Unclassified **ENV/EPOC(99)19/FINAL**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 22-Jun-1999
Dist. : 25-Jun-1999

English text only

ENVIRONMENT DIRECTORATE
ENVIRONMENT POLICY COMMITTEE

ENV/EPOC(99)19/FINAL
Unclassified

Cancels & replaces the same document:
distributed 28-May-1999

STATUS OF RESEARCH ON PROJECT BASELINES UNDER THE UNFCCC AND THE KYOTO PROTOCOL

OECD Information Paper

English text only

79500

ACKNOWLEDGEMENTS

This paper was prepared by Ingo Puhl, as a consultant to the OECD, for the Annex I Expert Group on the UN Framework Convention on Climate Change. Many people assisted in the preparation of this paper. Ideas, information, and comments were provided by government delegates. Fiona Mullins, Jan Corfee Morlot, and Jane Ellis (OECD) and Kristi Varangu and Jenny Hou (IEA) also provided comments. Fiona Mullins oversaw and edited the paper.

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FOREWORD

The Annex I Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy makers and other decision makers. In a collaborative effort, authors work with the Annex I Expert Group to develop these papers. As such, the papers do not necessarily represent the views of the OECD, nor are they intended to prejudge the views of countries participating in the Annex I Expert Group.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

A project baseline defines a benchmark to be used to assess mitigation performance by comparison with actual emissions. The baseline is the standard from which a measure of valid emission reductions or sink enhancement is derived. It must therefore be set at a level that ensures the emission mitigation activity is additional to what would have otherwise occurred. Approaches for defining project baselines can be classified in three categories: method-based approaches; comparison-based approaches; and simulation-based approaches.

- Method based approaches, such as benchmarking, top-down (e.g. sectoral) baselines, technology-matrix, and default baselines, establish a standard baseline that can be applied to a number of projects once it has been agreed and the projects have been found eligible.
- Comparison based methods identify a valid reference project and observe greenhouse gas emissions from that project so that mitigation project emissions can be compared to the reference case.
- Simulation-based approaches examine which project, if any, would have been implemented in the absence of the proposed activity.

Some methods determine baselines on a project-by-project basis, whereas others remove the need for case-by-case decisions which can reduce transaction costs and improve consistency between projects. Some approaches, such as "top-down" baselines, have high up-front development costs, but minimise the approval costs of individual projects and reduce leakage possibilities. Other approaches require little up-front development but place a high cost on the individual project developer. Some approaches are suitable for single, one-off projects while others are more suitable for large numbers of projects within the context of a national program.

To date most of the practical experience with baseline setting has been in the context of the AIJ pilot phase. This experience has shown that current definitions of additionality do not provide sufficient guidance for determining project baselines. Considerable difficulties remain in determining project baselines that are environmentally sound, have minimal transaction cost implications, and are politically feasible. Challenges such as defining additionality, deciding the period for which baselines should be set, and defining system boundaries for the baseline activity are discussed in this paper.

A great deal of work is needed on international guidelines for baseline setting for the project based trading mechanisms; particularly Joint Implementation and the clean development mechanism under Article 6 and 12 of the Kyoto Protocol. A menu of options for baseline setting is likely to be more appropriate than any single approach. Baseline setting approaches should take into account regulatory capacity, national strategies for participation in the project-based trading mechanisms, and the suitability of methods for different project types. Lessons can be drawn from the application of different baseline setting approaches to real-world projects that have already been implemented. Early decisions on baseline guidelines would facilitate investment in projects. However, any decisions should allow for new experience to be built into the design of the respective mechanisms at a later stage.

1. INTRODUCTION

1.1 Objective

The objective of this paper is to review the work that has been done to date on baselines for the project-based mechanisms under the UNFCCC and the Kyoto Protocol. The paper draws on both the experience that has been gained from projects submitted under the pilot phase for Activities Implemented Jointly (AIJ), and on more general academic analysis in the literature. The first section of this paper introduces a number of baseline setting approaches that could be used for the three project-based mechanisms and discusses the advantages and disadvantages of each approach. The second section discusses key difficulties and possible solutions to ensure that project baselines meet the criteria of environmental effectiveness, administrative efficiency, and political feasibility. The third section proposes areas for future work.

