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Simon Bisore and Walter Hecq

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Regulated (CDM) and voluntary carbon offset schemes as carbon offset markets: competition or complementarity?

Simon Bisore[1] & Walter Hecq[2]

Abstract

As one of the offsetting instruments, the Clean Development Mechanism (CDM) allows industrialized countries to meet their compliance objectives by undertaking and financing project activities in developing countries with certified emissions reductions (CERs) in return. Next to Kyoto mechanisms, voluntary offset markets for GHG emissions reductions that are not compliant with the Kyoto Protocol are developing quickly. Emissions offsets in this latter category are verified by official or independent agents but are not certified by regulatory authorities for use as a compliance instrument, and are commonly referred to as verified emissions reductions (VERs) which are not a standardized commodity. This paper compares the two types of projects-based carbon offset markets and analyses the question of complementarity or competition between them in their contribution to the mitigation of global warming as well as to sustainable development in the host countries.

Key words: Climate change; CDM carbon offset market; Voluntary carbon offset markets; Competition; Complementarity; Standards; Carbon credits; Sustainable development.

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1. Introduction

The development of human activities increases the concentration of greenhouse gases in the atmosphere, and consequently provokes a rise in temperature on the Earth's troposphere (IPCC, 2001), as well as a risk of important climate change on the planet. The international community has become aware of the issues at stake and has drawn up measures to curtail this phenomenon. Out of all greenhouse gases (GHG), the Kyoto Protocol has only kept six, namely carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (PFCs); perfluorocarbons (HFCs) and sulphur hexafluoride (SF_6) as mentioned in Annex-A of the Kyoto Protocol (United Nations, 1998). Although present at small concentrations in the atmosphere, these gases (which are nearly transparent to solar radiation) retain strongly the infra-red radiation emitted by the Earth. This results in a warming of the Earth's surface by about 30 °C more than without them (Bowman, 1990).

According to the World Meteorological Organization GHG Bulletin (WMO, 2011), the global concentrations of CO_2, CH_4, N_2O reached new high levels in 2010, with CO_2 at 389 ppm, CH_4 at 1.808 ppb and N_2O at 323.2 ppb. These values are greater than in pre-industrial times (before 1750) by 39%, 158% and 20%, respectively, whether 280 ppm for CO_2, 700 ppb for CH_4, 270 ppb for N_2O (WMO, 2011). On a global scale, an increase in GHG emissions from 28.7 $GtCO_2e$ to 49.0 $GtCO_2e$ (more than 70%) between 1970 and 2004 (IPCC, 2007a) has been estimated. The UNEP Report suggests that under business as usual projections, global emissions could reach 56 $GtCO_2e$ (range: 54-60 $GtCO_2e$) in 2020 (UNEP, 2010).

The global anthropogenic GHG emissions per capita reached an average of 7.5 tCO_2e in 2004 (Banque mondiale, 2007; IPCC, 2007), with great differences regionally and according to the development within each country. In fact, the emissions per capita was 1.7 tCO_2e for Africa in 2005 (Couth & Trois, 2011), 10.5 tCO_2e for Europe (EU-27) in 2005 (EEA, 2007), 24 tCO_2e for USA in 2006 (EIA, 2008; FUNAP, 2006). These high emissions per capita in Western countries can be explained partly by the lifestyle adopted, which creates a structural dependence for energy intensive activities. If adopting these western lifestyles brings comfort and a feeling of well-being to these inhabitants, it is obvious that in the medium to long run they offer very little comfort to humanity as a whole. Choices can nevertheless be presented which could cut these GHG emissions, called mitigation measures and policies, i.e. shifting towards new and renewable energy systems, changes in behavior, and to a lesser extent, an improvement in technologies within the industrial and agricultural sectors, etc.

Along with this, some businesses and other institutions, which have already undertaken domestic actions related to the improvement of production processes, energy shift, etc, are allowed to finance projects which contribute to stabilizing GHG emissions in developing countries in a cost-effective manner (the case of the Clean Development Mechanism: CDM) or even in industrial countries (the case of Joint Implementation: JI) within the context of flexible mechanisms under the Kyoto Protocol (regulated instruments). Apart from all this, it is possible to offset the CO_2 emissions which we have not been able to (or have not wanted

to) avoid by financing offset providers allowing for an equivalent amount of CO_2 to be saved. These projects either enable CO_2 to be sequestered (basically the fight against deforestation and replanting of trees), or allow CO_2 emissions to be reduced at their source - improved energy efficiency and use of renewable energies instead of fossil ones. This process is called the voluntary offset mechanism, which is not regulated contrary to the flexibility mechanisms in the Kyoto Protocol (Estrada et al., 2008; Kollmuss et al., 2008).

Nevertheless, we must not lose sight of the fact that at most, offsetting is just one way to mitigate the effects of our lifestyle, because it is voluntary. This does not mean consuming in an unrestrained way and imagining that a few thousand dollars (or Euros) will be enough to erase all our excessive consumption! Furthermore, Kyoto Protocol with its flexible mechanisms, on account of its constraining nature, could play a significant role in this domain if the actors concerned take their involvement seriously. It needs to be noted in this field as well, however, that such mechanisms are only complementary to the domestic policies that have to be taken.

2. Objectives and Methodology

The issue of climate change is always at the centre of debate today, as much on the local level as on the international one (COP and COP/MOP in the context of the United Nations framework Convention on climate change (UNFCCC) and the Kyoto Protocol). The policies and measures to mitigate climate change are developed and include flexible mechanisms, among them the CDM. These mechanisms involve the procurement process, which has given carbon a monetary value. Moreover, when the carbon market is created, different providers of voluntary offsetting have also developed programs which contribute to a lesser extent to climate protection: the voluntary carbon-offset scheme.

After analyzing the literature relating to the regulated and to the voluntary carbon offset systems, we focus on a certain amount of characteristics which are relevant as much for the regulated as for the voluntary carbon offset systems. The comparative analysis involves applying different situations to the questions already developed, so as to draw out the points of similarity and/or dissimilarity and thereby bring up any relevant objective comments. The aim of this paper is to show the issue of their competition or their complementarity, notably regarding their contribution to sustainable development in general, and their contribution towards stabilizing the climate in particular.

The methodology is based on official documents and scientific literature analysis. The choice of comparison criteria is made to describe some characteristics for each criterion in each of the two systems. Inter-relationships are shown linking the main actors to different steps in order to identify roles of different actors involved in the CDM procedures on the one hand and in the voluntary offset program steps on the other hand. Therefore, after a first review of the issue looking at the different arguments, opinions and considerations available from the international literature, as well as our own comments on all these aspects, the aim of

this paper will be to reveal the compatibility or incompatibility of the two systems in the global warming policy, given that both are market-based.

3. The regulated carbon offset market : CDM

As mentioned above, the CDM is one of the regulated instruments of Kyoto Protocol which allow industrialized countries (parties to Kyoto Protocol) to comply with their commitments by financing project activities (in developing countries) which contribute to stabilizing GHG emissions in a cost-effective manner, and allow also to achieve sustainable development in these developing countries. In this section we define the CDM concept, giving its basic principle, main objectives and operating mode (which includes terms of realization, project cycle, types of project activities in the CDM carbon offset market and main actors involved in the CDM project activities process) and finally we identify the project types in pipeline, CERs matching and investments involved in the registered project activities.

3.1. Concept of the regulated (CDM) carbon offset market

The Kyoto Protocol does not impose any limits of GHG emission reductions for developing countries (Non-Annex I Parties), as shown in Annex B of the Kyoto Protocol which quantifies commitments assigned to industrialized countries. However, that does not prevent the fact that emissions from developing countries are still growing, especially in the case of emerging countries, like BASIC countries[3] (Brazil, South Africa, India and China), which are expanding rapidly (Unnikrishnan & Singh, 2009). Defined in Article 12 of the Kyoto Protocol (United Nations, 1998), the CDM is among the strategies adopted by industrialized countries to comply with the Kyoto Protocol commitments, in accordance with the Article 3 of this letter mechanism. By its ability to reduce GHG emissions in developing countries, (offsetting them globally) the CDM managed to give the monetary value to carbon dioxide (CO_2e). According to its objectives, the CDM addresses the need to finance the sustainable development by implementing project activities. Nevertheless, this mechanism reveals the complexity involved in the process of setting up these project activities (Figure 2), and high transaction costs, especially in the case of small-scale project activities (Michaelowa & Jatzo, 2005).

3.2. Basic principle

The CDM is a mechanism based on the implementation of projects which allow agents from the public or private sector, primarily from the Annex B countries which have binding targets for carbon reduction, to invest in activities that will reduce or sequester GHG emissions in the Non-Annex I countries and to receive carbon credits (CERs) in return (Figure 1). These carbon credits can then be used by the same Parties who have to meet their commitments taken in the Kyoto Protocol, or sold on the carbon market. Therefore:

[3] The BASIC countries are a bloc of four large developing countries including Brazil, South Africa, India and China, formed by an agreement on 28 November 2009. The four committed to act jointly at the Copenhagen climate summit including a possible united walk-out if their common minimum position was not met by the developed countries.

- Industrialized countries from Annex B invest in project activities contributing towards a reduction in GHG emissions in Non-Annex I countries. In principle this reduction in carbon emissions must promote a contribution towards sustainable development in the host country in the form of new investments, transfers of technology and local development.
- Non-Annex I countries can also achieve similar projects autonomously and thus benefit from the sale of CERs within the context of unilateral CDM projects. According to the World Resources Institute (WRI), the defining feature of unilateral CDM is the absence of an Annex B entity in the development, financing and implementation of a project (Baumert et al., 2000).

