

# **The Clean Development Mechanism: An Economic Approach to “Environmental Additionality”**

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The purpose of this paper is to consider if economic analysis can offer an easy and reliable method to measure the “environmental additionality” of project activities under the Clean Development Mechanism. The paper has been substantially revised after the UN International Working Group on C.D.M. meeting in Buenos Aires in order to accommodate many of the concerns and suggestions expressed with respect to the previous version.

## 1) The need for baselines

In order to introduce the notion of an economic approach to “environmental additionality”, we will first recall why baselines are necessary.

What is the requirement for a “project activity” to be qualified for certification under the CDM? It would need to provide emission reductions that are “additional to any that would occur in the absence of the certified project activity”. This is usually referred to as the “environmental additionality” criterion. It must be underscored that an economic approach to this question has nothing to do with the concept of “financial additionality” in the sense of Decision 5/COP 1 on “Activities Implemented Jointly under the Pilot Phase”; this “financial additionality” is relative to the financial mechanism of the Convention and to current flows of Official Development Assistance.

To demonstrate that emission reductions satisfy the environmental additionality criterion, and to calculate these emission reductions, one must construct and agree upon a “baseline” from which it can be determined what would have happened in the absence of the project activity. It is understood that this baseline cannot be simply the situation prevailing before the undertaking of the project.

To see why, let us give two opposite examples, both with an investor from an Annex-B country owning and operating an electric utility in a potential host country<sup>1</sup>.

In *case one*, he has to replace an old coal-fired power plant. He will do so by using the state-of-the-art technology, taking advantage of increasing natural gas availability. Thus, he chooses a gas-fired power plant. Because of the lower carbon content of gas compared to coal, and the increased efficiency of the new plant, carbon dioxide emissions will be greatly reduced.

Could we consider this investment as eligible for certified emission reductions? One may argue that any investor would have done the same thing, with or without the existence of the CDM. If credits were given for such a case, credits should be given for many day-to-day, business-as-usual investments. The use of the “certified emission reductions” (CERs) by the investor’s countries (K.P. Article 3, para 12) would allow increasing their “assigned amount” of emissions in compensation. This would lead to a global increase of emissions as compared

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*\* The views expressed here are those of the author, and do not necessarily reflect those of UNEP.*

<sup>1</sup> This example refers to a “bilateral” scheme. But our investor may be from the host country itself, with the intention to sell the CERs to an entity of an Annex-B country (unilateral scheme). Be he from the North or the South, he could also sell, ex-ante or ex-post, the CERs to an international institution (multilateral scheme). These different possibilities make no difference in the matter.

to what would have been the case without the CDM (this is called “tropical air”). So it seems that such an investment should not qualify for CERs.

Consider *case two*, where the same investor now has to face increased electricity demand. He decides to build a thermo-solar power plant, combining a solar field with a gas boiler to feed a turbine, so that power generation is guaranteed all the time<sup>2</sup>. Because of the use of some gas, this investment would increase the carbon dioxide emissions compared to the previous situation. However, this increase will be much smaller than the increase that would have occurred if he had chosen to build a gas-fired only power plant. Of course, with current state-of-the-art, the cost of electricity produced by the solar-gas power plant will be higher than the cost of electricity produced by a gas-fired only power plant.

Could we consider this second investment as eligible for certified emission reductions ? If we said yes for the first one, we should now say no: emissions will increase compared to present situation. But if we said no in the first case, we will say yes in this one, because it is very probable that no investor will ever decide to build a solar-gas power plant except if that investor hopes that the use of certified emission reduction will at least cover the extra-cost of the electricity produced<sup>3</sup>. So there is an emission reduction additional to what would have been the case in the absence of the CDM.

## 2) The “profitability” question

What can be drawn from these examples is that one possible way to deal with environmental additionality in the sense of article 12 is to determine if an investment would not be fully profitable without the use of Certified Emission Reductions. If this were the case, one could be almost be sure it would not have been undertaken without the CDM.