1.2 Context

Three project-based mechanisms of co-operative implementation have been established under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol:

- Activities Implemented Jointly (AIJ): The first conference of the Parties (COP1) in its decision 5/CP1 on a pilot phase for Activities Implemented Jointly introduced the project baseline concept to the climate change mitigation agenda. This decision establishes that Parties can jointly implement climate mitigation activities. The decision stipulates that credits for sequestered or reduced greenhouse gas emissions shall not accrue to any Party during the pilot phase, which will end no later than the year 2000. The future of AIJ after the pilot phase is not clear given that the Kyoto Protocol has established two new project based mechanisms.
- Joint implementation (JI): Article 6 of the Kyoto Protocol enables Annex I Parties and authorised legal entities in Annex I Parties to reduce emissions from specific projects and to transfer the "emission reduction units" thus generated to other Annex I Parties.
- Clean Development Mechanism (CDM): Article 12 of the Kyoto Protocol Article 12 enables developing (i.e., non-Annex I) countries to transfer certified emission reduction units from projects to Annex I Parties. The Article allows Annex I parties to count such project-level emission reductions achieved from the year 2000 towards their compliance in the first commitment period (2008 to 2012).

Establishing baselines against which project emissions can be compared is needed for determining environmental additionality under all three of these project-based co-operative implementation mechanisms. Analysis on baselines for AIJ projects is further advanced than for JI or CDM and may provide useful insights for the other project-based mechanisms. However, these mechanisms have different rationales, so it is possible that different approaches may be appropriate for establishing project baselines for each of them.

2. APPROACHES FOR ESTABLISHING BASELINES

2.1 Criteria for assessing project baseline approaches

Criteria for assessing project baselines are useful for judging the quality of baseline setting approaches. Criteria can also be used for comparative analysis and to identify the strengths and weaknesses of different approaches. Criteria proposed in the literature typically include the following: [1]

- environmental effectiveness: i.e., whether a baseline setting approach leads to the real and long-term reductions of greenhouse gases. An approach could fail this criteria if it:
  a) allowed a non-additional baseline,
  b) did not allow an additional baseline,
  c) system boundaries are not drawn properly and emissions leakage occurred, and
  d) reductions from the baseline were not permanent at the end of the baseline validity period;
- administrative feasibility: i.e., whether an approach is useful on the practical level, considering institutional/regulatory capacities in all participating countries, and the transaction costs for project sponsors; and
- political feasibility: i.e., whether an approach meets the policy objectives of the participating Parties, such as the integration of national development objectives.

Reference to these criteria will be made throughout the document.

2.2 Defining baselines

A baseline defines a level of emissions against which the actual or estimated emissions of a climate mitigation project is compared. The baseline is the standard from which a measure of valid emission reductions or sink enhancement is derived. It must therefore be set at a level that ensures the emission mitigation activity is additional to that which would have otherwise occurred. Otherwise, total emissions could increase beyond the agreed level.[2]

The baseline level is typically defined as the level of emissions that:

[1] CCAP (1998b), IEA (1997) and Carter (1997)

[2] If the greenhouse gas benefits of a particular project would have occurred anyway, because, for instance, the energy efficient equipment associated with a project is standard and not new, the project would result in no additional greenhouse gas emission reduction or sequestration. In such a case, project investors or hosts should not be given "credit" to apply against emissions reductions obligations they would otherwise have to achieve. (Carter 1996).

a) would have prevailed in the absence of such activities (AIJ),[3]

b) ensures that the mitigation activity is "additional to any that would otherwise occur" (Article 6 JI). In the Article 6 context, arguably mitigation should be "additional" to a baseline of emissions that is consistent with compliance with Annex I Parties' national emission reduction commitments.

c) ensures that the mitigation activity is additional to any that would occur in the absence of the certified project activity (Article 12 CDM).

Experience from the AIJ pilot phase has shown that these definitions are not sufficient for determining project baselines. Researchers, project developers, national AIJ programs and the uniform reporting format established by the Subsidiary Body for Scientific and Technological Advice (SBSTA) have subsequently proposed and used a number of more practical approaches. These approaches can be classified in three categories: method-based approaches; comparison-based approaches; and simulation-based approaches. These different approaches are summarised below.

2.3 Method-based approaches

Method-based approaches seek to reduce transaction costs and improve consistency between projects by elaborating generally applicable guidelines that are independent from the specific conditions of an individual project. According to Jepma (1996), such approaches would generalise the baseline setting process and move away from more or less subjective case-by-case decisions. Work on method-based approaches is included in the UNFCCC secretariat's list of issues for further work on project-based co-operative implementation.[4] Method based approaches include benchmarking, top-down baselines, technology-matrix, and default baselines.

2.3.1 Benchmarking

Under a benchmarking approach, project baselines would be developed from criteria or rules that reflect the standard which must be improved upon in order to generate valid emission reductions. The benchmark could be based on objectively verifiable information such as the historic or current emission intensity of a sector (current practice in the host country or international best practice), or on projected emission intensities. Benchmarks could be static (i.e., fixed over the life-time of the activity), or dynamic (i.e., adjusted periodically). Depending on the rule from which the benchmark is derived, data needs for developing the benchmark may be more or less extensive. Historic approaches are generally easier because information is more readily available, whereas projected data is less certain and can be more difficult to obtain.

