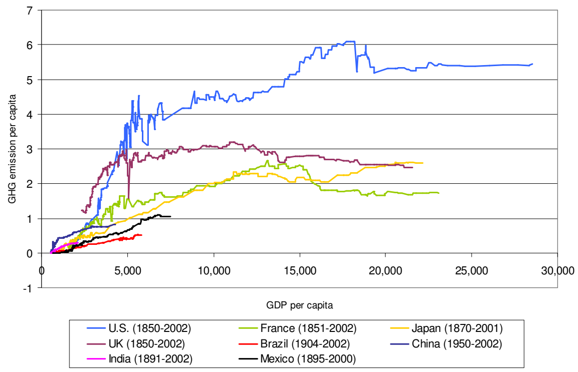
[3] Note, however, that there is a sizable degree of heterogeneity within both groups of countries. Japan and most of Europe, for instance, have emissions of about 10 to 12 tCO2e per capita while the U.S. and Canada emit about twice as much. Similarly, while India's per capita emissions are below 2 tCO2e, China's are close to 5 tCO2e.

[4] Data is from WRI (2008): http://cait.wri.org/cait.php (September 9, 2008).

converge to the levels of income of the industrialized world. In this context, climate change introduces two additional complications. On one hand, additional resources will be needed for adapting to the various impacts of climate change, so as to avoid negative and persistent damages, which could compromise development achievements. On the other hand, the above described arithmetic of the emission reductions needed to stabilize GHG concentrations suggests that developing countries will have to find a way of rapidly decoupling their patterns of income and GHG emissions growth, in a way that is unprecedented.

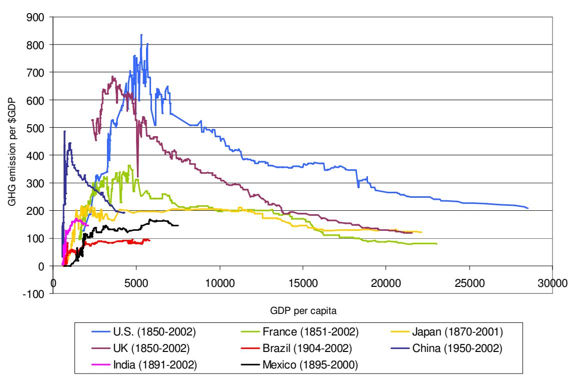
Figure 4.2: Historic trends in per capita GDP and per capita CO2 energy emissions



Source: WB calculations using data from Angus Madison and WRI.

Indeed, as shown in Figure 4.2 and 4.3, at least since the industrial revolution GHG emissions have been closely linked to economic growth. In particular, the first figure shows that in today's industrialized countries emissions per capita grew almost continuously with income per capita between the 1850s and the 1970s. Moreover, the rates of growth of their per capita emissions were much higher during that period than what has been observed, for similar levels of income, in China, India, Brazil and Mexico during the 20th century. In order words, when industrialized countries had levels of income per capita comparable to those of today's developing countries, both the level and the rate of growth of their per capita CO2 emissions were much higher than in today's developing countries.

Figure 4.3: Historic trends in per capita GDP and CO2 energy emissions over GDP



Source: WB calculations using data from Angus Madison and WRI.

A similar pattern applies to the evolution of the ratio of emissions to GDP (figure 4.3), which grew at much faster rates in today's industrialized countries, when their levels of income were comparable to those of today's largest developing countries. Thus, even though in the U.S., the UK, France and Japan emissions per unit of GDP peaked during the early 20th century and have been declining ever since, they only reached levels that were comparable to those today's developing countries, when their levels of income per capita had reached between 2 and 4 times those exhibited in the present decade by Brazil, China and Mexico.

This suggests that patterns of development have already become relatively "cleaner" at least in comparison to the historical experience of today's rich countries. This is probably due to several factors. First, thanks to technological change, during the past 150 years the world has shifted to relatively cleaner energy sources – e.g. with gas and oil substituting for coal. Second, energy consumption has been reduced significantly, at least in industrialized countries, as a result of increasing oil prices, particularly after the oil shocks of the 1970s (see chapter 5). Finally, the growth in global trade has caused many energy and carbon intensive industries to move from industrialized to developing countries, with the former specializing in the production of cleaner knowledge intensive goods and services.

In this context the challenge that the developing world will face is that of further decoupling GHG emissions from economic growth during a relatively short period of time without compromising their economic development goals. Indeed, while there are a number of opportunities for reducing emissions in ways that have concomitant development benefits and relatively low costs, a theme we will explore later, the rapid deployment of low carbon energy technologies will likely come at a significant cost. How to maximize efficiency in order to minimize this cost, and how to share the corresponding "bill" across countries with different levels of development and responsibility for GHG emissions are the questions that we address next.

4.3. The efficiency challenge

Setting equity aside, and as shown in chapter 1, in an ideal situation in which the marginal costs and benefits of mitigating climate change are known with certainty for different alternative levels of emission reductions, the optimal level of mitigation expenditures would be that for which the cost of abating an additional ton of GHG is equal to the value of the marginal climate damages avoided. To reach that optimal level of abatement at the lowest cost, in an ideal word policy makers would use economic instruments – namely global "cap and trade" or "carbon tax" systems[5] – that result in the emergence of a price on carbon emissions that is equal to the marginal damages of additional emissions (the so-called "social cost of carbon").

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[5] These could be complemented with government regulations aimed at addressing various types of market failures that may limit the diffusion of low carbon technologies – e.g. lack of information, credit constraints or the presence of "split incentives".

In practice, however, there are considerable degrees of uncertainty on both the costs and the benefits of mitigating climate change. This, coupled to the presence of irreversibilities associated both with mitigation investments (e.g. in fixed assets to produce clean energy) and with increases in the stock of GHG (e.g. the difficulty of reducing them if "bad news" arise on their actual size or negative impacts) may tilt the balance in favor of one or the other policy instrument, as well as lead to lower or higher levels of optimal abatement than the above simple framework would suggest (Pindyck, 2008). Moreover, the relative virtues of both instruments would also depend on how governments use the revenues generated respectively through carbon taxes or the auctioning of allowances (Aldy et al., 2008). In summary, there are differing views on how to weigh the pros and cons of these two approaches, with no consensus having emerged as yet. In the end, which is more likely to be adopted will probably be decided by what is politically feasible to negotiate.

But regardless of the level of abatement envisaged and of the specific mechanism used to generate a price on GHG emissions, mitigation efforts will only be efficient when the same "carbon price" applies to all emitters. Indeed, this would ensure first that all possible mitigation opportunities are considered when deciding – in most cases implicitly, through market mechanisms – which ones to pursue at each level of abatement. Second, a common price on carbon would also ensure that only the least expensive mitigation alternatives, with marginal costs below the common carbon price, are implemented.

A recent study found, for example, that reducing global emissions by 55 percent in 2050 (relative to a baseline scenario) using a uniform carbon tax would have a cost equivalent to 1.7 percent of global GDP. In contrast, the cost of achieving the same global emission reduction without a common price on carbon would be about 50 percent higher. In particular, if country-specific taxes were to be used, setting their rates so as to deliver the same 55 percent emission reduction in each and all countries, the cost would reach 2.6% of global GDP (Medvedev and van der Mensbrugghe, 2008). The lower mitigation costs achieved in the first case would result from a different allocation of emission reductions across countries, with larger efforts being implemented in those which offer cheaper mitigation opportunities, as opposed to the second alternative in which all countries would reduce their emissions in the same proportion, regardless of their different mitigation costs.

Achieving a common carbon price within national boundaries implies harmonizing various domestic government policies across sectors, so that the combined impact of emission caps, carbon taxes and other Government policies and regulations – i.e. the shadow price of GHG emissions – is the same for all emitters. While this is not trivial, achieving the same goal at the global level is certainly much more challenging, especially if one expects the corresponding global agreement to also satisfy equity considerations.

4.4. Combining equity and efficiency: a critical role for climate finance

The discussion above implies two desirable characteristics for a global agreement to address climate change mitigation: First, equity considerations would call for developing countries to carry a very small share of the burden. Second: efficiency would require a mechanism to establish some kind of uniform price for carbon, which would mean that the reductions would be carried out in the ways and places that it could be done most cheaply. So, if developing countries have a comparative advantage in activities that could reduce GHG emissions – e.g. relatively low production costs for renewable energy, or a potential for reducing deforestation at a relatively low opportunity cost – efficiency considerations would call for a relatively large share of global mitigation efforts to be allocated to them. In fact, the Investment and Financial Flows study of the UNFCCC estimates that 68% of the mitigation needed for a total reduction of 31 GTCO2 by 2030 is located in the developing countries and can be achieved for 46% of the cost of the global mitigation (UNFCCC 2007). [6]

Is it possible to build a "global deal" which could satisfy both equity and efficiency considerations? The answer is a clear yes. As argued by Spence et al (2008), the key is to decouple the *payment* for mitigation from the *site* of mitigation. The traditional interpretation of the principle of "common but different responsibilities and respective capabilities" would have us conclude that the only way of addressing the extreme inequality in both capability (wealth) and responsibility for the problem is to defer aggressive action on climate change in the poorer countries. As long as we assume that every country has to pay for the emission reductions achieved on its territory, developing countries will understandably argue that they cannot act on climate in a significant way because of inequity and their other priorities which have to take precedence. However, we have seen that in order to stabilize the climate, we need urgent action everywhere. The only solution to this dilemma is to share the global burden according to transparent principles of equity and capability, independently of the territorial origin of the emission reductions.

