DRAFT, FOR COMMENTS ONLY

NOT FOR CITATION

The role of private investment in increasing climate friendly technologies in developing countries

Stephany Griffith-Jones, Merylyn Hedger and Leah Stokes

Background paper

World Economic and Social Survey 2010

This paper was written for UN DESA. We thank Rob Vos and Richard Kozul-Wright for commissioning this paper. We thank Allan Miller, David O'Connor, Richard Robb, Bruce Usher and Jurgen Weiss for providing valuable information and insights during interviews. The responsibility for any errors is, as always, our own.

TABLE OF CONTENTS

BACKGROUND & INTRODUCTION

This paper contributes to a review examining the responsibilities of developed and developing countries alongside the relative roles of the public and private sector in developing climate friendly technologies. The paper focuses on the private sector's present and future role in driving carbon reductions in developing countries. However, private sector action in this area is fundamentally framed and driven by policy frameworks at international and national levels, and in the light of the recent global financial crisis, the interfaces between the private and public sector are more complex. This overview will therefore look at both sectors' relative roles, particularly examining how public policy will shape private investment flows. This paper:

- Shows how the private sector can contribute to carbon reductions alongside sustainable development, including highlighting the sector's limitations;
- Argues how market–based resources could be mobilised to address these challenges;
- Analyses the current implementation and financing facing clean technology transfers to developing countries.

Significant barriers remain to directing large foreign private investment towards low carbon technology implementation in developing countries. First of all, many of these technologies are not yet profitable in commercial terms, and for private investment to take place, support mechanisms are needed. Secondly, the lack of certainty around a post-2012 agreement is significantly impeding private financing of emissions reductions in developing countries. Since projects have a several year development period, we are already nearing the point where all the necessary CERs under the Kyoto Protocol and the European Union Emissions Trading Schemes' (EU ETS) second phase will have been created. Without a clear understanding of how carbon will be valued moving forward, further private financing is stalled. Climate change is currently being addressed within the sensitive international negotiations that began with the Rio Convention in 1992 and are now being continued through the Bali Action Plan and latest Poznan COP meeting. To move forward, it is critical to acknowledge long-standing global political issues surrounding a climate change agreement.

Thirdly, sharp fluctuations in the price of oil, natural gas and other key energy commodities, dramatically illustrated by recent price falls, can significantly affect the profitability of low-carbon investments, particularly in alternative energy resources. This volatility could be moderated, for a period, by some possible government and/or MDB guarantee of a minimum price of oil assumption to guarantee profitability; however, great care would have to be taken to design and limit such guarantees to avoid excessive potential liabilities.

Finally, the present financial crisis poses significant new challenges and opportunities for low-carbon technology transfer to developing countries. Private investment in low-carbon technology will fall significantly during and after this crisis. One clear policy response is a great increase in public investment, at both the national and international level, in large-scale, low carbon development. Drawing on the historical precedent of the 1930s, this would be a Global Green New Deal. This would both help meet urgent carbon emission reduction targets and boost investment in developed and developing countries, as well as contributing to higher growth globally.

It would be ideal if a new Global Fund were created for supporting this Global Green New Deal, to help mobilize public resources on a sufficiently large scale, and in a timely manner, to deal with massive climate change mitigation and economic recovery needs.

Swift and timely action is also necessary through large-scale public policies aimed at increasing private financial flows in the longer term, through a clear investment framework. This reality first became recognised at the G8 Gleneagles meeting in 2005; the business sector, including the World Business Council on Sustainable Development, has delivered this same message since then:

> *"The track record tells us that in the absence of strong policy support mechanisms and incentives, and while fossil fuels are cheap and widely available, public and private funds are unlikely to deliver the necessary technologies at a cost and scale necessary to address climate change unless there are major changes in investment frameworks."*[1]

Scale of needs

Before the full extent of the present crisis was apparent, the UNFCCC[2] emphasized the need for additional investment of $200-210 billion USD in 2030. The report, however, highlights that while this number is large, it is small compared to overall GDP (0.3-0.5%) and overall global investments (1.1-1.7%), both assumptions made before the global crisis hit. Investments, for mitigation alone, are needed in a wide number of sectors, including energy supply, industry, buildings and transportation. Although these numbers are interesting in terms of delineating the macro level scale of necessary investment, they do not illuminate the changes needed to bring about these financial flows, including whether private capital will be available in sufficient quantity. In order to incentivize large scale capital flows, private companies will need to see potential profit. While this has begun to occur on a small scale, through the EU ETS, Clean Development Mechanism (CDM) as well as other private investment channels for mitigation, a greater

[1] World Business Council for Sustainable Development (2008). "Investment in a low carbon energy future in the developing world."
[2] UNFCCC (2007). "Report on Existing and Potential Investment and Financial Flows Relevant to the Development of an Effective and Appropriate International Response to Climate Change."

number and broader class of policies are necessary. Overall, these policies may yet prove insufficient given the magnitude of the challenge. Reforming CDM process, and providing supplemental, public funding through new mitigation funds, will be crucial to filling this gap.

Providing sufficient resources from developed to developing countries will help to complete the "Bali triangle," which includes a consideration of the politics, technological/scientific and financial aspects of climate change. As the Bali Road Map illustrates, these considerations must be considered simultaneously, with their corresponding different viewpoints on climate change. To achieve to goals set out in this document, national mitigation targets are needed alongside commitments for very large transfers of finance and technology to developing countries. If such transfers are made and if pledged funds are actually committed, then the likelihood of developing countries accepting a new agreement at Copenhagen will significantly increase.

I. INVESTMENT TO MITIGATE CLIMATE CHANGE

The need for scaling up of resources rapidly

It is widely recognised that significant increases in financial flows are needed to provide technologies and investments on a scale necessary to reduce emissions and keep concentrations of greenhouse gas emissions at levels required to avoid dangerous climate change.[3] New scientific evidence since the IPCC Fourth Assessment report suggests there is a narrow window of opportunity before 2020 to reduce emissions and avoid triggering irreversible impacts such as the melting of the Greenland Ice sheet.

Rapid and large response is, therefore, a critical factor when assessing financing options, although this fact is not usually addressed.

The global carbon market is one important way to channel private investment towards low-carbon technology in developing countries, although it is clearly not the only way. In 2007, the global carbon market was estimated at over $64 billion USD.[4] The rate of growth has been particularly noteworthy, with the market more than doubling from 2006 to 2007, both in terms of value and tonnes of carbon. Already, 2008 estimates put the

[3] See, IPCC (2007). "Climate Change Mitigation 2007: Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change;" Stern (2007). "The economics of climate change: the Stern Review." Cambridge University Press, Cambridge; and, UNFCCC (2007). "Report on Existing and Potential Investment and Financial Flows Relevant to the Development of an Effective and Appropriate International Response to Climate Change, Bonn Finance Report."
[4] World Bank (2008). "State and Trends of the Carbon Market 2008," p. 1.

market at ~$95 billion USD by year-end.[5] Given the present estimated value of the EU ETS at just over $50 billion USD, the New South Wales market at $224 million USD and the CCX at $74 million, significant new growth remains possible through creation of new markets, particularly formalized and regulated market expansion within the USA. However, it is critical that these new markets provide policy mechanisms linking with developing markets, including foreign investment in low-carbon technology.[6] To date, the largest contribution to the carbon market remains the EU ETS, which allows some use of Certified Emission Reductions (CERs) generated by the CDM. These CER credits represent one tonne of CO2 equivalent reductions, and, up until November 2008, 215.3 million had been issued under the CDM.[7] This is one example of linking developed and developing countries' carbon markets.

The CDM has shown rapid growth in the past few years, as investors gain greater experience with its mechanisms and approval process. According to International Emissions Trading Associations' 2008 report, the entire CDM portfolio of projects in 2007 was valued at almost $13 billion;[8] using World Bank estimates, the total CDM market has more than doubled from 2006 to 2007.[9] Particularly high growth is seen in the secondary CER market, which grew exponentially year over year from 2006 to 2007 because of perceived risks over fungibility of CERs and EU allowances in the post-2012 EU ETS market.[10] Changes in the secondary market provide liquidity; however, the primary market is the relevant one for new investment flows. It is important to note that while there is rapid growth in the overall size of the carbon market, growth in the secondary market does not represent an increase in investment flows to developing countries. To increase these flows, clarity surrounding the future Post-Kyoto international agreement is essential, since an agreement will increase investor confidence through outlining rules. For this reason, future growth in new flows is heavily dependent on a new international agreement on climate change.

The speed with which these flows begin to build will be disrupted by the present financial crisis. Already, we are seeing some impacts on financing for low-carbon technologies within developed and developing countries as credit becomes more difficult to access. Swift action is important for two main reasons: first, infrastructure investments today will translate into emissions or emission reductions in the future; second, policies may take several years to perfect. As the UNFCCC, IPCC and World Bank, among others, have pointed out, carbon intensive infrastructure, such as electrical generation facilities, have

[5] Point Carbon figure, cited in Gunther, "Doing well by clearing the air," *Fortune*, Nov 3 2008.
[6] For example, the Regional Greenhouse Gas Initiative (RGGI), which began operating in January 2009, does not currently include the ability to link with international credits. According to some, this occurs because of provisions within the Kyoto Protocol, which prohibits linking sub-national carbon markets. There are plans, however, to potentially import CERs into the RGGI market if the carbon price goes above a price threshold.
[7] Point Carbon (2008). "Weekly CDM Update" - http://www.pointcarbon.com/news/1.1006001
[8] IETA (2008). "State of the CDM 2008," p. 7.
[9] World Bank (2008). "State and Trends of the Carbon Market 2008," p. 1.
[10] World Bank (2008). "State…" p. 20-21.

long life cycles. The faster investment begins to flow towards low-carbon alternatives, the less carbon will be emitted in the future.[11] For this reason, policy makers must work quickly to increase the amount of investment in this area.

Second, encouraging increased investment is particularly important since policies may take several years to perfect or for investors to understand and begin responding to. This reality has already been observed with the CDM and national renewable energy incentive programs throughout the world,[12] and is likely to be reflected in other low-carbon technology policies. The sooner policies are put in place, the faster learning by doing can begin, allowing policies to be reformed and improved upon. We have already witnessed the strength of this early action approach through the EU ETS and CDM. Now is the opportunity to build more policies in new jurisdictions, simultaneously reforming existing policies to strengthen them. Ultimately, if private financing proves insufficient, public funding must be increased.

Although the financial crisis may pose problems for investors seeking to access funding for new, low-carbon technology transfer projects, it as also possible and highly desirable that the crisis will spur new public investment in this area. In order to kick-start the global economy, governments may choose to invest in new, low-carbon infrastructure projects; this is already being witnessed in the United States with the passage of the American Recovery and Reinvestment Act, which included billions of dollars for building retrofits, green infrastructure and other environmental initiatives. Whether this extends to developing countries or only operates at a domestic level within developed countries is yet to be seen.

The creation of a new and large publicly financed Global Fund to address climate change mitigation in developing countries is highly desirable. In addition, a very large expansion of lending by MDBs/RDBs to finance low-carbon investment in developing countries could provide a major boost for such investment, especially in countries that are foreign exchange constrained. Innovation may be swift if investments are large, funded by the public sector, and would be best to include global R&D collaboration efforts, as is beginning to emerge bilaterally between Canada and the US through their Clean Energy Dialogue. Overall, if such an approach generates profitable opportunities, it will contribute to higher future investment by the private sector.

To increase funding in this area, governments could require a certain proportion of bank lending to flow towards carbon mitigation. The present crisis, which finds governments sitting on the boards of banks in some developed countries, may prove an ideal time to shift investment towards this critical need. Innovations could then be spread across the globe through private investment flows. Developed countries have an incentive to help

[11] World Bank (2008). "The Clean Technology Fund," p. 2.
[12] GEF & UNDP (2008). "Promotion of Wind Energy."

facilitate this process since climate change impacts will be felt globally. In addition, developing countries' emissions will continue to grow relative to developed countries' emissions, reinforcing the need for technology transfer. Defining appropriate mechanisms and ensuring sufficient transfer of financial flows to developing countries will also facilitate a post-Kyoto global agreement, as developing countries will see they can both reduce carbon emissions and continue essential growth.