That is the reason why many analysts have considered the existence of some “extra-costs” or “incremental costs” as the cornerstone of additionality - for activities implemented jointly as well as for the C.D.M. For example, Pierre Cornut<sup>4</sup> wrote: « *Joint implementation resides in the fact that additional funding has made it possible to recast a standard project in a direction more favourable to the prevention of climate risk. For a claimed emission reduction in such a configuration to be credited, it is essential that it could not have been obtained in the absence of specific funding under joint implementation. Consequently there is a strong link between ecological additionality and the ways and means of funding each joint operation: a reduction in emissions achieved under a joint project should be additional with respect to the reference situation, i.e., with respect to the situation that would have prevailed in the absence of any specific and additional funding.* »

Japanese researchers<sup>5</sup> also point out that « *Regarding private funds, approval of commercial projects that are profitable themselves might conflict with the condition for “additional*

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<sup>2</sup> Nine plants of this kind have been built in the US in the 80's by independent investors, with the help of tax credits and mandatory long-term fixed-price contracts for power and energy. They provide more than 350 MW of power to the electric utility serving the Los Angeles area.

<sup>3</sup> This is true whether the certified emission reductions are used by the investor himself to avoid more expensive emission reductions in his own Annex-I country, or they are sold to someone else for the same purpose.

<sup>4</sup> Pierre Cornut, *L'Application conjointe dans le cadre des négociations climats* [Joint Implementation as part of the Climate Negotiations], Scientific and Technical Council of the [French] Committee for the Evaluation of Joint Implementation, October 1997.

<sup>5</sup> Naoki Matsuo *et alii*, *Issues and options in the design of the Clean Development Mechanism*, The Institute for Global Environmental Strategies, Kamiyamaguchi, Hayama, Kanagawa, Japan.

*emission reduction” mentioned in the Protocol. That is, commercial projects may have gone ahead even were they not have been approved as a CDM project generating credits. »*

However, there is no doubt that such a “non-profitability” requirement is not by itself asked for by the K.P. text. And there might be some other ways to demonstrate additionality. We will try to sort out possible advantages and disadvantages of an economic approach to the “environmental additionality” question.

### 3) The theory of investment

The mere fact that a particular investment is more expensive than another possible investment responding to the same situation does not prove that it would not have been chosen in the absence of the CDM. This is all the more true when the emission reduction arise from a higher efficiency of an energy process and a lower consumption of fossil fuels - usually implying lower operating costs. What matters here is the Net Present Value (NPV) of a possible investment, that is, the sum of the discounted proceeds, minus the up-front investment costs, minus the discounted operating costs.

For any project to be undertaken, its Net Present Value should be positive. And all projects with a positive NPV should be undertaken (except when they are exclusive of each other - see below point 4). Therefore, NPV seems to provide an easy way to demonstrate environmental additionality: Projects with a negative NPV when the value of CERs is not taken into account would not have been undertaken otherwise, and may be considered as additional. Projects with a positive NPV in the same conditions would have been undertaken, and should not be considered as additional.

But this is textbook theory, and one may argue that in real life, many “profitable” investments, according to the theory, are not undertaken, for a large variety of reasons: lack of capital, risk, uncertainties, “barriers” or market failures of diverse nature. Less frequently, apparently non-profitable investments may be performed for some strategic considerations (e.g., gaining monopoly position).

However, from an economic standpoint, the lack of capital, or the conditions of access to capital for a particular firm, is reflected in the discount rate the firm uses to compute the net present value of an investment and to compare different possibilities. Risks and uncertainties should be dealt with the use of computed expected returns. And if market failures or barriers to technology diffusion might be overcome by the use or selling of CERs, this means they have a cost for investors, and this cost could be incorporated into the economic analysis of the project. In other words, an economic analysis should be able to give due consideration to all these aspects.

Energy subsidies are a special case. Some projects in some potential host countries may seem to be “additional” with our analytical framework in a situation where energy prices are artificially kept low by energy subsidies, although they would just be “business-as usual” in the absence of these subsidies. There is a risk here that the inclusion of such projects would give those countries an incentive to maintain these costly and environmentally-unsound subsidies, in contradiction with the purpose of the CDM to assist non-Annex-I Parties in achieving sustainable development.

Of course, all firms do not strictly apply these (theoretical) criteria. Many do not adjust their discount rate to precisely reflect their access to capital, and select the investments with the highest profitability. Many do not compute expected return with their probabilities, but increase their discount rates for risky projects. Others do not use NPV, but more simple and less precise criteria like the “internal rate of return” of an investment or its “pay-back time”.

However, there is no need to go deeply into a firm's own criteria; there is a need to perform a convincing economic analysis along the most convincing lines.

#### 4) Baselines and "alternative investments"

When firms consider mutually exclusive investment projects to face the same demand, they may just find that many could be profitable - but some more than others.

