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How do regulated and voluntary carbon-offset schemes compare?

Esteve Corbera, Manuel Estrada & Katrina Brown

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Abstract

The Kyoto Protocol's Clean Development Mechanism (CDM) has become a key instrument for climate change mitigation. Parties with emission targets are using it to buy greenhouse gas (GHG) emission reductions for compliance against the Protocol's emission reduction targets. In parallel, the purchase of emission reductions through a voluntary carbon market has become a mainstream practice across business and individuals who, although not having any regulatory mandate, aim to offset their emissions. This voluntary market relies on mitigation projects which may or may not follow the standards of the CDM. This review compares these two instruments and traces similarities and differences in terms of project types, offset quality and contribution to sustainable development. It is shown that both mechanisms support a wide range of mitigation options and technologies, and differ considerably in the contribution of forestry and industrial gas offsets to their markets. There is not enough empirical data to assess the actual additionality and quality of produced offsets and empirical assessment. Large scale mitigation options provide a substantial percentage of GHG reductions in both markets, with methane-based mitigation and fuel switching dominating over renewable investments such as solar and tidal. Africa remains the least benefited continent in both schemes. The review supports proposals towards reforming the CDM so that the least developed countries can also participate in a transition towards a decarbonised global society. Voluntary markets, in turn, are likely to remain driven by investors' willingness to support projects which are in line with poor countries' demands and priorities.

Keywords:

climate change | Kyoto Protocol | clean development mechanism | carbon markets | carbon offsets | sustainable development

1. Introduction

The Clean Development Mechanism (CDM) and voluntary carbon offset schemes share a number of similarities and continually influence each other. The number of projects generating emission reductions under these two instruments has increased over the years, whereas there have been heated academic and press debates about their actual contribution to climate mitigation and their likely perpetuation of historical injustices in the distribution of 'pollution rights' across developed and developing countries (Minns 2007). The CDM and voluntary offset schemes have their conceptual origins on the pilot phase of Activities Implemented Jointly (AIJ), established by the First Conference of the Parties (COP-1) to the United Nations Framework Convention on Climate Change (UNFCCC) in 1995, through which collaborative emission reduction projects were established to increase the flow of resources dedicated to climate mitigation activities and technological innovation in developing countries, with no emission reduction credit-issuing involved.

On the basis of the AIJ phase, the Kyoto Protocol defined the CDM as a market mechanism aimed at facilitating compliance with emissions reduction objectives by reducing the overall mitigation cost while promoting sustainable development (SD) in mechanism to pursue the same objectives through projects in European economies in transition and in countries with emission targets. CDM projects shall generate certified emission reductions (CERs) additional to any that would occur in the absence of the project and provide real, measurable and long-term mitigation benefits.

Although the first official CDM project was registered in 2004, the first voluntary carbon-offset project was carried out in 1989, when a US electricity facility invested voluntarily in an agro-forestry project in Guatemala. The project paid farmers to plant 50 million trees, which would sequester carbon dioxide and offset the greenhouse gas (GHG) emissions arising from the generation of electricity, thereby improving the company's image (Corbera and Benet 2007). Offset schemes gained popularity a few years later, when the UNFCCC AIJ pilot phase was launched and a total of 157 projects in the energy and land-use sectors were implemented in developing countries and European economies in transition between 1995 and 2002 (UNFCCC 2002). Unlike the CDM, voluntary offset schemes are not compliant instruments, but a means for individuals and entities to reduce emissions over and above mitigation goals set by regulations. In most cases, investment in voluntary offsets responds to the interest of the public in becoming more environmentally responsible and the interest of corporations to increase their environmental profile and demonstrate leadership (Hamilton et al. 2007, 2008a,b).

Scholars have started to examine both CDM and voluntary offset markets from different perspectives. Ellis et al. (2007) argue that there are implicit trade-offs between CDM project types, their size and their SD contribution, with large industrial projects offering few employment opportunities and additional benefits for local populations. They also show that those countries receiving large foreign direct investment flows are also attracting a higher number of CDM projects. Along these lines, other studies also suggest that the CDM projects' uneven distribution across countries and the prioritisation of emission reduction activities, which do not necessarily have wider environmental benefits or a strong social component, such as HFC decomposition, fuel switching or methane mitigation projects show that the mechanism is not contributing to global equitable development (Lohmann 2006; Wara 2007). There seem to be evident trade-offs between the achievement of low-cost emissions abatement and the realisation of SD benefits (Brown et al. 2004; Olsen 2007).

In turn, voluntary offset markets have been criticised for being unlikely to deliver and energy consumption patterns in developed countries (Revkin 2007). It has also been noted that voluntary offset markets have enabled a number of private, non-state actors to accumulate profits through a more horizontal and networked evolving system of governance, which contrast with the CDMs state and policy-regulated approach (Bumpus and Liverman 2008). Advocates of voluntary offsets argue that these may achieve significant social and environmental benefits, such as pro-poor employment benefits and improved health and education in comparison with the CDM, and projects may hold a different geographical distribution, with higher participation from African countries (Hamilton et al. 2007). Tyler (2007) also suggests that the voluntary offset market is the only access many high SD carbon projects currently have to carbon finance. She recognises that increased market standardisation and regulation is necessary for its integrity and longevity and that any measures to support high SD emission reduction projects should be welcomed. In this essay, we contrast both CDM and voluntary offsets in order to trace their differences and similarities and complement the growing literature examining the role of carbon offsets in reducing GHG emissions and promoting SD. We challenge the assumed proposition that voluntary offsets are 'a source of "innovation" for the credits and projects operating outside the compliance market', are located 'in different countries from where most of the compliance market projects are based, in particular in Africa' and 'projects have more 'value-added' characteristics than those found in the compliance market, such as additional environmental or sustainability benefits', holds true (HoC Environmental Audit Committee 2007: p. 16). In this sense, it has been shown how project developers and traders of voluntary offsets have constructed a marketing narrative where consumers are persuaded that carbon offsets are a type of sustainable and ethical product, which embeds a number of additional benefits to carbon reductions such as poverty alleviation, reduced indoor pollution and preserving biodiversity (Lovell et al. in press).