Growth is essential for developing nations to provide additional employment alongside other essential goods and services to large parts of their still very poor populations. For this reason, investment in low-carbon technology needs to flow into these countries to support emissions reductions without compromising economic development and poverty alleviation. As the revised "Greenhouse Gas Development Rights Framework," jointly developed by several NGOs, suggests, the challenge in allocating emissions reductions stems back to the 1992 Framework Convention on Climate Change, which speaks of both responsibility for past emissions and capacity to reduce current emissions. Today, the impasse over equitable reductions obligations can perhaps be overcome by adopting a more nuanced approach towards capacity – defined, in this framework as the amount of people living above and below a certain "development threshold."[13] As this discussion should illustrate, it is critical to consider development imperatives when designing climate policy. Financial, it is important to ensure pledged ODA is not being replaced by mitigation financing; new funding should be additional.

Once the agreement and emissions reductions responsibilities are finally resolved, carbon markets and other economic tools, such as carbon taxes, will act to increase investment flows, by putting a cost on emissions and allowing companies to trade credits in order to ensure an efficient path to reductions. As the EU ETS has already demonstrated, these markets can be linked globally, allowing credits to flow from developing countries, where emissions reductions may prove less expensive, thereby reducing the marginal cost of emissions reductions.

According to the UNFCCC 2007 Report,[14] to reduce GHG emissions to 2007 levels, annual additional investment and financial flows of $200-210 billion will be needed in 2030. This figure is for mitigation alone. To address the challenge, the report concludes it is necessary for:

- Developed countries[15] to provide major <u>additional</u> financial assistance to developing countries;

[13] Baer, Athanasiou, Kartha & Kemp-Benedict (2008).
[14] UNFCCC (2007). "Report on Existing and Potential Investment and Financial Flows Relevant to the Development of an Effective and Appropriate International Response to Climate Change, Bonn Finance Report 2007."
[15] Defined here as Annex 11 parties under the UNFCCC

- National policies to encourage private investment. The report emphasizes private investment since this accounted for 86% of financial flows at the time; the present financial crisis has dramatically altered the relative contributions of private and public flows, and public firms will need to make a major contribution.
- Carbon markets to expand through more stringent commitments leading to increased demand for mitigation and additional mechanisms to reduce emissions and increase supply of emissions reduction credits;
- New sources of predictable funds for mitigation in developing countries.[16]

The debate between developed and developing countries

This menu approach is to some extent a reflection of the tension about how action should and can happen within the global political framework. Developing countries expect developed countries to deliver their part of a post 2012 deal, by providing financing and technology transfer in exchange for developing countries' participation.[17] In response, developed countries' governments argue that they cannot bear the full financial burden, and that private investment is vital, pointing out that overall FDI is much more significant than ODA. Table 1 provides a summary of these relative views and positions.

Table 1: Overview of developed and developing country positions and views

This list provides a general overview of positions and views. There are variations and differences among countries and groups of countries.

Common concerns

- The need for increased financial and technological flows.
- Questions over the types of institutions and funding mechanisms for mitigation at the international and national levels.

Developed countries

- The need to meet obligations and provide financial assistance to cover costs from impacts caused by historically accumulated greenhouse gas stocks and to encourage low carbon pathways. This perspective does vary.
- Discussions on support for in-country studies and on engaging developing

[16] Haites (2008). "Negotiations on additional investment and financial flows to address climate change in developing countries UNDP Environment and Energy Group publication."

[17] See for example FCCC/A AWGLCA/2008/16 20 November 2008 Ideas and Proposals on paragraph 1 of the Bali Action Plan Poznan Ad hoc group on long-term cooperative action under the Convention Poznan 1-10 December 2008, Note by the Chair. www.unfccc.int accessed 27-11-08.

countries more directly on mitigation.

- The effectiveness of financial mechanism, particularly for taxpayers.
- The need to integrate climate change mitigation into Official Development Assistance (ODA).
- No new funds proliferation under the Convention.
- Minimum conditions for developing countries to access funding.

Developing countries

- Equity and justice issues resulting from climate change impacts in vulnerable countries due to emissions from "rich" developed countries.
- The need for developed countries to deliver on their obligations under the Convention on finance, technology and capacity building.
- The need for funding to cover the additional costs of climate change adaptation without diverting existing ODA commitments. In addition, the need to abstain from new conditionalities for ODA.
- The need for transparent governance of financial mechanisms, which include an equitable and balanced representation by all Parties, and operate under the authority of the CMP. Governance structures should provide "direct access" to funding and ensure that recipient countries are involved during all stages. "Predictable" sources of funding are needed, not just more funding.
- The need to provide support through the UNFCCC instruments rather than through fragmented efforts outside these instruments, most notably through the World Bank.
- The creation of new institutional arrangements, such as an adaptation committee or an expert body like the one covering technology transfer (EGTT) within the Convention.

Types of future financing mechanisms

The Bali Action Plan outlined a framework for negotiations on mitigation alongside finance and technology delivery mechanisms for both mitigation and adaptation. These discussions to extend the Kyoto Protocol will culminate in the December 2009 Copenhagen COP meeting. Overall, there are a number of different viewpoints represented in the Bali Action Plan, each of which is necessary for a successful post-2012 deal. Apart from the politics behind the negotiations, and the science and technology, finance remains critical. What should be clear, however, is that this Bali Triangle does not contain separate parts; instead, finance overlaps with both the politics of the negotiations, and, critically, the need for technology transfer.

Currently, several options are being discussed in the UNFCCC and related forums. Ideas include raising funds for adaptation through mitigation mechanisms[18] and taxation measures in developed countries to finance mitigation programs in developing countries. Some propose building on current mechanisms while others propose innovative funding mechanisms. In addition to the UNFCCC discussions, supplementary contributions from developed countries have emerged, including Japan's Cool Earth Initiative and the World Bank's Clean Investment Funds. There appears to be some sensitivity about the process for pledging financing and the institutions that govern the funds. For example, China has stated that funds committed outside the Convention should not count as obligations within the Convention, and therefore, albeit implicitly, should not require positive responses from developing countries to further the Convention.

The key point is that developed countries will need to make significant pledges of additional public funding, and follow through on these commitments, in order for a deal to be reached with developing countries.[19] This is particularly the case if binding targets are expected from developing countries.

Table 2: Summary of the options to enhance international investment and financial flows to developing countries[20]

Increasing the Scale of Existing Mechanisms	The Convention Funds (from developed countries)	
	The CDM and Other Possible Crediting Mechanisms	
	The Adaptation Fund	
Additional Contributions by Developed Countries	*New Bilateral and Multilateral Funds*	Cool Earth Initiative
		International Climate Protection Initiative
		Clean Investment Funds
		Global Climate Financing Mechanism

[18] Such a policy would be similar to the current levy on the CDM for the Adaptation Fund.
[19] Recent research by the *Guardian* suggests pledged funds under the World Bank's CIF have not been committed. Vidal (2009). "Rich nations failing to meet climate change pledges." http://www.guardian.co.uk/environment/2009/feb/20/climate-funds-developing-nations
[20] Source: Haites (2008). "Negotiations on additional investment and financial flows to address climate change in developing countries UNDP Environment and Energy Group publication." Significant modifications were made to this original chart given recent developments.

	Proposals Funded by Defined Contributions from Developed Countries	Convention Adaptation Fund, Technology Fund and Insurance Mechanism
		Adaptation Fund and Multilateral Technology Acquisition Fund
		Mechanism for Meeting Financial Commitments under the Convention
		Efficiency Penny
	Proposals Funded by Contributions from Developed and Developing Countries	World Climate Change Fund
		Multilateral Adaptation Fund
More Stringent Commitments by Developed Countries	Auction of Assigned Amount Units under EU ETS	
	Nationally Appropriate Mitigation Actions	
	Carbon Market Expansion (RGGI, Western Climate Initiative)	
Other Possible Sources of Funds	Extension of the 2% levy on CDM to other Market Mechanisms	
	International Air Travel Adaptation Levy	
	International Maritime Emission Reduction Scheme	
	Auction of Allowances for International Aviation and Marine Emissions	
	Funds to Invest Foreign Exchange Reserves	
	Access to Renewables Programmes in Developed Countries	
	Tobin Tax	
	Donated Special Drawing Rights	
	Debt-for-clean-energy Swap	

The role of private sector investment in climate change mitigation policy

Although it is often forgotten, parts of the private sector actively supported the climate change sceptics stance, particularly through the Global Climate Change Coalition. This group argued there was no sound basis on which to assert anthropogenic climate change was occurring. Around the time of the IPCC Third Assessment Report (2001), the science became more certain and attitudes began to change. At this point, the costs of action and the economics of climate change were used as arguments for deferring action. This lobby was influential with the US Government, even in the pre-George W. Bush period. Overall, the economic concern over efficient emissions reduction was a major reason for establishing the flexible mechanisms in the Kyoto Protocol, including emissions trading, JI and the CDM.

Although the US had significant experience in emissions trading through their NOx and SOx Clean Air Act Amendments, it was the European Commission that picked up the gauntlet on emissions trading, developing Directives to establish the Emissions Trading Scheme in an exceptionally fast time period.[21] In the EU ETS' first period, allowances were allocated free to industries, after which these permits could be traded. During this period, attitudes in the business community started to change, particularly as the observational evidence on temperature and sea-level rise alongside other climate change impacts became clearer. In addition, the private sector increasingly saw that clean energy could provide profitable opportunities, in part due to new government incentives.

The renewable energy private sector is one area that has been working to support climate change mitigation policies. Renewable energy technologies have been advocated as replacements for fossil fuels, since the oil price hikes of the 1980s and as concerns about the long-term security of oil supplies has grown. But, outside Brazil with its ethanol programme, investments have been traditionally been project-by-project rather than programmatic. Nevertheless, substantial experience has been built in the renewable energy sector about what works and where, and technological improvements have been funded from research and development budgets. This meant that once policy signals began to change over the past two decades, there has been an explosion of investment in renewable energy technology. According to a status report on renewable energy, in 2007 an estimated $71 billion was invested worldwide, of which 47% was invested in wind, 30% in solar photovoltaics and 9% in solar hot water.[22] An additional $10-20 billion continues to be invested annually in large hydropower. A significant amount of this

[21] For an excellent summary of the successes, failures and motivation behind the EU ETS' first period, see Ellerman & Joskow (2008). "The European Union's Emissions Trading Scheme in Perspective."
[22] Ren21 Renewables (2007). "Global Status Report, Renewable Energy Policy network for the 21st century." www.ren21.net

investment is in China, India and Brazil. Overall, both mainstream and venture capital investment is accelerating for both proven and developing technologies.[23]

II. EXISTING FINANCING MECHANISMS TO SUPPORT PRIVATE FLOWS

II.I THE ROLE OF THE CDM

At the international level, the Clean Development Mechanism (CDM) is a current policy mechanism encouraging both private and public financing flows towards developing countries. The CDM is one of the flexible mechanisms included as part of the Kyoto Protocol. According to Article 12 of the agreement, the CDM has two express purposes: reducing emissions in developing countries while supporting sustainable development. In other words, the CDM was established with the dual aim of assisting developing countries in achieving sustainable development while enabling Annex 1 parties to meet their mitigation reduction commitments under the Convention. Expanding the CDM and linking it with developed country carbon markets is important to achieving efficient mitigation. Allowing emissions credits to be traded on an open market means that price signals will align firms' marginal costs, ensuring the overall market is reducing carbon most efficiently. When, for example, the EU ETS is linked to the CDM, this broadens the market for emission reductions, theoretically increasing the efficiency of the market. To date, this integration between developed countries and developing countries carbon mitigation efforts has already been supported by developed country legislation, for example, the National Allocation Plans of the EU ETS.

