Global Sustainability: A Nobel Cause

Carbon offsets, the CDM and sustainable development

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Carbon offsets comprise one of the international climate regime's core strategies for reducing greenhouse gas emissions in the developing world. Carbon offsetting involves purchasing 'credits' from projects to reduce greenhouse gas emissions in order to compensate for emissions that an individual, organisation or country is unwilling or unable to reduce domestically. Offset projects include energy efficiency, renewable energy, forestry, and include the full range of greenhouse gases through projects such as capture and destruction industrial gases and methane from landfills[1]. They are managed under the flexible carbon trading mechanisms of the Kyoto protocol as the Clean Development Mechanism (CDM) and through an emerging voluntary market. In many cases the projects are identified and developed by private sector companies who prepare a project development document (PDD) to begin the process of demonstrating potential greenhouse gas reductions, obtaining project financing, and, in the case of the CDM, getting formal approval from the international CDM executive board. The growing potential of offsets to emission reductions is indicated by the projection that the CDM will produce more than 600 M t of carbon credits (CO_2e) each year until 2012 (UNFCCC, 2008) - compared, for example, to overall annual CO2 emissions from fossil fuels of about 8000 mmt per year (Raupach et. al. 2007)

Several other papers and commentaries in this volume refer to bargains between north and south for emission reduction and forest projects. The use of offsets in reducing emissions is controversial, but is an important component of the UN climate negotiations that in Bali in 2007 set out a 'roadmap' for a major new agreement in 2009 in Copenhagen that would include a reformed Clean Development Mechanism. One of the main arguments for offsets is that they can contribute to sustainable development in developing and transitional economies through a variety of direct and indirect benefits that include cheaper and healthier energy, forest and biodiversity protection, and income and jobs for local people. But in order for offsets to contribute to greenhouse gas reductions they must fund projects that would not otherwise have gone ahead and should reduce emissions compared to what would have happened otherwise (called additionality).

What are the problems and possibilities of carbon offsets in reducing the risks of dangerous climate change and contributing to sustainable development? In the remainder of this paper I discuss the scientific, ethical, and economic debates over offsets and argue that their sustainable development benefits depend critically on the nature of the offset project, especially the type of technology and the governance

[1] The CDM sets out to reduce the 'basket' of six greenhouse gases included in the Kyoto protocol (carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons and perfluorocarbons). For comparative purposes these are often converted, using a weighting related to their global warming potential, to carbon dioxide equivalent (CO_2e).

mechanisms. I conclude by looking at the potential role of offsets within the Bali roadmap to Copenhagen, and at the current proposals to regulate and reform the offset market.

The origins of offsetting

Most of the initial carbon offsetting projects were forest conservation and reforestation projects designed to compensate for corporate carbon emissions by sequestering carbon dioxide (CO_2) in tropical forests and included projects in countries such as Bolivia, Ecuador and Guatemala. Environmental non-governmental organisations were often involved in these early voluntary projects (dating from around 1990) which mirrored other initiatives to put a price on nature and its environmental services in the international market place. Offsets were brought into the UNFCCC framework in 1995 through a pilot programme (Activities Implemented Jointly - AIJ) which were supposed to allow for emission reduction projects in other countries to generate carbon credits. The US and Brazil were influential in the discussions to include the developing world in the international climate regime through offsets and carbon trading with Brazil proposing a clean development fund and the US seeing offsets as a cheaper way to achieve reductions and foster developing world participation.

The 1997 Kyoto Protocol formalised offsetting within the set of flexible mechanisms for achieving emission reductions. The Clean Development Mechanism (CDM) has been called the Kyoto 'surprise' to provide a benefit to the developing world through allowing for emission reduction projects in the south that would produce certified emission reductions (CERs) that could be purchased and used to meet emission commitments under the protocol. The CDM was proposed as a cost effective way for the north to achieve emission reductions through sustainable development in the south.

