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CENTRE FOR ECONOMIC ANALYSIS

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Status and possible options for baseline calculations

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1 Executive Summary

The Kyoto Protocol (the Protocol) establishes two project based mechanisms: the clean development mechanism (CDM) under Article 12 and projects under Article 6 also known as Joint Implementation or JI. Article 12 of the Protocol states that certified emissions reductions from the CDM can begin accruing in 2000. Minimum modalities and procedures for baseline setting, a critical issue for the CDM, is therefore urgently needed at COP-6 in November.

The objectives of this paper are to:

- define and assess various baseline approaches
- discuss methodological issues that will need to be considered in designing modalities and procedures, and
- provide possible options for developing modalities and procedures.

Baselines attempt to estimate what would have happened to emissions in the absence of the project. A baseline should be *environmentally credible* (ensure project additionality), *transparent and verifiable* by a third Party, *simple and inexpensive* to draw up and *provide crediting certainty* for investors. It should allow broad participation in the mechanism to ensure considerable emission reductions/sink enhancements to achieve an *environmentally effective* mechanism.

Trade-offs between these criteria will have to be made. Low costs, crediting certainty for investors, relatively lax baselines and highly standardized methodologies for baseline estimation is believed to bring a relatively high number of project activities. Promoting a high number of project activities must, however, be carefully balanced with environmental credibility.

The three main approaches to baseline setting discussed in this paper are project-specific, multi-project and hybrid approaches. The multi-project approach aims to make baselines valid across project types and geographical locations (e.g. an emission benchmark for types of projects in a region/country), while the hybrid approach combines elements from both the project-specific and the multi-project approaches.

Many cross-cutting methodological issues will need to be taken into account in estimating a baseline. Given time constraints facing the climate negotiations, it will be important to formulate a process by which baseline methodologies can be designed and approved. The modalities and procedures will need to be simple, clear and concise, while enabling the Parties to the Protocol to update or modify them as experience with the CDM grows.

The following are the most important elements that should be included in the standardised methodologies for establishing baselines:

- *Historic data set or a projection of future trends?* In our view baselines should in all cases include some considerations of future trends. Even if historic data are not available in a particular location, some sort of projection should be made, e.g. based on comparable data from another country, region or sector.
- *How to take free riders into consideration*. Some guidance on whether for instance «no-regrets» projects and «greenfield» projects should be eligible for CDM should be established.
- *Should the baseline be static or dynamic?* We think that in several project types the baseline might be adjusted over time, and the interval between updates and revisions of the baseline should be decided at the start of the project.
- *Determination of the CDM project activity lifetime* (i.e., time period during which CERs may accrue). A definition of the lifetime of a project activity may be desirable since there will not be one time period that will be applicable for all project types.
- *Treatment of indirect effects*. This is in our view not as crucial as the other elements to get CDM activities started.

2 Introduction

The Kyoto Protocol (the Protocol) establishes two project based mechanisms: the clean development mechanism (CDM) under Article 12 and projects under Article 6 also known as Joint Implementation or JI. Both articles state that reductions in emissions from the use of the mechanisms are to be additional to any that would occur otherwise/in the absence of the project[1]. Because of these requirements, a critical issue in the negotiations on the mechanisms is how guidelines for baselines should be structured. Baselines are essential to determining the additionality[2] of a project, and the quantity of «credits» (certified emissions reductions or CERs under the CDM and emission reduction units or ERUs under JI) a project has generated. How baselines are structured will affect transaction costs, as well as monitoring and reporting requirements.

While baseline issues are similar under the project-based mechanisms, it is unclear how stringent the guidelines need be under JI. Unlike the CDM which includes participation by developing countries, JI is open only to Annex I Parties and will be based on the emission limitation commitments agreed to in the

[1] Article 6 states that transfers or acquisitions of emission reduction units can be made provided that: «…any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur.» Article 12 states that emissions reductions will be certified based on : «reductions in emissions that are additional to any that would occur in the absence of the certified project activity.»

[2] Only *environmental* additionality, as stated in Article 12.5(c) of the Protocol, is treated in this paper. *Financial* additionality (even if not explicitly stated in Article 12) has, however, been brought up by some Parties and will have to be dealt with in the general context of the CDM.

Protocol. JI is a project based form of trading that will be based on the assigned amount of a Party in Annex B; therefore «credits» can be transferred or acquired but not created. Essentially no additional «credits»[3] will be created by these projects since the overall assigned amount for Annex I countries does not change. CDM projects on the other hand, will produce certified emissions reductions which can be added to an Annex I Party's assigned amount for compliance purposes.

Given the urgency with which methodologies for baselines for the CDM are needed, this paper focuses primarily on baseline issues under the CDM and discusses options for minimal modalities and procedures that could be set in place at COP-6 in November this year. It is important to note that many of the issues discussed here are relevant under JI. However, because of the structural differences in the mechanisms, as well as JI's links to other obligations for Annex I Parties under the Protocol (compliance, reporting, national systems, etc.) it is unclear at what level the issues discussed in this paper will need to be dealt with (for Annex I Parties that are in compliance) under JI.

2.1 Background

Article 12 states that certified emissions reductions from the CDM can begin accruing in 2000. Because of this, many stakeholders will be looking for decisions to be taken at COP-6 outlining how the CDM will operate. Baselines are one of the key areas that private sector investors in particular will be looking for guidance and assurance on. Baseline methodologies will be needed in order for potential project investors to determine their interest in CDM project activities. As with many other issues under the climate negotiations, the baseline issue has both technical and political aspects. Baseline methodologies will have a large impact on how successful the CDM can become.

Thus far, the majority of experience with baselines has been under the UN FCCC's Activities Implemented Jointly (AIJ) pilot phase where baselines have been used to determine whether a project is additional to «business as usual.» While these experiences are still somewhat limited, they have provided insight into how one could set up baseline methodologies under the CDM.