While this mechanism is by no means exhaustive or adequate, the CDM has shown rapid growth in the past few years, as investors gain greater experience with its mechanisms and approval process. According to IETA's 2008 report, the entire CDM portfolio of projects in 2007 was valued at almost $13 billion;[24] using World Bank estimates, the total CDM market has more than doubled from 2006 to 2007.[25] Within the first half of 2008, the primary CDM market was valued at almost $12 billion,[26] demonstrating high likelihood for strong growth again this past year. However, the financial crisis, which became acute in the second half of 2008, may have altered this growth rate somewhat; figures are not yet available here. According to optimistic estimates made in December 2008, the aggregate financing flowing from developing to developed countries per year,

[23] *ibid*
[24] IETA (2008), p. 7
[25] World Bank, (2008). "State…" p. 1.
[26] Point Carbon, http://www.pointcarbon.com/trading/cpm/analysis/analystupdates/1.943897

through the CDM, could be as high as $5 billion.[27] Nevertheless, the present scale of flows is inadequate to meet the necessary reductions needed to avert dangerous climate change and the program is in dire need of scaling up.

CDM strengths

There are several reasons why the CDM is an important model for private sector financing of technology:

- It is an innovative mechanism that has grown and developed results in a short time; between November 2006 to October 2007, the number of CDM project activities more than doubled to 819 registered projects. By mid-November 2008, 1,210 projects were registered under the mechanism, for a total of 215.3 million CERs.[28]
- It provides an interface between developed and developing countries. Despite challenging early negotiations, countries such as China and India who were once sceptical have entered the market with enthusiasm.
- Private investors have already made use of the mechanism to fund mitigation projects, with great creativity. This initial phase has demonstrated the overall competence of the mechanism's principles, and has fostered a community of practitioners in both developed and developing countries skilled in implementing projects. Overall, the CDM has been effective at supporting 'learning-by-doing.'
- It has established an effective operational principle currently being copied in many of the innovative financial mechanisms under discussion (see Table 2 above): a 2% levy on all CERs, used to fund the Adaptation Fund. This is currently the only independent source of funding for adaptation.
- It is a one-sided trading mechanism, which gives developing countries the opportunity to continue to focus on development imperatives. This recognizes the 'differentiated responsibilities' between developed and developing countries as a result of differences in aggregate past emissions.[29]

CDM weaknesses

This is not to say that establishment of the CDM has been an effortless process nor that it is without current controversy. It is a dynamic instrument, in a constant state of

[27] This estimate assumes $10 USD / tonne CO2. Teng, Chen & He (2008), p. 2. Similarly, Stern estimated annual flows of ~$6 bn USD, which he regards as inadequate.
[28] Point Carbon (2008). "Weekly CDM Update" - http://www.pointcarbon.com/news/1.1006001
[29] Stern (2008). "Key Elements of a Global Deal on Climate Change."

modification and adjustment, with some major reforms proposed for the post-2012 situation. Key criticisms of the CDM's operation include:

- Governance structures have been questioned due to a lack of transparency and engagement of all players. In particular, the lack of adequate resources for governance and an inability for feedback between project developers and the Executive Board regarding decisions is problematic. By some estimates, ~50% of projects proposed under the CDM are rejected.[30] While some researchers view this as evidence of an active and engaged CDM,[31] in reality, it points to unclear rules and inadequate feedback between project developers and CDM staff. The result is significant wasted resources and an uncertain investment environment.
- Delays on establishment and project approvals have reduced its effectiveness, and led to questions on its' relevance and impact. The average project may take 300 days to proceed through a project cycle, with initial financing costs of ~500,000.[32] Overall, the scale is considered woefully inadequate to deal with the magnitude of necessary financial flows and emissions reductions.
- Establishing procedures on selection and verification for various project types have proved difficult and controversial. This reality discourages investment, due to lack of clarity on which projects can qualify under the mechanism.
- Substantial issues remain about the inequitable distribution of its impacts. In particular, regulatory costs for complying create the need for large emissions reductions in order to generate economies of scale. As a result, few investors are attracted to smaller or more risky investments, since there is little potential for a return. For this reason, projects directly targeting sustainable development or decreasing poverty are unlikely under the mechanism, as presently structured. One study suggests less than 1% of all projects approved under the CDM contributed to sustainable development.[33]
- The mechanism's effectiveness in 'additionally' reducing emissions has been repeatedly questioned. Ultimately, verifiable emissions reductions must remain at the core of the CDM, since this is the prime objective.
- Lack of clarity surrounding a post-2012 agreement has lead investors to favour short-term emissions reductions projects.[34]

Now that we have a broad overview of the weaknesses, we can examine their causes and consequences in more detail. The challenge remains balancing competing interests from various stakeholders. To satisfy the need for scientific integrity, effective delivery of

[30] Michelowa et al. (2007). "Understanding CDM methodologies: a guidebook to CDM rules and procedures," Defra, November 5 2007
[31] Paulsson (2009).
[32] Ellis & Kamel (2007). "Overcoming CDM Barriers."
[33] Sutter & Parreno (2007).
[34] Ellis, Winkler, Corfee-Morlot & Gagnon-Lebrun (2007).

emission reductions, and maintaining confidence of all parties with regional balance, a complex array of institutions and procedures have been established and a great deal of capacity has been built. Nevertheless, NGOs and many researchers have complained that CERs lack environmental integrity, whilst industry organisations argue for less stringent rules.[35] On the one hand, there is a need to determine that emissions reductions are verifiably additional. A definition of additionality can be interpreted in two ways—financial and environmental. Typically, environmental additionality is employed, which means that fewer emissions were created than under a baseline scenario. This baseline is constructed as part of the project plans submitted by the project developers, which it perhaps a conflict of interest. As a result, some have called for independent baseline assessment by the EB,[36] which would require additional resources. As has already been made clear, the current resources dedicated to the EB is already small; is there enough commitment to this process to allocate more funds for such a purpose?

Of course, satisfying environmental additionality does not satisfy the financial additionality—were there already plans in place to undertake this project? Was funding already available? This second criteria is somewhat more stringent, but it is also crucial to CERs' environmental integrity. To date, the interpretation of the Marrakesh Accords has meant this second criteria is not strictly adhered to.[37] Instead, project developers tend to use a barriers analysis to argue that a project is additional.[38] Again, this creates a conflict of interest, since project developers are more likely to have their project approved if they mask the economic viability of a project.[39]

Clearly, additionality is still questioned by many outside observers. One study by Sutter and Pareno which reviewed a number of CDM projects, found 72% of CERs demonstrate a "high likelihood that the emission reductions happen[ed] only due to the CDM component of the project."[40] While this may seem a high success rate, it is important to recognize that CDM emissions are offsetting reduction efforts in other, capped markets such as the EU ETS. As a result, any credits for environmentally ineffective projects means emissions have actually increased by that amount globally.[41]

Questions have also been raised on mitigating emissions of HFC-23 and industrial sources of N2O, which account for 40% of expected credits under the CDM. Since the value of HFC-23 is actually less than the CER subsidy, the high price has distorted the overall CDM market, with some arguing it has made the CDM an inefficient subsidy.[42] However, the UNFCCC has responded to these concerns, and no future credits are

[35] Michaelowa et al. (2007).
[36] Sterk (2008). "From clean development mechanism to sectoral crediting approaches: Way forward or wrong turn?" JIKO Policy Paper 1/2008. Wuppertal: Wuppertal Institute for Climate, Environment and Energy.
[37] Paulsson (2009).
[38] Schneider (2007).
[39] Michaelowa & Purohit (2007).
[40] Sutter & Parreno (2007), p. 85.
[41] Schnider (2007); Paulson (2009).
[42] Wara (2007).

available for eliminating these gases. More broadly, the CDM could alleviate some of these problems by only crediting emissions reductions for CO2 projects; given the scientific uncertainty over residence times of various GHGs and the overall greenhouse gas warming potential of different molecules, this may be a wise outcome. However, the bi-product of such a decision could include leakage, if other GHGs are not covered under another emissions reduction scheme and if these gases are easily substitutable.

Although considerable effort has gone into ensuring that emissions reductions are real, additional and credible through baseline determination and additionality of projects and sustainable development benefits, the results remain dubious. For The role of the Executive Board (EB) has been critical here, as it underpins the currency of the CERs.[43] Without meaningful emissions reductions, the CDM is unlikely to be accepted as a legitimate financial tool for emissions reductions.

Yet, while NGOs and researchers call for a more rigorous approval process there is also push for faster turnaround on project approval and for greater transparency in the CDM process on the part of investors. These reforms would aid project developers, and would help to bring more investment into the CDM sector (assuming there were markets to sell these credits in.) As should be clear, this tension is unlikely to be solved by small tweaks of the current CDM system, given the lack of funding and potential for perverse incentives. The EB has attempted to resolve some of these challenges through a number of supporting panels have provided technical expertise to prepare the CDM's EB for decisions.[44] Generally the EB has expanded the roles of Members as panel chairs and in conducting reviews.[45]

More broadly, there is a significant need for rules, approval processes and eligible projects to be clearly and transparently delineated. This would not only aid the CDM in ensuring additionality, it would also help project developers to more clearly understand the process. Likely, this would also shift the ratio of approved to rejected projects towards greater approval; once again, less resources could be wasted on project design, and more could go towards actual implementation were this the case. In particular, many of the early projects in the CDM market were aimed at low-hanging fruit; further credits will likely be generated through new and likely more expensive solutions. In order for these changes to be undertaken through private financing, reforms prove essential. Mobilizing large sums of private capital towards the critical task of reducing emissions in developing countries requires a clear and stable investment framework. To date, the CDM has not been able to provide this at scale.

Another issue involves use of CDM resources; investment through the CDM has not been evenly spread. Seventy-five percent of projects in the pipeline throughout 2008 are from

[43] Michaelowa et al. (2007).
[44] *ibid*
[45] *ibid*

four major countries: Brazil, India, China and Mexico.[46] All of these countries have significantly higher per capita GDP than many other developing countries. Even when project development is examined regionally, nearly 75% of all CER credits from projects in Africa were generated in three countries: Nigeria, South Africa and Egypt. South Africa alone accounts for 30% of all CDM projects on the continent, largely because of their higher emission levels and greater potential for projects that capture higher CERs.[47] In part, this concentration may be occurring because countries that attract strong CDM investment may be the same as those attracting strong FDI. In order to reduce risk, investors may be looking for stable political regimes, institutional capacity and strong human capital.[48] Strides have been made to expand country participants, with 15 new countries applying for project approval in 2007.[49]

In addition, reduction efforts have been concentrated in certain sectors. Energy industries, including both non-renewable and renewable sources, made up over 55% of all approved CDM projects up to November 2008. While energy supply represents the largest segment of necessary financial flows towards climate mitigation, according to the UNFCCC, this nevertheless demonstrates that CDM efforts have been focused on a few, key areas where emissions reductions projects fit well with the requirements for project approval.

This concentration in a limited number of countries and sectors has been analysed by several authors. Identified causes include a lack of technical capacity at the national level in many developing countries; a weak CDM related institutional framework; lack of a clear and consistent CDM policy; high transaction costs throughout the CDM project cycle limiting projects in poorer developing countries as well as projects focused on sustainable development.[50] This reality limits participation of many of the least developed countries, particularly those who do not have a track record of successful CDM implementation. This uneven distribution has also occurred despite recognition at the outset of the CDM's design that private investment tends to gravitate towards a handful of the larger developing countries, which have relatively good infrastructure and stable governance systems. A specific obligation in Article 12-6 has been an entry point for the Executive Board of the Kyoto Protocol, which states that Meeting of the Parties (MOP) to the Kyoto Protocol has an explicit function to reviews the regional distributions of projects with a view to identifying systematic barriers to their equitable distribution.[51] Clearly, while the CDM has begun to channel foreign investment into developing countries for low-carbon technology, the results have been clustered in a few countries and sectors.

[46] UNEP (2008). "CDM projects by host region." http://www.cdmpipeline.org/cdm-projects-region.htm
[47] Arens et al. (2007).
[48] Ellis, Winkler, Corfee-Morlot & Gagnon-Lebrun (2007).
[49] IETA (2008). "State of the CDM," p. 7.
[50] Overview in Arens et al. (2007); see also Ellis & Kamel (2007). "Overcoming Barriers to Clean Development Mechanism Projects," Paris: OECD COM/ENV/EPOC/IEA/SLT
[51] Yamin & Depledge (2004). "The International Climate Change Regime, A Guide to Rules, Institutions and Procedures."

