Emission baselines for Clean Development Mechanism projects:
lessons from the AIJ pilot phase

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Introduction

The Clean Development Mechanism (CDM) was first set out in the Kyoto Protocol at the third Conference of the Parties (COP) in 1997. The wording in the Kyoto Protocol (KP) on how the CDM will work is vague, although more substantive than for the other Kyoto mechanisms. Indeed, the Buenos Aires Plan of Action, agreed at COP4 in 1998 (UNFCCC 1998a, decision 7/CP.4), sets out 50 separate items that need to be addressed in order to set up the principles, modalities, rules and guidelines for the operation of the CDM. These range from the basic "purpose of CDM projects" to more specific criteria on methodological and technical issues. Two of these refer explicitly to baselines, i.e. "criteria for project baseline" and "environmental additionality and baselines".

CDM projects will have some similarities with Activities Implemented Jointly (AIJ) projects[2]. Both CDM and AIJ are project-based activities whose aims include greenhouse gas mitigation or removals by sinks. Both are open to Annex I and non-Annex I country participation. Both have projects that would be sited in one Party although financed wholly or in part by another Party, or an entity from another Party. Examining the way in which emission baselines were set for AIJ projects could allow some useful lessons to be drawn when determining how to set up emission baselines for CDM (and JI) projects. This paper explores these lessons, and also outlines an alternative way of setting emissions credits for CDM projects.

Emission baselines in AIJ projects

The FCCC secretariat listed 95 AIJ projects (UNFCCC 1998b) in its second compilation and synthesis of project information submitted by Parties. All 95 projects are reported to the UNFCCC in a uniform reporting format. This format requests the emissions baseline scenario with and without the AIJ project, as well as other information. However, there is at present no agreed method by which an emissions baseline should be calculated.

Emission baselines are important for CDM projects as they will form the basis for determining certified emission reductions (CERs) from these projects. However, AIJ projects do not accrue emissions credits as they are part of a pilot phase. AIJ emissions baselines are therefore used as an indication of the real and measurable greenhouse gas mitigation effect of the project. In this context, they are relevant to potential CDM projects.

Information on AIJ emission baselines is sparse. Many AIJ project reports outline a quantified emissions baseline (and some projects present <u>more</u> than one possible baseline scenario). However, descriptions of the

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[2] AIJ was set up as the pilot phase of Joint Implementation at COP1 in 1995 (UNFCCC 1995).

methodology used to calculate the emissions baseline in different project reports is often short, and it is rarely possible to reconstruct the emissions baseline presented from the data and descriptions given.

The shape of the emissions baseline used in different AIJ projects can vary significantly. This can be illustrated by examining the emissions baseline used in a common project type: lowering the carbon-intensity of heat production via fuel switching at heating plants. These projects make up more than half of all AIJ projects, and typically involve replacing a boiler and installing or upgrading ancillary equipment at existing heat-producing installations.

Actual emission baselines reported for different AIJ projects of this type are illustrated in Figure 1 and explained in Table 1. The most striking aspect of this figure is the diversity of emission baselines in the different projects. These differences are due to site-specific variations (such as location), and to different assumptions in:

- the length of time over which an emissions baseline is valid;
- the relative energy output before and during the AIJ project;
- whether fuel switching would have occurred in the absence of the AIJ project, and if so, when; and
- the timing and effectiveness of any demand or supply-side energy-efficiency measures.

Despite the importance of these different assumptions, not all AIJ project reports outlined the reasons behind the assumptions presented.

Figure 1
Emission baselines reported in different fuel-switch AIJ projects (not to scale)