In doing such a comparative exercise, the paper sheds light on a number of questions: how have the CDM and voluntary offset markets evolved over time and what are their demand drivers? Do they support different emissions reduction projects and sectors? Do the CDM and voluntary markets provide the same quality of offsets? Which type of additional benefits their projects provide? And finally, are projects distributed differently across the world's regions? These questions are answered through the analysis of available data, reports and research articles on these two instruments. The review they are often supposed to be. Their main difference lies in market volumes and the relative number of small-scale projects contributing to the market. Project typologies do not differ substantially and both markets are characterised by an uneven distribution of projects worldwide, with Africa being the least benefited region, contrary to the assumptions made by carbon brokers and consumers (HoC Environmental Audit Committee 2007). Desk-based research assessing projects' impact on local and national SD suggests that their outcomes vary widely, with some technologies such as energy efficiency, biomass and some renewables being more likely to promote additional benefits.

2 How do regulated and voluntary carbon-offset schemes compare?

2.1 Markets evolution and demand drivers

According to the World Bank, from 2002 to 2007, about 1471 MtCO_2e from primary CDM project activities were transacted 1. A majority of primary transactions for project-based credits in 2007 (about 87%) came from CDM activities that reduced 551 MtCO_2e, valued at US$7426 million, representing a slight increase from 2006 volumes (537 MtCO_2e). This figure, in turn, represented nearly twice as much as the volume of emission reductions traded under the CDM in 2005 (374 million tCO_2e). The secondary CDM market traded 25 and 240 MtCO_2e in 2006 and 2007, respectively. The average price for primary CERs during 2007 was US$13.60, a 24 and 52% increase relative to 2006 and 2005. Higher prices of approximately US$17.8 rewarded projects which had already been registered, had been developed by highly experienced sponsors and had high expected issuance yields. Unlike Phase I European Union Allowances (EUAs) traded under the European Union Emissions Trading Scheme (EU ETS), CER prices were stable over 2006 and increased in 2007, partly due to the market power of China, which maintained an informal pricing policy by raising the minimum price floor in the US$10–12 range in 2006, and the increased competition of 2007 in the market, respectively (World Bank 2006, 2007, 2008). As of November 2008, 1190 CDM projects have been registered, 277 are in the registration process and 2684 projects are at validation stages (UNEP/RISOE 2008). The CDM market is projected to deliver 2838 million CERs before the end of 2012.

The voluntary carbon market is divided into two main segments: the voluntary, but the counter (OTC) offset market. The CCX and the OTC are not easily comparable as their structure and procedures are fundamentally different. The CCX is a cap-and-trade system in which both emission allowances and project-based offsets are traded under the form of CFI contracts, each of which equivalent to 100 tonnes of CO_2e. Participants include high GHG emitters, businesses, organisations and individuals from the United States (US), Canada, Brazil and Mexico, although offset projects can take place anywhere in the world. In the OTC market, where credits are generically known as Verified Emission Reductions (VERs), transactions are made on a deal-by-deal basis and information on the amount of emission reductions transacted can only be obtained through project developers, brokers and investors, thus making data compilation a costly and time-consuming process (Hamilton et al. 2008b). Since 2002, the voluntary market has experienced annual ups and downs, but since 2006 the growth of the market has been unprecedented. According to Hamilton et al. (ibid.), 42.1 and 22.9 $MtCO_2$e were transacted on the OTC market and the CCX in 2007, respectively. Relative to 2006 volumes, this represents a tripling of transactions for the OTC market and twice the volume for the CCX. These data also reflect that the CCX supposed a significant development for the voluntary market; in 2007, trading under such an instrument already represented a 32% share of the overall voluntary carbon market 2. In 2007, a VERs average price was US$6.1, although their value varied widely across project typologies and contracts. For the same year, CFI contracts were worth, on average, half the OTC figure (US$3.15/$tCO_2$e), with prices falling within a narrower range of US$4.20-1.62/$tCO_2$e (ibid.).

The number of emission reduction volumes traded through regulated and voluntary markets has thus increased over time, with an exponential growth for the case of VERs and CFIs transactions, which still represent an insignificant volume compared with CERs transactions up to 2012 (2.2%). However, it is worth noting that the CCX has experienced a substantial reduction in the contribution of project-based offsets to traded volumes in the exchange, moving from over 13 $MtCO_2$e of offset credits in 2006 down to 0.8 $MtCO_2$e in January to November 2008. The overall upward trends in the CDM and voluntary markets over the last 5 years can be attributed, on the one hand, to investors' commitments under the Kyoto Protocol and, on the other hand, to increased public awareness on climate change, and the interest of a growing number of companies to meet social and environmental standards (Hoffman 2006; Hamilton et al. 2008a). An analysis of the most capitalised one-hundred UK companies in the London among the FTSE 100 group in the last 2 years' (Okereke 2007: p. 479). Beyond CDM and voluntary offsetting, it seems that operating in a carbon-constrained world is increasingly seen as an opportunity to gain competitive advantage, adapt to rising energy prices, respond to consumer's concerns, or even profit from emissions trading and the sale of CDM offsets (Schultz and Williamson 2005).