In this case, to demonstrate additionality, firms would have to show that the project they have selected reduces emissions compared to the most profitable alternative.

*In such a case, the NPV criterion does not apply to the investment as a whole, but to the difference in costs between the two.* If the NPV of this increase in investment cost is negative, this means that it would not happen in the absence of the use or selling of CERs. *The project as a whole might be fully profitable, even highly profitable: what would matter here is only the profitability of the part of it, which leads to additional emission reductions.* But obviously only these additional emission reductions will be credited.

Let us build an example with the same electric utility having to replace an old coal-fired power plant. It may choose an efficient gas-fired power plant, or an even more efficient combined-cycle gas-fired power plant. Both would reduce emissions compared to the existing situation; but the latter would reduce them more, compared to the former, while using less gas. If the difference in investment costs is fully repaid for by the reduction of fuel expenses, the NPV of this increase would be positive and there would be no additionality. If it is not, the project would be additional compared to a single-turbine gas-fired power plant; the amount of CERs would be deduced from the difference of emissions in both cases - and not from the difference with the replaced coal-fired power plant.

#### 5) Subjectivity, accuracy, simplicity, and transaction costs

It has often been said that economic analysis to define the additionality of CDM projects would entail high transaction costs. This is not certain. Sound investors perform at least some kind of economic analysis before investing. And when they do not use textbook criteria (see above, point 3), they still gather the information needed to compute a Net Present Value. Therefore, it would not be such a big effort to perform an economic analysis along these lines. And the international community has recently gained a great deal of experience on a closely-related issue - the question of "incremental costs" in the financing of projects through the Global Environmental Facility. However, we will consider below (see point 6) ways to reduce transaction costs.

One may object to the use of NPV as a criterion for "environmental additionality", that firms may "manipulate" the information embodied in their calculation to demonstrate that the "baseline alternative investment" would not have been profitable or would have been less profitable than the project proposed for certification under the C.D.M.

This risk exists. While much economic information could be checked from markets, other information is more difficult to evaluate. Economic analysis will reflect preferences of the investor in the face of uncertainties: probabilities for future operating costs and future proceeds reflect risk-aversion, discount rates reflect the firm's access capital. The choice of this latter parameter, in particular, may make a big difference in economic analysis of long-lived investments.

There may be ways to deal with this difficulty or at least to simplify things. One may consider that any project - or part of a project - with a negative NPV computed with a "low" discount

rate (e.g. 6% in the power sector, 8% in others) would be considered as additional. On the other hand, any project or part of a project with a positive NPV computed with a “high” discount rate (e.g. 15%) would be considered as not additional. Only the remaining projects would have to be looked at more closely.

More generally, the choice of alternative investments, of baselines, may itself be challenged. Even in the example above of a solar-gas power plant, some may consider that it would have been possible to have demand-side management programs, not necessarily more expensive<sup>6</sup>, which would have led to an even lower level of emissions...

Those difficulties will remain. There is no way to achieve 100% accuracy, because “what would have happened otherwise”, by definition, did not happen, and its determination will always include some subjectivity. The CDM can only exist with some risk of tropical air, and we must accept it - although trying to reduce that risk to a minimum.

In any case, other criteria which could be suggested to deal with environmental additionality will face the same problem of potentially manipulated information and subjectivity. Could they easily face it, not increasing the risk of tropical air? Cost-benefit analysis has often been accused of being arbitrary, but the alternatives suggested to replace it are usually as much, if not more, vulnerable. Moreover, economic analyses drives people to make explicit and weigh their assumptions, making them more transparent, and easier to test.

#### 6) Reducing transaction costs: towards a “fast-track” approach

However, some fear that an economic approach to environmental additionality would lead to high transaction costs, especially for small projects. It has been suggested to establish lists of technologies, or “technical criteria”. These lists could be either “positive” (technologies eligible to CDM) or “negative” (technologies not eligible to CDM), or both.

Both kinds of lists have their advantages. A positive list will not only define what technologies are supposed to be additional, but also may indicate what alternative technology should be considered as the baseline, and give some precise indication on how to compute Certified Emission Reductions. It would also reduce transaction costs for investors in “good” projects. A negative list would prevent investors in “bad” projects from devoting time and resources to trying to get CERs which they would not receive in the end, but would give no indication on baselines. But it may help make the CDM more reliable.