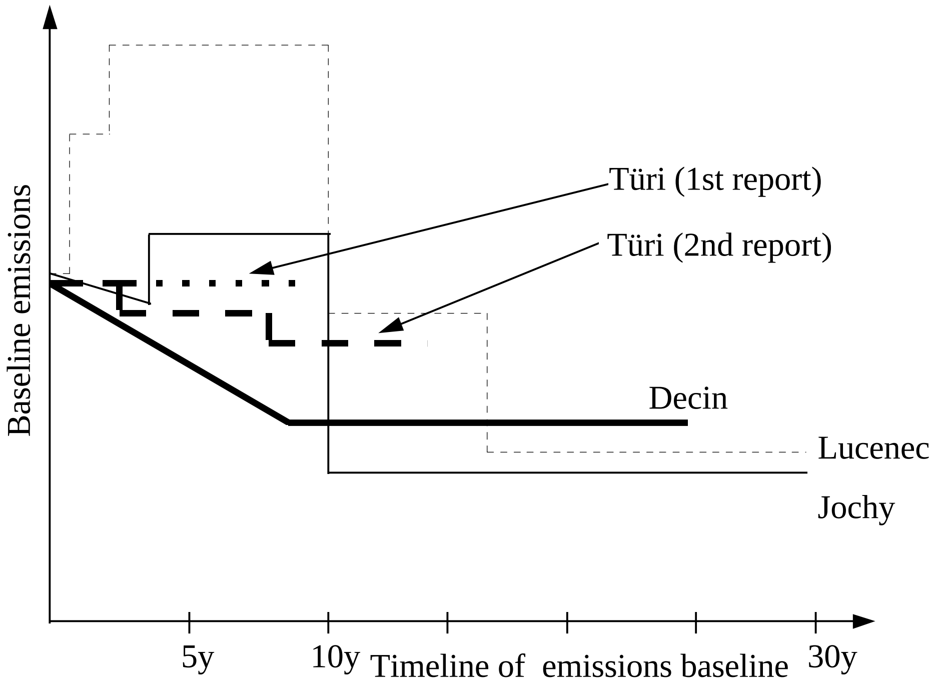


Table 1
Assumptions made in different fuel-switch AIJ projects

Project name	Timeline chosen		Fuel switch in baseline?	Baseline energy output assumptions	Other assumptions
	Length (y)	Comment			
Türi (1st report)	10y	Length of loan repayments	No	Same as pre-project	None
Türi (2nd report)	15y	Estimation based on life of new equipment and life of equipment not replaced	No	Same as pre-project	Stepped energy efficiency improvements
Decin	26y 8m	No reason given in report submitted to the UNFCCC.	No	Energy output from plant decreasing and then plateauing from year 8.	None
Jochy	30y	Estimated life of new equipment (equipment replaced by AIJ project was old, with a short remaining lifetime).	Yes: to gas	Assumes energy demand will increase 25% in 2003.	Assumes old boilers will be rehabilitated to improve their efficiency slightly.
Lucenec	30y	Estimated life of new equipment, although equipment replaced was old.	Yes: partial switch to biomass	Assumes energy demand will increase 25% in 2001.	None

Source: UNFCCC project reports and Yager and Mydske, 1998

Examining other AIJ projects, such as those aiming to increase energy efficiency of existing equipment, highlights other reasons why emission baselines differ from project to project. Major reasons include:

- different assumptions in the carbon-intensity of displaced electricity;
- whether learning effects would affect the technology's performance in the early years of the project;
- the relative production of goods before and during the AIJ project; and
- whether or not the mid or low-point of possible values have been taken (e.g. to ensure environmental conservatism).

These examples illustrate the importance that assumptions have on the shape of the emissions baseline, even when the AIJ project involves upgrading or renewing an existing installation. The relative importance of different assumptions will change according to the project type, although the time over which a project generates emission benefits is perhaps the most important overall. The examples also show that assumptions are highly site-specific, and that the reported baseline for each project may represent a choice from a number of feasible emission pathways (Yager and Mydske 1998).

However, not all AIJ projects involve upgrading existing equipment. Some AIJ projects involve installing new energy-producing equipment at a "greenfield" (new) site. The discussion above has shown that determining the emissions baseline for a project already underway is not simple. Difficulties are compounded for totally new projects where there are no direct pre-project comparisons available for the major factors that determine that project's emissions, i.e. which fuel and technology are used, and what the system output was.

CDM project sites are limited to non-Annex I countries. Areas in which CDM projects may be promising, such as the energy sector, are growing rapidly in many of these countries. Therefore, a relatively high proportion of CDM projects are likely to be at greenfield sites. Determining project-specific emission baselines for these CDM projects is thus likely to be subject to many uncertainties.