2.1.1 What is a Baseline?

Baselines are artificial constructs that attempt to estimate what might have happened (to emissions) in the absence of the project. Since many assumptions have to be made when estimating a baseline (also some times referred to as a «reference case»), baselines are hypothetical in nature and impossible to establish as fact. According to Vine and Sathaye (1999) baselines could be estimated using

[3] The «assigned amount» is based on the commitments agreed to by Annex I Parties in the Kyoto Protocol (see Annex B of the Protocol). Transactions under Article 6 will be based on emissions reduction units (ERU's) which will be derived from a Party's assigned amount.

one or more techniques such as modelling, review and analysis of literature on similar projects or expert judgement.

Under the CDM baselines serve two critical functions. The first is to determine the additionality of a project (and therefore whether the project is eligible to become a CDM project activity), and the second is to determine the amount of CERs generated by that project activity.

2.1.2 Additionality

As stated above, in order for a project to qualify as a CDM project activity a determination must be made of the project's «additionality»—the project's emissions would be found additional if it is expected to perform better than the baseline.

Under AIJ, additionality and baselines were treated separately—baselines needed to be established and additionality needed to be determined. However, the additionality test under AIJ was not always consistent, in part because of the way the pilot phase was structured—there were no clear international guidelines. There is a greater tendency under the CDM discussions to treat additionality and baselines as linked issues, particularly when standardised methodologies are discussed. With standardised methodologies, it should be possible for the additionality of a project to be determined automatically, whereas project specific methodologies would require a determination by the entity reviewing the project (the operational entity) that its emissions reductions will be additional. It should also be possible to create categories of projects that are considered automatically additional.

Regardless of the baseline methodologies used, the determination of a project's additionality should be made when the project is reviewed by operational entities (this would generally be prior to implementation of a project) for acceptance as a CDM project activity. Following a project activity's implementation, any emissions reduced or sequestered would be compared to the baseline and a determination on that project activity's emissions would be made.

Some would argue that the determination of whether a project is additional comes from calculating the difference between the *verified* emissions (presumably emissions that have been verified after they occur) of the project and the baseline emissions (Michaelowa and Dutschke, 1999). This definition suggests that a continual assessment of a project activity's additionality would need to be made whenever the emissions are certified. Presumably this could set up a situation where a project activity that had previously been found additional, and therefore eligible as a CDM project activity, could become ineligible. This poses two problems. First, it would require an additional and possibly complicating step in the process of certifying emission reductions, which in turn could pose negotiating problems since the concept of additionality has been a highly politicised issue. Secondly, it would increase an investor's risk in participating in such a project since at any point throughout the expected lifetime of the project activity it could become ineligible.

2.1.3 Determining CERs

The second critical function of baselines is to determine the quantity of CERs that a project activity has generated. After a project has been implemented and reductions in emissions have occurred (or been sequestered), operational entities will compare actual measured data to the baseline. From this comparison, a determination would be made on the actual amount of emissions that have been reduced and how many CERs could be issued.

3 Baseline Approaches

3.1 Introduction

Various possible approaches to calculating baselines are being developed by different fora such as NGOs, IGOs, private consultancies, government agencies and research institutions. Most of these approaches are, however, in their infancy as the baseline concept only very recently was acknowledged as essential for project based GHG emission mitigation. The main bulk of experience from estimating baselines has been gained from the Activities Implemented Jointly (AIJ) pilot phase, where mostly project specific baselines have been applied. Even from the relatively small number of AIJ projects carried out since 1995, a whole range of (problem) issues have surfaced, such as how to define a timeline for CERs, and how to treat gaming, free-riding, and indirect effects of project activities. Current analyses of baseline setting are generally based on the rather limited AIJ experience, and the further beyond the project specific baseline these analyses go, the more uncertain they should be regarded.

Section 3.2 starts out by describing the criteria a baseline should fulfill to be regarded as (environmentally) *effective*. A baseline serves its purpose (is effective) if it ensures that projects are *additional*, and of a *sufficient number* (and magnitude), so that total project activities contribute to achieving the objectives of the CDM (given in Article 12.2 of the Protocol). Hence, both many projects and additionality of the projects accepted are important. A discussion of inevitable trade-offs between the baseline criteria is also given.

Section 3.3 briefly describes the various approaches to baseline setting which have been proposed in the literature, and discusses these in relation to the effectiveness criteria. Important methodological issues, common to all approaches, are discussed in chapter 4.

3.2 Criteria for Assessing Effectiveness of Baselines

It is generally agreed that baselines should fulfill certain criteria. Ellis and Bosi (1999) propose that baselines should:

- be *environmentally credible* to prevent fictitious emission reductions and sink enhancements;

- be *transparent and verifiable* by a third Party;
- be *simple and inexpensive* to draw up (low transaction costs); and
- provide *a reasonable level of crediting certainty* for investors.

These criteria can be regarded as important for achieving the overall goal, environmental effectiveness (as defined above) (Michaelowa, 1999b). It is acknowledged, however, (as do Ellis and Bosi, 1999) that implications for JI and CDM may differ.

Other important criteria for assessing baseline approaches mentioned in the literature are *administrative feasibility* (i.e. if an approach is useful on a practical level) and *political feasibility* (i.e. whether an approach meets the policy objectives of the Parties) (OECD, 1999). Most criteria for assessing the effectiveness of baselines contain to some extent both political and technical aspects. We will in the following focus on the technical elements of developing baseline methodologies.

Many of the above mentioned criteria are closely intertwined, and there will in practice, no matter what approach to baseline calculation is preferred, be *trade-offs* between criteria, some of which will be discussed in turn here.