In fact, behind these lists, one will find economic analysis again. If photovoltaics or wind power look like obviously eligible technologies under the C.D.M., it is because anyone considers that nowadays they usually cost too much to be integrated into energy projects without some kind of financial incentives - be they given by governments or by the private sector through CERs.

In the case of such technologies, the economic analysis may be done once for all, “off-line”, at least for a period of time. These technologies would be considered as additional by definition. This would be a “fast-track” approach, which would reduce transaction costs for small projects.

However, the truth is that some sectors already use these technologies in a very profitable way. This is the case, for example, with telecommunication relays built in remote situations far from any electric grid and using PV. It appears then that not all projects using PV will be additional. One way to deal with that could be to specify that PV projects in this sector are not

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<sup>6</sup> Here another difficulty may appear: expensive to whom? DSM programmes may lead to the least-cost solution for the end-users, but may be more costly for utilities, as they will not receive pay-backs...

a priori eligible - they would have to go through an economic analysis, taking into account the power needed, the distance from the grid, the cost of using diesel instead, etc. The positive list will specify “PV in rural electrification, PV in water pumping”, and so on.

Here too, 100% accuracy is not possible with such a fast-track approach, and one may object to such an approach that would let some amount of “tropical air” enter the system, and not fully correspond to the requirements of Article 12. However, one may choose to consider that these (hopefully small) amounts of tropical air may be more than compensated by some external benefits that economic analysis would probably fail to take into account. These benefits are those arising from technological development, and reductions in costs for new techniques when their market niches increase.

#### 7) Static or dynamic baselines ?

Once decided, should a baseline be reassessed in the light of unexpected events, after the investment has been made? There might be two questions in one here: the case of the emergence of a new technology which reduces emissions at a lower cost, and the case of different than expected performance of an investment which leads to lower than expected emissions.

In the first case, the baseline should not be changed, for the alternative to the investment, at the time it was made, was not this new, emerging technology. Therefore the emission reductions calculated with respect to the original alternative scenario are still there.

In the second case, one may suppose, for instance, that lower than expected production of the investment - which leads to lower emissions - has some cause not related in any way to the CDM. In other words, the same reduction would have happened anyway. In this case, the baseline could be reassessed, and the CERs be proportionate to the level of production.

But it is also possible to consider that the baseline should not be reassessed in light of reduced production - because this would not be the case of a commitment taken at a country level if the country faces a recession.

It might also be possible that the reduction of production be linked with the CDM: if, for example, the value of CERs turns out to be less than expected, then the cost of the products (electricity or whatever) will increase, contracting the demand and creating a competitive disadvantage due to the increased cost of the investment made relative to the “business-as-usual” alternative. It would be fair in such a case to keep the baseline as it was projected ex ante, when calculating the amount of emission reductions.

#### 8) Too strict a criterion ?

One may wonder if investors will ever invest in projects - or even parts of projects - which would not have been profitable without the use of CERs. By trying to prevent “tropical air”, one would have prevented all projects - and kill the C.D.M. itself.

This risk exists, and must be carefully balanced with the risk of tropical air. However, the purpose of the C.D.M. is not limited to reducing costs for Annex-B country Parties; but it is to do so while not increasing global emissions, and while providing new technologies to developing countries to facilitate their sustainable development.

The biggest cost reduction for Annex-B countries would be to accept tropical air, certify business-as-usual investments under the C.D.M. But this would increase global emissions, undermine the Annex-B commitments laid down in the Kyoto Protocol... and provide no new, efficient, environmentally sound technologies to developing countries.

A recent study<sup>7</sup> suggests that carbon value - that is, the use of CERs - may be of some importance in the profitability of projects. In different case studies in the electricity sector, the value of a ton of carbon may represent between 2,5% and 30% of the cost of kWh (2,5% in the case of substitution of oil by gas, with a carbon value of 20 USD/tC; 30% in the case of renewables, with a carbon value of 100 USD/tC).

Again, one must insist on the fact that probably most CDM projects will not be investments from scratch, with the alternative being no investment at all (a power plant or nothing, to keep our example), but rather additional parts or different design for a given investment. This means the CERs will not have to make the difference for the profitability of the whole - but only of that additional part or alternative design.