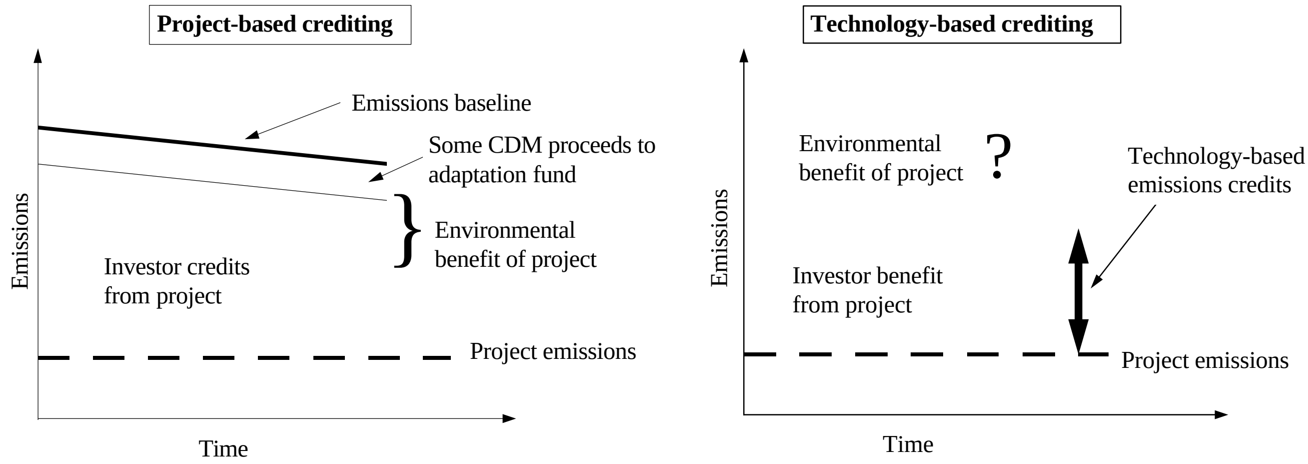
Technology-based crediting

The Kyoto Protocol states that CDM projects have to result in emissions that are real, measurable and that *are additional to any that would occur in the absence of the certified project activity.* However, this does not necessarily mean that project-specific emission baselines have to be drawn up for each CDM project.

A system could be envisaged in which a project-specific emissions baseline is not needed for CDM projects, but that CERs are allocated on the basis of technology installed[3]. For example, installing a heat-producing plant based on fuel F and technology type T would result in X_{FT} CERs per energy output (or per year of operation). Technology-based emissions crediting has a number of advantages and disadvantages with respect to allocating emission credits on the basis of a project's actual and baseline emissions. The difference between this and the system described above are outlined in Figure 2.

[3] Other potential ways of determining emission credits from projects, such as via sectoral baselines, are not examined in this paper.

Figure 2
Schematic representation of different crediting mechanisms



The main advantages of a technology-based crediting system are that it would be cheap and simple to use for investors. Such a system would save time and money otherwise spent analysing and monitoring the pre-project situation and projecting how this would develop. It would therefore reduce the transaction costs and lead times required to set up a CDM project compared to a system in which a project-specific emissions baseline was required. These lower transaction costs means that smaller projects would face a lower cost barrier than under a system of project-based crediting. Technology-based emissions credits could also be varied by country, region or other level to take into account differing levels of fossil fuel use and energy efficiency. In this way, energy-efficient technology installed in an area where current efficiencies are low could obtain higher credits than installing the same technology in an area where average efficiencies are higher.

A technology-based emissions crediting system could also result in relatively predictable emissions benefits. This reduces the uncertainty of a project's benefits and may increase the number of CDM projects initiated. Such a system would also mean that CDM projects could be initiated and generate credits even if there is not enough underlying data on a project or sectoral level to set up a meaningful project-specific emissions baseline.

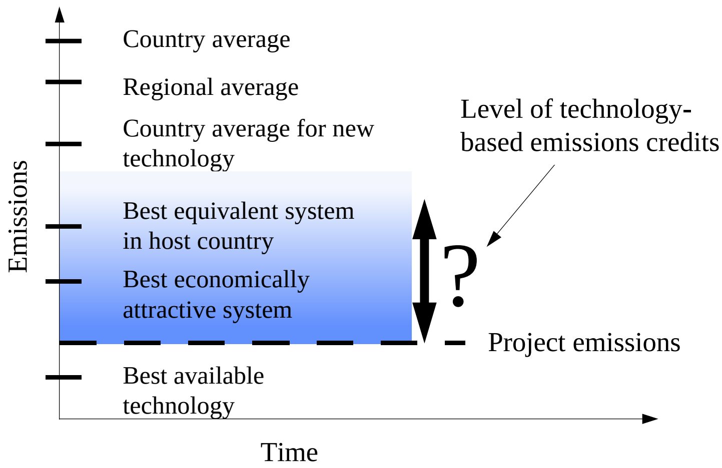
There are two main disadvantages of a technology-based emissions system. The first is that the environmental effectiveness of a project is more difficult to determine if there is no reference scenario against which to compare its performance. Because of this, some analysts (e.g. Carter 1997) suggest that only a few technologies, such as those based on renewable energy, should be eligible for technology-based emissions credits. Allowing other, more GHG-intensive, technologies to become eligible to generate investor credits under a technology-based system is possible. However, it is also problematic (see later discussion and figure 3). If GHG-intensive systems were to be allowed to benefit from technology-based emissions credits, the environmental integrity of the system could perhaps be best ensured if the technology credits were limited, either in per unit technology terms, or in terms of the emission timelines for such projects.

The second major disadvantage of technology-based credits is that they could be costly to set up at the international level. The system would be internally consistent only if agreement was reached on the technology-specific level of credits. However, agreement between Parties on this and on whether or how any regional modifications are taken into account is likely to be long, difficult and therefore costly. Moreover, a centralised credit matrix may prove difficult and lengthy to update (although periodic updates would be needed in order to take technology improvements into account).