CDM reform

The problems with the CDM as currently structured have created calls for reform on a number of fronts. In order to spread CDM benefits more fairly, and to achieve more sustainable development goals, some specific initiatives were designed to increase capacity building for CDM institutions. In Africa, for example, the CD4CDM initiative, started under the Nairobi Framework for Sub-Saharan Africa (SSA),[52] is a targeted capacity building scheme, which has operated in SSA and East African countries, increasing the number of CDM projects developed on the continent.[53] Specific remedial recommendations include offering premiums prices for CERs generated in regions such as Africa and South East Asia.[54] More broadly, CDM reform must consider how it could value sustainable development benefits explicitly, since the mechanism as currently structured only values emissions reductions.[55]

Such concerns have also led to the development of the Gold Standard, which has environmental integrity at its centre, alongside an established procedure to ensure sustainable development benefits to local communities.[56] This standard has a more participatory approach to project development; it ensures key stakeholders endorse the project early in the design phase. Such an approach is also expected to reduce financial risk, making it attractive to investors. Overall, the Gold Standard, and other voluntary certification processes such as the Climate, Community & Biodiversity Alliance (CCBA) have contributed to the CDM meeting more of it sustainable development goal. However, this approach is only viable if investors can charge a premium for these CERs. It is possible that some companies meeting the EU ETS emissions allowances will be interested in using these socially responsible CERs to promote their CSR portfolio. But this additional demand may prove insufficient to improve the overall sustainable development imperative meant to underpin the entire mechanism.

More broadly, reform is needed to move away from a project-by-project approach towards a sectoral approval process. As Stern has pointed out, a high degree of regulatory complexity is inherent under a project-based approach.[57] To overcome this implicit cost and regulatory burden, there are a number of policy options being proposed to reform the CDM including a sectoral CDM, programmatic CDM, policy CDM and, most recently, technology CDM.[58]

[52] ICF International (2007). "Analysis of activities implemented under the Nairobi Framework in Sub-Saharan Africa Final Report."
[53] *ibid*
[54] OIB (2008).
[55] Ellis, Winkler, Corfee-Morlot & Gagnon-Lebrun (2007).
[56] WWF, "The Gold Standard" an eight page booklet - see www.cdmgoldstandard.org
[57] Stern (2008).
[58] For an excellent, and critical summary, of these proposals see Teng, Chen & He (2008).

By far the most widely discussed approach, in various iterations,[59] is sectoral CDM. Under a sectoral CDM approach, developing countries would adopt sectoral baselines for major industries; any emissions reductions below this level would be credited to that country in the form of CERs, which could then be sold on various carbon markets in developing countries. The baseline itself could be set nationally or internationally.[60] This system has also been referred to as "no-lose sectoral targets" since developing countries would adopt voluntary sectoral emission targets;[61] but surpassing the target would have no consequences.

This approach would move away from many of the problems inherent in the project-based system as currently structure. It would improve the overall mechanism's efficiency, reduce transaction costs, increase economies of scale and, thereby, encourage more private capital flows. Critically, leakage problems, in which emissions move from one capped country with emissions reduction obligations (developed country), to another without obligations (developing country) would be resolved. Rules under a sectoral CDM are also more likely to be clear cut for investors since the process of establishing a baseline would require considerable documentation, likely on the part of UNFCCC. However, as this point should illustrate, this also implies greater costs and administrative resources for the UNFCCC.

Sectoral CDM could also be paired with an emphasis on technology transfer. As Teng, Chen & He (2008) have pointed out, effective mitigation is highly dependent on the timing of new technology introduction in developing countries. Despite this reality, little emphasis has been placed on technology through the CDM thus far. Establishing additionality under this scheme would work through the assumption that such technologies would likely have considerable delay before being implemented in developing countries due to lower price, conventional energy sources.

Policy or programmatic CDM would involve a greater emphasis on coordinated emissions reductions within the host country. For example, under policy CDM, a government could receive credits for implementing a policy, which reduces GHGs; this design avoids the transaction costs inherent in a project-by-project approach. However, determining a baseline or the emissions reduced could prove challenging. Programmatic CDM is similar, but with a greater emphasis on the projects targeted by the government's policy.[62]

[59] See Sterk & Wittneben (2006), for a review of the many policy options that have been proposed under the heading 'sectoral CDM.'
[60] Paulsson (2009).
[61] Ward (2008). "The role of sector no-lose targets in scaling up finance for climate change mitigation activities in developing countries," prepared for Defra, UK.
[62] Paulsson (2009).

Regardless of the chosen approach, the rules must become more clear-cut, allowing investors to understand which projects will and will not qualify before going through a lengthy registration process and burdensome upfront costs. These changes are critical in order to encourage more private investment. In addition, the overall CDM needs to be broadened to include more sectors, particularly land-use change and avoided deforestation. Without a broad carbon market covering the majority of carbon emissions, distortions and perverse incentives are likely, as emissions can simply be moved from capped to uncapped sectors.

One solution here is the so-called "CDM with atmospheric benefits." In this scheme, emissions reductions in developing countries would not be credited on a one-to-one ratio for emissions released in developed countries. In other words, if a project reduced an estimated amount of carbon, fewer CERs would be granted, perhaps by a 2:1 ratio.[63] This would help to overcome some of the problems associated with additionality examined above; given the finding that 72% of projects appear to be effective, a ratio lower than this value might prove useful to ensure offsets do not lead to overall global increases in emissions. This idea also resolves some of the issues inherent in importing credits from an uncapped market, the CDM, into a capped market, for example the EU ETS.

Finally, the EB and associated committees themselves need reform. There has been significant criticism that there are inadequate administrative resources and staffing to implement that CDM; this reality is highly problematic given the vast amount of capital the mechanism aims to encourage in new flows. Overtime, the administrative resources have increased,[64] but these resources are likely to prove insufficient once again if the CDM is scaled up in the post-2012 agreement and if reforms are to be implement effectively. As the IETA, among others, have argued, the management structure of the overall mechanism is in need of significant reform.[65] Communication mechanisms must be built into the CDM's operation in order to interface more effectively with investors. Upgrading these components of the CDM's operation is a matter of basic management. Without these changes, the CDM will never reach its full potential in terms of the scale of necessary investment flows.

II.II RENEWABLE ENERGY FINANCING & ENERGY EFFICIENCY

Decarbonizing the world's energy supply is a key challenge throughout the 21st century. Once problems of the credit crunch are overcome, private investment will be important to solving this problem by supporting new technology introduction. These financial flows will exist within a policy framework, being driven by the price signals policy-makers set.

[63] Schneider (2008).
[64] Schneider (2007).
[65] IETA (2008). "State of the CDM."

Policies, which have already demonstrated some success, include feed-in tariffs (also known as standard offers), quotas and tenders. Some financiers view these policies as more critical than carbon markets in driving change.[66] In the past few years, growth in renewable energy has been large; by mid-2007, at least 140 publically traded companies worldwide, focused in part or whole on renewable energy, had a market capitalization greater than $40 million USD. Overall, the estimated total market capitalisation of the companies and divisions in mid 2007 was more than £100 bn GBP.[67]

Renewable energy policies

To date, the feed-in tariff has been most successful at attracting investors since it guarantees a reliable, stable rate of return, allowing investors to forecast revenue and their overall payback period. Generally, this policy instrument has been used widely throughout Europe. In order to increase early investment in renewable energy, it may be most effective to set the feed-in tariff high initially, and decrease it over several years. This approach will ensure investors act early, and that as technology improves, developers are not making windfall profits. If structured correctly, this policy should decrease at a similar rate as the technology is improving; ensuring new infrastructure is built continuously as technology and capacity continue to rise. In addition, requirements for overall renewable energy targets, often termed 'quotas,' can ensure long-term growth in the sector. Quotas have been used with success in many developed countries, primarily outside of Europe, and are beginning to be implemented in developing countries. These two policy mechanisms can be combined to increase their effectiveness, as is currently the case in Canada, China and India.[68]

Regardless of the chosen policy mechanism, the program must send a clear signal to potential investors that returns will be stable and reliable over a long period, allowing investors to forecast. The policy must also be cognizant of public resources, ensuring that funds provided to the private sector encourage new, additional private investment, and do not merely subsidize investment that would occur regardless of the public financing. Balancing between these two requirements will be challenging.

The CDM can also interface with renewable energy development. The mechanism has the ability to build up capacity in the least developed countries for renewable energy, including wind and solar. In particular, the CDM may be used as a mechanism to establish technical expertise in countries with little prior experience, helping to incentivize increasing amounts of foreign investment. For renewable energy, the question of additionality has not been an issue to date with CDM approval, but it is possible that as

[66] Personal communication, Nick Robins, Head of HSBC Climate Change Unit
[67] Ren21 Renewables (2007). "Global Status Report, Renewable Energy Policy network for the 21st century," p. 18. www.ren21.net
[68] Strictly speaking, China will use a tendering process to achieve their Quotas. Source: GEF & UNDP (2008), p. 6.

some countries gain greater experience in implementing wind, they will no longer qualify for CERs.[69] By that point, national policies could be in place within host countries to continue to encourage investment without CER credits. In addition, technologies may also be commercially viable, both because of experience and reduced production costs. For this reason, it is critical that early, CDM-based investment in renewable energy be used as a catalyst to improve national policies in order to incentivize future investment in this area. However, given the slow approval process for CDM, the risk of non-approval, projects' concentration in a few countries, and the present scale of investments through this mechanism, it is unlikely to provide adequate incentive for developing renewable energies on a broad scale.[70] If the CDM moved away from a project-by-project approach, as discussed above, it is possible it could play a larger role supporting renewable energy development. Ultimately, renewable energy investment will need underlying, profitable economic models in order to be successful broad-scale and long-term.

Setting stable policies is particularly important for countries with little experience in high-cost renewable technologies, since there are large upfront capital costs that private investors may be unwilling to undertake without a track record of success.[71] Apart from the CDM, a number of other financing mechanisms can encourage early learning by doing within countries. Experience can help to catalyze policy reform, encouraging future renewable development by demonstrating a business case for the industry. For example, the GEF has funded some renewable energy projects in countries with little experience, in order to begin to build capacity and lower risk for investors. Similarly, the new World Bank Clean Investment Funds, worth $6.1 billion USD, aim to create projects focused on market transformation, increasing the likelihood that private investors will increase in scale once technical capacity is demonstrated. Japan's new Cool Earth Partnership also contains a component aimed at improving energy access through renewable development in countries with poor overall energy availability.

Wind energy in China and India

Globally, wind energy has been the fastest growing renewable technology since 1995, with annual growth rates of 18.4% on average between 1995 and 2005.[72] In fact, before the financial crisis a large barrier to wind energy projects in developing countries was long wait times, as well as increasing prices, for installations. This occurred because of high global demand for wind energy technology, particularly from OECD countries, leading to long back-orders.

A handful of developing countries have already begun to build significant renewable energy capacity at low cost, making these energy sources competitive in world markets.

[69] GEF & UNDP (2008). "Promotion of Wind Energy," p. 6.
[70] *ibid*, p. 6-7.
[71] *ibid*, p. 12-13.
[72] *ibid*, 10.

Probably the most well known example is Brazil's sugar cane based ethanol industry. More recently, China and India have begun to demonstrate significant capacity in wind energy. Often, production is export-led, with more of the technology being exported to developed countries than being implemented within the country; in part, this is the case with India and China's wind and solar energy sectors. Three major factors seem to be driving the rapid development of wind energy in China and India: supportive government policies, significant private investors and sometimes technology transfer from developed countries through revenue sharing agreements.

From a policy perspective, both the Chinese and Indian governments have progressive policies in place to encourage growth of domestic wind energy companies. In China the leading company is Goldwind, while in India, the leading company is Suzlon, now headquartered in Amsterdam. Both nations' policies have favoured local production in order to stimulate growth of the wind industry domestically. As a result, both Goldwind and Suzlon have become large players globally. It is unlikely that this local production approach will work for most developing countries, since many will not have the necessary wind conditions or technological capacity to develop large-scale industries domestically; nevertheless, the approach has been successful for China and India.