#### 9) The “early start” problem

The Kyoto Protocol, Article 12, paragraph 10, states that “*Certified emission reductions obtained during the period from the year 2000 up to the beginning of the commitment period can be used to assist in achieving compliance in the first commitment period*”. But many think that before 2008, the market for CERs will not have matured sufficiently to give a clear indication of the future value of the certificates. They fear that it will be impossible to start projects before the beginning of the commitment period. Therefore, some people advocate using (either as a transitory rule or permanently) an approach to measuring environmental additionally which does not impose economic additionality. In this case, investors could acquire CERs at no cost.

But this would allow massive tropical air entry in the whole system, by allowing mere “repackaging” of business-as-usual projects. On the other hand, the premises of this line of reasoning are not necessarily true. First of all, because companies in Annex-B countries already know they will have to reduce their emissions; even not knowing precisely by how much, they can anticipate being obliged to a percentage effort at least equal to their country’s commitment; therefore, they will have an idea of their marginal cost of reduction.

Furthermore, some Annex-B country parties might decide to create early national or even international (if they are numerous) trading regimes, and therefore give their national industries some reduction targets at an intermediate date. They would do so for a number of reasons: to put themselves on track for compliance during the commitment period, to fulfil the requirement under Kyoto Protocol of having made demonstrable progress in achieving commitments by 2005 (Article 3, paragraph 2), to demonstrate the feasibility and economic efficiency of emission trading, or for a mix of these reasons. In any case, the creation of early trading markets will give a ton of carbon a value, and this would certainly help the start-up of project activities under the C.D.M.

In order to specifically help the start-up of the C.D.M., national authorities of Annex-B country Parties may allow their industries to add the CERs to their specific assigned amounts of emissions under the intermediate target. As these targets have no value for the Protocol, this use of the CERs would not exhaust them, and the Parties will be able to add them to their assigned amount (country level) during the commitment period. National authorities could even allow their industries to use the CERs twice - first against their specific intermediate target and second against their specific target during the commitment period - even though as Parties they will of course use them only once.

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<sup>7</sup> Michel Colombier, *Les synergies environnement/développement - Impact d'une valorisation du carbone selon le type de projet*, Association Global Chance, 41 rue Rouget de Lisle, 92150 Suresnes, France

By introducing incentives for the private sector to undertake project activities in host countries, those Annex-B countries, particularly willing to demonstrate the importance and efficacy of emissions trading and the C.D.M., would be helping to ensure early start of the Clean Development Mechanism - without undermining the Protocol itself as would very weak “environmental additionality” criteria.

#### 10) The special needs of least-developed countries

The specific needs of least developed countries to take advantage of the clean development mechanism have been widely recognised. This may imply special criteria for “environmental additionality” for project activities in these countries. The risk of tropical air exists here if a very weak criterion were adopted, but is limited by the very low level of foreign investments in least developed countries. Should we consider this level as being null, all project activities would be additional by definition.

The urgent necessity of the economic development of these countries may be considered as overruling the fears for small quantities of tropical air and justifying the application of a special criterion for “environmental additionality” in their case.

#### 11) Incorporation of other environmental aspects

It has been suggested that criteria for additionality should try to include some other aspects, like the fact that increasing energy efficiency usually also reduces emissions of other pollutants like CO, SO<sub>x</sub>, NO<sub>x</sub>, VOC or particulate, which have strong local and regional detrimental effects.

However, although economic theory recommends giving economic value to such “externalities” and to integrate them into economic analysis, one may prefer not to do so. For this would make projects under the CDM appear more profitable than they are *for the investor*. Therefore, such an inclusion would not help projects with good environmental side-effects, but on the contrary, undermine them in reducing their additionality.

Reductions in pollutants other than greenhouse gases incorporated in the Kyoto Protocol basket should therefore be kept apart, and be given due consideration in the examination by local or national authorities of the “sustainable development” character of the project.

#### Main conclusions

An economic approach to “environmental additionality” as defined by the Kyoto Protocol seems to have more advantages than disadvantages. It provides a relatively clear rule for deciding what is additional, and what baseline to compare with. It has some difficulties, but other possible approaches would have to demonstrate they solve them and provide the same level of confidence.

However, in order to reduce transaction costs especially for small projects, positive and negative technical lists of project-types might be established, with the risk of some tropical air but with the advantage of external benefits in clean technology improvements. For other projects to demonstrate additionality, an economic analysis framework could be established, with some reasonable assumptions on future energy prices and usual discount rates (maybe with an interval). The special needs of least developed countries may also lead to some specific criteria. The early start of the CDM should result from early action taken by Annex-I countries, and not by relaxing the additionality criterion.

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