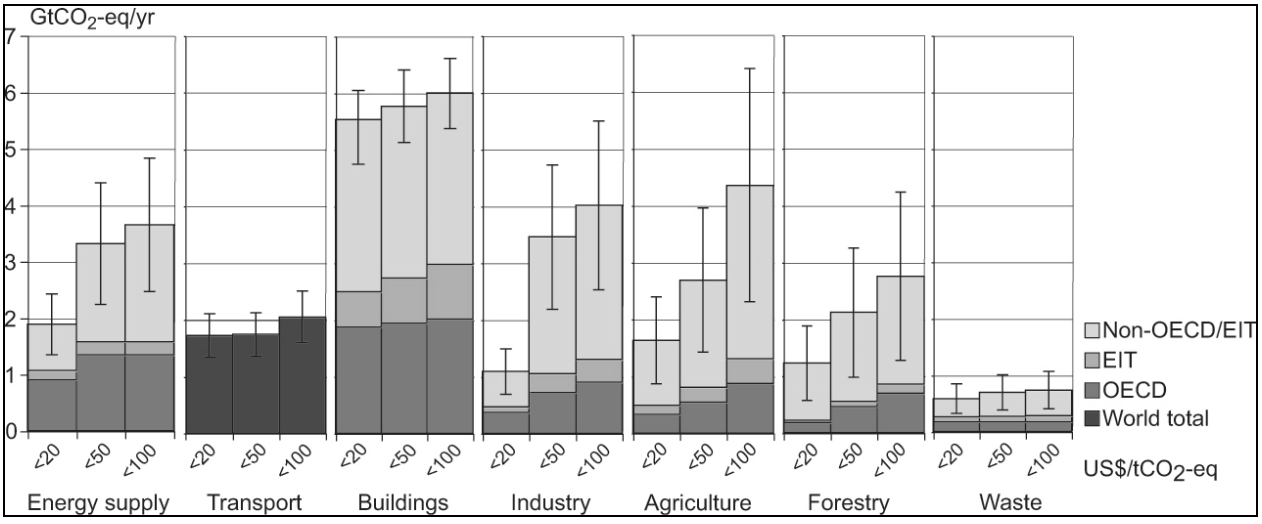

Figure 1: Estimated potential for carbon reductions (CO_2e) per year as a function of carbon price in 2030 (IPCC, 2007, Working Group III Summary for Policy Makers, p11 http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf (OECD represents the

industrialised countries, EIT represents Economies in Transition – many in eastern Europe, and non OECD/EIT is the developing world)

The potential for emission reductions in the developing countries was estimated by IPCC who show many gigatons of potential savings even at relatively low carbon prices across activities that include energy supply shifts to low carbon alternatives, energy efficiency in buildings, and forestry (Figure 1). The developing world (light blue in the graph) has large potential for carbon reductions including in buildings, energy supply, and forestry, and at higher carbon prices in industry and agriculture. Offsets are one way to achieve these reductions without the developing world taking on their own binding commitments.

In anticipation of the first Kyoto commitment period (2008-12), the World Bank catalyzed the offset market through a Prototype Carbon Fund which has now grown into an investment of almost $2 billion in ten different carbon funds supporting a wide variety of projects. A supplementary voluntary offset market also grew rapidly during the mid 1990s and mainly since 2005 with companies such as Climate Care and Future Forests established to develop carbon reduction projects which could provide carbon offset credits to consumers and businesses. As of 2007 about a gigaton per year (CO2e) of emission reductions had been contracted through the CDM and the voluntary market with carbon credits had a market value of almost $14 billion (World Bank, 2008, p1).

Although forestry dominated some of the early offset projects, offset projects have now expanded to encompass a wide range of technologies and greenhouse gases. A large volume of credits has been generated by large scale projects to capture and destroy HFC (hydroflurocarbon) gases at refrigeration and other industrial plants and by projects that prevent emissions of methane from landfill sites (Table 1). HFC and methane are popular with investors because their high global warming potential generates many more credits per unit of reduction than CO_2. Energy efficiency projects, ranging from manufacturing processes to light bulbs, and renewable energy projects including small scale hydro, biomass, solar and wind, are also producing carbon credits in dozens of countries.

Table 1		
CDM Project Type	**Number of projects**	**Total emission reduction credits per year (million)**
HFC, PFC and N2O	95	132
Renewables (hydro, biomass, wind, solar, geothermal)	2603	215
CH4 (landfill, mines) and cement	657	101
Supply side energy efficiency	425	70
Fuel switching (e.g. coal to gas)	135	44
Demand side energy efficiency	194	8
Forests	34	2
Transport	8	1
Total	4151	572

Source: UNEP RISOE CDM/JI Pipeline (on-line,1 Nov 2008)

There are now several distinct markets for carbon offsets including the CDM and the voluntary sector, with the CDM used to supply credits for compliance with Kyoto and the European Union Emissions Trading Scheme (EUETS). The voluntary sector can operate in the US (where the CDM is not yet used because of US failure to sign Kyoto), serves individuals and firms, and often pilots methods and technologies not yet approved by the CDM.