In China, initial policies overstated the incentives needed for wind energy development, leading to some market inefficiencies in some provinces and windfall profits for developers. The policy is in one sense a tariff coupled with a quota; however, functionally feed-in tariffs are chosen through tendering, which has some drawbacks for securing foreign private investment.[73] Beginning in 2003, the Chinese government moved forward on creating a comprehensive policy, through the Energy Bureau. As a result, China has begun to craft targets for wind energy.[74] Similarly, in India action has occurred through the creation of government bodies tasked with increasing wind energy capacity. Here, efforts began much earlier with the creation of the Ministry for New and Renewable Energy, originally created in an earlier form in 1981.[75] In India's case, a much broader set of policies is in place, including quotas, feed-in tariffs and capacity building measures through R&D support and pilot projects. Studying these cases more in depth may provide additional insights for building wind energy and other renewable infrastructure in developing countries; however, India and China are likely to be comparatively unique cases for many reasons including their relatively large domestic markets.

From a technology and knowledge transfer perspective, both firms acquired their initial technology through revenue sharing agreements with Western-based corporations. In

[73] In some cases, the Chinese government matched companies seeking joint-venture with partners, rather than letting foreign investors choose who they would partner with. This approach can dissuade foreign investment by raising risk and project uncertainty.
[74] GEF & UNDP (2008). "Promotion of Wind Energy," p. 13.
[75] The name of this ministry has changed several times over the years, as explained in GEF & UNDP (2008). p. 13.

1995, Suzlon signed an agreement with the Germany company, Sudwind GmbH Windkrafttanlagen in exchange for royalties for every wind turbine sold over the course of the five, proceeding years. In 2001, when the company was further established, it paid Enron Wind Rotor Production B.V. for technology capacity in manufacturing rotor blade components, and the company has gone on to make acquisitions in key areas to improve its technical capacity.[76] Similarly, Goldwind received its technological capacity through purchasing a license from a German wind turbine company, Jacobs, which has since been bought out by REpower. Again, a royalty was established, and in this case, the information did not include how to design the machines, but only specified component specification and assembly. Goldwind has since entered into other technology license agreements.[77] As these two cases demonstrate, knowledge transfer between developed and developing countries is critical to building renewable capacity. Whether these transfers happen between independent entities or are facilitated through implementation by foreign companies working in developing countries will likely depend on the size of the developing country in question and its potential market for renewable energy development.

Private investment in renewable energy

Some private equity investment firms focused on climate change mitigation are beginning to see clean infrastructure, primarily renewable energy, as viable financing opportunities in their own right, outside of the CDM.[78] Again, this is likely to occur on a limited scope, in fast-growing developing countries including China, India and Brazil, all of which have significant infrastructure demands. Although China is likely the largest market for this type of private financial flows, there remain challenges to private investment because of national policies requiring links with Chinese-based firms. Nevertheless, investment firms are beginning to see opportunity, likely because of renewable energy quotas and feed-in tariffs rewarding investment in this area, and investment firms are beginning to act on these prospects. Again this reality underscores the need for rapid action in policy creation; private investors, particularly in this market, may take significant time to respond to incentives.

The financial crisis may already be exerting detrimental impacts on growth in the renewable sector. As one investor reported to us, credit for renewable energy even in developed countries is frozen as part of the general credit crunch, which is accentuated in this case because of the costs associated with these large infrastructure projects. The only projects that appear able to continue on schedule within this investment climate are those with their own capital. New World Bank financing programs, alongside a replenishment of the GEF could lessen this reality, but the underlying problem remains lack of liquidity in the marketplace, especially for investments that only become profitable after a long period.

[76] Lewis (2007). p. 6-9.
[77] *ibid*, p. 15-17.
[78] For example, Climate Change Capital, a London-based investment private equity firm, is currently working on launching a China-based clean infrastructure fund.

In addition, the wind energy sector is currently overcoming challenges faced by technical problems and overly optimistic wind analysis estimates. Solar faces additional technical difficulties, because research and development remains inadequate, and high performance systems are not yet available on a large scale. While concentrated solar power may show some promise, particularly within Africa where sunlight hours present favourable opportunity and other power sources are relatively expensive, the technology is not yet being invested in, produced or installed on a wide enough scale. It is likely that solar in particular will require relatively high feed-in tariffs to support expansion of this industry. In developing countries with little capacity or previous experience, GEF or CTF supportive funding can establish experience and help to shape the policy landscape, making it more favourable to renewable energy technologies.

Energy efficiency

Energy efficiency is an important area where private financing can encourage low-carbon technologies are implemented in developing countries. Since applying an energy efficient technology implies inherent returns on investment overtime, there is not the same need for public financing, subsidies or policies to support this activity. Instead, barriers can include lack of knowledge or experience. The IFC has been particularly innovative in this area; through partnership with banks in developing countries, the IFC helps financial institutions identify which of their clients could implement energy efficiency programs, if given a loan, and trains them on how to structure these mechanisms. To further encourage investments, IFC also issues a partial risk guarantee against default. In practice, as reported in discussions with the IFC, default rates are significantly lower for energy efficiency projects than for other sectors. Providing guarantees has thus been an efficient use of IFC resources, helping the private sector overcome its initial reluctance to invest in these sectors. In other words, energy efficiency is an effective private investment. As the IFC example illustrates, lack of knowledge or capacity can be the missing link hampering private investment in this area.

II.III REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGREDATION (REDD) IN DEVELOPING COUNTRIES

Unlike climate change and biodiversity, which each left the 1992 Rio summit with legally binding agreements, it was not possible to reach consensus on a global forest convention. Instead agreement was reached on some general Forest Principles and since 1992 there have been various strands of negotiations under several frameworks. Attempts have been made to replicate what are perceived to be successful elements of the climate negotiations, with an Intergovernmental Panel on Forests. In 2002, the UN Forum on Forests was finally established. However, it has proved difficult to make significant progress and engage all players. At the last meeting of the UN Forum for Forests in April

2007, there were only 600 participants and there were apparently two weeks of difficult negotiations, resulting in a non-legally binding instrument for sustainable forest management (NLBI) for all types of forests and a Multi Year Work Programme (MYPOW) for the period 2007-2015 which will go forward to ECOSOC.

Whilst the UNFCCC places obligations on its Parties to protect and enhance their greenhouse gas sinks and reservoirs, concerns over environmental integrity meant that within the Kyoto Protocol, key sinks such as soil carbon were completely excluded, due to uncertainty over measurement and leakage. In addition, due to debates within the formal forest negotiations, there was a lack of willingness to engage on deforestation by forest nations because they did not want to be 'blamed' by developed countries. However, at the Montreal meeting (MOP1/COP11) a major new initiative by the Coalition for Rainforest Nations, which includes many developing countries, transformed international forest debates as it sought to create a new mechanism to reduce deforestation that included carbon emissions reduction funding.

This development is not only important because it provides new funding for developing countries to mitigate emissions; new science underscores the importance of land-use change and deforestation as significant contributors to worldwide GHGs. By IPCC estimates, almost 20% of global emissions in 2004 emanated from deforestation.[79] Moreoever, the need to take a comprehensive approach towards emissions reductions has been emphasized by the Stern report, which highlighted emissions from the agriculture and forest sectors, and the relative cost-effectiveness of action in these sectors.

Some moves in this direction are underway but remain incomplete,[80] and there has been some hesitancy to pay fully for such carbon services.[81] While avoided deforestation was explicitly excluded from the Kyoto Protocol, the principle was endorsed at the Bali meeting in December 2007, where significant progress was made on REDD financing. The Bali Action Plan provides for exploration of policy approaches and incentives relating to REDD, particularly concerning the role of conservation, sustainable management of forests and enhancement of forest carbon sinks in developing countries. The Coalition for Rainforest Nations, who is leading these efforts, wants a REDD mechanism established, with links to the existing UNFCCC, in the post-2012 agreement; lobbying for these changes has continued at the recent COP in Poznan.

[79] IPCC (2007). "Summary for Policymakers. Climate Change 2007: Synthesis Report," p. 13.
[80] See, for instance, the recent initiatives undertaken at the World Bank as part of the program to Reduce Emissions from Deforestation and Forest Degradation (REDD). See the World Bank's discussion of its Forest Carbon Partnership Facility, at www.carbonfinance.org. For a discussion of the initiatives of the Coalition for Rainforest Nations (of which IPD is a partner), see www.rainforestcoalition.org. For a more analytic discussion of some of the issues, see J. E. Stiglitz, Making Globalization Work, op. cit.
[81] See, for instance, the Stern Report (Stern, Nicholas (2006). "The Economics of Climate Change: The Stern Review." Cambridge University Press.) From the perspective of efficiency, a unit of carbon should have the same value everywhere; but some environmentalists have been worried that bringing in avoided deforestation will depress the price of carbon. If true, the correct "answer" is that there needs to be stronger emission reductions targets, which become economically more viable by bringing in avoided deforestation.

The EU has been a relatively vocal critic to including avoided deforestation credits because of concerns that the potential scale for avoided deforestation credits is too large, and will flood the EU ETS market. While this is a valid concern, there are policy mechanisms which could limit the scale of REDD credits in the EU ETS. In addition, it is possible that the eventual REDD credits will come under a scheme separate from the CDM, making regulations distinguishing between these two credit types clear cut.

Although early work in this area has been hampered by significant disagreements between developed and developing countries, the Coalition appears to be making significant progress through employing a diplomatic and technical capacity model. In July 2008, the UN-REDD Programme was launched collaboratively between the FAO, UNDP and UNEP, with $35 million USD in the portfolio to date.[82] Similar to some IMF & GEF efforts, this fund aims to support capacity building in developing countries. More broadly, the funding will support research on linking REDD to present UNFCCC mechanisms, and is attempting to resolve the challenges associated with valuing avoided deforestation's carbon. In order to be effective, the financial flows must be directed to the people making the decision whether or not to preserve forests. As the UN-REDD itself has stated, "A functioning international REDD finance mechanism needs to be able to provide the appropriate revenue streams to the right people at the right time to make it worthwhile for them to change their forest resource use behaviour."[83]

There are significant technical and scientific challenges facing REDD; nevertheless, these challenges can be overcome, and an effective mechanism for channelling investments towards avoided deforestation in developing countries is possible. Part of the challenge lies in uncertainty over forest ecology. Depending on their lifecycle stage, latitude and composition, forests can be net sinks or sources for carbon; in addition, scientists are still uncertain about biological feedbacks, and whether carbon storage will increase or decrease under various climate change scenarios.[84] Politically, questions remain, including whether co-benefits such as biodiversity and water filtration, will be maintained under a carbon-prioritized program. Finally, the problem of leakage, in which deforestation pressures are displaced outside of the credited area, must be overcome to ensure the mechanism's success.[85]

Linking REDD to carbon markets would require a base-year to be established. However, the data requirements for setting such a baseline involves time series data and information on changes in land cover, which are difficult to obtain for many regions. Given the complexity of the issues an independent technical body may be necessary to assess whether a country's assumptions are appropriate and consistent with information

[82] http://www.undp.org/mdtf/UN-REDD/overview.shtml
[83] http://www.undp.org/mdtf/UN-REDD/overview.shtml
[84] Bonan, G. B. (2008). "Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests." Science 320(5882): 1444-1449.
[85] Miles & Kapos (2008). "Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation: Global Land-Use Implications." Science 320(5882): 1454-1455.

from other sources, and with those of other participating developing countries. Design choices between sectoral or project-based approaches would also have important implications for issues such as domestic leakage, administrative and transaction costs and perverse incentives. Domestic leakage for example, is likely to be better addressed via a sectoral crediting system rather than a project-based mechanism.

A technical assessment undertaken by the OECD has shown that from a legal perspective, incorporating a REDD instrument into the existing climate change regime should not be problematic with respect to public international law.[86] However, the prerequisites for a successful instrument at the national level include clear, well-defined and secure property rights. Any institutional structures with international level mandates need to focus on harmonised policies across national governments, in order to ensure the environmental integrity and cost-effectiveness of the instrument. This would include (i) accurate and consistent monitoring and reporting mechanisms (ii) compliance mechanisms (depending on whether targets are binding or non-binding).

