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The Clean Development Mechanism in Belgian Climate Policy

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The Clean Development Mechanism in Belgian climate policy

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VII. The Clean Development Mechanism in Belgian Climate Policy

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1 INTRODUCTION

The carbon market organised under the Kyoto Protocol makes use of the three so-called flexible mechanisms[1]: tradable permits, joint implementation (JI) and the clean development mechanism (CDM). While the two first instruments occur between industrialized (or Annex B) countries, the CDM involves developing countries that are not committed to carbon abatement under the first commitment period. These countries can be regarded as carbon abatement suppliers on a voluntary basis, considering the CDM as an opportunity to foster technological transfers. However, the CDM has long been neglected as an instrument for national climate policies in industrialized countries, despite the fact that its purpose was to help them to comply with their Kyoto commitment at low cost, while contributing to the human development in developing countries. In fact, it seems that the conditions for the achievement of this twin objective mainly depend on the response of industrialized countries. They will invest in CDM projects only if they significantly reduce their compliance cost; this will depend not only on some specific features of this instrument (related, for instance, to the procedure of accreditation), but also on the conditions prevailing on the world carbon market.

The purpose of this chapter is to tackle this issue by developing a partial equilibrium model of the carbon market at the world and Belgian levels, in which the key features of the CDM as a project-based instrument are considered. This model allows an evaluation of the optimal mix of instruments both at the Annex I countries level and in Belgium. We show that the conditions for the CDM to become a success story (at least during the Kyoto first commitment period) are today rather unlikely, due to the market outcome.

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[1] Hereafter we use the generic term *carbon* for all the greenhouses gases expressed in terms of global warming potential.

This chapter is organized as follows. Section 2 briefly describes the main issues related to the implementation of the CDM as a climate instrument. Section 3 shows how the CDM and the other flexible mechanisms interact in the carbon market. Section 4 presents the model and its assumptions. Results and policy implications are presented in Section 5. The last, concluding section summarizes our results.

2 IMPLEMENTING THE CDM

The CDM allows industrialised countries to finance investment projects for GHG emission reduction in developing countries so as to generate credits that can be used to meet their own commitments. Nonetheless, the Kyoto Protocol also states that CDM projects must contribute to the sustainable development of their host countries. This twin objective was explicitly confirmed in article 12 of the Protocol (UNFCCC, 1997).

The UNFCCC through the Marrakech Accords defines several requirements for CDM projects that are verified by a CDM Executive Board composed of representatives of Parties that have ratified the Kyoto Protocol (UNFCCC, 2001). Beyond the quantity of GHG reduction, they deal with the voluntary participation of the countries involved, the project's environmental impacts and the stakeholders' participation. In order to comply with the UNFCCC criteria, a CDM project will have to follow several steps: validation, registration, monitoring, verification and, finally, issuance of credits. All these steps are sources of additional costs that may be quite significant compared with the credit value obtained, especially for the smallest projects. In order to reduce the transaction costs for these small projects (which may be considered as particularly efficient in terms of contribution to the sustainable development[2]), the Marrakech Accords allowed for simplified modalities and procedures for small-scale CDM projects.

CDM projects can be financed by a single partner from an industrialized country (*bilateral* CDM), by a group of partners from industrialized countries (*multilateral* CDM), or by a single partner from a developing country who afterwards sells the credits to Annex I countries (*unilateral* CDM). Clearly these three structures may have different impacts on transaction costs, on the profit for the developing countries and on the technology transfer (Lussis, 2004).

The contribution to the sustainable development of host countries is not assessed by the Executive Board but by the host countries themselves. They indeed have the right to determine whether a project contributes or not to their sustainable development prior to its implementation. However, Boulanger (2004) shows that, despite the effort of the developing countries and the scientific community, there is no one methodology for assessing projects' impacts on sustainable development that has been universally accepted.

The additionality issue is probably the most controversial and the most difficult condition to demonstrate for a project developer. The credits resulting from a

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[2] See Boulanger (2004) for an analysis of the contribution of CDM projects to human development.

CDM project are calculated according to the difference between the emissions that would have been produced without the project (the baseline) and the emissions observed in the project's actual conditions. The measurement of the baseline constitutes the main source of uncertainty since, by definition, these emissions will never take place. It has been decided that the baselines of projects that are similar with regards to context and technology should be calculated using the same methodology, and then approved by the Executive Board. One major issue is to verify that a project would not have been implemented in the absence of the CDM. A project is different from the baseline, and therefore is able to reduce the GHG emissions, if there is at least one barrier preventing its implementation in a BAU scenario and if the CDM allows the removal of this barrier. Different kinds of barriers can avoid the implementation of the most environmental effective technologies: these include financial (profitability, capital resources), technological, cultural and institutional barriers (CDM Executive Board, 2004). A methodology has to produce the means to identify the existence, or the absence, of such barriers, and to demonstrate the impact of the project on GHG emissions.