The delinking of the site of reductions from their payment can be achieved in several ways. One option is to adopt an international cap and trade scheme, through which a common price on carbon would emerge even if countries agree on different levels of contributions to global efforts – i.e. different caps on emissions. Resources would flow automatically to pay for emission reductions in countries that offer the lowest cost mitigation opportunities, thus potentially funding an important level of mitigation efforts. . A similar outcome could be achieved with a carbon tax mechanism – and some authors argue that such a mechanism might even be easier to negotiate and easier for developing countries to administer (Aldy et. al. 2008). But with a carbon tax, equity would require a parallel agreement on a set of international resource transfers aimed at ensuring that the share of the global "bill" of climate change mitigation that is paid by each county is proportional to its responsibility for generating the problem and not necessarily to the country's actual contribution to its solution.

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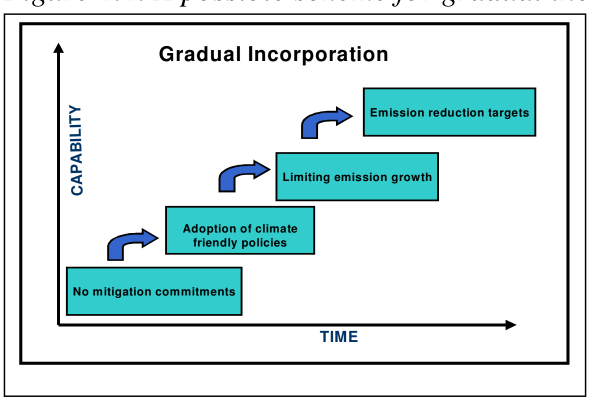
[6] UNFCCC 2007, Investment and Financial Flows to Address Climate Change.

However, developing countries are not open to either a global cap-and-trade scheme or a global carbon tax. At least for the time being, the decoupling of the site of mitigation from its payment will have to be achieved through an admittedly more cumbersome but politically much more acceptable avenue: the combination of deeper reduction commitments on the part of all industrialized countries (including the USA), the continued use of the CDM although it may be marginally improved, an expanded market based instrument (which could be part of the CDM system or another one) and a complementary non market financial instrument that would help defray some of the costs of mitigation in developing countries but would not transfer emission rights to those who provide the funds. Not all reductions in developing countries can be put on the market, first because these substitute domestic action, and secondly because there is potentially higher supply (68% of global reductions are in the South) than demand. The appropriate combination of these measures will be complex to negotiate into an agreement, as it ideally must balance not only supply and demand within the market mechanism(s), but also willingness to pay (on the part of the industrialized countries) and effectiveness (to promote reductions in the South) within the non market mechanism(s).

If negotiated, this palette of climate finance instruments could provide the framework for a global agreement which would confirm most (small) developing countries as continued hosts of market-based mitigation efforts, but would at the same time provide the necessary incentives for the larger developing countries togradually move towards the adoption of their own climate mitigation commitments. In order to alleviate the trade-offs between economic development and climate change mitigation objectives, some developing countries could start with a focus on "climate-friendly" development policies without explicit mitigation commitments, and transit over time, based on demonstrated capability (e.g. as measured by per capita income), from a, to limiting emission growth and, finally at some point in time, to some of them adopting emission reduction or at least emission intensity targets (Figure 4.4).

Figure 4.4. A possible scheme for gradual incorporation of developing countries



Source: Figueres (2008).

In order to uphold the integrity of the system, all mitigation efforts, whether based on climate friendly policies or eventually on targets, would have to be measured and reported, and internationally verified. In order to ensure fairness and equity, the gradual incorporation of developing countries could be linked to – i.e. conditional upon – industrialized countries' verified performance (e.g. in terms of both the provision of financing for developing countries mitigation efforts and emission reductions achieved at home).). Moreover, an agreement would have to be reached on possible objective criteria for defining the thresholds that would trigger an increasing degree of incorporation of developing countries. In this respect, it is important to recognize the wide variety of country circumstances that are found not only across rich and poor countries, but also within the group of developing countries.

In particular, as argued by Yamin (2006), it is important to take into account countries' different degrees of *responsibility* for the climate challenge, as well as their *capability* for addressing it, and their *potential* to implement mitigation activities. In the context of the *North-South Dialogue* Ott et al. (2007) have proposed a specific framework in which: (1) mitigation efforts would be concentrated in countries with medium or high potential; (2) the amount that each country would contribute to the funding of global efforts would depend on its levels of responsibility and capability; (3) the contributions by countries with low responsibility would be voluntary; and (4) those of countries with medium responsibility or with low to medium capability would be conditional on financial and technical transfers from high capability countries.

Table 4.1. Potential, responsibility and capability to reduce GHG emissions

	Annex I (*)	LAC	Brazil	Mexico	Other developing countries	China	India
Potential to mitigate							
GHG/GDP, 2000 (in t CO2/Mill. US$-PPP)							
Group Range	239 - 2,446	203 - 16,486			352 - 35,632		
Group Average	759	2,477	1,876	752	3,619	975	655
Group Total	643	1,425			1,395		
CO2 (excl. LUC)/GDP, 2000 (in t CO2/Mill. US$-PPP)							
Group Range	208 - 1,583	117 - 2,166			0.1 - 3,310		
Group Average	561.5	460	280	436	511	686	434
Group Total	535	377			630		
GHG/capita, 2000 (Tons CO2e Per Person)							
Group Range	5.5 - 26.6	1.3 - 93.7			0.7 - 53.8		
Group Average	12.3	12.2	13.4	10.0	7.7	3.8	1.5
Group Total	14.3	10.0			4.4		
CO2 emissions growth, 1990-2000 (in %)							
Group Range	-6.8 - 4.3	-5.5 - 8.1			-11.3 - 17.4		
Group Average	-0.44	0.30	-2.3	0.8	2.35	2.2	5.2
Group Total	0.07	-1.60			2.51		
Responsibility to mitigate							
Cumulative CO2/capita, 1990-2000 (in t CO2)							
Group Range	32.5 - 241.8	-75.1 - 1,099.3			-12.4 - 373.4		
Group Average	100.9	107.5	117.0	51.5	53.3	27.2	8.6
Group Total	121.1	82.4			33.5		
Capability to mitigate							
GDP/capita, 2000 (in US$-PPP)							
Group Range	4,037 - 50,564	1,499 - 16,958			226 - 42,166		
Group Average	20,446	6,442	7,142	9,262	4,994	2,371	1,517
Group Total	22,170	7,026			2,399		
HDI, 2000							
Group Range	0.75 - 0.96	0.67 - 0.86			0.92 - 0.32		
Group Average	0.89	0.76	0.79	0.81	0.61	0.732	0.578
Total GHG emissions, 2000 (in Mt CO2 equiv.)							
Sum	17,583	5,166	2,333	682	18,777	4,850	1,574
Top five	United States 6,611	Brazil 2,333			China 4,850		
	Russia 1,991	Mexico 682			Indonesia 3,068		
	Japan 1,406	Venezuela 384			India 1,574		
	Germany 1,044	Argentina 353			Malaysia 861		
	Canada 751	Colombia 274			Korea (South) 547		

Notes: (*) Defined as Annex 1 countries in the UN Framework Convention on CC, including all the developed countries in the OECD, and economies in transition.
GHG = CO2, CH4, N2O, PFCs, HFCs, SF6 (includes land use change & intl. bunkers), CO2 emissions growth (CO2, including LUC & intl. bunkers), Cumulative CO2: CO2 (energy), CO2 (land use change)
Sources: GDP - PPP constant 2000 in intl $ & Population 2000: WDI, Emissions: Climate Analysis Indicators Tool (CAIT) Version 5.0. (Washington, DC: World Resources Institute, 2008)., Human Development Index (HDI): UNPD

In order to make such a framework operational, an agreement would have to be reached also on how to measure the relevant variables. *Responsibility* could be proxied by cumulative GHG emissions, starting for example in the mid 19th century, when global man-made emissions experienced their first significant trend break or starting much more recently, when a sizable scientific consensus was reached on the climate impact of GHG emissions – e.g. in 1990, when the first IPCC report was launched.[7] The level of *capability* of different countries, in terms of their ability to fund adaptation and mitigation activities, could be proxied by levels of GDP per capita or with the UN's Human Development Index. As for countries' mitigation *potential*, it could be proxied by the level and rate of growth of their GHG emissions, either relative to population or GDP, or in absolute terms. Indeed, as argued by Elis et al. (2007), there is less room for domestic mitigation actions where emissions levels or growth rates are already low.

As shown in Table 4.1, in comparison with industrialized countries and the rest of the developing world, LAC countries can be described as having intermediate levels of *potential*, *responsibility*, and *capability* to mitigate climate change. The region's standing on the first two criteria, however, critically depends on whether emissions from land use change are or not considered in the analysis. If not, the region can be described as having at most medium levels of responsibility and potential for implementing mitigation activities.