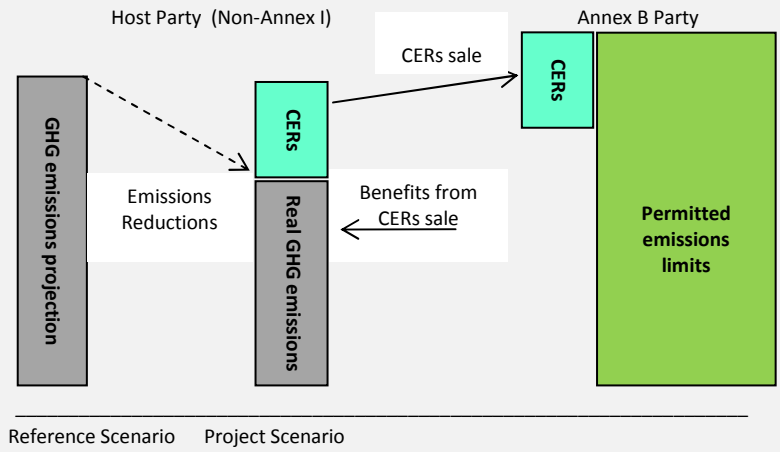

Fig. 1. CDM Basic Principle of Operation

Source: Adapted from Mizuno, 2008

3.3. The main objectives

According to Article 12 of the Kyoto Protocol (United Nations, 1998), the objectives of the clean development mechanism can be considered in three parts. Firstly, the CDM has as its vocation to assist Non-Annex I countries, to achieve their sustainable development: the goal of promoting sustainable development. Secondly, the CDM attempts to help the Annex I countries to meet their commitments as stipulated by Article 3 of the Kyoto Protocol, by limiting their GHG emissions during the first period of engagement (2008-2012): the goal of conformity. Thirdly, the CDM contributes towards saving the climate globally by stabilizing concentrations of GHG emissions in the atmosphere to a level such that this concentration will not cause a dangerous disturbance to the planet's climate: the ultimate goal of the (UNFCCC) as mentioned in its Article 2.

3.4. Operating mode

The regulated carbon offset market recognizes two standards (the CDM and the CDM Gold Standard) and a centralized single registry (Kollmuss et al., 2008) that achieve the highest possible quality of the carbon offset emissions credits to ensure the arrangements of the Kyoto Protocol (Estrada et al., 2008; Kollmuss et al., 2008). This section analyses the four

following aspects: terms of realization; project cycle in the regulated scheme (CDM); type of project activities involved in the CDM carbon offset market and the main actors involved in the CDM process. These characteristics still remain important because they show the main characteristics of all the CDM process involved in project activities, in particular its complexity, which ensures also its viability.

3.4.1. Terms of realization

Since the CDM is the result of a binding international agreement, fulfilling CDM projects has to meet a certain amount of prerequisites governed by the relevant authorities. So, in order for a CDM project to begin, several conditions must be fulfilled, both for the investor Party and for the host Party, as stated in the Marrakech Accords (UNFCCC, 2002), among them the following:

- Participation in project activities relating to CDM is voluntary, and no Annex I Party should feel constrained to resort to the CDM to respond to its obligations taken in the Kyoto Protocol, in the same way that no non-Annex I Party should feel obliged to resort to the CDM in order to achieve its sustainable development.
- Participants in CDM project activities must be in agreement with the Kyoto Protocol which has carried out this mechanism, to prevent some countries, Non-Parties to Kyoto Protocol, whether industrialized or not, from gaining any benefits arising from an agreement in which they are not committed Parties.
- Parties will participate in CDM project activities once they have set up a national framework within which the mechanism can work, i.e. the Designated National Authority (DNA) to this purpose. The mechanism will thus be kept separate from other frameworks of activity at a national level. The Designated National Authority to the CDM has a key role in the general functioning of the CDM at a local and an international level (Olivas et al., 2005).

In addition, project activities must meet additionality and sustainable development as eligibility requirements (United Nations, 1998; Shrestha *et al.*, 2005). Sustainable development refers to benefits/advantages in terms of economic impacts (employment, livelihood) environment impacts (local air, water pollution control) and social equity (impacts on disadvantaged groups). Additionnality allows doing something that it would not have done without the CDM. Three types of additionality can be distinguished.

- Project additionality indicates that without the ability to register under the CDM, the proposed project would be, or would have been, unlikely to occur.
- Environmental additionality indicates that if the proposed CDM project activity was not implemented, a less GHG friendly activity would have been initiated or continued instead.
- Technological additionality indicates that project activities must be accompanied with a transfer of clean technologies initially unavailable in the region of implementation of these project activities.

3.4.2. Project cycle in the regulated scheme (CDM)

The operational procedures for setting up CDM projects (project cycle) are long and complex, involving many actors (Figure 2).

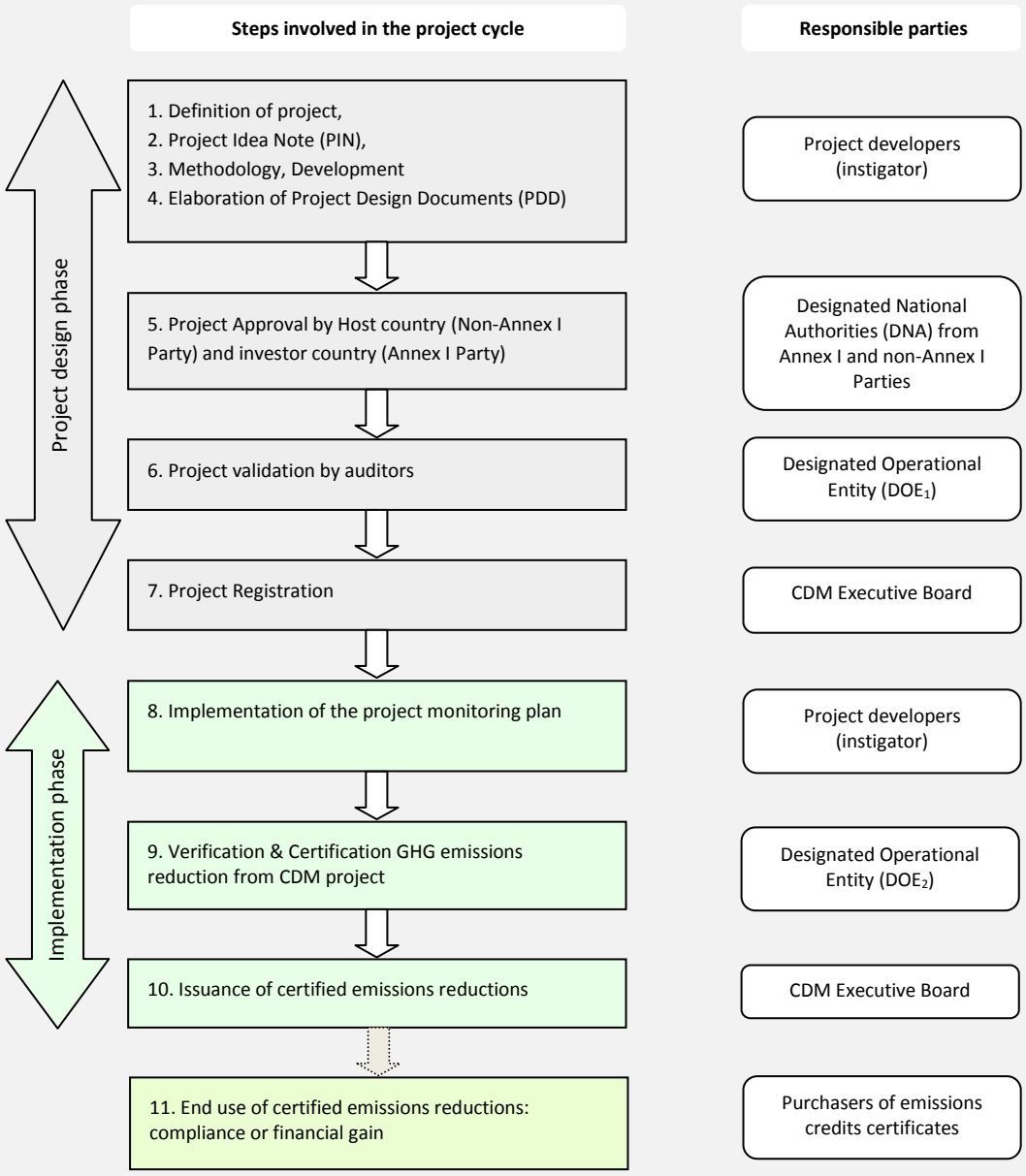

Figure 2: Main administrative stages in a CDM project life cycle

Source: Adapted from IEPF, 2002; Olivas et al., 2005; Michaelowa et al., 2007; Kollmuss et al., 2008.

The operational procedures for setting up CDM projects (IEPF, 2002 ; Olivas et al., 2005 ; Michaelowa et al., 2007; Kollmuss et al., 2008) show some minor differences about the number of steps to follow in the whole process. A CDM process will therefore involve several stages before finally delivering the certified emission reduction (CERs). Normally the project cycle includes two main phases: the construction or designing phase and the achievement or implementation phase.

Figure 2 sums up the whole implementation procedure for a CDM project as well as the planning and the different actors' responsibilities that go along with it. It includes an identification phase where all documents relevant to CDM are fulfilled [stages 1 to 4]; project approval based on the Project Design Document (PDD) by both host and investing countries through their Designated National Authorities (DNAs) [stage 5]; validation and registration of the project respectively by the Designated Operational Entity (DOE) [stage 6] and the CDM Executive Board (CDM-EB) [stage 7]; implementation of monitoring plan by Projects Developers [stage 8]; verification and certification by the Designated Operational Entity [stage 9]; and issuance of certificates of emissions reduction by CDM Executive Board [stage 10]. Thus, certified emissions credits (CERs) already issued are used to help the investor compliance with the Kyoto commitments or for potential financial gain (capital gain) on the carbon market [stage 11].

According to Fenhann (2012), there is a considerable increase in delays in registration and issuance for many project activities. On average, it took over 540 days from validation start to registration. These delays can be manly attributed to increased scrutiny by the CDM Executive Board combined with a lack of manpower in the Secretariat and the designated operational entities, and the increase of project activities amount in the CDM pipeline. The projects also appeal to several actors, both institutional and economic, as well as to non-governmental organizations (for local involvement) whose intervention at one or other stage in the fulfillment process is still very useful (Figure 3). To this must be added the transaction costs and the administrative costs attached to project activities at each stage in the procedure (Michaelowa et al., 2003), by no means any less important, but which change according to the nature and size of the project. All these time-consuming and costly issues may constitute barriers towards implementing CDM project activities as reviewed by Bisore & Hecq (2010) in the case of Africa.