3.2.1 Lax versus Stringent Baselines

The overall environmental effectiveness of the CDM/JI will be a function of both the environmental additionality of project activities and the total number of project activities undertaken under the mechanisms (Ellis and Bosi, 1999). It is generally believed that more projects will be undertaken under the mechanisms the less stringent (more lax) the baselines are. In other words, if the baseline level (path) of GHG emissions is set too low, to ensure additionality, relatively few project activities would gain credits. In this case many projects which are additional would be ruled out. On the other hand, baselines assuming relatively high GHG emissions in the reference scenario would attract many investors, and most likely give (spurious) credits to some non-additional projects.

The scale from stringent to lax is of course continuous, but the point remains that as the level of stringency of baseline setting increases the number of project activities will decrease. It is thus not obvious whether lax or stringent baselines should generally be preferred. For instance, the environmental benefits from a stringent baseline may be offset by the benefits forgone from a higher number of project activities that would have been implemented under a more lax baseline. A large number of only additional projects would, of course, be optimal, whereas a situation with many non-additional project activities should be avoided. The realistic situations one would need to consider probably lie somewhere in between these two extremes.

3.2.2 Environmental Credibility versus Low Costs and Simplicity

Environmental credibility is about ensuring all stakeholders that project activities are contributing to long-term benefits greater than would happen in the absence of such activities. In order to achieve high environmental credibility the baseline needs to mimic a most likely «without activities» scenario. But it is also important that the baseline calculations are *transparent* and *verifiable* by a third Party (criterion 2 above). It is likely that the closer to a real situation the baseline aims the more complex such an analysis would turn out. A more complex approach, e.g. containing advanced model simulations for fuel use, carbon sequestration etc., may be harder to make transparent and easily verifiable for other Parties. Thus, there is a trade-off between drawing an environmentally credible and a simple, transparent and easily verifiable baseline.

Another, and potentially more important trade-off is between environmental credibility and costs involved in setting up a baseline (i.e. criterion 3). Baselines are generally costly to set up if they are complex and detailed. The costs are related to the appraisal, monitoring and verification processes etc. A very important point in the baseline discussion is thus how to strike a balance between credibility of the baseline and the costs of setting it up. High costs may be assumed to limit the potential number of implemented CDM/JI projects, as well as (*per se*) counteracting the central economic efficiency criterion of the mechanisms.

Relating the discussion about costs to the previous subsection, it is sometimes assumed that the costs associated with setting up a baseline are independent of whether it is lax or stringent (Ellis and Bosi, 1999).

3.2.3 Potential for Standardization of Methodologies

The issue of standardization of methodologies for baseline calculations is an important one. By «standardization» in the broadest sense we mean establishing a common set of guidelines on how to calculate baselines for different project types, i.e. which elements should be included etc (see below). As will be clear in section 3.3.2, more detailed elements within a methodology can also be standardized, such as a technology benchmark for energy efficiency projects.

There are at least three reasons why standardization may be useful: First, a common methodology may make the baseline calculation process less cumbersome for project participants. Second, it may enable comparison and secure consistency between projects and generally make the verification process more objective and transparent. A third reason, closely related to the first, is that standardization may reduce both the transaction costs for private investors as well as for official entities, and thus encourage a high number of project activities. There may, however, be high up-front costs involved in standardization, but it is generally believed that as the number of projects increase beyond a certain number, the cost per project will be lower if a standardized methodology is applied.

Some elements are better suited for standardization than others. Ellis and Bosi (1999) assess the potential for standardization of various essential elements in the methodologies. The timeline for emission reductions is relevant to all projects, and regarded as having a high potential for standardization between similar types of projects. The baseline fuel used, relevant for «greenfield» (new) and refurbishment energy/industry projects, is seen as having a medium-high potential in the short term and a low potential in the longer term. This is because the longer the horizon is, the harder it is to predict fuel use because of the possibility of autonomous fuel switching (e.g. coal/oil to gas). A third factor considered is carbon content for biotic projects (e.g. reforestation, afforestation and forest preservation). The potential for standardization is only considered as medium for this parameter due to site-specific differences and natural variabilities (may be in the order of +/- 25%) (WBGU, 1998).

Fully standardized methodologies for baseline estimation from the beginning of the CDM will be almost impossible to establish. A minimum set of guidelines should, however, be established, and further elements taken in as experience from the range of potential types of project activities is gained (Matsuo, 1999).

3.3 Three Approaches for Baseline Calculations

Many different classifications of the main approaches to baseline calculations have been proposed in the literature. The only practical experience one has of baseline setting is from the AIJ pilot phase, where most baselines were calculated on a project-by-project basis. Analyses and discussions concerning more aggregated baselines have thus no direct empirical foundation, and are uncertain.

The following three subsections will briefly describe some of the main approaches to baseline setting, based on Ellis and Bosi (1999). This classification is only one way of cutting the cake, and many others are possible[4].

3.3.1 Project Specific Baselines

Project specific baselines are the most dis-aggregated type of emission baselines. A baseline is elaborated for one particular project in a particular location, and only project-specific assumptions, measurements, or simulations for all key parameters are taken into account. These parameters may for instance be *technical*, such as fuel and technology characteristics and changes in output/fuel/technology over the life of the project, and *political*, like subsidy regimes, political goals of future fuel use etc.

The quality and consistency of the baseline estimations, as well as the quality of the reporting to the UNFCCC secretariat under the AIJ vary. Some AIJ projects even lack a baseline altogether, while others mention the baseline only «in

4 Strictly speaking a nationwide, «top-down» baseline (which is not treated here) would fall outside such a classification.

passing». Some of the (valid) experiences, related to the first three criteria under 3.2, are mentioned here, while other problem issues from the AIJ phase, as well as a discussion of crediting certainty for investors (criterion 4), are treated in chapter 4.