The future evolution of CDM and voluntary markets will be determined by the stringency of commitments under the second commitment period of the Kyoto Protocol and the sectors subject to regulation in the future, as well as the extent to which developed countries enact legislation to favour the adoption of voluntary emission reduction activities by non-regulated entities (for example through tax incentives). Although the size of reduction commitments in the second phase of the Protocol is still unknown, it is recognised that achieving reduction objectives in the range of 25–40% below 1990 levels by 2020 by developed countries would make an important contribution to overall global efforts required to meet the ultimate objective of the Convention (UNFCCC 2007). This would imply the continuation of the CDM as it currently stands or in a reformed version, which may include other mitigation options and technologies like traditional biomass energy use (Schlamadinger et al. 2007), avoided deforestation activities (Skutsch et al. 2007), and carbon capture and storage (de Coninck 2008). As discussed further below, these changes may also be accompanied by a reform of the mechanism's procedures so as to improving the performance of some technologies, scaling-up the impact of the mechanism and promoting a more even distribution of projects worldwide (Olsen and Fennhan 2008a).

2.2 Project types and sectors comparison

Table 1 illustrates the contribution of different project typologies to the CDM and OTC markets for 2006 and 2007. In the CDM, nearly half of the credits to be delivered up to 2012 will be covered by industrial gases and methane-related projects (with 26.7% and 13.7% of total CERs up to 2012, respectively), as well as by hydro, wind and biomass energy projects (33.7%). These options will be followed by supply-side energy efficiency (10.8%) and fuel switching projects (7.2%), while demand-side energy efficiency projects, renewables such as solar, tidal and geothermal, afforestation and reforestation and transport would have an insignificant participation (UNEP/RISOE 2008). When comparing the CDM with the OTC market, it is surprising to see that there are only substantial differences for the case of industrial gases, forestry and, to some extent, contribution of industrial gas emission reductions to the OTC market has decreased substantially in the last 2 years (and the same has occurred to a less extent in the CDM) but investment in methane mitigation projects has increased. Meanwhile, investment in renewables has remained stable and has been reduced in the case of forestry projects. In November 2008, the CCX had a total of 119 offset projects registered, from which over 35% were agriculture and landfill methane mitigation projects, followed by renewable energy (12.6%) and agricultural soil carbon offsets (11.8%) (Figure 1).

Figure 1. Offset project numbers and typologies in the CCX market, November 2008.

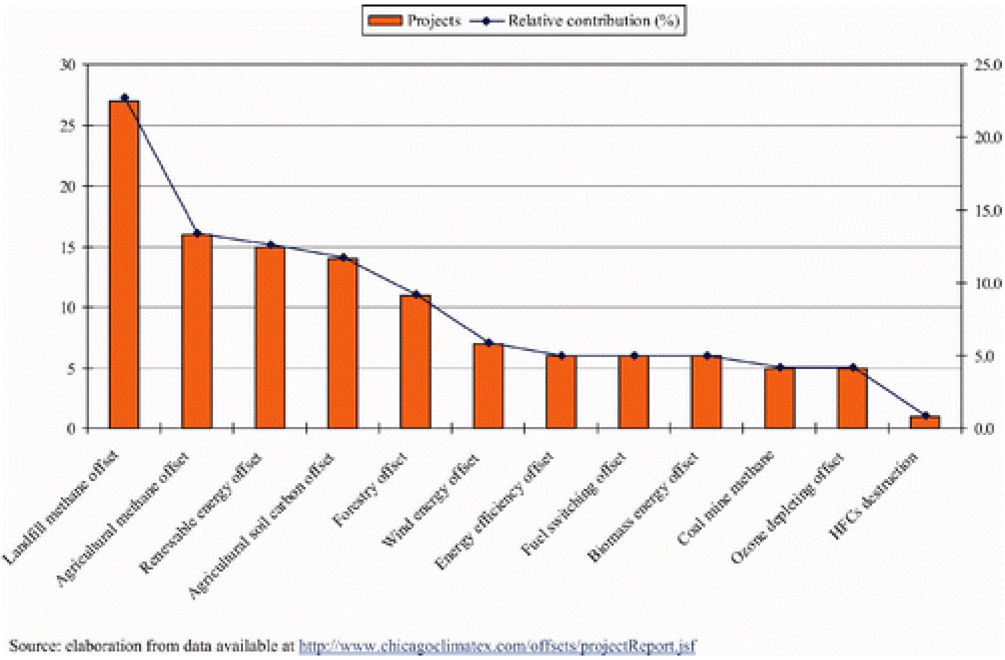

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Table 1. Comparison of project-based offset shares by project type in CDM and OTC markets, 2006–2007[1].

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The high proportion of offsets from industrial gas projects in the OTC market in 2006 can be surprising, since these projects do not match with the supposed profile of activities in the voluntary market (i.e., with emphasis on social and environmental benefits). This can be explained by the exclusion to date of HFC-23 incineration projects developers towards the voluntary market. However, 2007 data shows a substantial reduction in the support for this option, which is explained partly by the reduction in potential supply but more importantly by changes in consumer preferences (Hamilton et al. 2008b: p. 38). In parallel, the aforementioned growth in the number of methane-based mitigation projects, both in OTC and CCX schemes, reflects the existence of a great number of US market players who are concerned about mitigation costs and thus act more like their CDM counterparts in the regulated market, probably responding to the boom of proposals to regulate GHG emissions in that country, which include numerous state and regional-level initiatives (e.g., The Western Climate Initiative, the Regional Greenhouse Gas Initiative).