3.4.3. Type of project activities in the CDM carbon offset market

Annex A of the Kyoto Protocol provides information on the different sectors of socio-economic activities in which CDM projects are eligible. The portfolio for CDM projects, i.e. projects already registered or which are in one or other stage in the process leading towards registry mention a number of important sectors of activity as shown in Table 1. All the same, originally, some project activities had not yet benefited from this preferential title of CDM activity, at least were not valid under the CDM during the first commitment period from 2008-2012. Among others, this includes sink projects related to Land Use, Land Use Change and Forestry (LULUCF) other than afforestation & reforestation and projects concerning nuclear power plants, as specified in the Marrakech Accords (UNFCCC, 2002). The exclusion of activities notably associated with LULUCF could be one of the causes for a lack of project development in certain Least Developed Countries (LDCs), particularly in Africa, which holds a marginal place. Of all the 3,743 projects registered throughout the world (December 2011), only 77 are located in Africa, i.e. about 2% of the total amount (Fenhann, 2012). In fact, emissions there associated with forestry, including deforestation, represented already 17.4%

of emissions worldwide in 2004 (IPCC, 2007), and these activities are responsible for 62% of emissions from the Least Developed Countries (Baumert et al., 2005) the majority of which are African. Whereas Africa's part in all projects is still marginal (2%), its part in LULUCF represents about 20% of all projects in this sector.

3.4.4. The main actors in the CDM process

The main actors involved in the CDM process belong to the following categories: institutional actors, policy-makers, economic and financial actors, and stakeholders. Figure 3 shows an illustration of these key partners in the CDM project activity process.

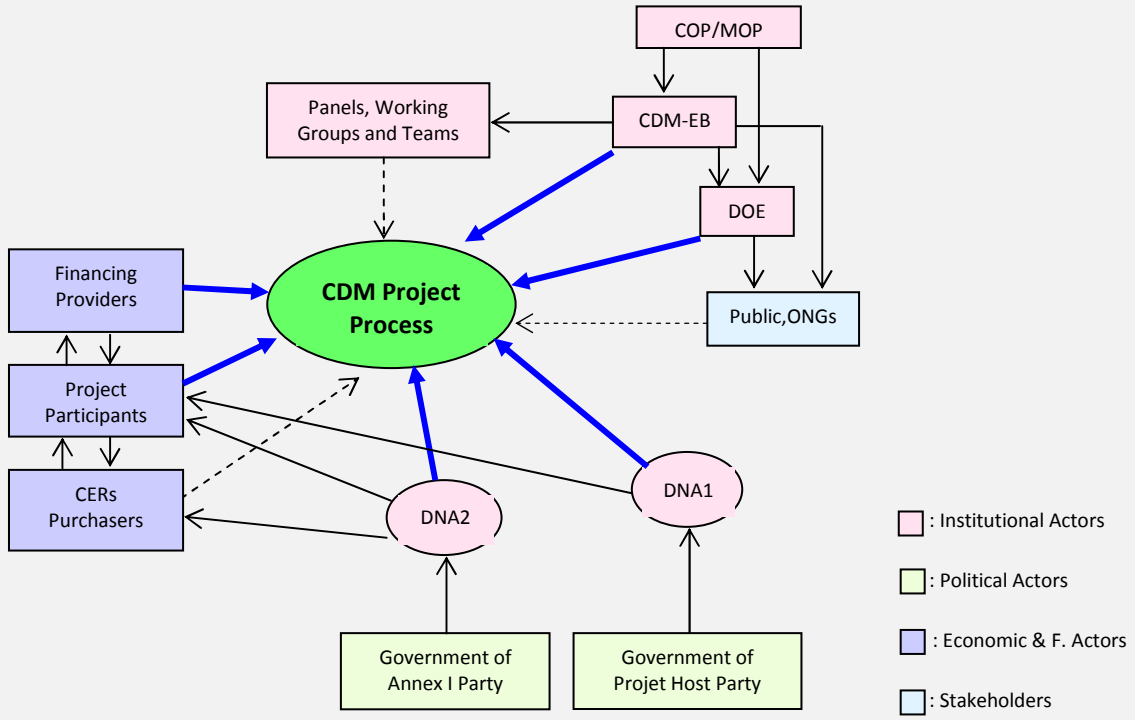

Fig. 3. CDM actors' involvement in CDM project process

Source: Authors

Institutional actors include the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP) the supreme body of the Kyoto Protocol; the CDM Executive Board with its Panels, Working Groups and Teams; the Designated Operational Entities (DOEs); and the Designated National Authorities (DNAs). Those actors take care of all the administrative steps in the CDM project procedure. In particular, the COP/MOP acts as an agent responsible for the CDM rules and procedures, while others act as operational implementation of CDM project activities as mentioned in the Marrakech Accords (UNFCCC, 2002). Thus, the CDM Executive Board is in the charge of supervising the CDM, under the authority and guidance of the COP/MOP, implies approving new baseline and monitoring methodologies, accrediting DOEs and making recommendations to the COP/MOP for their designation, as well as for the suspension and withdrawal of this designation, registering project activities and issuing CERs. In addition, Designated Operational Entities validate proposed CDM project activities and verify and certify emissions reductions resulting from

such projects. Moreover, Designated National Authorities assess the environmental and social impacts of projects and, if applicable, issue letters of approval of voluntary participation, including confirmation that the project activity assists the host country in achieving its sustainable development, and project participants (Olivas et al, 2005).

Political actors are Annex B and host countries who delegate their Designated National Authorities for decision-making. Economic or financial actors (investors, primarily private business in the West) ensure the financing of CDM project activities' implementation and participate in the purchasing of CERs (Cochran & Leguet, 2007). Among stakeholders are the local population (public) and Non Governmental Organizations (NGOs). The local population is invited to make comments on the proposed project activities that then have to be considered by the project leaders in their PDD revision. The Non Governmental Organizations are in place to ensure monitoring of projects in their development phase and raise their voice when they are aware of any laxness in the CDM project achievement procedure. They also have the role of promoting CDM projects.

3.5. CDM project pipeline, CERs matching and investments

A history of the CDM project portfolio and CERs matching can be found on the UNFCCC and UNEP-Risoe-Centre websites[4], where we can see that the first CDM project was registered by the Executive Board in Brazil on 18 November 2004 (UNFCCC database). Given that the CDM is a market mechanism. Therefore investors, primarily private businesses in the West, are far more interested in honoring their commitments taken in the Kyoto Protocol, by all possible ways and at a low cost. This could be the reason why investors prefer to put their funding into industrial project activities (emitting PFCs, HFCs, N_2O), located essentially in emerging countries, (e.g. China, India, Brazil, Mexico…), whose project activities have a substantial return because of the high Global Warming Potential (GWP) of these gases and because these countries have a substantial capacity building. These projects which reduce GHGs in the industrial sector require little investment but generate high carbon credits amounts (Ellis & Kamel, 2007). Table 1 gives an overview of CDM project activities and corresponding carbon credits expected in different CDM project types. At the present time (December 2011), taking all categories together, the highest percentage of CDM projects in the pipeline comes from projects involving renewable energy, at 66%, whereas only less than 2.0% are from industrial projects; but in terms of CERs expected in 2012, this latter group generates a great volume of emissions credits: 27% against 35% for renewable energy projects (Fenhann, 2012).

[4] These websites are: http://cdm.unfccc.int/index.html and http://cdmpipeline.org/ respectively.

Table 1: Overview of CDM projects and corresponding CERs expected, per category

Categories	All Projects	Registered	All 2012 CERs (000)	Investment (M$)
Hydro	1,992	1,114	437,038	47,201
Wind	1,932	870	333,141	60,784
Biomass energy	823	399	165,991	5,414
Methane avoidance	717	420	105,795	1,129
Energy Efficiency own generation	481	203	199,248	5,853
Landfill gas	375	217	200,782	2,368
Solar	189	60	6,318	2,669
Energy Efficiency Industry	152	65	18,519	1,099
Fossil fuel switching	140	69	171,172	12,240
Energy Efficiency Supply side	107	28	58,909	13,084
Coal bed/mine methane	100	53	106,416	1,104
N_2O reduction	92	68	252,020	482
Energy Efficiency Households	82	27	5,406	139
Afforestation & Reforestation	62	35	20,202	192
Cement	57	19	34,614	258
Fugitive emissions	53	23	82,645	1,754
Transport	47	11	9,767	9,422
Energy Efficiency Service	34	5	1,056	77
Energy distribution	25	6	11,475	1,909
HFCs	23	22	476,504	78
Geothermal	22	12	13,389	1,735
PFCs and SF6	18	14	11,827	405
CO_2 usage	5	2	305	60
Tidal	2	1	1,104	807
Agriculture	2	-	41	-
Total	**7,532**	**3,743**	**2,723,684**	**170,263**

Source: UNEP-Risoe Centre CDM pipeline database, December 2011.

In conjunction with the increase in CDM projects throughout the developing world, related investments have followed the same pattern, with different investors wanting to profit from this evolving market at all costs and for different reasons. Some want to accelerate their conformity to the commitments taken in Kyoto Protocol (e.g. governments of industrialized countries subject to the obligations to reduce their GHG emissions at a national level, notably within the European Union). Others want to make their investments attractive (e.g. financial investors who can buy emissions credits in the hope of gaining a better financial value after 2008, once the commitment period is in progress). The private sector has been able to position itself well on this market since the Kyoto Protocol took effect and its share exceeded a half of all investment funds in 2007 (Cochran & Leguet, 2007). Numerically, the growth, as much in the number of funds as in the corresponding financial volume, has highly increased (Bellassen & Leguet, 2007). Indeed, "Mission Climat" booked 33 into its accounts with a total capital of € 4 billion in 2005. Less than two years later, 33 new funds had seen the light of day, bringing the total up to 66, with the capitalization investment of € 9.2 billion. Those funds reached 96 in 2009, giving a total capitalization of € 10.8 billion (Alberola & Stephan, 2010), i.e. an increase in capital of 17.4% since 2007 and 170% since 2005.