4.5. LAC's Performance in the CDM

For the time being the CDM is the only financial vehicle for developing country mitigation efforts that are recognized and quantified under the UNFCCC. The CDM represents the first generation of mitigation efforts in developing countries: it promoted a first wave of emission reductions achieved by single site projects that either displaced more carbon intensive alternatives (e.g. renewable energy displacing fossil fuel energy) or were submitted to a 'carbon upgrade" (e.g. capture of methane in landfills, increasing efficiency in energy generation, etc.). And yet, in the face of the shortcomings that we discuss below, and the concurrent need to scale up mitigation, the calls to expand/reform the CDM are well documented. As we approach the end of the first commitment period countries may create other avenues (market and/or non market based) to catalyze a second generation of mitigation efforts that are broader in scope and higher in volume, and which are discussed at the end of this chapter. However, the CDM, with its strengths and weaknesses, has undoubtedly been successful in creating a class of market-based mitigation activities in LAC and elsewhere in the developing world.

We first review LAC's participation in the CDM and identify the barriers that have been encountered, before exploring options to further promote mitigation by stimulating a second generation of emission reductions in developing countries.

The CDM has evolved rapidly since the adoption of the Kyoto Protocol in December 1997, growing from 20 Mt CO2e in emission reductions traded in 1998, to 100Mt CO2

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[7] An agreement would also be needed on whether to look only at cumulative per capita emissions or, alternatively, to also consider total absolute levels of emissions. The latter could be particularly relevant in the context of stringent stabilization targets, which would require a strong involvement of the world's largest emitting nations, regardless of their level of development (Elis, 2006).

traded in 2004 and 537 Mt CO2e in 2007. In this year the value of primary CDM Certified Emission Reductions (CERs) reached USD 7.4 billion. Moreover, 2007 also saw the emergence of secondary markets, which traded 240 Mt CO2e in emission reductions for an amount of USD 5.4 billion.

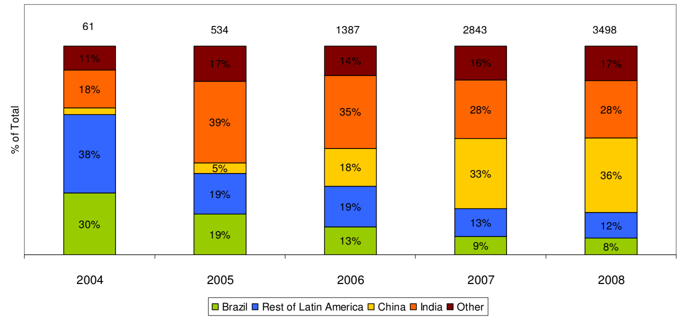
By mid 2008 LAC accounted for about 20 percent of the 3,498 active projects in the CDM pipeline. If all the expected CERs from these projects were to be delivered, they would generate 2,640 MtCO2e in emission reductions, of which about 15% would be sourced from LAC projects. Assuming an average price of USD 15 per ton, the investment in emission reductions in the region would be USD 5.8 billion by 2012. It is worth noting, however, that after accounting for various risks – e.g. of issuance failure, negative DOE validation, or rejection by the CDM Executive Board (EB) – and taking into account registration delays and the expected future stream of new projects, most market participants expect a smaller number of CERs to be delivered by 2012. Thus, for instance, UNEP RISO estimates that only 1,568 MtCO2e will be issued before the end of 2012.

A declining market share

The LAC region was clearly the early mover in the CDM. The region began experimenting with Activities Implemented Jointly (precursor to the CDM) in the early 1990's. The *Programa Latino Americano del Carbono* (PLAC), the first carbon finance program to be established by a regional development bank, was created by the Andean Development Corporation in 1999, even before the Marrakesh Accords established the modalities and procedures for CDM. From 1999 to 2002, the region had more Designated National Authorities (DNAs) –the entities which handle the host country CDM project approval process – than any other region in the world, and received a total of USD18 million in CDM-related capacity building.[8] The investment in technical training bore immediate fruits, as from 2001 to 2004 the region had submitted 62% of all CDM projects to the EB, and had prepared 68% of all approved CDM methodologies. The first project to be registered by the EB was the landfill methane capture project of Nova Gerar in Brazil in 2004, and the first certifications of emission reductions were issued to Rio Blanco and La Esperanza hydro projects in Honduras in 2005.

Figure 4.5. Cumulative number of projects in the CDM pipeline, by country/region of origin

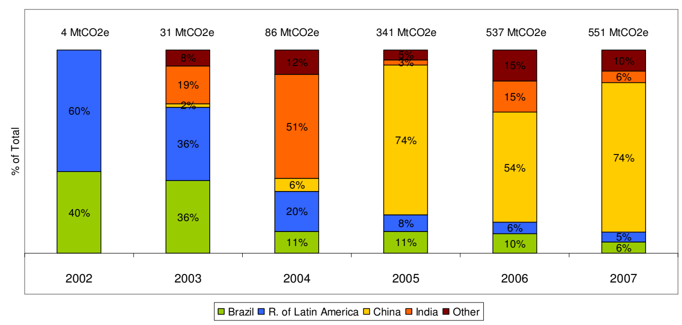
[8] Figueres, C. 2004 "Institutional Capacity to Integrate Economic Development and Climate Change Considerations: An Assessment of DNAs in Latin America and the Caribbean." Inter American Development Bank.



Source: WB staff calculations using data from the CDM Pipeline database published by UNEP Riso, June 2008.

By the middle of 2006, however, the region had lost its dominant position in the market, as India and China had entered with much higher volumes. As shown in Figure 4.5, LAC went from accounting for 68% of all active projects in the CDM portfolio in 2004 – there were just 61 active projects at the time – to 33% of the 1,387 projects in the pipeline in 2006 and just 20% of the 3,498 projects that were active by early June of 2008. Similarly, the share of LAC in the total volume of transacted CERS fell from 72% in 2003 to 11% in 2007 –6% of which were from Brazil – compared to 74% for China and 6% for India (Figure 4.6).

Figure 4.6. Primary CDM transaction for compliance, by country/region of origin

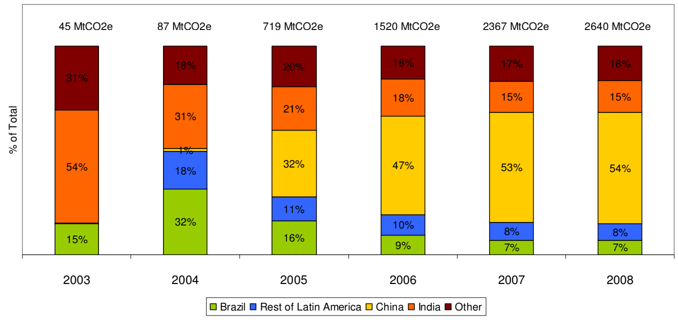


Source: WB staff calculations using data provided by Philippe Ambrosi (World Bank).

The rapidly growing market shares of China and India were originally due to a few "end of pipe" HFC-23 destruction projects that, given the very high global warming potential of HFC-23 as compared to CO2, achieved extremely large volumes of Certified Emission Reductions (CERs).[9] However, this type of project has been nearly exhausted worldwide and over the past few years, China and India have been able to diversify their supply, expanding their CDM portfolio to other sectors (renewable energy, energy efficiency improvements in the industrial sector, and methane recovery and utilization) while managing to maintain their hold on the market.

Figure 4.7. Cumulative 2012 CERs from CDM pipeline, by country/region of origin

[9] In terms of warming potential, one ton of HFC is equivalent to 117,000 tons of CO2.



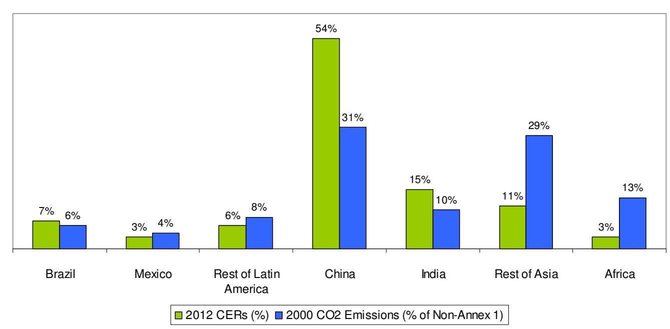
Source: WB staff calculations, data from the CDM Pipeline database published by UNEP Riso, June 2008.

In contrast, the projects from LAC have been, since the early years of the CDM, smaller than those from other regions. For instance, the region's share in the 2012 CERs expected from the active CDM pipeline – assuming no risks – was always smaller than its share in terms of number of projects. For example, while in 2004 LAC had 68% of all active projects, it had just 50% of the corresponding 2012 CERS (Figure 4.7). By 2007, when the region's share of the pipeline had fallen to 22%, its fraction of the expected 2012 CERs was only 15%. In contrast, with 33% of the active projects in 2007, China was able to capture 53% of the 2012 expected CERs.

LAC's Supply

While LAC countries have been outperformed by China and India as CER suppliers, one could hypothesize that this is due to their higher GHG emission levels. In particular, it should not be a surprise if countries with high emission levels were also among those with a high supply of emission reductions. We thus compare the fraction of 2012 CERs from projects in the CDM pipeline held by selected countries, to their respective share in GHG emissions from non Annex 1 countries – the only ones that can supply the CDM. Land use change and forestry emissions are not included as most of these emission reductions cannot be included in the CDM. Using this approach, Figure 4.8 reveals that if emission levels can be interpreted as an indication of potential supply to the CDM, Mexico, Brazil and the rest of LAC are almost "on target" – if anything Brazil is slightly oversupplying and the rest of the region is slightly undersupplying CDM projects. However, India and particularly China are clearly over performing, and the rest of Asia and Africa are under performing in the carbon market.