In the CDM context, up to November 2008, there are 34 afforestation and reforestation projects in the pipeline, but only one has been registered. This almost inexistent contribution of forestry projects to the CDM market responds partially to the limitations set for these projects under the CDM rulebook (including only afforestation and reforestation activities), implementation complexities like additionality, carbon permanence and leakage and, possibly most of all, to the decision of the European Union of excluding forestry CERs from the EU ETS (EU ETS) (Boyd et al. 2008). In contrast, the interest in forestry projects in the voluntary market, particularly in its early years, can be attributed to these projects' higher appeal in terms of public image for investors, their likely additional environmental benefits (e.g., landscape and biodiversity conservation), and the interest in funding avoided deforestation projects. OTC forestry offsets originate from a wide range of countries and regions, including – in order of importance – the US, Canada, Australia, Asia, Latin America, Africa and Europe (Hamilton et al. 2008b: p. 78). In contrast, forestry credits in the CCX originate mainly from projects in the US and Latin America. The 2007 reduction in the contribution of forestry offsets to OTC markets is due to the fact that such deals do not enjoy the same level of support that they had in the early years and ex-ante deals may also be falling out of favour. This reflects consumers' concerns on carbon permanence, as has been the case for the CDM, and the increasing number of mitigation options being promoted in these markets (Hamilton et al. ibid.).

The future role of forestry offsets in regulated and voluntary schemes will be dictated by the actual performance of existing projects, which may help to increase investor and consumers' confidence, and by the post-2010 architecture of the climate regime, especially by the outcome of ongoing negotiations regarding the inclusion of activities the broader framework of the convention. The decision by COP-13 to start demonstration (pilot) activities, together with the recent establishment of international funds to support initiatives to reduce emissions from deforestation (e.g., the Forest Carbon Partnership Facility of the World Bank), are signalling a renewed interest in offsetting emissions through forest restoration and conservation (Estrada et al. 2008).

2.3 Offsets quality

CDM-based emission reductions need to achieve the highest possible quality to ensure the integrity of the Kyoto Protocol. This has led to the creation of uniform procedures and rules, as well as the establishment of an institutional structure within the CDM Executive Board – the committee in charge of supervising the CDM, which deals specifically with projects' methodological issues. This structure is complemented with the work, capacities and know-how of private consultants, which usually develop and propose methodologies for the estimation of emissions reductions from CDM projects, and of Designated Operational Entities (DOEs), in charge of reviewing projects during validation – including the appropriate application of methodologies – and of verifying and certifying emissions reductions before they can generate CERs. CDM project methodologies have reached high levels of detail and stringency. Moreover, the documentation and supervision of projects and emission reductions are also unprecedented, and the operation of the CDM is supported by a centralised registry and a number of publicly accessible databases, the international transaction log and standards for DOEs accreditation. On the down side, ensuring the quality of CERs has implied lengthy processes and high transaction costs, specifically for projects which need to design a new methodology for their development (Michaelowa 2005; Ellis et al. 2007).

Forthcoming independent verification processes by DOEs will be central to evaluate the real GHG benefits from CDM projects. Emerging evidence from early registered projects suggests that not all expected CERs may represent real and measurable emission reductions (Sutter and Parreño 2007). In this sense, the United Kingdom has taken a further step by releasing a Best Code of Practice for Carbon Offsetting in February 2008, which can be voluntarily adopted by UK carbon offset providers to seek accreditation of the CERs they commercialise, thereby increasing consumers' confidence and the quality of CDM projects. Over the course of 2008, there has been a consultation with interested parties about how to include voluntary offset projects and

Voluntary offset quality has become an issue of similar importance for buyers, who have feared criticisms on behalf of civil society (Taiyab 2006; Gillenwater 2007). Consequently, this market has experienced the emergence of a number of standards, programmes and registries to improve offset credibility, which can also be applied to the development of CDM projects (Table 3). Many of these programmes accept automatically in their systems methodologies and DOEs approved by the CDM-EB, including additionality tests, and it is to be expected that new methodologies and approved verifiers under such initiatives will have to comply with requirements similar to those established for the CDM. The existence of more solid standards and institutions in the voluntary market should increase the average quality of the offsets traded in the coming years (Peskett et al. 2007) or, otherwise, there is a serious risk of failure due to a lack of policing and credibility (Gillenwater et al. 2007). It is still too early to judge whether projects registered under existing voluntary standards comply with additionality requirements and effectively reduce emissions, as some standard-based projects have only recently been implemented (Kollmuss et al. 2008).

Table 2. Features of some of the main standards in the voluntary offset market 2008[1].

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Table 3. Examples of sustainable development (SD) criteria for carbon offset projects' assessment.

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2.4 Sustainable development benefits

2.4.1 SD assessments

In the CDM context, as defined in the Marrakesh Accords, it is the host country's prerogative to approve projects' contribution to national and local SD. Procedures vary from country to country, with some DNAs adopting a generic list of economic, social and environmental criteria, and others conducting field-based project analyses, involving project developers, communities and other stakeholders (Corbera 2005; Boyd from the host country alone is usually not required, although compliance with applicable regulations is. Some standards are stricter than many of the conditions established by host countries for the CDM, though they may not reflect the specific development priorities or interests of these countries.

Researchers undertaking project-based SD analyses also take into account three categories – economic, social and environmental – and define a series of criteria and indicators to evaluate project benefits, mostly through scoring methodologies like multi-criteria analysis (Sutter 2003; Brown et al. 2004; Cosbey et al. 2006). In some cases, criteria under each category are further differentiated between direct and indirect benefits. The former are those directly derived from project activities, and can include enhanced air quality, improved health, reduced fossil-fuel expenditure and technology transfer, while indirect benefits can encompass poverty alleviation, improved waste management, job creation and useful by-products, among others (Gupta et al. 2008: p. 69). In sustainability assessments, it has been recommended to involve the majority of parties affected by the project in criteria selection and evaluation, as actors' perspectives may differ substantially (Brown and Corbera 2003). Table 3 below illustrates some examples of SD criteria employed in some of these studies.