The additionality issue raised several important questions from a methodological viewpoint. In particular, listing all emissions reduced or increased by a project can be very difficult because of the existence of both direct emissions (due to the technological change) and indirect emissions related to the life cycle of the product and fuel consumption, for instance (Lussis, 2002). These emissions outside the project boundaries (called leakages) are generally not included in the methodologies or are estimated with less precision than direct emissions are.

3 THE CDM IN THE CARBON MARKET

In industrialized countries, emission abatement options are fourfold. The country can abate domestically (whatever the policy instrument); it can buy tradable permits; it can support JI projects in other Annex I countries; or it can fund CDM projects in developing countries. As project-based instruments, the last two solutions are the most cumbersome to implement, and this is particularly true for the CDM for all the reasons mentioned above (procedure for accreditation, transactions costs, etc.). Moreover, all these instruments are obviously in competition. Each country will, naturally, seek the least expensive solution. Hence, the CDM will represent an attractive opportunity only if it is cost-effective, even with all its specific costs.

The twin-figures below illustrate the functioning of the carbon market in a static setting corresponding to the first commitment period. At the world level (Figure 1*a*) the demand for CDM projects (coming from Annex B countries) faces the supply (coming from developing countries), and this determines the equilibrium price p^* for assigned units. The width of the horizontal axis represents the abatement effort to which Annex B countries are committed. Demand and supply (net of the allowance of credits) are given by the marginal abatement cost curves of each region. Figure 1*b* displays the situation for an Annex B country. The equilibrium price p^* is taken as given. The abatement options consist in domestic abatement (with marginal costs represented by the curve mac^{DOM} of the right side), the purchase of permits (at price p^*) and the funding of CDM projects (with a supply curve represented by mac^{CDM} of the left side). The supply of CDM projects addressed to this particular country is a fraction of the global supply used in the Figure 1*a*.

These figures allow us to highlight two key properties of this market and their implications for climate policy. Firstly, the equilibrium price of carbon p^* depends heavily on the amount of CDM projects supplied worldwide. Large uncertainties remain on that issue (see below). Secondly, any decrease of the world carbon price reduces the relative attractiveness of both CDM projects and domestic measures for national climate policies in Annex I countries. This occurs to the advantage of tradable permits. All in all, at equilibrium, the more successful the CDM worldwide (in terms of amount of projects available at a given price), the less attractive it is for a single national climate policy[3]. We developed an applied partial equilibrium model to capture and evaluate these effects, with a special implementation for Belgium.

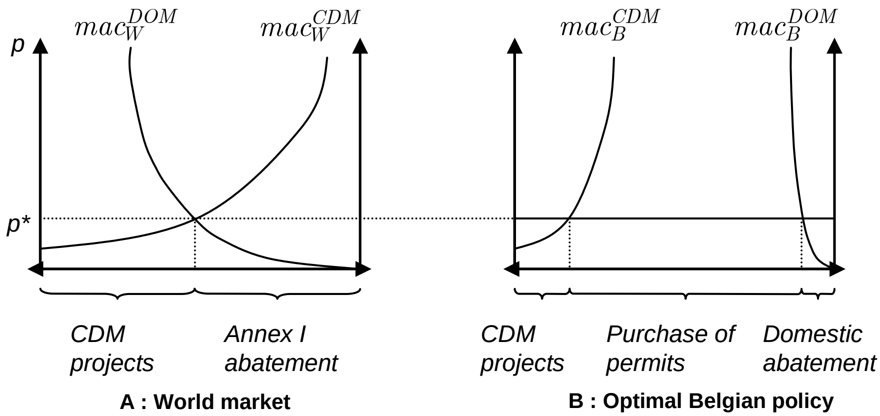

Figure 1.

4 THE MODEL AND ASSUMPTIONS

4.1 A world and nation-based carbon model

Our modelling framework consists of two nested models: a world model of the carbon market and a single-nation partial equilibrium model of optimal climate strategy. Modelling the world market allows us to determine the equilibrium price for carbon, whereas the single-nation market model sets the optimal strategy for a given country in terms of domestic abatement, purchase of permits, Joint Implementation and CDM projects implementations. Consider first an

[3] This holds in a country for which the market share does not increase too much and if the world demand elasticity for CDM projects is high enough (in absolute terms) at equilibrium.