Project-specific baselines are generally detailed and relatively costly to set up compared to the overall environmental benefits of projects (OECD, 1999). The costs of elaborating this type of baseline would generally be born by private project investors, as opposed to what would be the case for more aggregated baselines, mentioned in section 4.2. Under the AIJ phase the costs of baseline setting have been found to constitute a considerable proportion of total costs for many projects (OECD, 1999).

Despite the project-specific nature of this baseline approach, and the costs and details involved, environmental credibility can often not be ensured. There is often considerable uncertainty associated with project specific baseline calculations. Ellis and Bosi (1999) cite a telling example by Begg et. al. (1999) where «a project-specific baseline to estimate emission reductions from refurbishment-type energy sector projects results in uncertainties of the order of +/- 80%» (p. 15). What is more, these types of projects are regarded as relatively «easy» projects for which to set up baselines. The study indicates that much of this uncertainty is related to the choice and timing of baseline fuel and technology options, e.g. *when* would a fuel switch have been carried out, in the absence of the project? The problem of forecasting for CDM projects is, however, in principle, no different from investment decisions where e.g. future market demand etc. is uncertain.

3.3.2 Multi-project Baselines

Multi-project baselines, often labeled as «benchmarks», «intensity indicators» or «activity standards», are sub-sector or sector level baselines seeking to standardize emission levels or rates for many projects of a similar type. The main aim of this approach is to reduce the costs of setting up baselines, but an additional consideration is to ameliorate potential strategic behaviour (gaming and free-riding) by project participants (se subsection 4.5).

One way of setting a multi-project baseline for instance in the energy and industry sectors, would be to express a benchmark in terms of emissions per unit of output (e.g. X tons CO_2/GWh). Projects which are more CO_2-efficient than the baseline (benchmark) would obtain emission reduction credits. A closely related approach is the technology matrix, where efficiency standards for (groups or mixes of) technologies in a country or region could be set as baseline for new projects.

Multi-project baselines can be set at different levels of aggregation (see also section 4.2). The highest level would for example be a global energy efficiency benchmark, and a typically low level, a benchmark for a technology in a (part of a) country. The benchmark could be based on region or country average CO_2/GWh of recently installed technology, marginal technology, or the best system already installed in the host country (Ellis and Bosi, 1999). These are only

some of many potential ways of calculating a multi-project baseline. It is likely that agreeing on the underlying criteria for multi-project baselines will represent a considerable political challenge for the Parties (Friedman, 1999).

An example of a global multi-project baseline is given for the cases of Brazil and India by Ellis and Bosi (1999). Brazil covers her electricity needs largely from GHG emission-free hydropower (92% in 1996), while India to a large extent uses coal (> 70%) in electricity production. If both India and Brazil use the same multi-project baseline approach to set a baseline for new electricity projects at the level of their current average emissions, gas-fired electricity projects could generate certified emissions reductions (CERs) in India but not in Brazil. It would be politically very difficult to agree on global multi-project baselines due to the large differences in natural resource endowments across countries.

Comparing the multi-project baseline to the criteria in section 3.2, the following remarks can be made. The overall costs of establishing multi-project baselines depend on the level of aggregation and thus the number of such baselines that need to be set to cover all sectors. But the main aim, and the realistic outcome, is a considerable cost reduction compared to project-specific baselines for the same GHG emission reduction.

There is an ongoing discussion of which baseline approach would ensure the greater environmental credibility. Even though project-specific baselines to some extent can keep control of additionality on a micro-level, some claim that multi-project baselines are more effective at ensuring additionality on an overall level (see section 4.5).

Multi-project baselines would generally be more transparent, and make the verifying process easier since the criterion for credits is unambiguous. This unambiguity would also seem, when considering the last criterion (crediting certainty for investors), to reduce the risk involved for investors. An investor would know without further investigations, which are often required for project-specific baselines, whether his technology would be eligible for credits.

3.3.3 Hybrid Approaches

Hybrid approaches utilize elements from both project-specific and multi-project approaches. A hybrid baseline could for instance incorporate some site-specific parameters as well as standardized emission benchmarks for different technologies.

The level of aggregation would generally be higher for a hybrid- than a project-specific baseline, and lower than for a multi-project baseline. Not all parameters are suited for standardization across projects, as mentioned in 3.2.3, a fact the hybrid approaches aim to take into account. An example of a parameter which (nearly by definition) is hard to standardize is host country policies (local, regional or national).

An example of such a site-specific political factor is the goal the Costa Rican government launched of phasing out fossil fuel electricity production by 2001. For potential renewable energy projects this would mean that the baseline should be zero emissions after 2001 if it is assumed likely that the goal can be reached (Michaelowa, 1998).

4 Methodological Issues

Some methodological issues are common to all baseline approaches and are thus discussed under a common heading here. Each subheading represents a key methodological issue related to baseline calculations which must be further addressed in the near future before the CDM can be launched.

4.1 Historic Data or Projection of Future Trends

Since researchers have no crystal ball to consult when predicting what would have happened in the absence of a CDM project, the baseline estimation needs to be based on historic data (trends), a snapshot of current performance, e.g. at the start of a project, or a simulation (projection) of future trends (in fuel use, technology change etc.).

There are advantages and disadvantages associated with using different types of data. Simulations of future trends in fuel use, production level, technology change etc. may be the most plausible reflection of the business-as-usual scenario, but may be less transparent and easily verifiable than baselines calculated from historic or present performance data which are often readily available. The costs associated with carrying out model simulations of future trends etc. may, in addition, be relatively high. Another point, with a high degree of practical relevance, is that not all types of data may be available at any geographical location and at any point in time. There is a realistic concern that some developing countries, especially in Africa, would not be able to handle the data requirements for more complex or data intensive approaches.