This development corresponds on the one hand to the growing needs of the different countries concerned, who estimate that the reductions in emissions achieved on their territory through their own domestic policies and measures will not suffer by complying with their commitments towards Kyoto Protocol, and on the other hand to a growing appetite in the financial world for a carbon credits share which begins to prove itself.

4. The voluntary carbon offset markets

Besides the regulated tool (CDM), there is another carbon offset tool which does not comply with the prerogative of the Kyoto Protocol mechanisms (non-regulated). It functions outside of compliance markets, enabling businesses, governments, NGOs, and individuals to purchase carbon offsets on a voluntary basis (Bayon et al., 2007; ADEME, 2008; Kollmuss et al., 2008). In fact, many sources of emissions, such as households, public administrations, the majority of small to medium sized enterprises (SMEs), transport (especially aviation and shipping), events… are currently not eligible (or only insufficiently) by existing climate policy markets (Sterk & Bunse, 2004), like EU ETS market. Moreover, as it is difficult to reduce all of these emissions, offset schemes have come as a new approach which tries to use the principle of emissions trading to take in account these sources.

Voluntary carbon offset markets have become a vital part in the evolving puzzle of climate change mitigation (Ciscell, 2009). As consensus is growing on the necessity to mitigate future climate change impacts by stabilizing current emissions, some actors have taken steps to reduce their carbon footprint, even though they are not required to do so by regulation (Guigon et al., 2009). A growing amount of businesses; institutions; associations; NGOs; and individuals, both private and/or public, are committing voluntarily to offset the GHG emissions which they emit. This voluntary carbon offset market emanates from a market tool which dates back to the 1990s. A special case of this is voluntary carbon offsetting has its origins in the USA just a short time before the climate Convention. Indeed, an American utility company decided already in 1989 to finance an agro-forestry project in Guatemala to the amount of two million dollars, the goal being to offset the emissions from the new power plant built by the company in Connecticut by planting 50 million trees (Bayon et al., 2007; Bellassen & Leguet, 2007).

In the voluntary carbon offset, projects do not meet all the CDM eligibility conditions, but can be thus sometimes innovative (Kollmuss et al, 2008). Given their small-scale, these project activities have the added value of bringing tangible and significant benefits for the local population (Sterk & Bunse, 2004). In this section, we describe the characteristics of voluntary offset programs in terms of: definition, basic principle, objectives, operating mode (including terms of realization, project cycle, type of project activities in voluntary carbon offset market, main stakeholders involved, online calculators, carbon offset providers), and volume and value in the voluntary carbon offset market.

4.1. Concept of voluntary carbon offset markets

As mentioned above, voluntary offset markets function outside of the compliance market and enable companies and individuals to purchase carbon offsets on a voluntary basis (Kollmuss et al., 2008). They aimed at generating GHG emissions offset not required by Kyoto Protocol's derived regulation (Estrada et al., 2008) and thus not accounted as Kyoto Protocol commitments. Voluntary market transactions include: the purchase of carbon emissions credits by individuals or institutions at a retail level; the purchase of carbon emissions credits from project developers for resale; and the investment in project activities in exchange for emissions credits (Hamilton et al., 2007). Voluntary offset markets involve a financial system by which an entity (institution, company, individual) offsets partially or totally its own GHG emissions with an equivalent amount of carbon emissions credits (VERs: verified emissions reductions) which it buys from offset providers. In this context, voluntary offset companies offer organizations and individuals the opportunity to reduce their impact on global warming by purchasing carbon offsets emissions credits (Kollmuss & Bowell, 2007).

The voluntary carbon offset markets do not require their tradable carbon emissions credits to undergo an international certification process under the UNFCCC, i.e. the case of the CDM process (Hawn, 2005). The carbon emissions credits created on the voluntary markets, unlike the compliance market where emissions credits are tradable under the flexible mechanisms, are generally non-tradable between schemes (Yeo et al., 2007). The former project activities cover emissions reductions from deforestation and forest degradation in Developing Countries (REDD); landfill methane; renewable energy; energy efficiency... as shown in Figure 6, p.22.

4.2. Basic principle of voluntary offset carbon markets

The voluntary carbon offset schemes can be considered, in some way, as an application of the "polluter pays principle". Aware of their impact on the environment, individuals, companies or public services invest in emissions reductions projects associated with the pollution caused by their respective activities. The concept of voluntary offset is very important. It does not involve an obligatory target but also an eco-friendly behavior which the polluter consents to. The principle of voluntary carbon offset markets can be summarized in three main points: calculating the avoided emissions, converting these GHG emissions into offsetting costs and proposing a potential project activity to reduce GHGs (or buying carbon credits), and communicating actions involved as carbon neutrality (Douste-Blazy et al., 2008). According to Hamilton et al. (2008a), the central issue of participating in the voluntary carbon markets is deciding whether – and, if so, how – to purchase offsets.

Consequently, the entity (administration, business, individual) makes a corresponding donation to a voluntary offset provider who has a project portfolio in which a choice can be mad. In other words, he buys carbon emissions credits. The offset service provider invests the amount received into projects aiming to reduce GHG emissions (CO_2e) which offset, in

total or in part, the emissions associated with the activity carried out by the buyer entity. Nevertheless, the voluntary carbon offset scheme must be considered as an additional one in the struggle against global warming which is offered to businesses, institutions, groups or individuals, as well as the regulated carbon offset schemes (CDM/JI) in the context of Kyoto commitments for Annex I countries. They ought to be placed right at the end of the chain, along with a whole series of options to be proposed once all the solutions towards energy efficiency have been visualized, and once all efforts to reduce emissions at the source have been made, whether by improving technology or by changing behavior patterns.

4.3. Objectives of voluntary carbon offset markets

As a mechanism based on the project activities, the voluntary carbon offset market has likely to contribute towards stabilizing greenhouse gas concentrations at a global level by implementing project activities with co-benefits procurements. Nevertheless, contrarily to the CDM, investing cost-effective projects is not a priority for the voluntary carbon offset initiatives which instead often pursue wider environmental and social benefits (Estrada et al., 2008). Furthermore, if projects financed were to be carried out in developing countries, those programs would participate to some extent in contributing towards sustainable development in these countries through the transfer of technologies (in the field of energy efficiency for example), the flow of new investments, the creation of jobs and the improvement of living conditions for the local populations. Indeed, in addition to the mere avoidance or reduction of emissions, especially small-scale projects also claim to attain significant socio-economic benefits at the community level in host countries, such as developing local economy, employment, and thus can contribute to essential services like water or sanitation (Sterk & Bunse 2004).

Likewise, for carbon offset providers at the root of this voluntary carbon offset scheme, there is the willingness to associate their brand with an eco-friendly behavior and their reputation (Hamilton et al., 2008). Otherwise, owing to its voluntary aspect, this system would have the merit of stimulating among businesses, institutions and individuals the awareness of their impact on climate according to the different activities for which they are responsible. This includes awareness of local population towards climate change and towards the existence of offsets as a viable option.

4.4. Operating mode

Unlike the CDM, emissions credits from voluntary carbon offset project activities do not result from a unique overseeing authority, a common set of rules, procedures and standards, or centralized registry (Kollmuss et al., 2008). Instead, a number of independent standards, verification procedures and registries that rely on third party verifiers have emerged trying to guarantee the quality of the offset traded in the market (Estrada et al., 2008). Given that the CDM project certification procedure is long, complex and costly (Michaelowa & Jotzo, 2005; Olivas et al., 2005; Ellis & Kamel, 2007), it is therefore not adapted to very small-scale

projects (as often in the case of voluntary carbon offset) because of high transaction costs, that could reduce the viability of these projects. The voluntary offsetting service providers use their own standards to choose and verify their projects according to their own criteria, giving rise to verified emissions reductions (VERs). Apart from the official CDM/JI standards and the CDM Gold Standard, used in the regulated carbon offset markets (CDM/JI markets), a range of other standards is used by voluntary offsetting service providers. Thereby, according to Peters-Stanley et al. (2011), about 16 public voluntary offset standards and certification programs were identified until 2010 as mentioned in Table 2 below, and registries are diversified too.

Table 2: Offset Standards in the Voluntary Carbon Offset Markets, 2010

Standards	Co-benefits	Geographic scope	Total VERs Verified
American Carbon Registry Standard	No	Global	31.3 $MtCO_2e$
Brazil Mata Viva Standard	Yes	Brazil	0.0 $MtCO_2e$
CarbonFix Standard	Yes	International	0.7 $MtCO_2e$
Chicago Climate Exchange Offset Program	No	Global (USA)	83.5 $MtCO_2e$
Climate Action Reserve	No	USA, Mexico, Canada	11.7 $MtCO_2e$
Climate, Community and Biodiversity Standard	Yes	International	VERs not issued
EPA Climate Leaders Offset Guidance	No	International	None
Gold Standard	Yes	International	4.6 $MtCO_2e$
Green-e Climate	No	International	176.2 tCO_2e
ISO 14064/14065	No	International	Unknown
J-VER	No	Japan	34,148 tCO_2e
Panda Standard	Yes	China	0.0$MtCO_2e$
Plan Vivo System	Yes	International	1.0 $MtCO_2e$
SOCIALCARBON Standard	Yes	South America, Asia & Europe	1.5 $MtCO_2e$
VER+ Standard	No	International	3.7 $MtCO_2e$
Verified Carbon Standard	No	International	49.4 $MtCO_2e$

Source: Adapted from Peters-Stanley et al., 2011

Differences among them include the contribution to sustainable development versus emissions reductions; the type of project covered (forest versus energy); the geographical scope (international versus national/local); the share of market in terms of volume (tCO_2e) transactions (Peters-Stanley et al., 2011). Especially on the transactions point of view, there are variations from one year to another. However, during 2010, the Verified Carbon Standard (VCS) maintained its historic level of transaction with about 28 $MtCO_2e$ versus 16 $MtCO_2e$ in 2009, while the Gold Standard remained at 6 $MtCO_2e$ versus 3 $MtCO_2e$ in 2009 (Peters-Stanley et al., 2011). On the price point view ($/tCO_2e$), the volume-weighted average price of carbon credits traded in the voluntary market fell slightly to $ 6/tCO_2e in 2010, down from $ 6.5/tCO_2e in 2009, with disparities between project types: $ 16/tCO_2e for solar; $ 11/tCO_2e for geothermal; $ 5/tCO_2e for REDD/avoided conversion; $ 2/tCO_2e for large hydro; etc. (Peters-Stanley et al., 2011). As in the case of CDM, this section is devoted to the analysis of the operating mode of voluntary market which consists of the following steps: terms of realization; project cycle in the voluntary offset schemes; type of project activities in the voluntary carbon offset market; main actors involved in voluntary carbon offset markets and online calculators of voluntary offset providers.