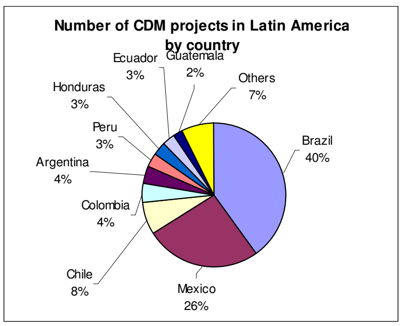
Figure 5.4. Shares of 2012 CDM CERs and non-LULUCF emissions (Non-Annex 1)

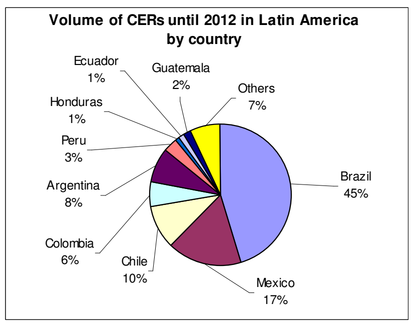


Source: CO_2 emissions (without LULUCF): CAIT; 2012 CER: WB staff calculations using data from the CDM Pipeline database published by UNEP RISO, June 2008.

The pattern of the highest emitters being the largest suppliers can also be observed at the regional level. Within the LAC region the market is clearly dominated by Brazil and Mexico, both in terms of absolute numbers of CDM projects, as well as in volume of CERs. From either perspective the two countries represent more than 60% of the supply from the LAC region (Figure 5.5), compared to a share of 55% in the region's emissions excluding land use change. This over-performance of Brazil and Mexico could be attributed primarily to their size, which allows them to support industries that have the potential for projects entailing sufficiently large emission reductions to justify the transaction costs involved in the CDM. This category of projects was initially made up mainly of projects to reduce HFC-23 emissions. However, more recently renewable energy, methane capture from landfills and agro-industries have also become attractive project types for taking advantage of the CDM in the LAC region (see below).

Figure 5.5. LAC's CDM portfolio by country (number of projects and 2012 CERs)





Source: CDM Pipeline database published by UNEP RISO, June 2008.

In summary, patterns of over- or under-supply in carbon markets (with respect to countries' shares in GHG emissions) are likely to reflect the relative availability of large-scale, low-cost and low-risk mitigation projects. For example, China's larger share of the carbon market compared to its share of developing countries' emissions would be a reflection of the large number of projects in that country that meet the above profile. In fact, as argued below, the limited participation of small and medium countries in the CDM, due to a large extent to the small scale of their mitigation projects (relative to CDM transaction costs), has been one of the reasons for introducing the option of registering programs of activities – as opposed to single projects – in the context of the so-called *programmatic* CDM.

LAC's CDM portfolio by sector

An analysis of LAC's current CDM portfolio by sector indicates some issues of concern. Industrial gases (HFC-23 and N20) continue to have a 17% share in 2012 CERs despite representing only 2% of the region's CDM projects. These shares are even higher in Asia, where industrial gases account for 31% of 2012 CERs (Figure 5.6). The potential of this type of project, however, will decline in the future, as most major industrial gas projects have now been tapped and are being gradually balanced out by other types of projects.

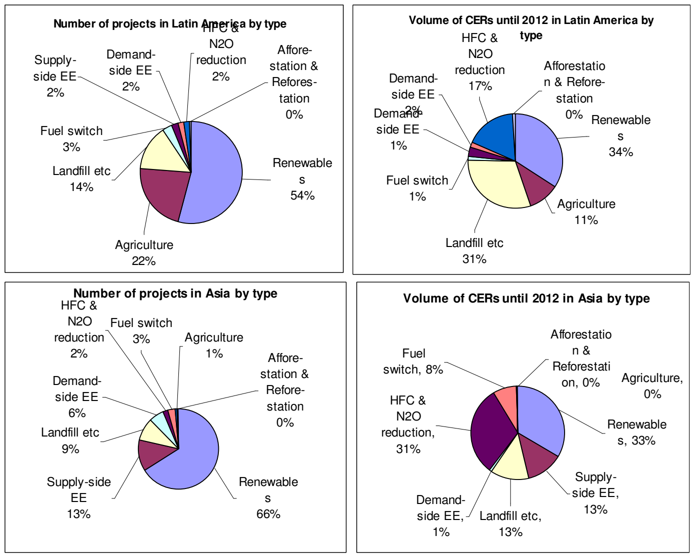
Today's portfolio also shows that 54% of LAC's projects are in the area of renewable energy, whose share in 2012 CERs is 34%. The share of renewable energy in LAC's portfolio is comparable to that found in Asia and probably commensurate with the mitigation potential of this sector in the region, at least if large hydros are excluded.[10] Besides hydros, the sugarcane industry's use of bagasse comprises most of the remainder of the CDM renewable energy projects in the region and will likely continue to do so.

Other major categories of emission reduction projects in the region are methane capture from landfills, agriculture, and the emerging field of sewage treatment. While projects aimed at capturing landfill gases represent only 13% of the LAC portfolio, they are responsible for 31% of the region's 2012 CERs. The average size of these projects is larger than in Asia, where the share of this project type is similar in terms of both number of projects and volume of 2012 CERs. As for LAC's CDM projects in the agricultural sector, they represent less than 1% of Asia's portfolio but 22% of LAC's 2012 CERs and 11% of the region's total number of CDM projects.

Looking forward, there are still many undeveloped landfills and agro-industry opportunities in the region. However, sites that may seem ripe for development may yield fewer reductions than expected for a variety of technical reasons. Unlined and unsorted landfills are susceptible to leakage of methane and low organic content to produce methane (Zeller, 2007). Agro-industry methane capture success depends on the pH, temperature, and antibiotic and water content of the excrement, which is determined by the relationship of the farmer and the farm doctor with the project developer (Gavaldon, 2007). For these reasons, despite the high global warming potential of methane, the CDM has not provided a sustainable solution to the burgeoning urban waste management problem.

Figure 5.6. CDM projects and 2012 CERs in LAC and Asia, by sector

[10] Currently the European Union, the main buyer in the market, requires that CERs derived from hydro projects over 20 MW must comply with the guidelines of the World Commission on Dams, which adds complexity to project registration and practically prevents the registration of those projects. Thus the inclusion of large hydro in the CDM has been limited to mostly smaller size plants. However, Annex I DNAs are sovereign while applying its own criteria on whether or not a given hydropower project complies with the WCD. In an effort to bring homogeneity to WCD compliance criteria for CDM projects, the EU Commission foresees the future introduction of an EU guideline on this matter.



Source: CDM Pipeline database published by UNEP RISO, June 2008.

However, the aspect that stands out most clearly in the analysis of the LAC portfolio is the absence of two asset classes that represent high emission levels in the region. The first of them is the reduction of emissions from deforestation. There is no doubt that one of the region's main contributions to global mitigation efforts would be a decrease in deforestation rates. However, activities that reduce emissions from deforestation are not eligible under the current modalities of the CDM. Land-use change and forestry assets are currently limited in the CDM to afforestation and reforestation activities. Discussions are underway about the role that emissions from deforestation may have in a post-2012 regime, but until then that mitigation potential – perhaps the largest of all sectors for the region – remains unleveraged by carbon finance.

The second sector that is clearly underrepresented in the region's CDM portfolio is transportation. As was discussed before, transportation is the sector with the largest share of LAC's energy related emissions. However, the potential of this asset class in the CDM is curtailed by the lack of methodologies. Currently there is only one approved CDM methodology in the transportation sector (rapid transit lanes as implemented by the Transmilenio project in Bogotá, Colombia). Several other types of transportation methodologies are under preparation (construction of underground transportation systems, use of biofuels, etc.) but until they are approved, transportation will remain underrepresented in the CDM portfolio of the region, despite the fact that it is one of the major emitting sectors.

Finally, the above mentioned problem of relatively high transaction costs limiting the participation in the CDM of projects with few emission reductions, particularly in small and medium countries, has a particularly dampening effect on projects in the area of energy efficiency. Indeed, by their own nature these projects tend to be dispersed among many small sites, although this could be less of problem in large countries (where each site could be of a large scale). Thus, energy efficiency projects represent almost 20 percent of Asia's CDM pipeline, compared to less than 5 percent in LAC.

Barriers to the expansion of the CDM in LAC

The decreasing participation of LAC in the CDM can be traced to several factors. An early 2006 survey of market participants[11] identified the following strengths in the LAC region, as compared to other regions of the world: better understanding of the CDM project cycle, more solid Project Design Documents (PDDs), higher participation of the private sector, more knowledgeable local consultants to prepare PDDs, and clear mandate from respective governments to actively engage in the CDM. However, the same survey pointed to the fact that the region was losing its first mover advantage in the market, and identified the following policy and regulatory weaknesses in LAC: major differences in procedures among DNAs in the region, more host country requirements than other regions and slower national approval processes. In addition, the survey mentioned the region's lower emission reduction potential as compared to Asia.

Another critical factor driving LAC's declining market share in the CDM is the *uncertainty regarding the post-2012 regime*. Long term commitments by industrialized countries are necessary to sustain carbon markets. The recent proposal of the European Union for the Third Phase of the European Trading Scheme (ETS) severely limits the use of the CDM for the purpose of compliance with European regulations unless an acceptable multilateral agreement is reached. Moreover, even if such an agreement materializes, the Third Phase of the ETS would only marginally expand the use of CDM. The proposal has not been ratified by the European Commission, but the potential ceiling on demand for CERs has already had a stifling effect on market optimism. Should it be carried through, the ceiling could result in an increased emphasis on projects with short lead times and projects where the financial closure does not strictly depend on the forward sale of emission reductions. This means that until the uncertainty regarding the future of the CDM is significantly reduced, carbon finance will have limited influence on investment decisions for large scale infrastructure projects with long gestation periods that have the potential to deliver a large quantity of emission reductions. In the LAC region, where many CDM projects require high and long term investments, the absence of a long term carbon market signal is already being reflected in the dwindling of CDM transactions.