The fact that most sustainability assessments are based on the examination of project documentation (i.e. Project Design Documents in the CDM case) and only occasionally are based on empirical field research implies that, generally speaking, we cannot talk about actual but rather expected benefits (Gupta et al. 2008). A desk-based review of 215 CDM projects under validation suggests that their most common SD benefits include employment generation, improved air quality, access to energy and, occasionally, improvement of public services (Olsen and Fenhann 2008b). Seemingly, Gupta and colleagues analyse 45 CDM registered projects and come to the positive conclusion that ‘about half of the CDM projects studied are designed explicitly to generate SD benefits which are not directly related to the GHG abatement component of the projects’ (ibid.: p. 84). However, these authors also acknowledge that the realisation of such benefits is more uncertain than the delivery of GHG reductions. They attribute such imbalance to the nonexistence of an international mandate obliging project managers to meet SD criteria during implementation, and to the non-incorporation of SD monitoring systems in project design. Another examination of agriculture-based CDM projects in India focuses on how co-benefits accrue to different project stakeholders and highlights that these benefits rarely trickle down to workers cases of poverty but they are unable to tackle the causes of structural and chronic poverty (Sirohi 2007).

In voluntary markets, Hamilton and colleagues suggest that forestry projects and those in the field of renewable energy and energy efficiency registered under a standard (e.g. the Gold Standard) are likely to deliver more co-benefits than other mitigation options. They also argue that CCX offsets are unlikely to contribute substantially to SD, as their co-benefits are irrelevant as long as the credit meets the CCX eligibility criteria and can be used for compliance (ibid.: p. 40). However, there is not enough evidence presented to back up their views. Emerging literature on the impact of OTC offset projects has been mostly focused on forestry initiatives and reveals mixed results. Corbera et al. (2007) show that participation in carbon forestry activities is by no means 'neutral' but mediated by political allegiances and land endowments, and that the distribution of additional benefits like information, forest management training and direct economic incentives can leave behind the most marginalised households. In their review of 12 forestry offset projects in Africa, both CDM and voluntary-based, Jindal et al. (2008) show that some projects do not offer substantial benefits to local communities and undermine local people's access to natural resources. Therefore, improving the outcomes of carbon-based forestry activities may require a better targeting of planting sites and contexts, a detailed explanation to local participants of their rights and duties when entering a carbon contract, investing in projects managers' and government governance capacities, taking into account complex land tenure systems, and reducing transaction costs through, for example, linking into existing rural development programmes or bundling projects (Boyd et al. 2007c; Corbera and Brown 2008; Jindal et al. 2008).

Finally, regarding technology transfer through regulated and voluntary offset markets, widely understood as a set of processes covering the flows of know-how, experience and equipment (IPCC 2000), most evidence focuses on the CDM and provides contradictory insights. Youngman et al. (2007), for instance, reveal that only half of CDM registered and under validation projects involve the transfer of technology hardware from outside the host country. This is due to the higher transaction costs on a per-tonne abated basis of lower and non-emitting energy technologies, which cannot create sufficient volumes of CERs to be economically viable unless emission commitment periods are extended into the future and carbon prices increase. These barriers are further complicated by lack of technical capacity in host countries to deploy contrast, Schneider and colleagues note that 'the CDM contributes to technology transfer in terms of both equipment and know-how, and it demonstrates that it is currently the strongest mechanism for technology transfer under the UNFCCC' (2008: p. 2936). Nevertheless, both papers coincide in suggesting that such transfer would increase by putting a higher price on carbon through more stringent emission caps and reducing transaction costs to the minimum favouring sectoral and programmatic approaches.

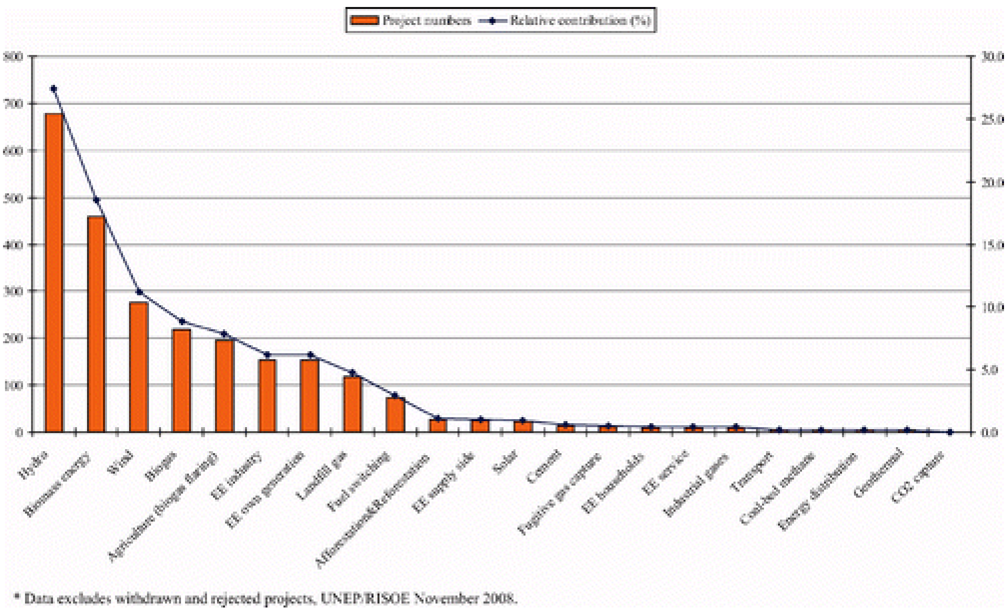
A more recent study by van der Gaast, Begg and Flamos (2009) discusses the potential for CDM technology transfer in the specific context of five developing countries, namely China, Chile, Kenya, Israel and Thailand. They show that it is not worth generalising about what types of technologies should be prioritised through the CDM, as required (and desired) technologies in each of these countries will vary according to the structure of energy systems and development priorities, among other factors. For example, while in China the transfer of clean coal technology is seen as crucial for their SD, mini-hydro and household energy-efficiency options are among the most preferred in Kenya. The authors thus argue that technology transfer through carbon markets must be promoted in parallel to increasing awareness of new technological options in host countries, challenging cost perceptions (i.e. the perception that new technologies are always more expensive than what it is currently available), historic experiences and confronting market powers. A preliminary step in this direction is, indeed, the development of programmatic CDM and the up-scaling of innovative demonstration projects, which should be further encouraged by investors and project developers.