The arguments for offsets

Proposals that offsets should be a significant component of international, national, corporate and even individual responses to climate change are based on several key arguments:

1. The atmosphere is uniformly mixed and therefore emission reductions can occur anywhere and reduce the overall concentration of greenhouse gases and thus the risks of dangerous climate change. We can sequester and reduce greenhouse gases wherever it is easiest so long as there is a measurable impact on the carbon cycle.
2. It is often less costly to reduce emissions where energy use is less efficient and land, labour and other costs are cheaper (such as many developing countries).
3. Including cost-effective offset credits into emission reduction agreements can make it easier and cheaper for countries to join these agreements and to accept potentially more ambitious targets. In this way, an agreement on Kyoto may only have been possible because it included flexible mechanisms and offsets.
4. Offsets provide multiple side benefits for sustainable development especially when projects provide cheaper and healthier energy, jobs and incomes, and/or foster ecosystem conservation and restoration.
5. Emission reduction projects can initiate larger scale shifts in attitudes and technologies in the developing world that set the stage for larger sociotechical and political transitions to low carbon futures and participation in international agreements.
6. Carbon offsets are a way for individuals and firms to compensate for emissions that they are unable or unwilling to reduce. It is better than doing nothing and creates an internal price for carbon that can drive changes in behaviour and technology.
7. Offsets are often small, locally based projects. While possibly inefficient from an economic standpoint, it is possible that the large quantity of projects will encourage a greater degree of experimentation and innovation than might more top-down or sectoral approaches.

These logics have convinced a wide range of international institutions, countries, corporations, NGOs and individuals to include the CDM and voluntary offsets as part of their carbon management strategy. In addition to a role in meeting Kyoto emission reduction commitments the CDM is incorporated into EU climate policy, and that of

countries such as the UK and Japan, and voluntary offsets are used or supported by organisations that include major banks (e.g. HSBC), airlines, and conservation groups (e.g. WWF).

The arguments against offsets

A backlash against offsets has been led by activists and the media who argue that offsetting is unethical and ineffective (Smith, 2007) but offsets are also generating considerable discussion in the scientific and development community (Boyd et. al 2007, Wara 2008). The arguments against offsetting include the following:

1. It is unethical to buy your way out of your carbon guilt by buying low cost offsets to compensate for a high consumption lifestyle (Smith, 2007). Offsets divert from the need to reduce consumption and to eliminate emissions from non essential activities such as flying. Carbon trading limited the overall potential of Kyoto and other agreements because it reduced the need for domestic reductions.
2. Some reductions would be cheaper or more effective if achieved through direct payments or bans rather than through carbon finance which may actually result in profits that are many times the actual cost of reduction.
3. Many offset projects may not provide verifiable emission reductions because of questions about
    a. measurement of greenhouse gas emissions and conversion to carbon equivalents
    b. the legitimacy and manipulation of baselines (emissions before the project started) and of projections of business as usual (it is difficult to establish a counterfactual scenario)
    c. proof that carbon finance was key to the project so that emission reductions are truly 'additional'. Some claim that most projects were already going to happen.
    d. permanence of reductions and risks of project failure, especially for voluntary forest offsets where some reforestation projects have failed
    e. the timing of delivery of reductions, especially in the voluntary sector where some object to selling offsets as forward contracts and not as reductions already achieved
    f. potential leakage as emissions are displaced outside the project boundary
    g. rebound as higher incomes or energy savings lead to other greenhouse gas emitting activities (which may be true of any efficiency savings, not just offsets)
4. Transaction costs associated with project development and verification are too high, especially for CDM projects (Michaelowa et al., 2003)
5. The sustainable development benefits of offsets are often less than claimed because of the use of technologies that do not provide benefits to local people (e.g. capture of industrial gases like HFCs), the lack of participation in decisions, the unequal distribution of project benefits, lack of attention to customary land rights, the diversion of resources such as water to the projects and negative impacts on biodiversity (e.g. from large dams or forest monocultures).

6. The voluntary carbon market may have unscrupulous companies that resell the same credit several times ("double-counting"), confuse the consumer, and do not adhere to criteria for additionality and sustainable development
7. Some of the most important potential offsets in terms of emission reductions and sustainable development are currently excluded from the CDM and ignored by the voluntary market. For example the CDM allows credits for reforestation and afforestation but does not permit credit for reducing or avoiding deforestation (which may be responsible for 15% of more of CO2 emissions). While some consider it a problem that technologies such as nuclear power and several geoengineering options are not eligible as offsets others feel that these technologies do not meet criteria for sustainable development.
8. Project based offsets are inefficient and too small scale. It would be much more effective to fund emission reductions on a sectoral or programmatic/policy level i.e. for the cement or electricity sector in a country or for a national forest or energy policy.