A third key barrier to the development of CDM projects in LAC is the lack of concerted CDM strategies. Only a very few countries in the region (e.g. Mexico, Brazil underway) have a concerted mitigation strategy and in most cases this strategy does not involve any specific measure to boost CDM utilization. During the past decade, however, in the context of the *National Strategy Study Program* (NSS) supported by the World Bank, several LAC countries took advantage of external technical assistance to identify the best way to implement CDM projects. Many of the initial CDM portfolios were drafted through this initiative but further follow up and commitment from usually divorced public and private sectors prevented them from going much further. A remarkable exception to this was Chile, where an unusual synergy between the private sector and the

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[11] Figueres, C. 2006 "CDM Trends in Latin America", prepared for OECD, Paris

government served as a framework for the promotion of CDM projects by business organizations such as the Manufacturers Society (SOFOFA) and the Chilean investment promotion agency (CORFO).

A fourth issue is the *lack of appropriate CDM methodologies.* As discussed above, several asset classes that are critical to the region's abatement potential have not been incorporated into the CDM. Land use change and forestry assets in the CDM are limited to afforestation and reforestation activities, and even those are restricted in size and type. The issue is compounded by the fact that there is a lack of demand, since the European Union ruled out forestry projects from the sectors eligible as offsets in the ETS. As also mentioned above, in the transport sector there is only one approved methodology. Broader and less onerous methodologies have to be developed for mass public transit, as well as to support the switch from fossil fuels to liquid biofuels for vehicles.

A fifth problem is that *public enterprises* remain, at least in LAC, for the most part unaware or unwilling to participate in carbon markets. In this respect, some of the limitations faced by these companies have to do with issues related to data disclosure and other procedural constraints. State owned utilities, for example, are usually not allowed to consider CDM revenues in their least-cost planning process. As a result, CDM projects that hope to make the financial additionality argument cannot be pursued (Mayorga, 2007). Furthermore, state utilities must declare all major capacity additions in their future expansion plans, which makes the additionality argument complex as expansion plans are the basis for business as usual scenario (Mayorga, 2007 and Barnes, 2007). Finally, state run utilities have little incentive to engage in the complex CDM process since the regulator determines the tariff calculation that will dictate the state utility's profits. In fact, the Public Utility of Medellín, Colombia was audited for participating in CDM: the regulator questioned why the prices the Utility received for the sale of CERs were so low and why the process took so long (Velez, 2007).

There has also been a *relative absence of the domestic financial sector* in the market for CDM credit. In addition to the well known reluctance of banks to lend for renewable energy or energy efficiency projects, commercial banks in the region have not recognized CER revenues as a bankable income stream. At best, banks are heavily discounting the carbon revenue stream, in part due to lack of knowledge or uncertainties regarding the carbon market, and will not consider Emission Reduction Purchase Agreements (ERPAs) as part of collateral or guarantees to finance a project with climate-friendly technologies. Thus the majority of CDM projects are either financed on the balance sheet or financed without taking into account potential carbon finance revenues, which directly restricts the size of the projects that can be brought to the carbon market.

Finally, a barrier to CDM development in LAC that has already been mentioned is the *lack of aggregation possibilities,* which prevents taking advantage of emission reductions projects that are individually small in size and are dispersed among many sites. The CDM modalities and procedures have been implemented mostly on the basis of single mitigation sites that offer a relatively high volume of emission reductions per site. This practice benefits larger countries and the highest emitting sectors, and disfavors smaller economies with lower mitigation potential as well as those sectors in which the mitigation potential is dispersed, such as energy efficiency, distributed rural energy, and transportation. As discussed below, however, the newly introduced *Programmatic* CDM offers the possibility of aggregating and structuring many small mitigation efforts. This could allow smaller countries without large emitting facilities to take advantage of the CDM by aggregating in a single program a large number of small projects which, together and over a period of time, could have the potential to achieve significant emission reductions.

The role of development banks in LAC's carbon markets: the World Bank

Mulitilateral development banks have had an active role in fostering the participation of LAC in the CDM. The World Bank initiated its activities in carbon finance in 1999 with one initial Prototype Carbon Fund, and has since expanded its fund management to nine funds and facilities (see Table 5.1). These funds are public or public-private partnerships managed by the Carbon Finance Unit (CFU) of the World Bank. Unlike other World Bank development products, the CFU does not lend or grant resources to projects, but rather contracts to purchase emission reductions. These purchases are akin to commercial transactions with the Fund paying for emission reductions annually or periodically once they have been verified by a third party auditor.

Table 5.1: World Bank Carbon Finance Funds

These carbon funds and facilities are capitalized by government and private sector investors from industrialized nations that are under emission reduction commitments and are interested in the expansion of the carbon market. The funds under WB management have a total capitalization of USD 2 billion, most of which has been channeled through the CDM. Of this total, approximately $96 million or 5% has been invested in emission reductions sourced by projects in LAC countries. Table 5.1 provides the breakdown by fund. Other than the obvious attractiveness of higher volume markets, there is no specific reason why the LAC share is so low. However, it is interesting to remember that the LAC region represents 5% of the world's energy related emissions (and land use reductions are virtually excluded from the CDM), emphasizing the previously discussed relationship between emission levels and mitigation potential.

In the face of the IPCC's Fourth Assessment Report's call for global mitigation scale-up, the World Bank has recently launched a series of new financial instruments which intend to jump-start a second generation of mitigation activities in the developing world. These instruments have the participation of other multilateral banks and will be discussed below.

The Andean Development Corporation (CAF)

In 1999 the Andean Development Corporation established the *Programa Latinoamericano del Carbono* (PLAC) to support the development of potential CDM projects in the LAC region, as well as to offer capacity building and strengthen climate change institutions in all shareholder countries. The Program has recently also begun to develop innovative financial instruments focused on renewable energy and energy efficiency. PLAC managed an emissions reduction contract for the government of the Netherlands for a total of 77 million euros, and has successfully delivered the corresponding 8.7 million tons of certified emission reductions. These stem from 19 mitigation projects in Latin America and have been channeled through the CDM. In addition PLAC has an emission reduction purchasing contract from the government of Spain for a total of 9 million tons, 3 million of which have been committed to LAC projects. PLAC has invested USD 1.5 million in technical cooperation and capacity building in the region.

The Inter-American Development Bank (IDB)

The Inter-American Development Bank created a Sustainable Energy and Climate Change Initiative (SECCI) in March of 2007, with an initial capitalization of USD 10 million. The goal of this Initiative is to support the Latin American and Caribbean region in finding economically and environmentally-sound energy solutions. SECCI focuses on financial solutions and will complete its task by helping renewable energy and energy efficiency projects achieve financing, removing institutional barriers and promoting novel policy ideas, making sustainable energy investment and financing tools more mainstream and accessible, utilizing the carbon finance market, addressing adaptation needs, and forming new partnerships with both the public and private sectors.

4.6. Moving beyond the first generation of mitigation efforts

For LAC, as for any of the other developing countries, the architecture of the post 2012 climate regime is going to be critical. As currently designed, the CDM cannot deliver LAC's potential to reduce its GHG emissions in a cost-effective way. Appropriate design of the new incentives to mitigate could help resolve this. There are two prominent issues for LAC. First, from the perspective of high volume cost effective mitigation and critical biodiversity protection, the new chapter of the regime must incorporate REDD. Second, from the perspective of long term low carbon (sustainable) economic growth, the region needs incentives to significantly shift the carbon intensity of investments that will be made in the energy and transportation sectors. Technology in those sectors is long lived, and as discussed, increasingly emissions intensive in the business as usual scenario. Avoiding the lock-in of such technology-related emission growth is critical for LAC.

It is as yet unknown whether the post 2012 climate regime will continue to rely exclusively on market based financial instruments to mobilize emission reductions in developing countries, or if non market based mechanisms, e.g. abatement fund(s), will be added. There are however two elements that are clear: mitigation cannot continue to pursued only a project by project basis, and climate friendly policies need to be incorporated into future financial mechanisms.

First, the CDM was created as a project-based instrument and we must go beyond that now. Restricting the CDM to emission reductions from single point sources has curtailed its potential to promote the needed sector-wide transformation, attained by cost effectively channeling capital and know-how to decarbonise carbon intensive sectors such as energy, transport and infrastructure. The project-by-project approach cannot stimulate technology development and underwrite the risk of major scale ups in R&D in low carbon/zero carbon technologies. From a financial perspective, project-based CDM cannot stimulate an adequate and reliable new source of risk capital to finance technology shifts and required policies/incentives on the scale of whole economies. It has yet to provide the essential investment climate of regulatory certainty and manageable business risk to ensure that a stream of anticipated CERs is bankable collateral for financing specific projects. Without that assurance, it is also unable to finance rapid expansion of already commercially proven leading edge lower carbon power and infrastructure technologies. (Figueres and Newcombe, 2007).[12]

Second, decarbonization of the key sectors will not occur without the necessary regulatory framework, and thus future financial mechanisms need to explicitly encourage climate friendly policies. The importance of policies is not a recent discovery. The 2004 World Energy Outlook published by the International Energy Agency warned that “if governments stick with the policies in force as of mid-2004, the world’s energy needs will be almost 60% higher in 2030 than they are now”, (IEA, 2004) with well over two thirds of the projected increase in emissions coming from developing countries. However, under an Alternative Policy Scenario global energy trends could markedly improve “if countries around the world were to implement a set of policies and measures that they are currently considering or might reasonably be expected to adopt.” (IEA, 2004). While it is clear that policies are critical for the success of the post 2012 regime, they have had an evolving treatment within the CDM.