2.4.2 Scale and project types as SD drivers

Even if it is difficult to generalise about the likely impacts of carbon offsetting due to the diversity of project options, procedures and operational contexts, researchers have noted that projects scale and typology may influence sustainability outcomes to a great extent. For example, it is generally accepted that small-scale projects may perform better in socio-economic terms than larger ones, especially if the latter do not have the mandate or are not designed to support on-site or external development initiatives, for example through CERs taxation and funding of additional activities 4 (Cosbey et al. 2006; Olsen 2007). Project typologies, in turn, will deliver distinctive SD profiles (Begg et al. 2003; Cosbey et al. 2006; Sutter and Parreño 2007; Olsen and Fenhann 2008b). Overall, there is consensus that energy efficiency projects and small-scale hydro, projects in these and other categories, such as industrial gases or fuel switching. These benefits include an enhanced provision of energy services, short and long-term employment, and reduced resource degradation and pollution.

Taking into account these considerations, it is possible to draw a comparison between the likely contribution of regulated and voluntary markets to SD. In the CDM context, small-scale projects 5 dominate over larger ones, but deliver less than 20% of CER volumes. They principally include investments in hydro, biomass energy, wind and biogas projects while large and very large projects account for 28% of total project numbers, provide 80% of all credits, and include the mitigation of industrial gases, landfill and agricultural methane, and wind power generation (Boyd et al. 2007a; ENTTRANS 2008; Hamilton et al. 2008b) (Figure 3). As shown in Table 4, these relative differences between project sizes have remained stable since 2005. In the CCX and OTC markets in 2006 and 2007, it may be surprising that approximately 50% of all credits came from large and very large projects (Table 5). Micro and small projects in the OTC market represent a higher share in project numbers than under the CDM – 46% versus 22%, for 2006 data – and they also deliver 14% of total offset volumes. For the CDM, this percentage is only around 1%.

Figure 2. Small-scale project types in the CDM pipeline∗, November 2008.



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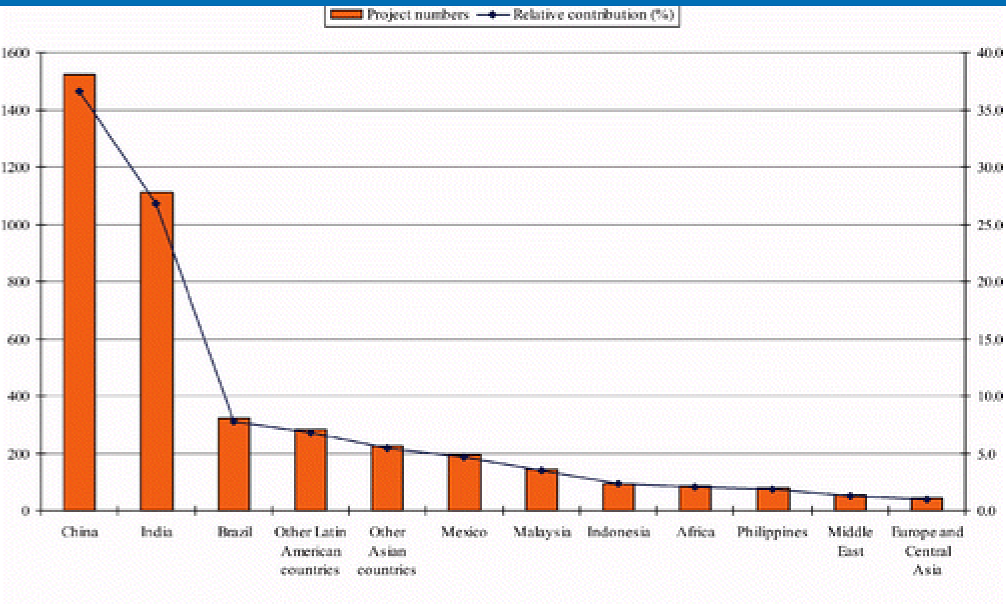

Source: elaboration from CDM pipeline database, November 2008 (UNEP/RISOE 2008)

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Table 4. Projects and transaction volumes by projects size in the CDM[1].

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Table 5. Projects and transaction volumes by projects size in the voluntary markets[1].