Many AIJ projects, of which the majority is «replacement» projects in the energy sector, have taken the existing performance as the baseline. For example, if an old technology or system was replaced with another that had lower emissions, the total GHG reduction was estimated as the difference between emissions before and after replacement for the lifetime of the project. A relevant question to ask, however, is whether the new technology would have been installed anyway during the project lifetime (a so-called autonomous technology change), in which case the baseline should have been adjusted. The certified emission reduction equals zero from the day the new technology is assumed to be (fully) operational.

To the extent appropriate data are available, extrapolations (forecasts) of parameters of importance to the baseline should be made. It is likely that such a projection of future trends will be increasingly important for ensuring the environmental credibility of the CDM in the future.

4.2 Level of Aggregation

By «aggregation» is usually meant the level of geographical zoom used for a baseline. Baselines could either be set at the project, local region, country, regional or global level. As touched upon in section 3.3, both costs and environmental credibility are important for deciding the preferred level of aggregation. Zooming in may give a better control of additionality on the project level, while zooming out may yield a good estimate of overall additionality for the CDM (conf. also section 4.5). The costs involved in setting up the baseline would generally increase when zooming in, and increasingly fall on project participants rather than on public entities (CCAP, 1998a, 1998b as cited in OECD (1999)).

One could also aggregate baselines along other dimensions than space. When constructing benchmarks or technology matrices for instance, the level of zoom for technologies and sectors would have to be considered. The lowest level of aggregation would be to include efficiency indicators (benchmarks) for all types of technologies in a given geographical area, while grouping similar technologies together would be a higher level of aggregation.

The issue of aggregation is therefore closely related to the choice of baseline approach since e.g. a hybrid approach is more aggregated than a project-specific approach, but the level of aggregation also needs to be decided within the scope of each baseline approach.

The higher the aggregation (regardless of dimension), the lower the costs of establishing baselines are likely to be. More aggregated baselines would generally be easier to verify and more transparent for third Parties. It is very much an empirical question whether the overall effectiveness of the mechanism would be higher or lower the more aggregated baselines are (conf. the discussion in section 3.3).

4.3 Lifetime of Project Activity (for CERs) versus Lifetime of Project

The total number of emission credits generated by a CDM project is extremely sensitive to the time during which emission credits are allowed to accrue. This lifetime of the project activity for CERs is sometimes referred to as the «emission timeline» (Ellis and Bosi, 1999).

The Subsidiary Body for Scientific and Technological Advice (SBSTA) under the UNFCCC has proposed that projects with equity financing should use the engineering or operating time of the project, whereas projects with debt financing should use the amortisation or depreciation lifetime of the project (UNFCCC, 1997).

Michealowa and Dutschke (1999) state that the amortisation lifetime usually is too short a period to make use of e.g. a plants benefits, while using the operating lifetime could lead to outdated plants running only because they generate CERs.

As a solution to this problem they propose the commercial lifetime of the project's hardware as an intermediate measure, i.e. that an investment is certifiable as long as it remains commercially profitable (incl. the value of CERs).

This view cannot, however, be applied to all types of projects. In biotic projects the timeline is hard to define. Forests for example, may keep binding CO_2 emissions for a century or more, while the lifetime of the project (funding) itself may extend to e.g. a decade or less.

United States Initiative on Joint Implementation (USIJI) applied this view directly when setting baselines for its forestry projects (e.g. in Russia and Mexico) where some timelines were longer than 60 years. The timelines for biotic AIJ projects range from 16-99 years, a variation that may partly be explained by the high scientific uncertainty in this field.

For many AIJ projects (e.g. Swedish energy efficiency projects in the Baltic states) it took longer than expected to make the new technology operate at its potential level (Michaelowa, 1999a). The consequence for setting the life of project activities (for CERs) must be that full crediting only is given from the time a project is operating at its (reported) potential.

A way of dealing with timeline uncertainty, proposed by the Center for Clean Air Policy (CCAP, 1997), is to discount emission reductions in the future at an increasing rate. Estimated future emission reductions would thus be of less value than reductions today. This is meant to reflect how difficult it often is to predict e.g. technology changes, fuel switches etc. even beyond short time spans like 5 years. Another way of dealing with this problem, which also seem to be generally accepted by the Parties, is to certify reductions once they have occurred, a solution which would shift risk onto private investors.

4.4 Static or Dynamic Baselines

Emission baselines can either be fixed at a constant level or as an ex ante determined path at the start of the project for the project lifetime («static»), or be revised during the project operation («dynamic»).

Dynamic baselines are thought to better describe what would otherwise have happened during a project lifetime, and is thus another way to ensure environmental credibility. Since the conditions underlying the baseline setting at the outset of a project may change unpredictably, there are good reasons for arguing that it is important that such changes prompt a revision of the baseline for the remaining project lifetime or, as some argue, retroactively. Important changes in conditions may for instance be political direction changes (e.g. as for the Costa Rican case in 3.3.3) or technological breakthroughs, scientific discoveries etc. The longer the timescale considered, the higher the probability for something unexpected relating to the baseline to happen. Project types with an inherently long timeline, such as biotic projects, should as a rule use dynamic baselines.

Referring back to the criteria for an effective baseline, two important trade-offs can be identified in considering the question of preferring static or dynamic baselines.

A static baseline gives investors a high degree of crediting certainty, since the level of credits for a defined time would be clear at the outset. This also depends, of course, on the investors' ability to control and predict the actual emissions from projects, which when compared to the baseline determines the CERs. This is, however, an uncertainty the investor can to some extent control. A static baseline would then, everything else being equal, encourage higher participation in the mechanism. Even though additionality can better be controlled through a dynamic baseline, the overall effectiveness of the mechanism may be lower than for static baselines due to limited investor participation (conf. previous discussions).