In addition, if technology-based credits were set up, this should be done such a way so that “idle technology” is not encouraged. This would occur if the installed technologies under a CDM project were not subsequently used to their full extent and/or economic lifetime and investors nonetheless benefited from emissions credits from these projects. (Underuse of new technology is not uncommon when inadequate user support or training is given.)

Even if there was agreement that some or all CDM projects could accrue technology-based emissions credits, determining the level of these credits would not be easy. Like determining the level of project-based emission baselines, there are several feasible options available for technology-based credits (figure 3).

Figure 3
Possible variations in crediting levels for a technology



Should the “reference” that sets the level of credits be the host country average; the regional average; the country or regional average for recently installed technology; the best equivalent system already installed in the host country, or the best economically attractive system? Should the level of technology credits be modified if the project technology emits significantly more than the best available comparable technology? How could the level of credits be set for competing energy supply technologies based on different fuels?

In addition to setting the level of credits, many other issues may have to be resolved before a technology-based crediting system could be agreed. Some of these issues are the same or similar to those that would also need to be resolved a project-based emissions baseline system. For example, how long should those credits last and should this be subject to revision? How could the system deal with uncertainties and learning effects? And should there be any distinction between crediting levels for replacement and greenfield projects?

The level at which technology-based emissions credits are set could vary widely for a particular technology type (figure 3). If technology-based emissions crediting is allowed, the level at which credits are set is extremely important. This level will influence the uptake of CDM projects and consequent emissions “leakage”[4]. The level of credits will also affect the mitigation cost of proposed CDM projects. The relative mitigation cost of different CDM project types will, in turn, affect the relative attractiveness of different project types and thus send wider signals leading to built-in incentives for certain fuels and/or technologies.

[4] Since CDM projects take place in countries that have no emission commitments, allowing Annex I countries to offset CERs from CDM projects against their domestic emissions effectively increases the Annex I emission cap agreed to at Kyoto. This increase is the emissions “leakage”.

Conclusions

Emission baselines are highly project and site-specific. The manner in which AIJ emission baselines have been drawn up under the AIJ pilot phase is, to a large degree, dependent on input assumptions. Project emission levels and project-based emission baselines are uncertain, and a quantitative assessment of a project's environmental benefit is subject to considerable uncertainty. Variations in the input assumptions used in different AIJ projects means that emission baselines are often not consistent between projects, even when these projects are similar. In addition, the rationale behind the assumptions used, and any underlying data or supporting documents, is rarely presented in detail, which means that these emission baselines are also not transparent.

Calculating and reporting project-specific emission baselines for AIJ projects, and for JI and CDM projects and activities, could be made more transparent and consistent if internationally-agreed guidelines set more specific guidance on the methodology and format for such reporting. Some improvements, e.g. on reporting format, could be made relatively simply and would not be very contentious. Other potential modifications, such as an agreement on how to set the length of time over which a project could generate emission benefits, will be less easily resolved.

Technology-based emissions crediting could be one option used instead of project-based emissions crediting for some CDM projects. This system is subject to some similar uncertainties and unresolved issues as project-specific emissions credits. But, with its highly simplified crediting structure, it would have a number of advantages such as being quick, simple and cheap at the point of use, and leading to predictable stream of emissions credits that could also be differentiable by project site. However, great care would be needed in such a system to ensure that credits were neither too small, which would inhibit the uptake of CDM projects, nor too generous, which could result in countries receiving emissions credits for projects whose economic and environmental additionality are questionable.

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In addition, the Uniform Reporting Format for the following AIJ projects were consulted:
Ainazi (Lat/Ger), Birzai (Lit/Swe), Cizkovice (Cze/Fra), Daugavgriva (Lat/Swe), Decin (Cze/USA), Grid-connected PV (Fij/Aus), Honiara (Sol/Aus), Hungarian municipalities efficiency improvement (Hun/Nld), Ignalina (Lit/Swe), Ilumex (Mex/Nor), Jochy/Lucenec (Svk/Nor), Jurmala (Lat/Swe), Limbazi (Lat/Swe), Mustamäe (Est/Swe), Mustamäe2 (Est/Swe), Oaxaca (Mex/USA), Orisssaare (Est/Swe), Rusagas (Rus/US), Saldus (Lat/Swe), Solar-based rural electrification (Hon/USA), Sustainable Energy Management (BFa/Nor), Talsi (Lat/Swe), Tartu (Est/Swe), Tegucigalpa (Hon/USA), Türi (Est/Swe), Tyumen (Rus/Nld), Ushgorod (Rus/Ger), Viljandi (Est/Swe), Zagreb (Cro/Bel)
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