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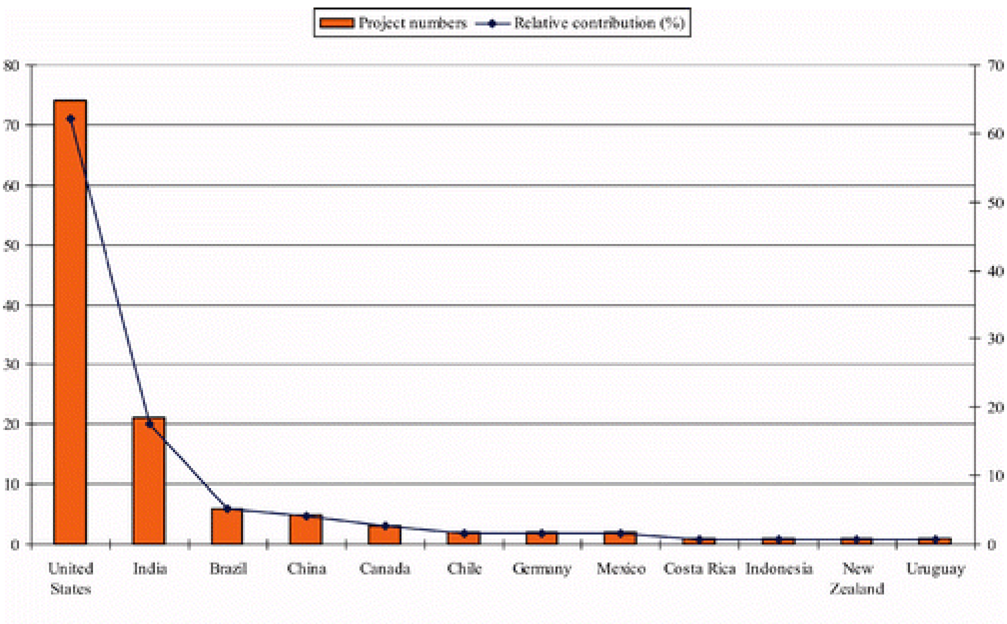
Data thus indicate that the number of small-scale projects and their contribution to credit volumes in voluntary carbon markets is higher than in the CDM but the much larger number of CDM small-scale projects implies that this mechanism may have a larger and potentially more positive impact on SD in global terms. Data also show that carbon offset markets are acting as vehicles to provide capital for the development of projects which would not otherwise enter commercial or CDM markets due to their high transaction costs, like small-scale biomass and forestry projects in the field of biodiversity conservation (Hamilton et al. 2008b). Nevertheless, certain renewable technologies (e.g., solar, tidal), transport-related activities, and very small projects have played so far an insignificant role in offset markets due to insurmountable transaction costs and the wide portfolio of eligible mitigation options (Pearson 2007).

The examination of offset projects' geographical distribution beyond their characteristics and boundaries draws important insights on equity issues, which are also central to global SD. Since its origins, the CDM has had an inherent bias towards large developing countries, an aspect which has not changed considerably over the years (Ellis et al. 2007; Boyd et al. 2007a). China, India, Brazil and Mexico, currently host 75.8% of all projects, which in turn will deliver 78.4% of CERs up to 2012; African countries represent only 2% and 3.5%, respectively (ENTTRANS 2008: p. 8) (Figure 3). This uneven distribution also characterises the OTC market, where 39% of total VERs sold in 2007 came from projects in Asia, predominantly from China and India. Projects in the US supplied 27% of VERs, and European countries and Russia a 13%. Africa and Latin America supplied only 2 and 7%, respectively. These data indicate a reduction in the total share of VERs coming from US and Latin American projects, which represented 43 and 20% of the market in 2006. They also reflect a growth in the contribution of China and India, similar to CDM trends, and a reduction in the contribution from African countries, which represented a 6% in 2006. On the other hand, as shown in Figure 4, CCX offset projects are predominantly located in the US (62%), and India (17%). Overall, there seems to be a trend towards investment in Asian countries, a growth in Europe and Australia and a reduction in the relative offset volumes from Africa, which suggests that, as in the CDM and the OTC markets, this continent remains the least benefited.

Figure 4. Offset projects' location in the CCX market, November 2008.



Source: elaboration from data available at http://www.chicagoclimatex.com/offsets/projectReport.jsf

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Projects' uneven distribution in regulated and voluntary offset schemes is due to the prioritisation of low-cost mitigation at the expense of global equity considerations and a variety of structural conditions from developing countries and markets themselves (Brown et al. 2004; Ellis et al. 2007). First, most mitigation activities are located in countries where large-scale mitigation potential at relatively low costs is found and where well-functioning CDM structures and procedures exist, such as an efficient DNA and high levels of expertise among project developers. In addition, these countries are also heavily populated, increasingly industrialised and intensive in energy use, which increases the opportunities for offset projects to be developed (Cosbey et al. 2006: p. 26). Second, the less benefited countries are generally those where there is a high risk of project failure, or where project design and transaction costs are prohibitively high, often as a result of their structural conditions, including unstable political regimes, unfavourable policy frameworks with, for example, nonexistent feed-in tariff regimes, unclear ownership structures for CERs and subsidies to fossil fuels, among others (Ellis and Kamel 2007). In this sense, investment in carbon offsets rewards mostly those countries with highest Foreign Direct Investment Confidence indexes (i.e. China, India, Brazil, Mexico and Indonesia), with the exception of Malaysia (Jung 2006: p. 2179). Third and finally, there are other aspects influencing carbon offsets' uneven distribution, which are related to the mandate and investment criteria of market players such as carbon funds and project developers (Ellis and Kamel 2007). Some carbon funds, like the World Bank's Community Development and Biocarbon Funds, prioritise CDM-compliant and voluntary investment in poorest countries of Africa, Latin America and Asia. In contrast, some project developers prefer achieving the highest level of CERs return in the first year or during the course of the project, while others focus only in one single technology, thus restricting the countries and locations where such technology can be more easily and cost-effectively deployed (ibid. 34–35).

3 Conclusions

3.1 CDM and voluntary offsets are growing exponentially

This review has shown that the CDM and voluntary offset market schemes have grown exponentially over the last 2 years. Although CDM growth can be explained by the mechanism's maturity and the proximity to the end of the Kyoto Protocol's first least three different situations. First, an increase in 'traditional' voluntary market projects due to an enhanced public awareness on climate change and other social and environmental issues, particularly in Europe and the US; second, the entrance to the voluntary market of projects currently not allowed in the CDM (e.g. afforestation and reforestation in areas not eligible under the CDM, HFC-23 reduction in new plants) and, third, a 'compliance attitude' by US companies in response to the imminent legislation on climate change and the uncertainty about the position of this country in the international regime post-2012.