The uncertainty for investors under a dynamic baseline regime may, however, be reduced if revisions of baselines are agreed at the outset, at e.g. regular biannual intervals. Parameters considered for revision should also be agreed upon, and be transparent and measurable.

A second potential trade-off is between the costs of setting up baselines and environmental credibility. Static baselines are less of an administrative, monitoring and reporting burden than dynamic baselines. But dynamic baselines are potentially more realistic, and thus better at ensuring environmental credibility.

As mentioned in section 3.2.2, however, more "expensive" and potentially more realistic baselines may hamper the overall participation in the mechanism especially if costs are born by private investors. These higher costs work in addition to the effect of increased investor uncertainty from a dynamic baseline. The overall result for environmental effectiveness of the mechanism from using static or dynamic baselines is uncertain.

4.5 Gaming and Free Riding

Two central issues affecting the environmental credibility of particularly the CDM, are the concepts of gaming and free riding. Since there is an overall cap on emissions both for investor and host countries under the JI, incentives to cheat are not as strong. JI is a zero sum game: what an investor wins (spuriously) in emission reduction units (ERUs) would be lost by the host if emissions reductions are not real, a situation the host would strive to avoid.

Investors and hosts of CDM projects - companies as well as countries' governments - have the same interests. They want to get a maximum emission reduction (credit) through a project. High potential credits attract investors, and hosts generally want to benefit from the mechanism (be it new technology, know-how, employment opportunities or other benefits). Both parties therefore have incentives to overstate baseline emissions in order to inflate the CERs. This is called *gaming* (or cheating).

The less standardized and transparent, and the more subjective and site-specific the baseline setting is for a project, the higher the chances are for wide-spread cheating of this kind. Even under the AIJ, where no credits were certified, there were incentives to cheat to build support for the mechanism through high reported emission reductions.

As mentioned in section 3.3.2, the use of multi-project baselines, is (in addition to reducing overall costs) an attempt to ameliorate the potential problem of gaming on a project level. Since baselines in this case are given by benchmarks that are agreed by parties, individual parties or investors cannot artificially inflate baselines for projects in «their» countries (once they have been set). Incentives for underrating e.g. national energy efficiency would, however, be present in the establishment process determining multi-project baselines.

Free riders, on the other hand, obtain emission credits for whole projects that would have gone ahead in the absence of the project-based mechanisms. Free riding is essentially a matter not of the baseline approach, but of baseline stringency (see 3.2.1). A lax baseline (be it project or multi-project) would generally lead to a higher number of free riders. The question of free riding is directly linked to the determination of environmental additionality of projects. A typical example of this is from the AIJ phase where some hosts seemed to seek investors for projects that were already planned to go ahead anyway if funding did not come through.

Curbing incentives for gaming and free riding is essential for ensuring the overall effectiveness of the CDM. Gaming could be taken care of in the structure of the CDM namely by having the operational entities and the executive board serving as checks against gaming baselines. Free-riding, on the other hand, will need to be taken into account more directly when establishing baselines.

4.6 Treatment of Indirect Effects

A last important methodological issue given its own heading, is the treatment of indirect effects of project activities outside the so-called system boundary.

The direct effect of a project activity is the ultimate aim a project is trying to achieve, i.e. GHG emissions reduction or sink enhancements within the geographical site of a project. Indirect effects are any other effects on GHG emissions, positive or negative, caused by the project activity, for example through market mechanisms such as production and price increases.

For example, if carbon–rich fuels are largely substituted by low carbon fuels, the price of the latter increases while the price of carbon-rich fuels falls. This price drop may lead to an increase in the use of carbon-rich fuels which can offset the positive environmental effects of the initial fuel switch. Another negative indirect effect would be the alleviation of energy supply shortages (Heister and Stähler, 1994 as cited by Michaelowa, (1998)).

The term «leakage» is often used to describe negative indirect effects, where emission reductions gained in a country or region leak out to adjacent areas in the form of increased emissions there. In some cases these effects may more than outweigh the positive, initial emissions reductions on the project site. It is, however, important to differentiate between the leakage of activities included in the baseline and the additional project (Michaelowa (1999b).

During the AIJ pilot phase indirect effects are often summarily mentioned but not quantified to any extent. A French project discusses the problem of a raised production capacity in the case of retrofits (Michaelowa, 1999b). Increased production capacity which often results from energy efficiency projects would be a potentially very important indirect effect under the CDM.

Multi-project baselines aim to have more of an overall perspective than the project-specific approach can have. It is thus easier to consider indirect effects within the framework of the multi-project baseline approach. It is of course important for the effectiveness of the mechanism that indirect effects are included in the overall accountancy of emissions reductions from project activities.

4.7 Other Issues

Here we present very briefly some additional methodological issues that, perhaps, are less pressing for the immediate launch of the CDM.

Treatment of «No-regret» Projects

«No-regret» projects are GHG emission reduction projects which either are profitable for private investors (micro), or beneficial to society as a whole (macro), *independently* of potential CERs. The question is if these projects should be included in the baseline, and therefore not be considered additional. Some developing countries would want «no-regret» projects to be included in the CDM.

Treatment of «Greenfield» Projects.

«Greenfield» projects are «new» projects, as opposed to the majority of AIJ projects which only improve existing technologies, fuel uses etc. Little experience has been gained from «greenfield» AIJ projects, especially for non-renewable energy sector projects (which may be important projects under the CDM). Determining emission baselines for «greenfield» projects may be subject to greater uncertainties than for «replacement» projects, because there is no direct reference in a «greenfield» project to major factors that determine its GHG emissions (e.g. technology and fuel used).