Additionality and the issue of perverse incentives in the CDM

In order to have a substantial impact on the GHG emissions of developing countries, mechanisms such as the CDM would have to be able to help transform overall development policies and make them more climate-friendly. One important obstacle for achieving this objective through the CDM has been the ambiguity on how to treat policies with respect to the project baseline. If climate-friendly policies that had already been announced by developing countries at the time of project submission are considered part

[12] Figueres, C and K. Newcombe, Evolution of the CDM: Toward 2012 and Beyond, United Nations Foundation, 2007.

of the baseline or business as usual scenario, the emission reductions to be achieved by the potential project can be diminished to the point of making the project non viable. While environmental integrity must be maintained, this is problematic for several reasons. First, as argued by Heller and Shukla (2003), baseline scenarios are often difficult to determine because they hinge on a range of policy decisions that are not yet sufficiently settled. As a result, the execution of the corresponding policies is in many cases uncertain and one could argue that including them in baseline scenarios – and thus failing to support them through mechanisms such as the CDM – would amount to missing an opportunity for providing critical further incentives for the implementation of climate friendly policies. More generally, whereas many climate-smart development policies could be justified solely on the basis of their domestic benefits, explicitly recognizing their contribution to climate change mitigation could be useful for gathering additional political and financial support, and ultimately for reinforcing their chances of success.

At least until 2005 the additionality requirements of the CDM created perverse incentives for Governments in host countries, in some cases leading them to delay the issuance of climate friendly policies (Ellis, 2006). In other words, countries with the least climate friendly policies were implicitly rewarded while those that were more proactive ran the risk of having most of their mitigation projects excluded from the CDM (Figueres, 2004). As a result, countries had an incentive to keep their climate-friendly policies in the realm of plans and programs, and to not take the additional step of embedding them into their official regulatory framework. This was reportedly the decision made by Colombia during 2003/2004, following country-wide consultations aimed at identifying potential CDM projects and low carbon policy options in the sectors of transport, energy and forestry (Hinostrosa et al, 2007). Another example, in this regard, is Costa Rica's 1995 requirement that privately generated power stem from renewable sources: while this measure has contributed to de-carbonizing the country' energy matrix, the CDM Methodology Panel has questioned the additionality of private hydroelectric plants and thereby severely limited Costa Rica's participation in the CDM.

Fortunately, in November 2005 the Executive Board of the CDM issued a new guidance on how to take into account national policies when calculating a CDM project's baseline, which to a large extent eliminated the perverse incentives for host countries to adopt carbon-friendly policies. The new guidance requires the exclusion from baseline scenarios of climate-harmful policies and regulations issued after the adoption of the Kyoto Protocol in December 1997, thus eliminating the incentive for host countries to inflate their claims for emission reductions by means of enacting policies that favor more emission-intensive technologies or fuels.

In addition, the new guidance allows for the exclusion from baseline scenarios of policies or regulations that give a comparative advantage to lower emission intensive technologies (e.g. through subsidies to renewable energy or more stringent energy efficiency standards), provided that they were enacted after the adoption of the CDM Modalities and Procedures in November 2001. The issue, however, is far from being settled, as the application of the new guidance for the definition of baseline scenarios may be hampered by methodological challenges associated with disentangling the effects of various policies. Moreover, as argued by Ellis (2006) the new guidance explicitly allows for either the exclusion or the inclusion in baseline scenarios of recent policies regulations.

From project to sector-wide approaches: Programmatic CDM

We recall that a fundamental concern with the current functioning of the CDM is whether its focus on project-level emission reductionsis sufficient for achieving an adequate engagement of development countries in global mitigation efforts. As argued by Figueres, Haites and Hoyt (2005), the CDM's single project approach makes it unlikely to "catalyze the profound and lasting changes that are necessary in the overall GHG intensities of developing countries' economies." A more effective approach would entail transforming the baselines themselves so as to make development pathways more carbon-friendly (Heller and Shukla, 2003). In this context, rather than focusing on actions at the project level, mitigation efforts in developing countries have to shift towards promoting policy-based reforms across entire sectors – e.g. energy, transport, agriculture, forestry.

One way of implementing such sector-wide approaches is to broaden the market mechanism to include reductions obtained by developing countries while pursuing climate-friendly "development-first" policies – not unlike the way in which domestic emission reductions of industrialized countries are counted towards their commitments under the Kyoto Protocol regardless of their source. One first important step in this direction was the decision to include programs of activities in the CDM, taken in December 2005 at the 1st session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP 1) in Montreal. The inclusion in the CDM of so-called programmatic CDM project activities, along the lines of a proposal made by Figueres et al (2005)[13], has increased the ability of the CDM mechanism to support lower carbon development pathways, without requiring a re-negotiation of the basic architecture of the Kyoto Protocol.

The decision made in Montreal states that while Government policies, regulations or standards themselves cannot be submitted as CDM projects, "project activities under a programme of activities" that implements a policy/measure or stated goal can be registered as a single clean development mechanism project activity. As argued by Figueres and Haites (2006), the decision to not incorporate into the CDM the adoption of a policy itself, is justified within the constraints of the Marrakech Accords that define the CDM as a project based mechanism. Furthermore, even after being officially adopted, government policies oftentimes fail to be implemented, either because of financial or technological barriers, or due to the Government's failure to enforce its laws and regulations.

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[13] Among the various precedents to their proposal, Figueres et al. (2005) mention the "sectoral approach" proposed by Samaniego and Figueres (2002), the "programmatic crediting mechanism" proposed by Bodansky et al (2004), and the "policy-based" mechanisms proposed by Cosbey et al (2005) and Sterk and Wittneben (2005).

However, the COP/MOP 1 decision does open a door –albeit a small one- to policies. It states that if a policy is implemented through a group or program of concrete activities whose emission reductions can be measured and verified under the rules of the CDM, then the whole program of activities can be submitted as a single project. As defined in the specific guidance issued by the CDM EB in June 2007, a CDM program of activities (PoA) can be coordinated by a private or a public entity, and it may involve the implementation of an unlimited number of voluntary actions. The latter must result in emission reductions, or removal of GHG by sinks, as compared to what would have occurred in the absence of the PoA. Programs stemming from mandatory government policies are eligible provided that the PoA increases their level of enforcement (Hinostrosa et al. 2007).

Pros and cons of programmatic CDM

Traditional CDM modalities already allowed for the bundling of stand-alone projects for registration purposes and the December 2005 CDM guidance incorporated the possibility of bundling large scale projects (Ellis, 2006). However, when using "bundling" as a registration option, the sites of all projects have to be specified ex-ante and all projects need to take place at the same point in time (Figueres and Philips, 2007). The bundling approach is thus not well suited to dispersed activities that are the result of a larger number of decisions made over a period of time, for instance by households, offices or factories in the context of energy efficiency incentives. In particular, it may not be possible to accurately predict at the outset the level of GHG emission reductions that will be achieved through a particular public sector incentive scheme or private initiative. While this would not have been possible under traditional CDM, programmatic CDM allows for open ended registration whereby the entity coordinating the program can add subsequent emission reductions during the duration of the PoA, for a period of up to 28 years in the case of energy related programs, and 60 years in the case of afforestation and reforestation programs. In other words, when using pCDM one does not need to specify ex-ante all the constituent activities of a PoA.

As argued by Figueres et al. (2005), the programmatic approach is especially relevant in the areas of energy efficiency and fossil fuel switching. Indeed, in these areas the deployment of carbon-friendly technologies usually does not occur on an individual basis but rather by multiple coordinated actions executed over time, often by a large number of households or firms, as the result of a Government measure or a voluntary program. Moreover, the transaction costs associated with CDM submissions, coupled with the relatively low volume of emission reductions generated by each individual activity or project, would often eliminate the possibility of incorporating the small individual stand-alone projects into the CDM.However, programmatic submissions could allow for diluting those transaction costs across many projects and, even in less developed small and medium countries, take advantage of the potential for emission reductions associated with the implementation of national or sector-wide programs.

As of September 2008, only four PoAs were in validation: a solar home systems program in Bangladesh, methane capture in swine farms in Brazil, solar water heaters in South Africa, and compact fluorescent lights (CFLs) in Mexico. The slow uptake of this new registration opportunity is probably due to the fact that the modalities and procedures are still not well understood, and to the reticence of Designated Operating Entities (DOEs), the auditors of CDM projects, to engage in PoAs due to a perception of undue liability – e.g. the fact that they would be responsible for the "erroneous inclusion" of project activities that do not comply with the inclusion criteria stipulated in the project design document. Faster deployment of the pCDM approach may also point to the need to better address complicated methodological issues in the context of pCDM projects – e.g. leakage, baseline, double-counting and monitoring (Ellis, 2006). Once the initial hurdles are overcome, pCDM will be continue to be limited in its scope as long as the current restriction to one single methodology remains. Indeed, this requirement limits the potential for supporting large scale initiatives that involve system-wide improvements that may require the combination of several CDM methodologies.