As mentioned, many of these challenges are being analysed by scientists and policy makers alike, and solutions are highly likely. Ultimately, the benefits from including avoided deforestation within carbon markets and international negotiations are too critical to continue to be overlooked. Not only will such a mechanism provide new funding sources for developing countries, it will also help correct present imbalances within carbon markets by including another major source of GHGs. The lack of inclusion of avoided deforestation projects within the present CDM means that many crucial emission reduction behaviours within developing countries do not qualify. To date, only one forestry project has been registered under the CDM, and no credits have yet been issued.[87] As a result, this large emissions category is being excluded from carbon markets, limiting developing countries' participation in global mitigation efforts and decreasing carbon markets' efficiency.

III. FUTURE DELIVERY MECHANISMS

Even with current financing mechanisms, several challenges must be met in order to increasing private investment in low-carbon technologies in developing countries. First of all, many low-carbon technologies are not yet profitable in commercial terms. For private investment to take place, there is a need for incentives and subsidies. As discussed above, this is an obstacle that can be overcome, through use of the CDM, feed-in tariff pricing, and other policies; furthermore, technological limitations may pose problems to widespread implementation in the short-term.

[86] Karousakis (2007). "Incentives to reduce GHG emissions from deforestation: lessons learned from Costa Rica and Mexico," May 2007, OECD COM/ENV/EPOC/IES/SLT 920070 1.
[87] Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1154534875.41/view

Secondly, the lack of certainty around a post-2012 agreement is significantly impeding private financing of emissions reductions in developing countries. Since projects have a several year development period, we are already nearing the point where all the necessary CERs under the Kyoto Protocol and the EU ETS' second phase have been created. Without a clear understanding of how carbon will be valued moving forward, further private financing linked to carbon markets is currently stalled.

Third, sharp fluctuations in the price of oil, natural gas and other key energy commodities, dramatically illustrated in the recent period, can significantly affect the profitability of these investments, particularly in alternative energy resources This volatility could be moderated, for a period, by some possible government and/or MDB guarantee of a minimum price of oil assumption to guarantee profitability; however, great care would have to be taken to design such guarantees and their limits to avoid excessive potential liabilities.

Fourth, the short-term perspective of many financial actors, such as fund managers, whose bonuses are linked to short-term performance, may discourage these actors from investments with longer-term profitability. Similarly, banks tend to be very unwilling to lend for long-term maturities, even in developed economies; this problem only increases within the developing country context. This short-term perspective is a problem not just for low-carbon technology, but is also a well-known issue for private investment in infrastructure. Again measures could be taken to overcome this. As we discuss below, the current crisis may actually provide an opportunity for modifying bonuses, so that these incentives encourage more long-term investment.

Most importantly at present, the current deep global financial crisis, which is increasingly hitting developing countries, implies a major change for the medium term prospects of private investment in low carbon technology transfer to developing countries. Foreign private investment, whether direct or portfolio, as well as bank lending to developing countries is highly likely to fall significantly for a long period. As in the aftermath of all crises, this will pose particular difficulty for investment or lending that is long-term, and that may imply extra risk. Implementing certain technology, such as renewable energy, for the first time in developing countries falls squarely within the category; this is often the case for much of low carbon investment

At the same time, providing investment for low carbon technology in developing countries on a large scale is very urgent, given the clear scientific evidence that if emissions are not reduced, climate change's risk and potential magnitude increases very significantly. This reality implies the urgency of far greater public funds commitments, whether through loans from the Multilateral and Regional Development Banks, grants, or from public resources in developing countries. The creation of a new Global Fund, with public resources, and a good governance structure becomes highly desirable.

In the current context, there remains a second major reason why using large public investment is desirable. Although initially, developing countries seemed to be fairly protected from the crisis, we now realize these nations could be the most affected in terms of growth and employment.[88] There is a broad consensus that monetary policy will only play a limited role in expanding demand in developing countries. Therefore, a large, coordinated effort to significantly expand demand in developing countries via fiscal policy is urgently needed. Investment in clean and low carbon technologies is one of the clear areas where such additional government spending could be focused. For those countries that do not have sufficient resources to do this on their own, it will be crucial for the World Bank and RDBs, to significantly increase their lending to them, for this purpose. In the poorest countries, increased aid for this purpose will need to play an important role. Such public investment, ideally combined with research and development for low carbon technology suited to developing countries, could pave the way for an increase in private investment at a future date, when and if markets recover.

The key point is that there is a dual urgent need for public investment to avoid climate change action alongside sustaining growth, in the face of the crisis. This reality calls for very large expansion of MDB, RDB lending and grants-for poor countries for investment in low carbon technology and technology transfer. In this sense, it is encouraging that the World Bank's Executive Board approved in September 2008 the Climate Investment Funds, and that donors pledged 6.1 billion USD to the funds. As these funds are so new, it is difficult to analyze what their impact will be. However, it is important to emphasize that the purpose of these funds is to provide additional grants and concessional financing to developing countries to address urgent climate change challenges.

A serious concern is that though the funds are pledged relatively large, little has been actually committed (see for example, The Guardian, February 20, 2009). This is a major source of concern to developing countries and could prove a barrier to effective negotiations at Copenhagen.

There are two main funds approved: the Clean Technology Fund (CTF) and the Strategic Climate Fund. In particular, the CTF may play a big role in leveraging private investment in low-carbon technologies via a range of financing instruments such as guarantees, concessional loans, and equity. There is also a grant element tailored to provide the appropriate incentive to facilitate the deployment of low-carbon technologies at scale. The concessional financing provided by the CTF can be blended with MDB loans, as well as other sources of finance, to provide incentives for low-carbon development. The CTF will provide concessional resources to cover identifiable additional costs, inhibiting a project's viability. It will thus scale up financing to contribute to demonstration, deployment and transfer of low carbon technologies on a broad scale, with large potential for long-term emissions reductions.

[88] For an excellent discussion, see Bhattacharya, Dervis & Ocampo (2008).

In the medium term future, private investment in low carbon technology can still play a very valuable and potentially large role. This financial crisis may actually facilitate willingness to design new instruments more appropriate for private investment in low carbon technology, or even require banks to lend a minimum for that sector.

III.I CURRENT AND POTENTIAL ROLE OF INSTITUTIONAL ACTORS

There are many mechanisms through which different actors (public, private; United Nations, multilateral and regional development banks; developed and South-South flows) can potentially support the transfer of financial resources to developing countries for mitigation of climate change, via investment in low-carbon technology. We have seen that the CDM already plays a positive role. Unfortunately, the current scale of these transfers is inadequate to meet the challenges posed by the threat of climactic changes and the lack of a firm post-2012 agreement is further limiting its impact at present. It is imperative to explore alternative sources of finance. However, a very important part of private flows to developing countries does not go through the CDM; in these cases, other policy instruments, such as those provided by the World Bank (mentioned above) or others could play an important catalizing role. We therefore examine some suggestions for instruments below. Before doing that, we examine institutional issues.

Institutional Design

An important issue here is *institutional design:* the relative roles that UN agencies, the World Bank Group, and the Global Environment Fund—an international agency administered by the WBG but independent from it—should play. For instance, there are some advantages in channelling resources through the GEF, such as the fact that it combines close collaboration with the World Bank, with close links with UNEP and UNDP; in addition, it has an innovative governance structure. Since its inception in 1991, the GEF has allocated more that $3.3 billion USD to climate change mitigation projects and has co-financed an additional $14 billion USD worth of projects.[89] This quantity is significant, although it has taken place over a long period, and thus year-over-year, it does not represent large investment flows. The amount available for climate mitigation should be increased even more significantly during the next replenishment period of the GEF trust fund, which is scheduled to conclude by the end of 2009. The GEF is particularly important because it is able to fund more risky projects,[90] and has demonstrated its competence working in countries that may not attract foreign private

[89] UNFCCC (2007), p. 4.
[90] See, for example, GEF & UNDP report, "Promotion of Wind Energy."

investors, whether through the CDM or directly. In particular, the GEF oversees the Special Climate Change Fund and the Least Developed Countries Fund.[91]

This analysis is echoed by the Clean Energy Investment Framework, which reinforces the idea that GEF pilot project funding should build capacity for larger programs to scale up low-carbon technology alongside poverty reduction and increased growth.[92] For this reason, the GEF mechanism shows some promise for catalysing future climate mitigation and low-carbon technology transfer; and this implies that financing should be increased. But so far, its impacts have been limited. Important questions remain including: a) what are the reasons for this limited financing?; and b) how could these limits best be overcome?

There has always been resistance in the climate Convention debates from developing country parties to the GEF being the Convention's financial mechanisms. Strictly speaking the GEF does not have development at its core, in part because it is housed within the World Bank. Experience of accessing Convention funds in the GEF has been difficult. Developing country parties (G77 and China) have made it clear for some time they do not want the GEF to manage the Adaptation Fund, and they were successful in Bali in reducing the GEF's role. Recent independent analysis on the way the GEF operates to COP guidance and the operations by the Implementing Agencies, concludes that the funds are not technically adequate for responding to developing countries' needs, owing both to the complex design of the funds and to poor implementation of the guidance.[93]

From an environmental perspective, the GEF is also problematic because it can be seen as compartmentalizing environmental initiatives, rather than facilitating environmental considerations throughout the World Bank's lending. For example, a 2005 assessment by the World Resources Institute found only 20% of energy projects considered climate change mitigation;[94] this is perhaps evidence that compartmentalizing the issue has dissuaded broad adoption throughout various departments. Rather than continuing to replenish the GEF or set up new funds within the World Bank, one option may be to create a new Global Green Fund, dependent on the United Nations and the World Bank, and with an appropriate governance structure.

An important issue relating to the World Bank Group and Regional Development Banks is the nature of their governance and their conditionality. Though institutions like the

[91] UNFCCC (2007). "Investment and financial flows to address climate change: Financial cooperation under the Convention and its Kyoto Protocol," p. 162.
http://unfccc.int/cooperation_and_support/financial_mechanism/items/4053.php
[92] World Bank (2008). "The Clean Technology Fund," p. 5.
[93] Mohner and Klein (2007).
[94] Sohn, Nakhooda & Baumert (2005). "Mainstreaming Climate Change at the Multilateral Development Banks," World Resources Institute.

World Bank have many and important advantages, and above all, experience and existing channels for providing loans, its conditionality – extending to issues unrelated to global warming – may be too onerous, or simply wrong, imposing conditions which actually impede not only development, but a broader addressing of environmental issues.[95] More importantly, how should conditionality for RDB loans for financing investment in mitigation of climate change best be designed? How should, as we discuss below, mechanisms be designed to catalyze in the most cost-effective way, private investment in low-carbon technology?

In the specific case of the Clean Technology Funds, concerns have been raised that funding will be channelled towards subsidizing GHG intensive coal-powered electrical generation facilities. Essentially, the CTF is technology neutral, which means any technology can conceivably be financed, including higher efficiency (supercritical) coal power plants or carbon capture and storage capabilities. In addition, greenhouse gas emissions are not actually accounted for in the decision-making process. As critics argue, these finances should not go towards GHG intensive energy sources, since any technologies implemented today will continue to operate and emitted several years into the future. In addition, CCS technology has not yet been demonstrated at a commercial scale, and therefore, building CCS ready coal plants does not seem sufficient justification for CTF funding.[96]

While the World Bank's conditionality has, in many respects, been problematic, WBG and RDBs involvement has certain important advantages; in particular, it could provide a possible wider assessment of climate change mitigation and adaptation impacts across the whole portfolio of their lending; this could ideally involve formal and transparent screening of all projects from a climate change perspective, which could – through policy dialogue and conditionality – influence a significant part of global emissions. However, would such additional conditionality be compatible with some developed governments' attempt to streamline conditionality and developing countries' unwillingness to accept additional conditionality, especially given that excessive conditions are an important reason for the reduced demand of multilateral loans by these countries? One important research question is, how best can environmental criteria be introduced into such loans, without excessively increasing conditionality and related transaction costs?