Many of these criticisms are based on case studies rather than a structured assessment of the risks and benefits of offset projects and there is a clear need for science and social science to undertake careful analysis of both the CDM and the voluntary market as well as for improved governance mechanisms that include self regulation and government oversight. But before we turn to potential reforms and improvements it is helpful to focus in more detail on sustainable development aspects of offsets.

Sustainable Development and the CDM

The Kyoto Protocol required the CDM to meet objectives of sustainable development but this has not been clearly defined and is implemented through a rule that the host country must certify that projects meet sustainability objectives. Countries vary in how strictly they define and implement the sustainability criteria and face a contradiction between the desire for investment and broader sustainable development objectives (Olsen and Fenhann, 2008). While comprehensive attention to sustainable development might examine the environmental, economic, and social benefits and costs of projects from the national to the local scale, it appears that for some governments and project developers only job creation or energy savings are seen as enough to justify a sustainability check off (Brown and Cabrera 2004, Olsen 2007).

The potential of the CDM to drive low carbon energy transitions and provide sustainable development benefits to the poor and ecosystems has been less than promised, partlybecause of the inclusion of gases with high greenhouse gas potential (HFCs, N_2O) which can be easily captured in large scale projects at industrial plants (refrigerants, adipic acid, Teflon). These projects have dominated the carbon credits within CDM to date, and until 2007 less than half of carbon credits are associated with renewables and energy efficiency (although these project types are now expanding). It has also been argued that the large scale industrial gas capture projects receive far more money than needed to eliminate the greenhouse gases. Wara (2008) for example argues that to abate all HFC emission in the developing world would only cost $31m a year whereas the CDM could pay up to 20 times that amount for eliminating these gases. He argues

that companies made three times more from reducing emissions from their operations in CDM than from selling the products that are produced at the plants and notes that in Europe and North America these emissions have been reduced voluntarily or through regulation. There are also indications of somewhat perverse incentives to maintain production levels in installations where N2O emissions are captured as a CDM project whereas production elsewhere is scaled down in face of the current economic downturn.

Capturing industrial gases generates much more modest benefits to local people and ecosystems than energy efficiency, renewable, and forest projects. Unfortunately there are very few studies which assess these benefits in a consistent, comparative, long term and carefully monitored fashion. Case studies suggest that the benefits to communities from wind, solar, and improved woodstove projects can include jobs, reduced indoor air pollution, lower energy costs, and direct carbon finance payments and that reforestation projects can protect watersheds and biodiversity[2]. A recent analysis of more than 700 project design documents found that the most likely overall benefits promised for CDM projects are jobs (66%), economic growth (46%), improved air quality (42%), cheaper energy (32%) and conservation (13%) (Olsen and Fenhann, 2008). They also look at different technologies and find that HFC and N_2O projects generate the fewest sustainability benefits and household efficiency, solar, hydro, wind and cement the most. Both cement (switch from limestone to use of waste fly ash) and landfill/livestock methane capture or fuel projects have environmental benefits in reduced pollution, cheaper energy and improved health.

One of the problems in linking offsets to sustainable development in very poor communities and countries is that emissions may be so low that savings are harder to achieve, such that renewable projects are not alternatives to carbon emitting activities but the first step to greater (if low carbon) energy use. The cost of developing a project can also be prohibitive, both in terms of transaction costs and in finding investors willing to take risks with certain technologies and weakly governed countries.

One added complication arises from factors external to the nature of offsets and carbon markets themselves. Many potential projects with very long-term emission reduction benefits and significant sustainable development benefits have not materialised under the CDM to date because of the prevailing relatively low carbon prices. This concerns projects such as renewable energy and small energy efficiency projects. Low carbon prices are primarily due to the very modest emission reduction targets agreed under Kyoto which generate relatively low demand, and hence prices, for CDM offsets overall. This in fact has skewed investment into CDM projects towards cheap and technologically easy interventions such as industrial gas capture. One extremely important constraint is that the lack of a post-2012 international agreement, together with political debate in the EU, UK and USA about the future role of the CDM, has created considerable investor uncertainty and reluctance to make long term investments.