Treatment of Co-benefits

«Co-benefits» is a term used to describe benefits from projects beyond the direct objectives of the mechanism. Such benefits may be the reduction of sulfur emissions (and acid rain) from switching fuel use from coal to gas (or coal with a lower sulfur content). For forestry-sector projects these co-benefits may be

potentially very large, as biodiversity conservation (if monocultural plantations are avoided), watershed protection, food production etc. (Trexler and Gibbons, 1999). In principle, all co-benefits of projects should be included to determine the overall level and extent of project activities.

5 Options for Developing Modalities and Procedures

5.1 Challenges for the Negotiations

Thus far, this paper has discussed various approaches to baseline methodologies and the issues that should ideally be given consideration in the formulation of modalities and procedures for baseline calculations. As stated above, a balance will need to be found between environmental credibility and economic efficiency. In addition, it will also be necessary to bear in mind the political realities in which these modalities and procedures will be negotiated. Some Parties may use baselines to try to limit projects to certain categories (thereby increasing their chances of receiving a larger share of projects), while others may use it as a way to stall implementation of the CDM.

Given the limited time (both actual and negotiating) prior to COP-6, trade-offs will also need to be made in the depth and proscriptiveness of the modalities and procedures. This is further complicated since little consensus seems to exist among Parties on how these modalities and procedures should be structured. At a minimum there is an acknowledgement that project specific baselines could be used, although how these baselines are calculated—what elements or methodological issues must be taken into account—has not been discussed in the negotiating forum. There seems to be a growing consensus among countries that standardized methodologies should be allowed, but again there has been no discussion of how or who would develop these guidelines.

Following is a brief synopsis of various Parties positions on baselines. Many of the positions are contained within the 5 November 1999 Note from the Chair on the Synthesis of Proposals. Very few contain any specifics on how or what the guidelines should be. Even within a Party or regional group there are many diverse opinions. For example, at COP-5 the Indian TERI Institute held a seminar in which they discussed the need for using standardized methodologies. The Indian government, however, is opposed to using standard methodologies.

- Umbrella Group (Japan, US, Canada, Australia, Norway, New Zealand, Iceland, Russia and Ukraine): both standardized and project specific baselines could be used.
- The EU: project specific baselines should be used. It is unclear whether the EU opposes or supports standardized methodologies, although many countries within the EU have discussed using standardized methodologies.
- Costa Rica: project specific baselines, although some standardization is possible, including projections from specific sectors in a given country.

- South Africa and Sierra Leone: baselines should be set at a national level and backed by project specific baselines when needed.
- China: only project specific methodologies should be used, and a test for technological additionality should be applied.
- India: only project specific baselines should be used.
- Peru: regional average of technology type that would be compared to an OECD average.
- AOSIS (Association of small island states): certain project types should be given preference, although no specific position on baselines is given.

At COP-5, Parties were requested to submit further views and information on technical issues on the Kyoto mechanisms by January 31 of this year. It is expected that at least some Parties will clarify their positions, possibly providing draft text on several issues, including baselines. From these submissions, it is expected that the UNFCCC secretariat will produce a compilation or synthesis document that could be the basis for a negotiating text on «technical» issues.

5.2 Modalities and Procedures for Baseline Methodologies

A great deal of importance has been placed on baseline methodologies since it is crucial to the environmental integrity of the CDM and therefore to the Protocol as well. CDM project activities can technically begin this year. Since the negotiating process has yet to look at baseline issues, it is highly unlikely that detailed methodologies can be adopted at COP-6. At best, Parties will need to take a minimalist approach, realizing (and incorporating into the decision language) that modifications will need to be made at a later date.

The modalities and procedures for baselines will need to elaborate an approach that can be used by those entities establishing a baseline. For project specific baselines, project developers will need to be given sufficient information to establish a credible baseline that will then have to be approved by operational entities or the executive board.

Multi-project baselines are likely to prove more difficult. The up front costs of establishing these baselines are high and they are data intensive. Sufficient guidance will need to be given to Parties interested in producing multi-project baselines, and a clear process of how these baselines are approved by the executive board will need to be defined.

It has been suggested that host country Parties or interested regional groups should be given the ability to establish multi-project baselines which would have to be approved by the executive board. Although it is not an ideal situation, particularly given «gaming» concerns, there does not seem to be any realistic alternative. Host country Parties may need to enlist assistance from various organizations as that Party sees fit. Unfortunately, some regions, such as Africa, may not be able to produce the data needed to establish multi-project baselines. For these Parties, project specific baselines might be the only option.

5.3 Interim Modalities and Procedures

Another important issue that will need to be considered when designing the modalities and procedures for baselines is how they will be (or can be) used prior to the existence of the executive board. Since CDM project activities can begin accruing CER's in 2000, provisions will need to be made for the early use of these baseline methodologies. This is problematic, however, since it is likely that any modalities and procedures for the CDM will have to be approved by either the executive board or the Conference of the Parties serving as the meeting of the Parties (COP/moP) to the Protocol. The baseline methodologies will need to be designed with enough specificity to encourage potential project investors to participate in the CDM, as well as with instructions on how to apply the methodologies in the interim period. It will also be important to look at the current structure of AIJ, including the Uniform Reporting Format (URF), to see what may be relevant for the CDM, and incorporate it into the modalities and procedures. Revising the URF may be one way of providing potential project developers with more guidance in this area.

5.4 Elements for Inclusion in the Baseline Modalities and Procedures

It is crucial to develop some standardised methodologies for project–specific baseline calculations. To get project implementation started, it is necessary for project developers to have some guidelines for how baselines should be calculated. These guidelines should describe how to calculate baselines for different project types, i.e. which elements should be included etc. and to some extent also how they should be dealt with. Such guidelines also are important to develop multi-project and hybrid baselines (see below).