Annex B country i and denote its Kyoto emissions target in 2010 e_i^{kyoto}. This represents an assigned amount of emission credits that can be exchanged on the world carbon market. Actual emissions e_i may differ from e_i^{kyoto} by funding CDM or Joint Implementation projects, and by selling or buying tradable permits. Hence, while committed to the Kyoto Protocol, the GDP of country i in 2010 will be given by y_i^{bau} less the cost of domestic abatement, $c_i(a_i)$, the purchase or selling of tradable permits at the market price and the funding of CDM project. We assume that each country wants to minimise its GDP loss when designing its climate policy, considering the fact that (*i*) its assigned amount of emission credits is given and that (*ii*) credits can be bought or sold on the international carbon market. Under perfect competition on that market, the formal condition for this minimisation problem is that emissions abatement is such that the marginal abatement cost equals the carbon market price. This condition also determines the optimal demand or supply of credits. What differentiates Annex I from non-Annex I countries is the fact that the latter are not committed to emissions abatement under the Kyoto Protocol while they are allowed to supply credits through the CDM. As is generally established in the literature, we acknowledge the fact that sinks have negligible marginal costs. All in all, the equilibrium market price will be the price such that supply equals the demand on the global carbon market.

The project-based nature of the CDM results in three key features. First, transactions costs are expected to be relatively high as a consequence of the project research and design, the registration, certification and monitoring upon the Executive Board. These costs have long been considered as significantly reducing the attractiveness of CDM projects since they operate as a fixed cost that shrinks the supply. Secondly, it is widely acknowledged that all the projects that could theoretically be accepted by the Executive Board could not be implemented practically for reasons ranging from failures in local infrastructures, problems with local administrations, to risk analysis. Hence an accessibility rate is imposed on the amount of projects supplied by developing countries for a given marginal cost. Thirdly, in order to promote a prompt start for the CDM, each project theoretically begins in January 2000, thus providing what is called *early crediting*. This feature is also introduced in the model. The presence of carbon sinks within the countries is also considered in the model.

The Belgian part of the model determines the optimal cost-minimization policy, considering Belgium as a price-taker on the carbon market. The Belgian abatement cost curve reflects its demand for foreign abatement. The supply of tradable permits is independent of the Belgian demand, and is flat. The supply of CDM projects addressed to Belgium is assumed to be only a fraction of the global supply (we consider here that the global CDM market is shared among all the Annex I countries). Figure 1 illustrates this part of the model and will be useful to understand its functioning.

4.2 Assumptions and calibration

Our model uses marginal abatement cost functions that represent the macroeconomic marginal cost of any abatement effort in any country or group of countries. They are calibrated on results from the GEM-E3 model (see Eyckmans *et al.* (2002) and Chapter 5 in this book) and following the methodology originated by Ellerman and Decaux (1998). The business-as-usual scenario is based on the 2004 World Energy Outlook. For Belgium we considered the latest medium-term forecast provided by the Federal Planning Bureau (Bossier *et al.*, 2004). Considering these forecasts, Annex I countries (excluding the USA, Australia and hot air) would have to abate 860 $MtCO_2$ and Belgium 17.2 $MtCO_2$ by 2010. The amount of 'hot air' hold by Russia and Ukraine would reach 1,145 $MtCO_2$. We assume that those countries supply the carbon quantity which maximises its return, *i.e.* 248 Mt (or 21.7% of the total amount available).

Michaelowa and Jotzo (2005) compare unit transaction costs for several kinds of CDM projects and suggest a benchmark of \$0.75/tCO_2. The accessibility rate of CDM projects is difficult to assess at an aggregate level and we retain the conservative value of 33% as Eyckmans *et al.* (2002). Sinks would amount to 370 $MtCO_2$ in Annex I countries (Jotzo and Michaelowa, 2002) and to 1.3 $MtCO_2$ in Belgium (Dedoncker et al., 2004). The early crediting is introduced as the ratio between the average actual crediting period of the projects (9 periods by assumption) and the Kyoto commitment period (5 periods). The market share of Belgium in the CDM market corresponds to the share of its abatement in the Annex I countries emission abatement, *i.e.* 2.0%. The impact of all these assumptions can, and must, be assessed with sensitivity analyses: this model has no real predictive value but it allows us to understand how the carbon market works, what the role of the CDM is and what its contribution to the climate policy might be (see Bréchet and Lussis, 2005*a*).