4.4.1. Terms of realization

Even if voluntary carbon offset scheme may appear, by nature, to be a flexible, unrestrictive mechanism, developing it raises similar questions to those concerning the highly structured CDM. Thereby, voluntary carbon offset buyers can choose if they want to buy offsets that come from CDM/JI projects (CERs/ERUs) or offsets that come from projects implemented exclusively for the voluntary market (VERs). According to Butzengeiger (2005), some voluntary carbon offset buyers apply directly for offsets that come from CDM/JI (i.e. CERs/ERUs) for their discerning customers. Nevertheless, their share in this voluntary market is still less important (Butzengeiger, 2005): 3.6% and 1.8% from CDM and JI respectively, against 94.6% from voluntary offset exclusively by 2004.

Therefore, to be valid, conditions are laid down for voluntary carbon offset programs. This is why it must comply with a number of criteria, even if the decision to purchase offsets is voluntary in order to make credits eligible. According to Hamilton et al. (2008a), companies should not consider performance optimal, and given the emergent standards and complex financial instruments involved, sub-performance of just one among the key criteria can render the offset virtually worthless. As in the case of the CDM, the bare minimum parameters for ensuring credibility must exist in the voluntary offset projects. Thus projects must be additional and credit reduction must be real, measurable, permanent and verifiable (Hamilton et al., 2008a). In the way they have been presented, these requirements come very close to the CDM project requirements of the Kyoto Protocol in terms of strictness. Their pertinence lies in the care given towards developing common references on which to build a trustworthy framework for implementing these voluntary offset operations, so that ideas such as synchronizing terms and above all transparency in relaying information relative to this mechanism might be unambiguous.

4.4.2. Project cycle in the voluntary offset schemes

In the voluntary carbon offset schemes, the most complete existing standards include a project cycle similar to the CDM compliance scheme, encompassing validation, monitoring, and verification; project registration is also a requirement under many voluntary offset schemes (Estrada et al., 2008). However, following the example of the CDM scheme, independent third party[5] verification is also widely used in the voluntary carbon offset market. According to Hamilton et al. (2007), there is a largely use of third party verifiers in the voluntary carbon offset market rather than the customers' and sellers' own verification procedures. Standards and registries involved in the procedures of this system are also diversified as mentioned in the previous sections (Table 2). Nevertheless, given that the voluntary offset projects do not follow exactly the same rigorous procedures as in the Kyoto projects (CDM) and within their variety of standards and registries, there is still a risk that all these requirements would not be respected. Synchronizing the operations involved in this

[5] An independent third party is required to verify the emissions reductions; this may be carried out by entities accredited by the UNFCCC to conduct similar activities for CER projects, or by professional environmental consultancies.

mechanism could therefore make it much stricter and fit it into the framework of the other institutionalized mechanisms, as in the example of the CDM/JI.

4.4.3. Type of project activities in the voluntary carbon offset market

In the voluntary carbon offset schemes, carbon most projects can be grouped by type of project. Most projects may be broadly categorized into bio-sequestration (sinks), industrial gases, landfill methane, energy efficiency, and renewable energy projects (Harris, 2007; Kollmuss et al., 2008; Hamilton et al., 2010). Not all project types are equally effective at delivering the emissions reductions that they initially set out to deliver. With new developments, the voluntary carbon offset scheme cover a wide range of projects within such covered by the CDM, as shown in Figure 6.

Furthermore, small projects and forestry projects are much more prevalent in voluntary offsetting and numerous projects take place in industrialized countries, whether they have engaged in the Kyoto Protocol or not (Harris, 2007), contrary to CDM projects which are carried out exclusively in developing countries. According to ADEME (2007), a complete dichotomy can be seen between American and European providers: all the American operators without exception have developed projects exclusively on their own territory while all the European operators propose the bulk of offsetting projects in developing countries, and for most of these cases, in these developing countries exclusively. It has been suggested that customers sometimes prefer projects located near home, where they seem more tangible, a trend particularly noted in North America (Harris, 2007). Indeed, the State of Voluntary Carbon Markets Report (Peters-Stanley et al., 2011), notes that in line with project location, companies headquartered in North America supplied the majority of emissions credits transacted in 2010 (36% of the total of 131 $MtCO_2e$), and the USA remain with a wide share of the emissions credits verified in 2010 as mentioned in Table 4.

4.4.4. Main actors involved in voluntary carbon offset markets

Designing, implementing and operating a carbon offset project also require the involvement of a large number of parties, stakeholders and authorities as underlined in the CDM projects case. In the case of voluntary carbon offset, there are many actors involved in the project implementation. According (Kollmuss et al. 2008), even though the parties involved differ from project to project, some general categories and types of stakeholders can be identified including project owners, project developers, project funders, stakeholders, third-party auditors, validators and verifiers, standards organization, brokers and exchanges, traders, offset providers and final buyers or consumers (Figure 4).

According to several authors (Hamilton et al., 2008; Hamilton et al. 2010; Peters-Stanley et al. 2011), depending on their position in the supply chain, sellers can be categorized at four major levels, including:

- Project developers who develop GHG offset projects and sell carbon to aggregators, retailers, or final customers ;
- Wholesalers (or aggregators) who sell only offsets in bulk and have ownership of a portfolio of emissions credits ;
- Retailers who sell small amounts of credits to individuals or organizations, usually online, and have ownership of a portfolio of emissions credits ; and
- Brokers, who do not own emissions credits, but facilitate transactions between sellers and buyers.

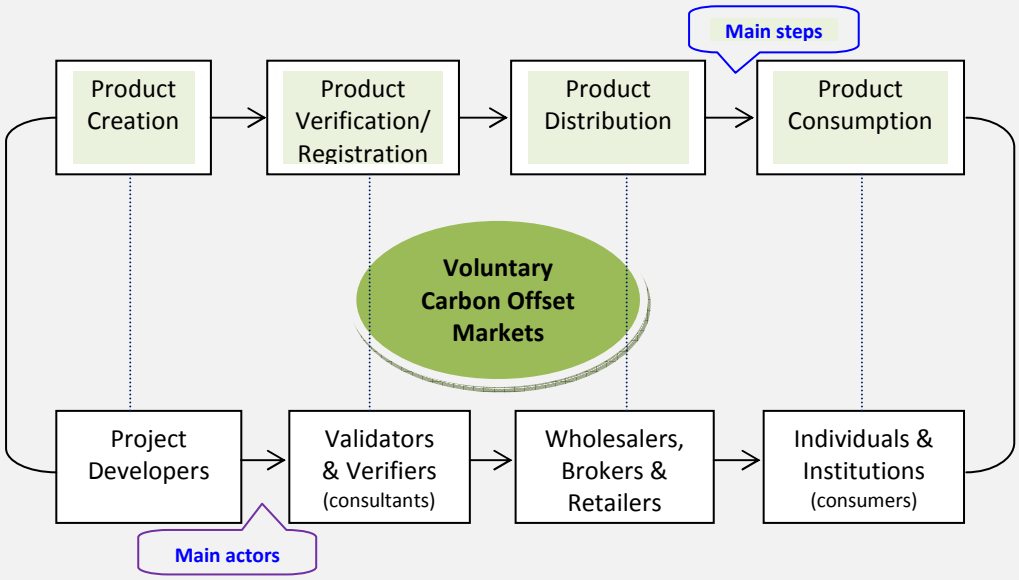

Fig. 4. Simplified Supply Chain of the Voluntary Carbon Markets

Source: Adapted from Hamilton et al. 2009.

Within the voluntary offset market, these definitions given above are often blurred, and some organizations frequently operate in more than one category type. Many suppliers, for instance, are engaged in business activities other than selling VERs (Hamilton et al., 2008). In the supply chain of the voluntary carbon market, in addition to these stakeholders mentioned previously, other actors can be added including independent or accredited third-party verifiers responsible for product verification and registration and individuals and institutions as final consumers, as shown in Figure 4 above.

As a market driven by entities choosing to minimize their climate impact on their own agreement, both non-profit and for-profit (commercial) organizations supply carbon offsets, and from all organizations specified, the vast majority were non-profit companies (Figure 5). In 2010, Ecosystem Marketplace and Bloomberg New Energy Finance (Peters-Stanley et al., 2011) carried out a survey of organizations (suppliers) involved in the voluntary carbon offset market process and organizations were identified. They include the above-mentioned categories including: project developers, retailers, wholesalers, and brokers. Since many organizations can wear several hats at the same time, the total number of organizations across the supply chain exceeds the numbers of suppliers that exist. Thus, there were 199 project developers, 92 retailers, 72 wholesalers, and 48 brokers (Peters-Stanley et al., 2011).

The number of companies operating as project developers and/or retailers is larger than any of the other categories.

Companies involved in the voluntary carbon offset market can be distinguished in two main categories: non-profit and for-profit organizations. Nevertheless, since 2010, a new category of suppliers emerges: public sector organizations but which still remain a few (Figure 5). According to Hamilton et al. (2010), while non-profit organizations pioneered the market, since 2004 they have been outnumbered by private companies, as shown in Figure 5 below. Although they did not see a tremendous growth in number in 2009, they did see a comeback in market activity Hamilton et al. (2010). Though commercial firms in the voluntary carbon offset markets continue to dominate transaction volume, their market share fell from 94% in 2008 to 91% in 2009, while the growth in non-profit market share was reciprocal, increasing from 6% of transaction volume in 2008 to 9% in 2009 (Hamilton et al., 2010). However, both non-profit and for-profit market shares held steady in 2010 (Peters-Stanley et al., 2011).