[95] The Bank has also imposed hidden conditionality, in the allocation of funds, with its reliance on CIPA indicators. On going research (including at IPD and by Ravi Kanbur, "Reforming the Formula: A Modest Proposal for Introducing Development Outcomes in IDA Allocation Procedures," CEPR Discussion Paper No. 4971, March 2005. Available at: http://www.afd.fr/jahia/webdav/site/myjahiasite/users/administrateur/public/publications/notesetdocuments/ND-22.pdf#page=116) has raised questions about the extent to which these indicators provide guidance to the efficient allocation of aid; and even more concern about the governance indicators.

[96] For further information on this subject, see Weiss & Logan (2008). "The World Bank's Clean Technology Fund," CRS Report for Congress.

There are broader issues that need to be addressed: What should the governance structure of new mechanisms for financing adaptation and mitigation look like? How can sufficient voice for developing countries be assured? What is the best balance between more democratic governance structures, and speedy, as well as outcome efficient mechanisms? Possible models might be found in the CDM Executive Board and the Adaptation Fund Board within the UNFCCC. After initial disagreement, there is now an acceptable balance in regional representation; this is then matched with nominees in whom all have confidence, and a degree of trust is established over time. On the other hand, the CDM Executive Board has not demonstrated itself to be the most effective body at interfacing with private investors, although this may be more to do with inadequate resources.

The fact that the World Bank Group, both in its explicit and "hidden" conditionality, has seemed to pursue agendas and perspectives that go beyond the promotion of growth and the reduction of poverty in developing countries is a source of concern. Is it not likely to similarly go beyond the environmental concerns that should dominate the allocation of funds for emission reductions? Also, how can the commitment of the international community to make the UNFCC the arbiter of funds provided be made compatible with an increasing role for RDBs?

How such funds are administered is not just a matter of technical details. It will affect both the allocation of funds and the magnitude of emission reductions. The governance of the World Bank, with a dominant role played by the G-8, is predicated on these countries providing funds, and thus having responsibility for ensuring their appropriate use. This stands in contrast with funds provided under an international agreements for climate change, where reciprocal obligations are undertaken by developed and developing countries—including obligations by developed countries to finance the costs of emission reductions by developing countries. These differences call for differences in governance.

However, the World Bank is playing a relatively important role in financing investment in low-carbon technology itself, as well as helping to catalyze private flows. This is occurring already via a number of World Bank activities, including the Prototype Carbon Fund, the Carbon Partnership Facility and the Forest Carbon Partnership Facility.[97] As the World Bank itself points out, it has been active in supporting private financing flows since before Kyoto came into effect, beginning with the Prototype Carbon Fund. This fund was launched in 2000, and has subsequently funded activities worth $2.1 billion USD, through 10 funds, pooling stakes from 16 governments and 66 private companies. Carbon finance, with its significant leveraging, has become one of the main channels to support low-carbon investment. The World Bank estimates its leverage factor is 6.[98] Leveraging is a key consideration in each of the World Bank's carbon finance projects,

[97] This section draws on "World Bank Global Consultations - Development and Climate Change: A Strategic Framework for the World Bank Group" and interview material. See: www.worldbank.org/climateconsult

[98] Excluding Hydro Fluorocarbon (HFC) projects.

including Carbon Partnership Facility, which was approved in 2007. The goal is to overcome key barriers to large-scale private financing by promoting sectoral-wide mitigation initiatives. This approach will help to overcome some of the problems with the current project-by-project CDM approach, and may provide a new model for private funding for developing country mitigation.

The World Bank is also supporting private sector funding for avoided deforestation through its Forest Carbon Partnership Facility. This initiative is quite timely, given the outcome of the Bali talks in 2007, which expressed strong support for creating incentives for forest preservation. This particular initiative, which aims to build the critical technical capacity to support implementation, may prove crucial to the overall success of avoided deforestation mitigation projects. As the IFC example above illustrates, capacity building through technical training and knowledge dissemination accompanied – where relevant – by guarantees can help developing countries overcome critical barriers preventing effective mitigation projects. Once these pilot projects are completed, there should be sufficient capacity to build the necessary regulatory and technical capacities for avoided deforestation credits to be used effectively within carbon markets and mitigation targets.

In addition to this finance for capacity building, the World Bank Group has a number of guarantees and insurance programs in place to reduce risk and encourage broader scale investment in low-carbon technologies in developing countries. The IFC's Carbon Delivery Guarantee is particularly innovative within the low-carbon technology domain. The IFC is reportedly fulfilling a positive role in supporting developing countries to undertake emissions reductions projects based on local level needs, identified through partnerships with local banks. A key challenge associated with low-carbon technology investment is its long-term nature in addition to the perceived risk, both from implementing new technology, and from investing in developing countries.

The IFC's Carbon Delivery Guarantee attempts to overcome these barriers, creating a secure investing environment by delivering CERs to buyers as an intermediary. However, some investors interviewed showed no knowledge of this facility, and argued that uncertainty about being able to obtain CERs discouraged investment.

In cases where the IFC's Carbon Delivery Guarantee is used, the CER producers, in particular, expand their access to buyers, becoming more attractive with their increase credit rating, gained through this IFC partnership. Buyers perceive less risk, since the guarantee ensures all CERs will be delivered within the required reporting period, by the agreed upon date. Although this guarantee mechanism is relatively new, it is already showing some results, particularly in countries that traditionally struggle to create CERs in a timely manner under the CDM due to lack of experience. For example, the first guarantee agreements were signed in South Africa and India, early in 2008. According to IFC, these two projects have secured and will help to sell 1.75 million CERs. The South Africa project, in particular, is interesting because it will contribute 5% of revenue from

the sale of these CERs to poverty alleviation in the surrounding community. This combined model- carbon reduction alongside poverty alleviation – is an important addition to the CDM as presently structured, helping it to achieve both of its core goals. This creative IFC guarantee mechanism, holds promise, although the amount of CERs generated through this program is currently quite small. There is a potential for future projects to reach out to nations with no experience qualifying under the CDM; such an approach could greatly increase equity in utilizing the CDM. The WBG is working more broadly to build capacity in a number of developing countries, both through carbon credit project aggregators and through providing technical assistance.

III.II SUGGESTIONS FOR FURTHER FINANCIAL INCENTIVES & MECHANISMS TO ENCOURAGE PRIVATE INVESTMENT

Though the governance and institutional issues raised above are clearly important, we will focus in the rest of this paper on proposed new financial mechanisms and incentives to encourage private investment in low-carbon technology. Indeed, it is crucial that discussions on governance, despite their importance, do not interfere with the urgency of encouraging investment on a sufficient scale.

Much of the existing analysis (summarized above)[99] has been usefully focused on the levels of required resources for "necessary" investment in low carbon technology, both globally and in developing countries, to ensure targets are reached that limit climate change. However, less attention has been given to the equally important issues of 1) providing resources and appropriate incentives for such massive investments, including public, private (where feasible and profitable), as well as public/private partnerships, and 2) designing efficient financial mechanisms that will quickly and effectively fund investment in carbon technology in different sectors.[100] We will focus in what follows, on mechanisms and incentives to encourage private, and joint public/private investment in low-carbon technology in developing countries.

[99] See also, for example, IPCC (2006). "Special Report on Carbon Dioxide Capture and Storage, Chapter 8: Cost and Economic Potential." Available at: http://arch.rivm.nl/env/int/ipcc/pages_media/SRCCS-final/SRCCS_Chapter8.pdf; Manne, A. and Richels, R. (1992). "Buying Greenhouse Insurance: The Economic Costs of Carbon Dioxide Emissions Limits." Boston: MIT Press; International Energy Agency (2008). "Energy Technology Perspectives: Scenarios and Strategies to 2050."

[100] For example, see DFID (2007). "Adapting to climate change in developing countries-what role for private sector finance? Report on workshop February 2007." London; and Mercer Investment Consulting (2007). "A Climate for Change. A Trustee's Guide to understanding and addressing climate risk." Report commissioned by the Carbon Trust and Institutional Investor Group.

Institutional investors and incentives

One area of significance relates to appropriate incentives for institutional investors (e.g. pension funds and insurance companies, that have huge resources), and that have begun playing a fairly important role in financing investment in low carbon technologies. How best to overcome the potential contradiction between standard quarterly assessments of financial performance – especially of fund managers – and the longer periods required for making profitable investment in mitigating climate change remains an important question. The financial crisis in the U.S., and increasingly the global crisis, has generated an important debate on the need for a realignment of reward structures towards evaluating more long-term performance.

There is increased consensus that high remuneration, and its link to short-term profits, contributes to the boom-bust behavior of financial markets, and thus played a large role in causing the current crisis. For example, the Financial Stability Forum Report (2008) argued that, "Compensation arrangements often encouraged disproportionate risk-taking with insufficient regard to long-term risks." The G-20 statement issued on November 15, 2008, again calls for the urgent development of measures to "mitigate pro-cyclicality, including…executive compensation."[101] The key problem is that as bonuses are tied to short-term profits, they remain one-sided; gains to private individuals are positive in good times and even when big losses occur, there are never negative repercussions. Besides contributing to boom-bust behavior, short-term bonuses bleed the banks of capital in good times, resulting in less available capital during bad times. This implies that in crises, taxpayers have to contribute more to bail-outs and bank recapitalization, despite the earlier, private gains during good times. Overall, this implies moral hazard.[102]

There is a simple solution to this problem:[103] bankers and fund managers could be paid a fixed basic salary, and their bonuses could be accumulated in an escrow account. These could only be cashed after a period equivalent to an average full cycle of economic activity has taken place. This would change incentives towards making more long-term profits. It seems unlikely the private sector will introduce such a change on its own, due to collective action problems and the wish to keep high, short-term incomes. Action by regulators seems essential. More focus on long-term profitability, if introduced along the lines suggested above, would significantly increase incentives for encouraging investment in low-carbon technology in the future. In addition, 'green' institutional investors could also give higher bonuses for investment linked to low-carbon technology.

An interesting proposal made by the U.K. Green New Deal Group is to use private savings from pension funds, individuals and other sources to invest in a government backed Global Green New Deal. For example, governments could issue "Green

[101] G20 leaders statement. *Financial Times*. November 17, 2008
[102] d'Arista and Griffith-Jones (2008).
[103] Griffith-Jones, *Financial Times*. November 5, 2008.

government bonds" that could be sold to the private sector, with a commitment that all their resources would be channelled to new green investments, in developed and/or developing countries. This excellent idea could be somewhat more difficult to implement temporarily in the current crisis context, if even developed countries' governments find it more difficult and/or more expensive to issue government debt. Another option to consider, in the short-term, is a special issue by the IMF of S.D.R.s that could be channelled to public investment in low carbon technology in developing countries.

An enhanced role for guarantees?

Assuming that reforms are put into place to encourage a longer-term focus, given uncertainties surrounding the long-term price of carbon, how can the international community best encourage investments in carbon saving technologies? This may be of particular interest to the increasingly large number of Socially Responsible Investors (SRIs), whose volume of assets in the U.S. alone is well above $2 trillion.[104] An important issue in this area is the design of appropriate mechanisms to encourage private investment in climate change mitigation, the focus of this paper. For example, it is important that policy makers consider how the private sector's first mover problem in investing in new – and thus untested technologies – is best overcome. Should public guarantees be given, e.g. by MDBs or RDBs? What risks should they cover? Or should pilot investments be financed directly by the public sector, perhaps through international, pooled resources or joint R&D collaboration? Are high initial subsidies/concessional loans for a limited and relatively short period a good way to encourage both technological innovation and/or implementing new technologies, e.g. in solar?[105]

For instance, is there a role to be played by public guarantees, as has been suggested in the case of malaria medicines? If so, how can guarantees best be provided on specific risks related to investments in mitigation technology, such as the dependence of profitability on the price of oil and other commodities, which fluctuate very significantly? How best should such risks be shared between the public and private sectors? Obviously, the ability of international economic institutions to bear risks is limited. How can excessive potential contingent liabilities of the public sector (e.g. WBG, RDBs, or of national governments) be avoided and/or limited? Should, for example, guarantees be time-limited, or limited for certain ranges of price of oil, to encourage risk-sharing, rather than having public institutions face open-ended liabilities? Most importantly, at least in the short to medium-term, will the impact of the current financial crisis continue to limit the availability of credit and/or other sources of private finance for investment in low-carbon technology to a very serious extent?