While not an exhaustive list, following are the most important elements that should be included in the standardized methodologies for establishing baselines. More work will be needed to determine to what extent they will need to be dealt with in the modalities and procedures.

- *Historic data set or a projection of future trends?* In our view baselines should in most cases not be based solely on historic data, some considerations of future trends should also be included. Guidance should be given on the types of methods that would be acceptable particularly for simulation of future trends.
- *How to take into consideration free riders*. Some guidance on whether for instance «no-regrets» projects and «greenfield» projects should be eligible for CDM should be established.
- *Should the baseline be static or dynamic?* More guidance should be given on when it might be appropriate to use static versus dynamic baseline. We think that in several project types the baseline might be adjusted over time, and the interval between updates and revisions of the baseline should be decided at the start of the project.
- *Determination of the CDM project activity lifetime* (i.e., time period during which CERs may accrue). A definition of the lifetime of a project activity

may be desirable since there will not be one time period that will be applicable for all project types.

- *Treatment of indirect effects*. Some guidelines on how the baseline addresses the potential for leakage could be desirable. However, this is in our view not as crucial as the other elements to get CDM activities started.

For the establishing of multi-project baselines, the following elements are important in addition to those for project specific baselines:

- *The level of aggregation* (e.g., sector, sub-sector, technology). Some further guidance should be given for some important sectors (for instance the energy sector) and technologies (for instance renewables).
- *The geographic area covered by the baseline*. e.g., country-specific, regional within a country, regional for a group of countries with a similar set of circumstances or conditions for specific sectors. Guidelines should be developed in close connection with guidelines for the level of aggregation.

6 Conclusions

Baseline methodologies are critical to the success of the CDM and therefore to the Kyoto Protocol. While work on baselines is ongoing in various fora, little has been done within the climate change negotiations. It is unclear how work done outside of the negotiations can be brought into the process since historically it is only submissions by Parties that have been used as the basis for negotiations.

Little negotiating time is left to work out detailed methodologies that could be acceptable to all Parties; therefore it will be important to formulate minimal modalities and procedures that set out an approach by which baseline methodologies can be designed and approved. More thought will also be needed on how these methodologies can be applied prior to the establishment of the executive board. Possible options could include using certain aspects of the AIJ pilot phase. Other options may exist but further work will needed to determine this. It will also be critical to get sufficient information into the modalities and procedures to give potential project developers assurances that the baselines they are calculating are likely to be accepted by operational entities and the executive board once those bodies are functioning.

References

Begg, K., S. Parkinson, T. Jackson, P-E. Morthorst and P. Bailey (1999) *Overall Issues for Accounting for the Emissions Reductions of JI Projects*, Presented at workshop on baselines for the CDM, Tokyo, Japan, Feb 25-26.

CCAP (Center for Clean Air Policy) (1998a): *minutes of the Feb 1998 meeting,* Joint Implementation Braintrust, February 1998.

CCAP (Center for Clean Air Policy) (1998b): *minutes of the May 1998 meeting,* Joint Implementation Braintrust, May 1998.

CCAP (Center for Clean Air Policy) (1997) *Joint Implementation and Trading: Integration of JI into an Annex I Greenhouse Gas Trading System*, Washington, D. C.

Ellis, J. And M. Bosi (1999) *Options for project emission baselines*, OECD and IEA Information Paper.

Friedman, S. (1999) *The Use of Benchmarks to Determine Emissions Additionality in the Clean Development Mechanism*, Paper prepared for the Workshop on Baselines for the CDM, Tokyo, Japan, February 25-26.

Heister, J. and F. Stähler (1994) *Globale Umweltpolitik und Joint Implementation: Eine ökonomische Analyse für die Volksrepublik China*, Kieler Arbeitspapier No. 644, Kiel.

Matsuo, N. (1999) *Baseline as the Critical Issue of CDM: Possible Pathway to Standardization*, Paper prepared for the Workshop on Baselines for the CDM, Tokyo, Japan, February 25-26.

Michaelowa, A. (1999a) «Baseline setting in the AIJ pilot phase». In Bundesumweltministerium, Wuppertal-Institut (eds.) *Reports on AIJ projects and contributions to the discussion of the Kyoto Mechanisms*, Berlin, p.82-93.

Michaelowa, A. (1999b) *Project-specific, benchmark, top-down approaches for baselines and additionality: a comparison*, Presentation for the UNFCCC Technical Workshop on Mechanisms, Bonn, April 9.

Michaelowa, A. (1998) «Joint Implementation-the baseline issue. Economic and political aspects», *Global Environmental Change* **8** (1) :81-92.

Michaelowa, A. and M. Dutschke (1999) «Economic and Political aspects of baselines in the CDM context». In UNDP/WRI *Trends and Baselines: Promoting development while limiting greenhouse gas emissions*, UNDP/WRI.

OECD (1999) *Status of Research on project baselines under the UNFCCC and the Kyoto Protocol*, OECD Information Paper.

Trexler, M. and R. Gibbons (1999) *Advancing the Development of Forestry and Land-Use Based Project Baseline Methodologies for the Developing CDM Regime*, Paper prepared for the workshop on baselines for CDM. Tokyo, Japan, 25-26 February.

UNFCC (1997) *Activities Implemented Jointly under the Pilot Phase*. FCCC/SBSTA/1997/INF.3, Bonn.

Vine, E. And J. Sathaye (1999) *Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation*, Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, USA.

WBGU (German Advisory Council on Global Change) (1998) *The Accounting of Biological Sinks and Sources under the Kyoto Protocol: a step forwards or backwards for global environmental protection?*, Special Report 1998, at http://www.awi-bremerhaven.de/WBGU/wbgu_sn1998_engl.html.