[2] Statement based on preliminary results from a number of student research projects in the Environmental Change Institute (www.eci.ox.ac.uk) and Corbera (2005)

Sustainable development and the voluntary offset market

The voluntary offset market has tended to focus on projects with greater apparent sustainable development benefits because both individual and institutional purchasers see added value in offsets that help poor people and protect ecosystems (Lovell, Bulkeley and Liverman, 2008). This is one of the reasons why many of the early voluntary offset projects focused on forests despite the technical challenges of securing forest carbon. Voluntary offset companies often highlight the sustainable development benefits of their carbon projects such as reduced indoor air pollution, lower energy costs or conservation values. But sustainable development has also been a source of criticism of offsets where activist and media investigations have suggested that forests have degraded after crediting, local people have not benefited from projects, or that profits are being made from neo-colonial practices that take advantage of low land and labour costs (Smith 2007, Ma'anit 2006).

Responding to the challenge: reforming the CDM and setting voluntary standards

Improving the effectiveness and quality of both CDM and voluntary offsets has become a priority for both private sector interests and governments on the road to the Copenhagen climate negotiations and serious greenhouse gas reductions. Several standards have been proposed to ensure the quality of offsets, with stricter rules for both carbon and sustainable development in terms of proven additionality, appropriate technologies, and local participation and approval of projects (Kollmuss et al 2008).

The CDM has become a major focus of negotiations with proposals that include scaling up to sectoral, policy or programmatic CDM, providing incentives or extra credits for projects in poorer regions, streamlining and simplifying project approval, expanding the range of approved methods and technologies, discounting credits to account for risk of underperformance of projects and ensure real atmospheric benefits, and shifting to a model where industrial countries take on obligations to buy and retire CDM credits directly rather than as offsets (Boyd et al 2007; Cosbey et al 2005; Ellis et al, 2004; Sterk and Wittneben 2006). Sectoral and policy CDM has the potential to transform concentrated economic sectors representing a large share of emissions – such as cement, iron and steel, or electricity - to lower carbon futures using CDM type carbon finance flows to countries rather than projects. Mechanisms might include large scale sectoral investments linked to no-lose targets, negotiated binding sectoral intensity targets, commitments to use best technology and practices, or implementation of particular policies and measures (Hohne et al 2008, Schmidt et al 2008).

The other important new proposal on the roadmap from Bali to Copenhagen is to provide carbon credits to countries for avoided deforestation or reducing emissions from deforestation and degradation (REDD). Tropical deforestation contributes up to 20% of carbon dioxide emissions yet forest protection was excluded from the CDM which only provides credit for new forests or reforestation (Ebeling and Yasue 2008, Miles and Kapos 2008, Schlamadinger et al 2007). Because REDD credits may parallel the CDM in that industrial countries may purchase them to meet emission reduction commitments they could dramatically shift the offset market. Unlike the CDM which is project based,

REDD is likely to be negotiated at the country level, and may operate separately from the international carbon market because of concerns about cheap forest credits swamping markets and reducing carbon prices or discouraging domestic emission reductions. Several conservation NGOs are supportive of REDD because of the potential benefits to biodiversity and because REDD would allow exactly those countries to participate in carbon markets that have so far been largely excluded because they are poor and lack an industrial base to reduce emissions. However, there are certain sustainable development concerns about the participation of indigenous peoples, property rights and land tenure, who will actually receive the funds, the distribution of benefits to and at the local level, the reduction of forest values solely to carbon, and about how countries will choose to enforce forest protections. These are added to technical concerns about the measurement of forest carbon and baselines, and the risk that climate change could reduce forest carbon benefits.

What is the future of carbon offsets in terms of sustainable development? First, it must be noted that the CDM can be viewed as an interim mechanism pending the establishment of a broader or universal cap on carbon emissions. And offsets may only make sense up to the point where the cost of buying emission credits rise to the point where it would be cheaper to reduce carbon domestically. Second, the viability of both the CDM and voluntary offsets depends on assurances of additional, permanent and verifiable emission reductions, hopefully at a scale that produces rapid reductions, in order to address criticisms about the atmospheric benefit of offsets. Third, the sustainable development value of offsets can be enhanced through a variety of reforms and incentives, including standards for sustainable development (e.g. the Gold Standard), although some new standards (such as the Voluntary Carbon Standard http://www.v-c-s.org/) focus only on carbon and do not address sustainable development because of its complexity (see alsoKollmuss, Zink and Polycarp, 2008).

Finally, there is an urgent need for carefully designed empirical studies of the sustainable development benefits and risks of offsets in order to resolve some of the urgent questions about the value of offsets and the design of new mechanisms and agreements.

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