3.2 CDM and voluntary offset schemes promote similar projects and technologies

The review has also highlighted that, with the exception of the forestry sector which is by far more supported by the voluntary sector, both regulated and voluntary markets support a variety of mitigation options and they are dominated by renewable energy projects (mainly hydro and wind), methane-based mitigation and fuel switching. This is an important finding, as it contravenes the idea that voluntary offsetting promotes pro-poor energy efficiency projects and renewable technologies other than those present in the CDM. Regarding projects' quality, CDM offsets are more reliable regarding their additionality due to the mechanism's strict procedures and much more divergent outcomes can be expected in the voluntary sector, even if the increase in the number of standardised projects is a positive move in this direction.

3.3 Contribution to local additional benefits is context-specific and not scheme-dependent

The contribution of both schemes to SD should be assessed in the mid-term to be accurate. There is not yet enough field-based research data to draw definitive conclusions on technology transfer and project impacts for different sizes and technologies. Emerging empirical studies, particularly in the forestry sector, reveal mixed results and implementation complexities, which prove that project outcomes may be highly context-specific. However, desk-based multi-criteria analyses tend to agree that small-scale projects, energy efficiency and renewable energy options will provide more benefits to local populations than larger ones, promoting additional benefits beyond GHG mitigation, occasional employment and reduced pollution. At this regard, the voluntary market may seem more promising, as the number of small-scale projects and their contribution to credit volumes in voluntary markets is higher than in operating worldwide suggests a larger and more likely positive impact of this mechanism in global terms.

3.4 Both CDM and voluntary offset projects are unevenly distributed and leave Africa behind

Finally, regarding projects' distribution, the review has shown that Africa is the least benefited continent, and that the voluntary market has an important share of projects coming from developed countries and regions like the US, Australia and Europe. The growth of voluntary projects in Asia has reduced the proportion of projects developed in Africa. This uneven distribution characterising both markets can be explained by investment risk factors and criteria, as well as institutional structures in host countries. These findings challenge those who think that the voluntary market performs better than the CDM in terms of the equitable distribution of projects worldwide.

In conclusion, regulated and voluntary schemes have yet to prove that they are valuable instruments to fight climate change and promote national and local SD priorities. Such a dual objective may only be realised if both markets are reformed so as to make SD more central than it has been so far. To date, the consecution of additional benefits has been more a product of project design and implementation arrangements than the broader institutional structures governing these markets. For this reason, in the CDM context, scholars have proposed a variety of interventions to maximise the SD outcome of these schemes, like geographical quotas (Rowlands 2001), the inclusion of SD checklists and standards in project design, monitoring and evaluation (Cosbey et al. 2006; Gupta et al. 2008), and the prioritisation of some technologies over others (Boyd et al. 2007a). They have also pledged international policy-makers, carbon funds, brokers and trading platforms like the CCX to reconsider their criteria in selecting eligible projects and recipient countries. In the OTC sector, the lack of a global regulatory body leaves in the hands of consumers and investors the responsibility to choose among project typologies, the standards available and to demand well-designed and implemented projects.

Regardless of the options taken in regulated and voluntary schemes to maximise SD outcomes, the divergent structural conditions characterising institutional, social and energy systems across developing countries justify continuous investment in capacity-building in forthcoming years, particularly in Africa. As in-country capacities for CDM offset projects. For this reason, programmes like the Capacity Building for the Clean Development Mechanism (CD4CDM), hosted by the United Nations Environment Programme, need to continue and be further strengthened. Left to market forces alone, carbon offsetting will generally support low-cost mitigation options (Olsen 2007). There is thus a need to incorporate all or some of the proposals already suggested to improving the CDMs contribution to global SD, even if this is difficult to negotiate due to national sovereignty concerns. This is important because one can expect voluntary trading schemes to follow suit and evolve in the direction of the international climate change regime, as it has happened to date. Otherwise, carbon offsetting will fail to promote a large-scale transition towards a non-fossil-fuel based global economy, and will leave behind the needs and priorities of the world's urban and rural poor.

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Notes

1. The CDM market is divided in two main segments: a primary market, selling primary CERs, and a secondary market, selling secondary or guaranteed CERs (gCERs). Primary CERs are generated by projects under development or implementation, and are paid upon delivery at a future date. Secondary or guaranteed CERs (gCERs) are either offered with a delivery guarantee by an entity such as a bank or fund or sold once they have been issued to the project developer. gCERs are often more expensive and tend to be sold close to the value of the European Union Emission Trading Scheme allowances, which were traded at an average price of US$24 in 2007.

2. Over the period Jan-Oct 2008, the CCX has already traded 63.5 MtCO2e, which represents a 244% increase from the same period in 2007 (CCX Market Report 5(10):

3. http://www.defra.gov.uk/environment/climatechange/uk/carbonoffset/pdf/carbon-offset-codepractice.pdf

4. The Chinese government, for example, is entitled to 30% and 65% of all CERs generated by CDM nitrous oxide and other industrial gases (PFCs and HFCs) projects, respectively. The collected revenues are earmarked to finance climate change capacity building across scales of governance (Boyd et al. 2007a)

5. Small-scale CDM projects include those which reduce less than 60,000 tCO_2e in emission reductions per year, renewable energy project activities with a maximum output capacity up to an equivalent of 15 MW, or energy efficiency improvement projects reducing energy consumption (both at supply and demand side) by up to 60 GW/h per year. In the case of afforestation and reforestation activities, the small-scale threshold is 16,000 tCO_2e of emission reductions per year.

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