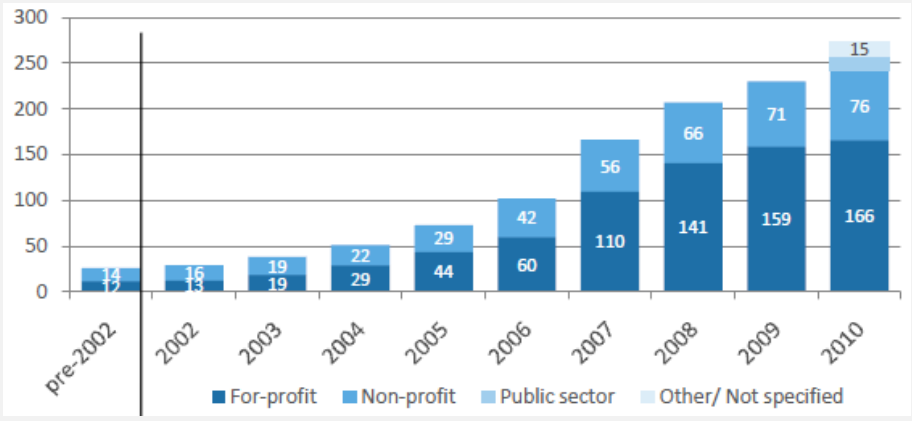

Fig. 5. Cumulative Suppliers by Profit vs. Non-Profit Organization Types

Source: Peters-Stanley et al., 2011.

4.4.5. Online calculators of voluntary offset providers

As mentioned above, voluntary carbon offset providers have developed online calculators for estimating how many emissions are offset and at what price. But the calculators offered on the websites of the different carbon offset providers show a wide variation in results, as much for the amounts of emissions saved as for the prices per ton of CO_2 proposed. To give a better comparison of how offset companies calculate and price their emissions, Harris (2007) compared two sample flights (a short domestic flight and an international flight), and his results show that there is a wide variety of results for CO_2 emissions over the same theoretical distance, in terms of the volume of emissions to reduce and the price per tCO_2e. In the same way, we have taken an illustrative example of an international flight, Brussels-Brasilia, and we compared offers of some different voluntary carbon offset providers as shown in Table 3.

Table 3: Example of calculations for an International flight Brussels - Brasilia

Company	Distance (km)	Emissions (tCO_2)	Cost to offset (€)	Cost/tCO_2 (€)
Atmosfair	---	6.340	147.00	23.19
Carbonfund	16021	1.790	24.14	13.49
Carbon neutral	---	1.620	31.58	19.49
Climatecare	17981	2.600	71.52	27.51
Climat Mundi	17981	3.960	75.16	18.98
CO2solidaire	---	3.950	95.00	24.05
Myclimate	18014	3.799	95.60	25.17
CO2logic	17940	3.950	86.90	22.00
Action Carbone	17972	3.954	79.08	20.00

Source: Authors' calculations based on companies' websites

In comparing the offers made by carbon offset providers, it is clear that the way of calculating emissions is not standard; each carbon offset provider has developed his own calculating system. A first reading of the different figures in this table leads us straightaway to two significant observations in the differences: in calculating emissions and prices per ton. We may then wonder why these differences are there! On the one hand, we can see discrepancies in the calculations for the emissions of CO_2 per round trip. These differences can be justified by the fact that the CO_2 emissions brought about by the passengers depend on several factors including type of plane, occupancy rate, speed and flight altitude, trajectory, take-off and landing times, origin and type of emissions taken into account (CO_2 alone or all GHGs together, emissions from aviation, road traffic, shipping and home energy consumption) (Heughebaert, 2006; ADEME, 2007). Under such conditions, it is therefore impossible to be really specific. It is nearly impossible to give a precise overview of current offset market prices, as the market is considerably fragmented due to the variety of available standards, projects types and locations, offset qualities, delivery guarantees, contract terms and conditions, etc.

The variability in prices creates a buzz, and the different quality labels and steps towards good management may allow for a progression towards better standardization of products and the emergence of a real market. It was with that in mind that some governments have expressed concern about the lack of quality control in the voluntary carbon offset market and are starting to explore possibilities to regulate the voluntary market (Kollmuss et al., 2008), including among others DEFRA (UK), Norwegian Government, US House of Representatives' Select Committee on Energy Independence and Global warming in the USA and ADEME (France) (ADEME, 2008; DEFRA, 2008; Kollmuss et al., 2008). Otherwise, on-line calculators cannot be divorced from the purpose for which emissions are being calculated. Indeed, the purpose of the website, its emissions' accounting status, or non-profit project based status, has implications for how we view the methodology used to calculate how much carbon the individual or organization should account for (Murray & Dey 2009).

4.5. Volume and value of the voluntary carbon offset markets

Project activities that reduce or avoid carbon emissions are the source of emissions credits in voluntary carbon offset market as well as in the regulated one. Each project activity is differentiated by its technology, location, and potential co-benefits, i.e. environmental and social contributions (Peters-Stanley et al., 2011). While the CDM keeps statistics on what percentage of projects emissions are realized in each project category, fewer statistics currently exist for voluntary market (Kollmuss et al., 2008). However, Table 4 below shows the emissions credits in the voluntary carbon offset scheme by 2010 in the main sectors.

Table 4: Volume of tCO_2e per Project Type and Region

Region	Forestry and Land Use	Methane	Renewable Energy	Energy Efficiency & Fuel-Switching	Other/Not specified	Total
US	6,562,193	10,276,751	389,839	6,332	4,219,261	**21,454,376**
Latin America	15,802,448	27,294	546,460	827,309	208,000	**17,411,511**
Asia	1,756,957	538,887	6,827,561	849,504	93,257	**10,066,166**
Europe (non-EU)	-	1,487,775	3,643,369	-	-	**5,131,144**
Africa	2,029,788	50,900	503,900	67,472	437	**3,652,497**
Canada	1,109,762	39,907	112,537	61,000	-	**1,323,206**
AU/NZ	25,000	21,807	61,555	450	-	**108,812**
EU	173,563	31,184	-	-	8,541	**213,288**
Mixed	176,500	84,590	462,180	40,000	2,056,511	**2,819,781**
Total	**27,636,211**	**12,559,095**	**12,547,401**	**1,852,067**	**6,586,007**	**48,634,245**

Source: Adapted from Peters-Stanley et al., 2011.

After their drop in 2009 of more than 24% in volume and 45% in value from 2008 (Hamilton et al., 2010), the voluntary carbon offset markets show growth in 2010's transactions, as can be seen in the State of Voluntary Carbon Market 2011. In fact, 131.2 $MtCO_2e$ were traded, valued at $ 424 million in 2010, representing an increase of more than 34% in volume and almost stability in value from 2009, which were 98 $MtCO_2e$ and $ 415 million respectively (Peters-Stanley et al., 2011). However, the volume of carbon emissions credits traded in 2010 represents less than a 2% share of the global carbon markets of 6,823 $MtCO_2e$ (Peters-Stanley et al., 2011). According to Hamilton et al. (2010), this drop in volume can largely be attributed to two major challenges: the global economic crisis and uncertainty surrounding the prospects for new compliance demand. Even in the voluntary carbon markets the recent economic recession has left its mark: the initiatives that numerous companies would have undertaken to cut back on emissions have been reduced, including offsetting emissions (Hamilton et al., 2010).

At a sectoral level, the State of Voluntary Carbon Markets 2011 Report (Peters-Stanley et al. 2011) has noted that land use-based projects (forest projects, typically forestry and other land-based credits) supplied the largest volume (28 $MtCO_2e$) from 2010. The leader of all project types transacted was REDD (17.8 $MtCO_2e$). This reflects a strong customer preference for projects involving sinks, probably due to the other associated attributes such as biodiversity which can be strong marketing tools. According to the same Report, REDD

type projects are followed by landfill methane ones (with 9.9 $MtCO_2e$) and wind (with 6.7 $MtCO_2e$). Figure 6 shows that several macro-level trends underline voluntary demand for these project types.

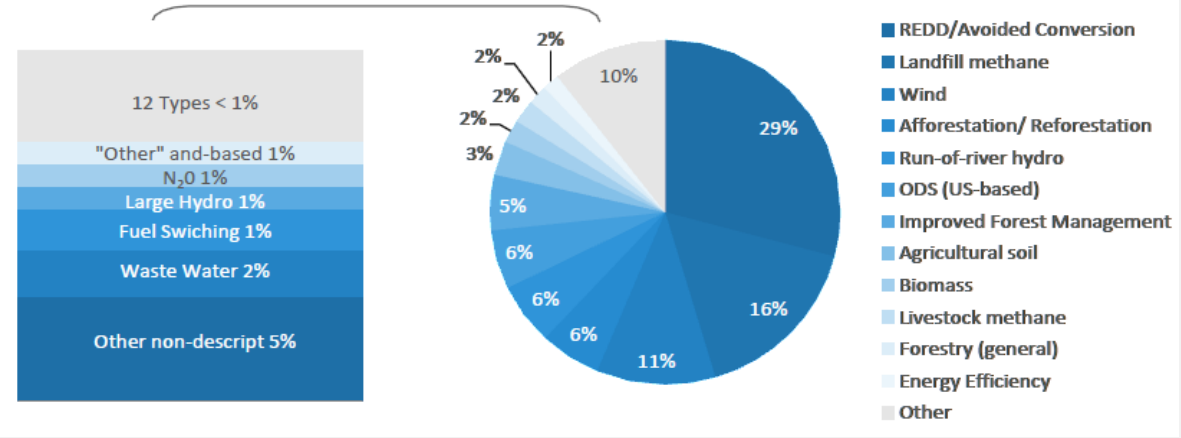

Figure 6: Market Share ($MtCO_2e$) by project types

Source: From Peters-Stanley et al. 2011

5. Complementary or competitive aspects of the two carbon offset markets

We have explored two types of project mechanisms (regulated and voluntary) based on the achievement of carbon offset markets. To date, the voluntary carbon offset markets involve both regulated (Kyoto: CDM/JI) and voluntary emissions credits while the regulated carbon offset markets recognize only Kyoto (CDM/JI) emissions credits, as shown in Figure 7 below.