[104] See Sparkes, R. (2002). "Socially Responsible Investment, a Global Revolution." John Wiley and Sons.
[105] See, for instance, Hoff, M. and McNutt, D. (1999). "Social Policy and the Physical Environment." The Handbook of Social Policy, ed. Midgly, J. and Tracey, M. London: SAGE; or Rodrik, D., Subramanian, A. and Trebbi, F. (2002). "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development" NBER Working Paper No. 9305.

Guarantees may be a valuable mechanism for enhancing flows to low-carbon investment, particularly in developing countries that are going through or emerging from a credit rationing process. Guarantee mechanisms from source countries or international financial institutions can catalyse private finance when other instruments do not suffice. These mechanisms should ensure that particular projects obtain the necessary financing where otherwise this would not be feasible.

In these circumstances, it is imperative that guarantees should be tailor made pari passu with market imperfections, otherwise they might undermine the initiatives to enhance private capital flows to developing countries for two reasons. First, they can discourage private investors' incentives to choose only good projects – a clear sign of adverse selection - and also to run them efficiently. If the government bears the risk of the project failing, the private investor will invest in projects that are potentially more profitable but more likely to fail; having invested in a project, the private investor has little interest in maximizing its chance of success. Second, guarantees can impose excessive costs on the host and source countries' taxpayers or consumers and expose them to too much risk. Because guarantees rarely show up in the government's accounts or budgets, governments may not know the extent of their exposure. In this sense, it is crucial that contingent liabilities of guarantees are carefully monitored and their risks assessed. This would become particularly important if guarantees become more widely used. Also, the guarantees need to be designed in ways that cap the level of contingent liabilities that international institutions assume.

As said before, one of the main concerns when structuring new mechanisms to enhance private flows to developing countries is the way risk is perceived. This problem is worsened by the fact that as after all the crises, fixed-income investors are increasingly reluctant to incorporate into their portfolio low investment-grade debt that could be issued by infrastructure projects. We will propose two guarantee mechanisms that could help to address these constraints and help restore or encourage private flows to low-carbon technology finance: liquidity facilities and counter-cyclical guarantees. Liquidity facilities were already used in; as they represent an important step forward, they deserve to be applied more generally. We also suggest guarantees have a more explicit countercyclical element.

Liquidity facilities

As pointed out, one of the reasons why profitability of low-carbon investment in energy is uncertain relates to the price of oil. Therefore, guarantees, including liquidity facilities, could be structured to deal with at least part of that risk. The conceptual operationalization of a liquidity facility is relatively simple; it aims to separate price from operational risk. The parties involved should first agree upon a 'floor value' as the project's minimum cash generation that allows payment of the scheduled debt service.

When establishing a floor value it is important that there is sufficient margin for deviations in the operational performance from the initially projected performance levels. The calculation to determine the possibility of cash shortfall is based on a given probability, linked to the price of oil. In the event of a major fall in the price of oil that results in the inability of the project to repay its debts, that is, the cash generation becomes insufficient to reach the floor value, the liquidity facility is temporarily drawn upon. A loan is made to the project's senior lenders to be paid back when the project's cash flow allows. It is presumed this will happen when oil prices rise.

Price, availability and size of a liquidity facility depend on the historical fluctuations of the real price of oil. Only one project to date has implemented this policy mechanism; located in Brazil and focused on infrastructure: AES Tiete. In the context of infrastructure financing, there are precedents for similar liquidity facilities in a somewhat different context, through currency devaluation risk.

The existing IFC Contingent Partial Credit Guarantees are liquidity facilities provided by the IFC for US dollars and local currency financing. The trigger for this facility is a major devaluation in the project's host country whereby the project will not be allowed to raise prices satisfactorily in the short term. This guarantee is usually provided for two years, that is the period IFC estimates as sufficient for the project to recover from an economic downturn and raise the tariff or prices sufficiently. In the case of a liquidity facility linked to oil prices, the period may need to be somewhat longer, given it is linked to the cycle of oil prices.

Long tenor makes liquidity facilities particularly suitable for low-carbon technology project financing. At the same time the long useful life of assets in such projects is a solid basis for the repayments of debts, allowing for more innovative instruments. The liquidity facility has an element of counter cyclicality, as the project continues without a problem in the face of external shocks, such as devaluation the existing facility, which could be applied to the price of oil for renewable energy projects.

Counter-cyclical guarantee facilities

It is increasingly and widely accepted that international financial and banking markets tend to overestimate risk in difficult times and underestimate it in good times. As a result, private lenders are prone to boom-bust patterns that are often more determined by changing global preferences for risk aversion and/or contagion, rather than being determined by country fundamentals. This provides a strong case for public institutions to play an explicit counter-cyclical role to help compensate for the inherent tendency of private flows to be procyclical, for example in long-term trade credit for infrastructure investment.

There are two potential paths for increasing the counter-cyclical role of national and international bodies. One, discussed above, involves public international bodies like the MDBs to provide more counter-cyclical lending than already occurs, particularly in low-carbon technology. As pointed out, this may be essential for some time during and after the current crisis. Indeed, there are plans for MDB lending to be significantly expanded, and a significant proportion should go to low-carbon technology deployment in developing countries. Another complementary path, that if successful could provide more leverage of public resources, is for MDBs to introduce an explicit countercyclical element in all the risk evaluations they make for issuing guarantees for lending to developing countries. This requires MDBs to assess risk for issuing guarantees with a more long-term perspective than is typically done by commercial banks; this implies that when banks or other lenders lower their exposure to a country, MDBs would increase their level of guarantees, if they considered that the country's long-term fundamentals were basically sound. When matters were seen by private banks to improve, and their willingness to lend increased, MDBs could decrease their exposure, for example by selling guarantees in the secondary market. This would avoid greater counter-cyclicality of guarantees, resulting in an increase in the long-term level of guarantees.

Taking a more long-term view would require the use of more long-term models than those used by private lenders; these would be models that are presumably better at 'seeing through the cycle,' as they would use more measures of risk focused on long-term fundamentals, less affected by short-term variations than market-sensitive measures typically are. To ensure that there is an effective expansion of the level of guarantees issued by multilateral and regional development banks, existing guarantee mechanisms may need to be improved or enhanced and new mechanisms may need to be created. In particular, specific guarantees, tailored to the need of encouraging private investment in low-carbon technology, will probably need to be designed.

As the wind case study, discussed above, demonstrates, the current crisis and credit crunch is aborting profitable investment in wind energy even in developed economies; this implies that it is even more difficult to obtain any private finance for low-carbon technology in developing countries. This could be as bad as, or worse than, the sharp decline that occurred in private investment in infrastructure after the East Asian crisis.[106] As discussed above, if internationally agreed upon targets are to be met, there may be a greater need for public resources, whether via grants or loans, to ensure necessary investment in low-carbon technology until the financial and banking markets fully normalize.

However, the current crisis also opens up potential opportunities for modifying private lending and investing practices, especially (but not only) where governments are playing some role as shareholders. We have already discussed drastically modifying bonuses to reduce short-termism; this could be complemented by socially responsible investors

[106]See, for example, Griffith-Jones and Fuzzo de Lima (2004).

giving 'extra' bonuses to fund managers investing in low-carbon technology. Regarding banks, it could be mandated by their regulators and/or Central Banks that a *minimum* (e.g. 5%) of lending for profitable investment must be allocated towards low-carbon technology, half of which should be carried out in developing countries. Alternatively, tax incentives could be given, for a limited period, to encourage such lending and/or investing. Time-limited, or tapering tax incentives, are important to encourage technological innovation to make such investments profitable after a period. Furthermore, government guarantees could be given on loans made for purpose of investing in low carbon technology.

If the developed countries fail to provide adequate funding, and there is a scarcity of funds available for subsidies to pay the incremental costs of mitigation, what principles should guide the allocation of those funds? Should our attention be limited to the incremental mitigation effect? It is important to consider the best criterion for the long run.

Ensuring a stable climate through both the financing of mitigation (including avoided deforestation) and the development of new technologies represents a classic global public good. This reality raises questions concerning finance, including the *sources* of revenue for financing such global public goods and subsidies. An interesting new source is the use of developed country government revenues from emission trading auctions or sales. The problems with allocating emission rights freely are leading to proposals to sell (and even better, auction) emission rights. Some part of these revenues may be used to compensate low-income individuals who will face higher prices as a result of pricing carbon. Other parts could be used to finance R&D on improved clean technologies in addition to financing avoided deforestation and other emission reductions in developing countries. Germany is launching a pioneering scheme, to be extended to other EU countries, whereby parts of emissions allowances will be sold, and in the future auctioned, to German companies. In the future the EU ETS may move towards more auctioning as part of their carbon market.[107] The revenues from this policy could be put towards any or all of the above proposals. Ultimately, proposals for burden sharing among developed and developing countries may be an important part of any post-Kyoto round discussions, and it will be important to discuss and evaluate alternatives.[108]

As pointed out, the Asian crisis dramatically reduced the total and foreign private investment in developing countries' sectors, such infrastructure, that require long periods

[107] CEC (2008). "Proposal for a Directive 2003/87/ec so as to improve and extend the greenhouse gas emission allowance trading system of the Community Brussels" 23.1.2008 COM (2008) 16 final 2008/0013 (COD)

[108] There are some interesting parallels in proposals for funding global research in health. See, for example, Love, J. and Hubbard, T. (2005). "Paying for Public Goods," Code: Collaborative Ownership and the Digital Economy. Edited by Rishab Aiyer Ghosh. MIT Press, Cambridge; or Love, J. (2006). "Drug development incentives to improve access to essential medicines." Bulletin of the World Health Organization. 84(5): http://www.cptech.org/publications/recent-publications.html.

to become profitable; a similar, or worse effect can be expected to emerge from the current crisis, and it is likely to effect low-carbon energy investment, which faces the same challenge as traditional infrastructure funding. Developing countries will need to become less dependent on private, foreign sources of finance and therefore establish a strategy for local financial market development.

CONCLUSION

Investment on a very large scale in low-carbon technology in developing countries is essential to avoid dangerous climate change. To date, foreign private investment has been playing an important role, encouraged particularly by policy mechanisms including the CDM and efforts by the WBG, IFC and GEF among others. These flows and policy mechanisms nevertheless remain insufficient given the large scale of necessary investments. It is vital that long term signals are established on the long term price of carbon with a post 2012 deal being agreed in Copenhagen in 2009. The current financial crisis will further discourage private investment flows in the short and medium term. However, this time period remains critical, since new infrastructure projects will emit emissions for decades.

Therefore a “Green New Deal” seems desirable, whereby public resources, from both the national governments and international bodies (including from a newly created Global Green Fund) need to be deployed urgently, on a very large scale. The likely new Obama package will be a very positive step in the right direction for the US, and will be particularly valuable if it includes flows to developing counties for low carbon technology. On the international level, the WBG and RDB loans, as well as grants from developed countries, and public South to South collaboration, can play a positive role to increase relevant public investment in developing countries. This investment will not only have desirable outcomes for climate change mitigation, but would help boost world demand, thereby sustaining growth in the light of the crisis.

Possibilities for funding such large public financial flows at an international level include new creative mechanisms, such as issuing “government green bonds” for institutional investors to buy and/or for the IMF to issue S.D.R.s to finance investment in low carbon technology in developing countries.

In the medium to long term, if appropriate instruments and incentives are designed, the private sector could play a significant role. There is a need for an enabling policy environment to be created by Governments. It is also vital to reduce burdensome market and governance administrative processes. The current crisis, though seriously limiting private flows for an important period, provides an opportunity for financial and regulatory innovation that supports future private investment in low-carbon technologies in developing countries.

BIBLIOGRAPHY

In progress. In most cases, bibliographic information is included in the footnotes.