Programmatic CDM is the first opening toward policy-based and sector-wide emission reductions in developing countries By assigning a CER value to reductions achieved under a program of activities, the regime is providing the first necessary but not sufficient incentive for developing countries to adopt and implement climate friendly policies and measures. However, in the context of an urgent need to scale up mitigation, a financial instrument that operates with modalities and procedures that were designed with a project by project logic may not be able to leverage the sector wide transformation that is necessary. It is possible that the market mechanism will have to evolve further in the direction of actively promoting enabling policies that will influence private investment and shift investment patterns.

Post 2012 climate finance

Over the past few years a number of proposals have emerged on potential market and non-market mechanisms for the post-2012 period that would share with the CDM the dual objective of supporting sustainable low carbon development and achieving climate change mitigation in developing countries. These proposals have emerged both in the context of formal negotiation processes and as a result of the large amount of research, analysis and informal discussions on future regimes that have taken place during recent years.[14] Two particularly promising groups of proposals encompass the so-called policy-based and sectoral approaches.

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[14] Cosbey et al. (2007) describe 44 proposals which have been made within and outside of formal UNFCCC processes. Thus, some of those proposals have come forward in the context of formal negotiations that are taking place both under the Kyoto Protocol, on possible future commitments beyond 2012 – the "Protocol track" – and in the context of a non-binding dialogue on cooperative actions to address climate change by enhancing the implementation of the UNFCCC – the "Convention Track" (Figueres, 2007).

The policy-based approach

This approach centers around providing abatement funding to countries that adopt binding or non-binding policies, voluntary or mandatory standards that reduce GHG emissions, even if they are primarily aimed at sustainable development objectives. On one hand, developing countries would be expected to make non-binding commitments in the form of voluntary pledges of either emission growth controls – e.g. as in a proposal by the South-North dialogue (Ott et al. 2007) – or in the form policies that they would pledge to implement – such as in the Sustainable Development Policies and Measures (SD-PAM) proposal originally suggested by Baumert and Winkler, 2005. The purpose of SD PAMs is to capture the potential co-benefits of local sustainable development and promote them via the multilateral climate framework. SD PAMs backcast from the desired future state of development and define more sustainable (i.e., lower emission) pathways to meet those development objectives. The focus is on large-scale policies and measures, not individual projects. Although crediting could be incorporated, typically the SD PAMs are a non market approach based on international funding made available specifically for this purpose. Developed countrieswould support the voluntary efforts of developing countries, both financially and through technology transfers. SD-PAMs are well suited for sectors that are important for sustainable development (energy efficiency, transport, residential, commercial) and those that have many small emissions sources (e.g. households, buildings, etc.).

Several issues remain open for discussion under SD PAMs: would countries be allowed to propose the policies they choose, or would there be an eligible list of policies that are supported internationally? How closely would emission reductions have to be tracked and reported, particularly if it is not used as a market mechanism?. As argued by Cosbey et al. (2007), one of the main concerns with policy based approaches is the the difficulty to prove additionality. To deal with this issue, specific criteria would have to be agreed upon, to distinguish between policies that would have probably not been implemented had it not been for the support of carbon finance. Alternatively, the corresponding emission reductions could be discounted to account for the difficulty in proving their additionality.

The "sectoral" approach

Originally proposed by Samaniego and Figueres (2002), the "sectoral" approach can be seen as an extension of the market mechanism in the sense that it would award CERs to developing countries which over-achieve on emission reduction or intensity targets adopted voluntarily for specific sectors.[15] The origins of the sectoral approach are related either to the above described limitations of the project based-based traditional CDM, or to concerns over leakages and negative competitiveness effects associated with regional or country-specific mitigation commitments (Sawyer et al. 2008). Motivated by the first type of concerns, one version of the sectoral approach focuses on unilateral country-specific emission reductions commitments. This proposal has evolved toward Sectoral No-Lose Targets (SNLTs). SNLTs are a form of non-binding emission targets, according to which developing countries would voluntarily propose a domestic interest crediting baseline (most likely a national emission intensity of the sector in question) over a commitment or 'management' period of time which would be below the business as usual projection and be negotiated internationally. The country would reach the crediting baseline through domestic efforts, and would then allowed to sell any surplus emission reductions which are achieved beyond the crediting baseline, but there is no penalty for not achieving that baseline. Two variations of the SNLTs concept have emerged, one by the Centre for Clean Air Policy (CCAP) and the other by Ecofys/GtripleC. In the CCAP version international benchmarks would feature explicitly as a negotiation parameter, i.e. to draw links with the performance of these sectors in industrialized countries for competitiveness reasons (Schmidt et al 2006).[16] Ecofys/GtripleC have developed sectoral proposal templates,[17] the purpose of which is to provide a standardized tool by which countries can prepare and propose crediting baselines without referring to international benchmarks.

Countries would typically opt for sectoral approaches where there was a high degree of alignment between domestic development priorities and climate change management. In principle countries could be attracted to consider SNLTs in those sectors for which they seek significantly scaled up private sector investment and where the current carbon finance tools could be inadequate. Some likely candidates are: electricity generation (measured in tons CO_2e per MWh generated); cement, aluminum or steel production (measured in tons CO_2e per ton produced), and 'upstream' emissions of oil and gas production -e.g. gas venting and flaring- (measured in tons CO_2e per barrel of oil delivered to refineries or export facilities, or volume of gas delivered) (Ward 2008).[18]

Proponents of the SNLT mechanism propose that crediting baselines be negotiated at the same time as Annex I country targets for post-2012 are being agreed, so additionality would no longer need to be an issue– as it is not for actions taken by industrialized countries that have emission reduction targets (Ward 2008). This distinguishing feature of NLSTs is its major strength and at the same time its fundamental drawback. The absence of the additionality criterion suggests it might have the potential for scaling up investments, at least in the appropriate sectors.

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[15] See also Bodansky et al (2004), Bosi and Ellis (2005), Figueres (2005), Schmidt (2005), Cosbey et al (2005), Sterk and Wittneben (2005). The interest in this approach permeated the political spheres with the 2005 OECD high level roundtable on transnational sectoral agreements for climate policy, the G8 Gleneagles Plan of Action, and the Major Economies Meetings.

[16] Schmidt, Helme, Lee and Houdashelt (2006) Sector-based approaches to the post-2012 climate change policy architecture, Center for Clean Air Policy (CCAP), International Future Actions Dialogue, August 2006

[17] See www.sectoral.org

[18] Murray Ward et al, The Role of Sector No-Lose Targets in Scaling up Finance for Climate Change Mitigation Activities in Developing Countries, DEFRA 2008.

However, the critical prerequisite for data and prepared institutions could mean that proposals for SNLTs for some key sectors in some developing countries will not be sufficiently developed at the time it is expected that industrialized countries' targets should be agreed. If this were to be the case, it would severely curtail the potential impact of SNLTs.

A second version of the sectoral approach, motivated by international competitive concerns, would involve international agreements aimed at leveling the playing field for specific industries, in order to avoid that competitiveness gains could be obtained through regulatory arbitrage. This is a special concern for trade-exposed energy intensive industries such as cement, aluminum, and steel. Crediting could be considered between companies within the same industry in both developed and developing countries. This type of initiative would normally be industry-led and would aim at engaging a sector on a broad international basis. It is aimed at industrial sectors which are concentrated in few companies worldwide, and which are so energy intensive that they alone represent a significant share of emissions (Egenhofer et al, 2007)[19] A current example is the Cement Sustainability Initiative formed under the auspices of the World Business Council for Sustainable Development (WBCSD). The CSI intends to propose industry baselines, to be negotiated on a country level.

A host of other concepts involving mitigation at the sectoral level have been explored (Bodansky 2007, Baron and Ellis 2006, De Coninck et al 2007, Fischer et al 2008). The common focus is to use the international regime to accelerate the decarbonization of a sector by moving from non-regulation to regulation or at least to agreements across the sector. There are, however, a number of practical issues that could greatly complicate the implementation of the sectoral approaches. Egenhofer (2008) emphasizes the fact that benchmarking is very data-intensive and may not be realistic in some countries or some sectors. Cosbey et al. (2007) point to the the challenge of negotiating adequate international baselines that take into account national circumstances and balance the risk of free-riding with the need to avoid perverse incentives that reward carbon-harmful policies. Moreover, the negotiating parties would have to agree on whether developed countries could or not use their contributions to the implementation of sectoral programs in developing countries towards their own mitigation commitments, and on whether large developing emitters would be able to use their sectoral achievements towards their own possible future mitigation commitments.

Sectoral approaches may only make sense for larger middle income countries with world scale carbon intensive industries where aggregation of revenue potential provides

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[19] Egenhofer, Christian, N Fujiwara and B Stigson, (2007) Testing Global Sectoral Industry Approaches to Address Climate Change. Center for European Policy Studies, Brussels.

financial leverage sufficient to transform the sector over a 10-20 year period (such as the iron and steel industry and cement industries in China and India, and pulp and paper industry in Brazil). However, the relevant developing countries have expressed their concern that the sectoral approach could be used as a back door strategy to push them into binding reduction commitments, and have therefore not embraced the approach, despite the fact that it is explicitly mentioned as an option in the Bali Action Plan.