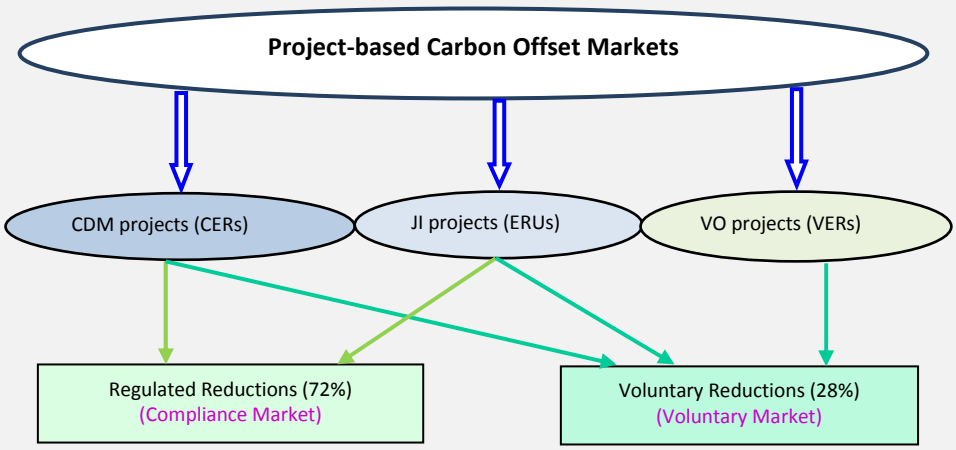

Fig. 7. Schematic diagram of project-based Carbon Offset Markets

Source: Adapted from Heughebaert, 2006.

According to Hamilton et al. (2010), regulated (Kyoto: CDM/JI) reductions and voluntary reductions represented 72% and 28% (respectively) of the volume of emissions credits-based transactions in 2009. The comparative analysis of the CDM compliance scheme and voluntary offset programs dealt with in this part will concentrate particularly on the

following aspects: the objectives of these carbon offset schemes; their regulatory system, standards and registries; the project type and credit-related volume; the project activities location and types of emissions offset; the types and origins of project funding; the types and uses of emissions credits from offset programs; the benefits from project activities-based carbon offset markets. These comparative analysis criteria have been chosen in agreement with the objective of this paper itself. It is from such a comparison that we will be able to judge the criteria for synergy or competition. A schematic comparison on these criteria is summarized in Table 5. We have seen fit to choose these criteria because they give good readability of all the different kinds of projects implemented from beginning to end.

5.1. Objectives of the two carbon offset schemes

The objectives of the two mechanisms are described in the previous paragraphs. By definition, the regulated (CDM) and the voluntary carbon offset schemes have to meet the same main objectives: the contribution towards stabilizing greenhouse gas emissions, thus contributing towards the Convention's ultimate objective and the contribution to sustainable development, but both don't give the same importance for the all objectives. Regulated (CDM) carbon offset scheme attaches the great importance on the first objective while the voluntary carbon offset schemes pursue widely the second one. Given that small-scale projects have the added value of offsetting emissions but also bringing tangible and significant benefits for the local population of developing countries (Sterk & Bunse, 2004), and these projects exist in the two systems, they all fit better in a sustainable development approach.

This means that the two mechanisms reinforce each other: they are complementary, since they target the same main goal of stabilizing the world's climate, and contribute towards guaranteeing benefits to local people in a sustainable way in developing countries, even if they contribute to these goals at different levels. Moreover, as the voluntary carbon offset markets serve as a niche for micro projects that are too small to warrant the administrative burden of CDM or for projects currently not covered under compliance schemes, this reinforces their complementarity.

5.2. Regulatory system, standards and registries

The regulation of the CDM carbon offset market is a coordinated system by bodies internationally recognized, within United Nations, including the COP/MOP, the Executive Board, the designated operational entities, the designated National authorities. Currently, a good number of rules, modalities, procedures and directive lines relative to the CDM are the subject of continuous negotiations in the different international conferences on climate, and different propositions for their simplification and their implementation are always being brought up. Moreover, have to be mentioned the following CDM tools: a unique centralized registry; two offsets quality standards (CDM and CDM Gold Standard); a unique centralized reference website for the CDM, where information relating to different CDM activities is

produced regularly; and the same price of carbon emissions credits ($/tCO$_2$e) [by type of project] which evolves according to the law of supply and demand.

In the case of voluntary carbon offset markets, each offset company has developed its own rules, and if we take a close look at the different companies' websites involved in the voluntary offset market, we can see that they do not charge the same price per tCO$_2$e (Table 3). Moreover, there is no single standard form of regulation for this as yet. These markets require a wide range of standards, there were 16 standards by 2010 (Peters-Stanley et al. 2011), and registries each one offset company uses his own methodology to fix the price, depending on the projects he is financing. This could discredit the legitimacy of this step otherwise judged potentially promising (Bayon et al., 2007). In order to promote this mechanism, which does contribute to safeguarding the climate globally, extensive changes in its working become indispensable, even simply to satisfy some investors and carbon offset customers, who are more concerned about strictness and quality products. Regardless of their strategies for implementation (regulated versus non-regulated way) the two carbon offset markets managed to achieve their respective goals without overlap. This demonstrates that they complete each over mutually.

5.3. Project type and carbon credits volume

In terms of the nature of projects implemented, there are some differences between the CDM and voluntary carbon offset schemes. The CDM covers all types of eligible projects listed in UNEP-Risoe Centre CDM/JI pipeline (Table 1). Project activities-related to industrial gases reduction (HFCs, PFCs & N_2O), Renewable energy (hydro & wind), and landfill gas (CH_4 reduction) dominate transactions. For voluntary carbon offset scheme, a wide range of these projects is also implemented, but this mechanism includes also other projects currently not covered under the CDM compliance scheme (Figure 6), and this increases the scope of project activities. In 2010, their success was registered especially in biological projects (REDD, forestry…), landfill methane, renewable energy (especially wind) (Peters-Stanley et al., 2011).

Concerning credit volume share per type of project, the regulated (CDM) system registered a wide range of projects, particularly CO_2 energy projects (35%); industrial processes HFCs, PFCs & N_2O reduction (27%); and CH_4 reduction (20%) (Fenhann, 2012), as shown also in Table 1. According to Peters-Stanley et al. (2011), the success for voluntary carbon offset schemes registered in 2010 comes from land-based projects (sinks), specifically from REED projects (29%); landfill methane projects (16%); wind (11%); afforestation/reforestation (6%), as shown in Figure 6. But these voluntary carbon offset markets remain a small fraction (about a 2% share of transactions in 2010) of all global carbon markets (Peters-Stanley et al. 2011). This is because Kyoto credits are much more in demand than those from offsetting programs, not only in their ability to meet the Kyoto compliance requirements, but also in the matter of economic questions, especially for the private sector, which wants to achieve a

capital gain on the carbon markets[6]. Moreover, Kyoto credits are also used in the voluntary market, as mentioned in Figure 7.

Exploiting the same kinds of projects could indicate that the potential in these project sectors still remains important. All the same, in the event of a lack in location where projects could be set up, which has not happened yet, these project mechanisms would begin to compete with each other to find carbon credits to satisfy their respective customers. It needs to be mentioned however that this potential competition is far from taking place, if we notice that some potentialities have not yet been exploited in certain areas of least developed countries (LDC), especially in sub-Saharan Africa. In fact, the World Bank study (De Gouvello et al., 2008) reveals a potential estimated to more than 3,200 project activities involving carbon emissions, likely to generate more than 740 $MtCO_2e$ per year of emissions reductions. These would correspond to an installed capacity of more than 170 GW of additional renewable power, i.e. about 1,245 TWh of annual electricity generation (Timilsina et al., 2010).

5.4. Project activities location and type of emissions offset

The Kyoto Protocol and the Marrakech Accords state clearly that CDM project activities are to be carried out exclusively in developing countries which are Parties to Kyoto Protocol (Decision 17/CP7). The emissions credits (CERs) from CDM project activities are used to offset greenhouse gas emissions in industrialized countries produced in their different socio-economic sectors. Contrary to CDM project activities, voluntary offset project activities are carried out around the world in industrialized countries as well as in developing countries, whether they are Parties to the previous instrument or not (Hamilton et al., 2010). Alongside the emissions offset by the CDM project activities, voluntary offsetting involves emissions linked to different events; air traffic emissions; shipping emissions; emissions from homes and administrations (Hamilton et al., 2007).Thus, this latter mechanism would have the merit of including the maximum potential emissions reductions, if it were not voluntary, allowing a large GHG emissions reduction.

Given that the voluntary carbon offset markets also cover some emissions not yet under the umbrella of the international bodies involved in the UNFCCC, this demonstrates once more the complementary feature of the two carbon offset markets. Furthermore, extending projects to include countries that are not Parties to the Kyoto Protocol as well as to countries other than only developing countries reinforces this complementarity, as the scope of development and accomplishment of the different project activities is far greater than can be contained. Nevertheless, the fact that the voluntary offset projects are implemented in developed countries could reduce to a lesser extent co-benefits involved in these project activities for developing countries, especially for Least Developed Countries.

[6] Some investors anticipate a price increase on the carbon exchange and so look either for a way of avoiding to pay the high carbon price for compliance purposes, or for a way to achieve a profit by re-selling these assets later at a higher price (Bellassen & Leguet, 2007).