5 RESULTS

5.1 A scenario of low carbon-constraint

The latest issue of the International Energy Agency's Energy Outlook (Fall, 2004) provided a picture that contrasts with previous studies: the carbon constraint associated with the Kyoto Protocol turned out to be rather non-binding at the world level. This results from three elements: (*i*) the withdrawal of the USA from the Protocol (it would have been a large net purchaser of carbon credits); (*ii*) an economic growth rate in Annex I countries that was lower than expected, causing a smaller global abatement effort; and finally, (*iii*) a larger amount of hot air available for Russia and Ukraine. Furthermore, the fact that industrialised countries or some industries already engaged themselves in abatement strategies cannot be ruled out, thus curbing the profile of GHG emissions in comparison with what was expected a few years ago[4].

The figures given above and coming from the IEA are such that the total amount of hot air available is larger than the abatement effort in Annex I countries in 2010. Assuming that Russia and Ukraine sell the quantity that maximises their return, we find that they will restrict their supply and provide 21% of the available amount. It thus turns out that the net demand of Annex I countries is very small compared to the supply of CDM projects coming from developing countries (here, one must keep in mind our assumption of an accessibility rate of one third). Under these assumptions the model shows that the carbon price would hardly reach 1.3€/t. As a consequence, the contribution of the CDM to Annex I strategies would be rather limited, at 11% (remember that CDM projects bear a transaction cost of 0.75€/t). In Belgium the contribution of the CDM would be reach 1.9 $MtCO_2$ and 13.7 $MtCO_2$ of permits would be purchased (nearly 80% of the abatement effort).

5.2 Policy implications for the CDM

The policy implications of this scenario are the following[5]. Firstly, the emissions abatement appears as rather limited and the industrialized countries actually would not need the CDM as a low-cost security valve to meet their Kyoto commitments. The effort is not that stringent and abundant cheap carbon permits should be available from Russia and Ukraine. As an illustration of this mechanism, the model tells us that, if the United States were still involved in the Protocol, the equilibrium carbon price would reach 6.4€/t and that the CDM would amount to 13.9% of the Annex B abatement effort, thus doubling its contribution with respect to our reference scenario. Secondly, in a world where the carbon price is high enough, being proactive on the CDM market, *i.e.* increasing one's market share in the CDM market, is an efficient strategy to reduce the economic cost of the Kyoto Protocol at the national level. As an unexpected corollary, transaction costs cannot be considered as necessarily prohibitive, except for small-scale projects (although simplified procedures exist), or when the permits' price is very low. Thirdly, a country like Belgium is shown to be very reliant on the external carbon market since it would purchase most of its abatement from foreign countries, thus entailing what we can call *carbon dependence*. A straighforward implication of this notion of carbon dependence is that the cost of the Kyoto Protocol largely depends on the carbon price on the world market, which can fluctuate wildly, thus implying uncertain macroeconomic compliance costs. Reducing the risks associated with these fluctuations on the Belgian economy and on Belgian firms could be an appropriate policy objective. This requires increasing the share of domestic

[4] In-depth analyses of these issues, as well as discussions between previous and current IEA forecasts on the energy and carbon markets are available in Bréchet and Lussis (2005b).

[5] Some of these implications are analysed in detail in Bréchet and Lussis (2005a) with extensive sensitivity analyses.

abatement (with domestic fiscal or regulatory measures) or supporting more CDM projects, as soon as they are negotiated at a fixed price over a long timespan.

6 CONCLUSION

The purpose of this paper was to analyse the potential contribution of the Clean Development Mechanism to the Belgian climate policy. To do so, we developed a partial equilibrium model of the carbon market explicitly including the key features that are likely to influence the supply and demand of CDM projects, both at world and national levels. This model evaluates the optimal mix of instruments both for Annex I countries and for Belgium.

We showed that the carbon constraint associated with the Kyoto Protocol turns out to be quite light in comparison with previous studies. This is due not only to the withdrawal of the USA from the Protocol, but also to the slow economic growth in Annex B countries, to a larger amount of hot air available and probably to a recent curtailment of the industrialized countries' profile for greenhouse gas emissions. In that context, the low carbon price on the world market would serve as a strong disincentive for industrialised countries to engage themselves in significant domestic abatements and in CDM projects.

The significant dependence of Belgium on the purchase of permits implies that, with a higher world carbon price as expected for the post-Kyoto periods, Belgium would gain from being proactive on the CDM market. This may be an appropriate strategy to minimize the economic cost of the Kyoto Protocol and to reduce the risks related to the fluctuations of the price of carbon.

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