Some considerations about the climate finance options

It is still too early to know how the various 2012 climate finance options will be designed, how they will relate to each other, and whether there will be decisions on differentiated access to them. At present, most of the political support for the consideration of how to structure mitigation efforts is coming from industrialized countries, while developing countries are more concerned with the need for reassurance that appropriate and predictable climate finance revenues will be on the table.

Not all the options under consideration would be relevant for a market based mechanism, but those that are, could only be effective if there is a demand. Given the supply of credits already prospectively in the pipeline from existing CDM projects, demand from the EU-ETS Phase III (2013-2020) provides limited extra demand, even if the EU takes on the -30% target they have proposed for 2020 if a comprehensive multilateral agreement is reached. In order to strengthen demand, ambitious reduction targets of all industrialized countries are needed, which is only consistent with the science-based calls for reductions of -25 to -40% by 2020.

On the supply side, the CDM process needs to be cautious about the automatic renewal of projects that have already produced large volumes of credits, such as the HFC destruction projects. With the bulk of industrial gases now eliminated by technically sound and cost-effective means, developing countries could be expected to require their continued elimination as a production standard.[20] Continued eligibility for industrial gases as a compliance asset would exacerbate existing biases in carbon finance flows to middle income industrializing countries and divert capital away from decarbonising their energy supply and infrastructure.

The risk of flooding the market stems not only from industrial gases but potentially also from areas such as reduced deforestation and energy efficiency, *if* they were successful and there is no guarantee of that. That risk could be diminished by an agreement that would automatically index the supply level allowed into the market to the demand level, as demonstrated by the increasing depth of reduction commitments assumed by industrialized countries over time. Thus supply and demand would grow *pari pasu,* tending toward greater mitigation while maintaining certain predictability in the cost per

[20] In the case of smaller economies that still have such facilities, the OECD could consider a grant program to ensure that they have the incremental funds to install the required catalysts and incineration equipment and operate this as per the Multilateral Fund for phase out of Ozone Depleting Substances

ton. It would however be complex to distribute a limited number of supply rights among developing countries in an equitable manner, since the default would privilege the cheapest reductions, re-enacting one of the realities of the current CDM.

Finally, even if successfully negotiated, it is highly unlikely that any of the climate finance approaches described above on its own will deliver the needed mitigation volumes in developing countries, given the different national circumstances and the variety of sectors that could achieve emission reductions. It is more probable that countries will have to use some combination of these, targeting each to the more appropriate national realities and types of mitigation activities, thereby achieving a mutually reinforcing effect. Reducing deforestation may be one of those types of mitigation activities that require special consideration.

Specific challenges associated with reducing deforestation

The first commitment period of the Kyoto Protocol did not include reduced emissions achieved by means of avoided deforestation. This was due in part to concerns over technical issues, including with regard to baseline setting and monitoring – i.e. to ensure the additionality and permanence of emission reductions – and with respect to leakages – i.e. the risk that avoided deforestation in some places could be compensated by increases in others (Schlamadinger et al. (2007). Moreover, at the time there were also concerns with a possible trade-off between the use of this potentially low-cost mitigation option and the implementation of domestic emission reductions in Annex 1 countries (Sawyer et al. 2008). More recent international negotiations, however, have moved towards recognizing decreases in deforestation from a pre-established baseline as generating credits and/or compensations in a post-2012 regime. In particular, the Bali Action Plan explicitly calls for addressing "policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries."

A conceptual framework for reducing deforestation rates in the Brazilian Amazon has been proposed by Nepstad et al. (2007). In their proposal, financial incentives would be used to partially compensate forest-based local populations –e.g. indigenous groups, traditional rural populations and some small land-holders – and legal private landholders, respectively for their "forest stewardship" role and forest conservation efforts. Moreover, a "Government Fund" would be needed in order to compensate the Government for expenditures above and beyond current outlays, including for the management of public forests, the provision of services to local populations and the monitoring of private forests (including expanded environmental licensing). Over a 30-year period, the deforested area would be 490,000 km^2 smaller and avoided emissions would be 6.3 billion tons of carbon lower than in a business as usual scenario estimated by Soares Filho et al. (2006).[21] The

[21] As per the estimates of Soares-Filho et al. (2007), current trends in agricultural expansion would lead to the elimination of 40 percent of Amazon forests by 2050.

overall cost of such a program would be about $8.2 billion, or about $1.3 per ton of avoided carbon emissions.

How does this compare to the opportunity cost of maintaining the Amazon forest instead of switching to other possible land uses such as agriculture and cattle ranching? Nepstad et al. (2007) estimate that preserving the remaining forests of the Brazilian Amazon – 3.3 million km^2 and 47 billion tons of carbon – would have an opportunity cost of $257 billion. This implies an opportunity cost of avoiding emissions from deforestation of about $5.5 per ton of carbon. It must be noted, however, that in 6% of the total area under study, the opportunity cost of forest maintenance is estimated to be about 17 times higher than in the remaining 94%. Excluding this area, which is located closer to the agricultural frontier, the opportunity cost of avoiding emissions through forest maintenance would be of about $2.8 per ton of carbon, or about $18 billion for the emissions that would be avoided through the above described REDD program (about 6 billion tons of carbon). As argued by Nepstad et al. (2007), part of the difference between the estimated cost of their REDD program and the opportunity cost of the corresponding avoided emissions could be diminished by the consideration of the substantial benefits that avoiding deforestation could bring to Brazilian society – beyond the mitigation of climate change.

In the context of the climate negotiations several different proposals have emerged over recent years with regard to possible global frameworks for reducing emissions from deforestation and forest degradation (REDD). Perhaps the main distinction between the various proposals is whether developed countries would be allowed to gain credits for their possible contributions to REDD efforts in the developing world. Using this approach, Costa Rica and Papua New Guinea have proposed to incorporate REDD into the CDM, thus allowing for the possibility of issuing credits to projects or programs that reduce deforestation with respect to some established baseline.

Brazil, on the other hand, has established a specific "non-market" fund dedicated to REDD. The "Tropical Forest Fund" will channel contributions from Annex I countries into activities that reduce tropical deforestation, but reductions achieved would not count towards Annex I mitigation commitments. The Fund will award financial incentives, either in the form of payments, technology transfer or capacity building, to countries that lower their deforestation rates below an established baseline rate. There would be no penalties for not meeting the corresponding goals, although failing to do so could count against future reductions below the baseline (Sawyer et al. 2008). The Fund hopes to receive donations in the order of $21 billion by 2021. Norway has already pledged $1 billion to the Fund. Other proposals have combined aspects of both market-oriented and fund-based alternatives. In all proposals, the resources allocated to reducing deforestation are to some extent transformed into financial incentives per avoided ton of CO2. However, as noted by Strasbourg et al. (2008), in order for those financial incentives to be effective in addressing the local drivers of deforestation, and because of sovereignty issues, the intra-national distribution of the resources to be allocated to reducing deforestation needs to be decided at the country level and is unlikely to be included in international REDD mechanisms.

A pioneering step

Even if successfully negotiated, it is highly unlikely that any of the climate finance approaches described above on its own will deliver the needed mitigation volumes in developing countries, given the different national circumstances and the variety of sectors that could achieve emission reductions. It is likely that the next chapter of the climate regime will include the CDM albeit with some improvements, an expansion of the CDM or additional market based mechanism, as well as one or more abatement funds, wrapped into a finance and technology package that would emerge as the result of negotiations. It will take time to negotiate the various components, their relationship to each other, and their relationship to industrialized countries' reduction commitments.

In the meantime, the World Bank has taken the initiative to pioneer some of the concepts being explored, without prejudice to the outcome of the negotiations. In the spring of 2008, the Bank launched global consultations on its *Strategic Framework on Climate Change and Development*, which aims at further articulating the Bank's vision on how to mainstream climate change and development challenges into its operations, without compromising growth and poverty reduction efforts. The *Framework* is a response to increased demand for the scaling up of Bank activities in support of developing countries' efforts to adapt to climate change while achieving low-carbon growth and poverty reduction. The Bank's *Framework* will attempt to integrate adaptation into its development programs with low and highly vulnerable medium income countries, including through the mainstreaming of climate risk management processes in its operations. Moreover, given the low levels of energy access and energy-related GHG emissions in most low income countries, the Bank will prioritize efforts to increase access to energy, and it will support "win-win" mitigation opportunities that also benefit local development. These include energy efficiency measures, cost-effective and reliable uses of renewable energy, and facilitated access to carbon markets. In addition, the Bank will prioritize the development of competitive products for financing lower carbon investments in middle income countries, including through innovative joint products across IBRD, IFC, MIGA, Carbon Finance and other climate funds.

In particular, the Bank is seeking to establish a portfolio of strategic climate investment funds (CIF) aimed at providing concessional finance for country-driven policy and institutional reforms and investments that achieve development goals through a transition to a low carbon development path and climate-resilient economy. The Funds will be guided by the UNFCCC principles and will seek to encourage early action and market-based solutions to the climate change challenge with a transformational impact. Two new facilities – the Carbon Partnership Facility (CPF) and the Forest Carbon Partnership Facility (FCPF) – have already been approved with the objective of addressing relevant

GHG sources bypassed by the existing regimes. The FCPF, which was launched during the 13th UNFCCC Conference in Bali in December 2007, aims at building capacity to reduce emissions through reduced deforestation and land degradation, and will pilot carbon transactions for REDD. It has already received contributions for $165 M. The CPF aims at scaling up the impact of carbon finance in the longer term and in the post 2012 period. It is expected to become operational during 2008.