5.5. Type and origin of financing involved in carbon offset schemes

We have seen previously that CDM project activities are financed by government and private sources which allow CO_2 investment funds to be set up in public, private or mixed finance. It should be noted that these investments aim to achieving compliance with Kyoto Protocol, as in the case of funds from government sources, or simply capital gain, especially funds coming from private sources (Bellassen & Leguet, 2007). Such funds are often paid out with this constraint to Kyoto compliance, contrary to voluntary carbon offset schemes, where funding is the result of the willingness of one natural or legal entity who, conscious of the impact his actions have on the environment globally, chooses to finance projects which contribute towards stabilizing GHG emissions in the atmosphere.

Unlike the regulated markets, like the CDM, individuals can also invest in the voluntary carbon offset markets, thereby enlarging the scope of carbon finance and even reinforcing the complementary feature of the two carbon offset schemes in stabilizing greenhouse gas emissions and providing co-benefits which contribute to sustainable development. Even if the voluntary carbon offset markets remain a small fraction of all carbon markets, as mentioned above (Linacre et al., 2011), investment involved in these types of carbon offset markets, weak as it may be, remains additional to the investment achieved by the funds invested in the Kyoto assets, and demonstrates once again the complementarity aspect in terms of financing.

5.6. End-use of emissions credits from carbon offset schemes

CDM project activities generate carbon credits which are certified by an operational entity which has been given its mandate by the United Nations, specially the Executive Board: these are certified emissions reductions (CERs). In the same way as for voluntary carbon offset schemes, project activities generate other carbon credits verified by independent or accredited verification organisms, as verified emissions reductions (VERs). Carbon emissions credits coming from CDM project activities are used in compliance with the Kyoto Protocol for Parties and companies who have agreed to the Kyoto commitments. Otherwise, they can be purchased for capital gain by the actors of the private sector who will sell them on the secondary carbon market (Linacre et al., 2011). In some cases, so as to maintain standards of quality and strictness, some clients of carbon offset providers will demand emissions credits from Kyoto project activities (CDM/JI), which in turn creates some competition for these regulated market emission credits.

Moreover, emissions credits from voluntary offset project activities are neither used for conformity nor exchangeable on the regulated market (Figure 7), but they are used by offset clients, once they have become aware of it, to neutralize emissions linked to their activities. Even if competition arises, a big demand for CDM emissions credits should encourage the promotion of related project activities, given that the scope of development and project achievement still remains fairly wide, as shown in the case of the World Bank study for

countries in Sub-Saharan Africa (De Gouvello et al., 2008). In this case it will be easier to speak about positive competition, as this latter competition could be an incitement for exploring and exploiting new scope in other sectors.

5.7. Benefits from project activities-based carbon offset markets

CDM project activities and voluntary project activities, both carbon offset project activities, can provide multiple benefits, including environmental protection (improving the quality of air-water-land), infrastructure development, employment creation, health improvement, education and training, provision of energy services to the poor local communities, growth improvement (Sterk & Bunse, 2004; Olsen & Fenhann, 2008). Some of the best offset project activities combine the Millennium Development Goals of poverty reduction with climate protection (Kollmuss & Bowell, 2007), so providing a threefold advantage in the context of sustainable development. This situation points out well the complementarity reinforcing these two mechanisms. In fact benefits will accumulate in both cases, in terms of environmental, social and economic aspects, guaranteeing their contribution to local development, as project activities involved in the two systems (the small ones) bring tangible and significant benefits to local people (Sterk & Bunse, 2004).

Nevertheless, as mentioned above, the main priority of voluntary carbon offset schemes is not achieving low mitigation costs, as his share in the global carbon market remains very small: about 2% by 2010 (Peters-Stanley et al., 2011), but they often pursue wider environmental and social benefits. Moreover, even if co-benefits exist potentially in the CDM context, they are very low in practice as this mechanism lies attached to greenhouse gas emissions mitigation. According to Sutter & Parreno (2007), projects likely to provide these advantages (usually small ones in renewable energy, energy efficiency, and waste management) represent a small share in the accounting carbon credits. In fact, while a large part (72%) of the total expected CERs are likely to represent real and measurable emissions reductions, less than a 1% share is likely to contribute significantly to sustainable development in the host country (Sutter & Parreno 2007).

In addition to the benefits registered from local populations in host countries and from atmosphere in particularly, other advantages can be noted (especially for CDM carbon credits) in terms of low costs compliance for countries under Kyoto commitments and in terms of capital gain for the actors of the private sector who operate on the secondary carbon market. Moreover, in the case of voluntary carbon offset projects, there are promotions of brand and reputation for the products offered to partners and customers, and awareness of environmental issues extends to all businesses, institutions and individuals who agree to participate in this kind of market. Otherwise, these carbon offset schemes have created a functional international carbon market which can contribute to increase worldwide transactions. This shows once again that the benefits of both carbon offset markets mutually reinforce each other.

6. Concluding summary

After exploring the two carbon offset systems, we compared them according to a few criteria developed above: carbon offset schemes objectives; regulatory system, standards and registries; type of projects and volume emission credits; project location and type of emissions offset; final use of emissions credits from carbon offset schemes; financing involved in carbon offset schemes; and benefits from project activities-based carbon offset markets.

The comparative analysis which was carried out on the above mentioned criteria for these two mechanisms has revealed that they are much more complementary than competitive. Complementarity stands out much more with regard to the following criteria: their objectives; the type of projects concerned; their location and the emissions to be offset; the type and origin of project financing; and benefits from the project activities. The cases where competition will prevail, especially the final use of emissions credits from carbon offset schemes, still remain hypothetical. Indeed, the demand for carbon credits on the market may be more important than the supply, since on the one hand, the need to comply to Kyoto Protocol can be felt all the more, and on the other hand some voluntary carbon offset providers turn to Kyoto carbon credits to satisfy their clients who are anxious about quality and strictness.

Another situation could arise if there were insufficient land or potential for setting up a project (which is still far from being the case!), and the promoters of project activities would argue over land in their search for projects to set up. In both cases, a situation like this would have more of a stimulating effect in promoting new projects, which would be much more innovative and consequently of a higher quality. This would be especially true for holders of investment funds in the private sector wanting to achieve a capital gain, but also for actors who have agreed to meet the Kyoto Protocol commitments. Otherwise, the World Bank study (De Gouvello et al., 2008) has revealed a large, diversified range of CDM opportunities across Sub-Saharan Africa's energy sector which could be implemented in this region, providing substantial benefits in terms of emissions reductions (CERs) and contributing to sustainable development, as mentioned above.

In Table 5 below, we summarize this comparison. This vision gives us an idea of their synergy or competition to achieve, among other main objectives, an effective contribution towards stabilizing the concentration of greenhouse gas emissions in the atmosphere and towards contributing to sustainable development.

Table 5: Summary of comparison between the regulated (CDM) and voluntary carbon offset markets

Criteria	Regulated (CDM) carbon offset market	Voluntary carbon offset markets
Objectives of the carbon offset schemes	Contribute to climate protection by stabilizing GHG emissions; complete domestic measures and policies; provide co-benefits (social and environment benefits: sustainable development); and comply with Kyoto commitments.	Provide co-benefits (social and environment benefits: sustainable development); assert brand and best reputation; and contribute to climate protection by stabilizing GHG emissions.
Regulatory system and standards/registries	Regulated market: CDM compliance scheme is placed under the UN authorities; all decisions are adopted by bodies recognized internationally. Regulation is standardized. CDM compliance scheme recognize two standards: Official CDM and CDM Gold Standard. The regulated (CDM) carbon offset scheme uses a unique centralized registry.	Non-regulated market: in voluntary carbon offset schemes, each offset service provider has developed his own offsetting rules and procedures. Regulation is not standardized. Voluntary carbon offset markets use diversified standards and registries: there were 16 standards for voluntary carbon offset schemes in 2010 including the Gold Standard for VERs (Table 2).
Type of projects and volume of credits.	CDM compliance scheme covers a wide range of types of projects listed in UNEP-Risoe Centre CDM/JI pipeline (Table 1). They include both small-scale and large-scale project type. Volume of emissions credits is important: its share was about 64% volume of global carbon market of project-based transactions in 2009 (211 $MtCO_2e$). [The JI remain with about 8% or 26 $MtCO_2e$].	Voluntary carbon offset schemes also cover a wide range of project types and includes also other projects currently not covered under the CDM compliance scheme (Figure 6). Many of projects are small-scale type. Volume of credits is weak: its share represented more than 28% volume of global carbon market of project-based transactions in 2009 (94 $MtCO_2e$).
Project location and type of emissions offset	All projects are located in developing countries, Parties to the UNFCCC and Kyoto Protocol. In the CDM compliance context, emissions credits are used to offset GHG emissions from industrialized countries produced in their different socio-economic sectors.	Projects are located in developing as well as industrialized countries, parties to UNFCCC and Kyoto Protocol or not. From voluntary programs, credits are used to offset (among others) GHG emissions related to different activities including: aviation, shipping, road travel, various events, administrations…
End-use of credits	There is a unique type of emissions credits (CERs) used in the regulated (CDM) carbon offset scheme. They are used in the context of cost-effective compliance to Kyoto commitments, and in the context of capital gain (plus-value).	Voluntary carbon offset schemes use many types of emissions credits including: VERs, CERs and ERUs emissions credits. They are used in the context of offset only on the voluntary basis.
Financing involved	Public or private financial actors are involved in CDM project activities. Financing in regulated (CDM) carbon offset scheme come from government funds, private investors' funds and mixed funds public-private. Price ($/$tCO_2e$ or €/tCO_2e) in regulated (CDM) carbon offset market is higher than in the voluntary one.	Public or private financial actors are involved in the voluntary project activities. Financing in voluntary offset schemes come from institutions, communities, companies and individuals. Price ($/$tCO_2e$ or €/tCO_2e) in voluntary carbon offset market is lower than in the regulated (CDM) one.
Benefits/profits	Regulated (CDM) carbon offset scheme seeks cost-effective mitigation for industrialized countries; provides capital gain for private investors; and to a lesser extent, provides environmental and socio-economic impacts for host countries.	Voluntary carbon offset schemes focus on environmental and socio-economic impacts for host countries; promote brand and reputation for carbon offset consumers; allow the awareness of environmental issues; and to a lesser extent, allow the generation of emissions credits from project activities implemented.

Source : Authors

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