2.3.2 Top-down

Under a top-down approach, a baseline would be fixed at an aggregate level that would cover a number of possible activities. A baseline could be set for a sector, a type of technology, or a system. The level of aggregation should suit the respective circumstances. Once the aggregate baseline has been set, a national

[3] AIJ projects must also meet the requirement of financial additionality, which requires that AIJ financing is additional to overseas development assistance (ODA) and UNFCCC related financial obligations of Annex II countries. The financial additionality criteria is limited to AIJ and is not included in other project based mechanisms. It is not treated here further and references to additionality in this paper are to environmental additionality.

[4] UNFCCC (1998b)

authority can allocate baselines for project activities without project-by-project assessment. Additionality of emission reductions from any projects that fall within the aggregate level is determined as any reduction from the project baseline that has been allocated (rather than individually assessed). All sources and sinks of greenhouse gas emissions included in the aggregate baseline would be monitored. There are significant time and cost implications in developing top-down baselines. However, once such baselines are defined, their application to individual projects is simple and fast.

A top-down approach could be applied to emission reductions of policy initiatives as well as to multiple projects. For example, it could be argued that measurable reductions from government policy initiatives could be used under the CDM to partly finance the implementation of such policy initiatives. Similarly, it could be argued that pioneer CDM investors pushing an innovative climate-friendly technology into the market may have a partial claim on reductions that are achieved from later investments using the same technology on a commercial basis, since the pioneer investors removed the barriers to commercialisation.

2.3.3 Technology matrix

Under a technology-matrix approach, an inventory of existing technologies might be made for a country or region. Some or all of these technologies could be defined as baseline technologies. The technology selection could be limited to the average technology or the top 25% performers. Technologies used in projects would be compared to the baseline technology or mix of technologies that best fits the profile of the proposed investment (i.e. in terms of size and operation characteristics). The list of baseline technologies would be regularly updated. All technologies that reach a certain production share in the local inventory could be included in the list. Once included, they would no longer qualify as technologies that generate additional emission reductions. One drawback to this approach could be that a narrow range of technological options could be picked as baseline technologies. This could inhibit innovation of non-recognised technologies if there were no suitable baseline technologies against which to compare emission reductions from the new technology.

2.3.4 Default baseline

Under the default baseline approach, a standard baseline would be defined for a narrow category of projects. Further baseline additionality testing for each project in that category would not be required. It might be difficult to obtain the initial agreement on a list of projects that could generate emission reductions from the standard default baseline. However, once such an agreement is made, unlimited numbers of projects of that category could be implemented (at least until the list is reviewed).

2.4 Comparison based approaches

Comparison based methods do not seek to construct an artificial "without project" case but identify a "real-world" reference project (or control project) against which project emissions are measured. This approach entails finding a valid reference project and observing greenhouse gas emissions in that project. This approach is suitable for replacement investments because there is a real baseline plant and the performance of two real facilities can be compared.[5] However, this approach raises questions about the validity of the baseline period. This issue is discussed in the second section of this paper. According to experience gained in the United States Initiative on Joint Implementation (USIJI) programme, this approach is quite costly.

[5] Swisher (1997), Hamwey et al (1998)

2.5 Simulation based approaches

Simulation-based approaches investigate which project, if any, would have been implemented in the absence of the proposed activity. The assessment is carried out in the context of the proposed activity. This approach applies behavioural and/or financial models to predict whether the proposed project would have been undertaken anyway in preference to a baseline project or whether climate change mitigation provided an incentive to switch technologies. Methods under this approach include barrier removal, commercial tests and multiple baselines. Each of these methods is summarised below.

2.5.1 Barrier removal

The barrier removal method entails identification of barriers that are specific to implementation of a project compared to a baseline project. If implementation of a project becomes feasible because the added benefits from climate change mitigation overcome such barriers, part of the emission mitigation from the project can be considered to be additional. Lists of relevant barriers for a number of project types already exist and can be regularly updated.

2.5.2 Commercial tests

The commercial test method entails a shadow price calculation of the greenhouse gas benefits of a project by comparing the cost of the mitigation project against that of a baseline project. If the cost of the mitigation project is higher than the baseline project, it might be argued that the additional cost reflects the value of climate change mitigation and therefore that the project was undertaken at least partly for climate change mitigation purposes. This approach requires a significant amount of information that might be available to the project sponsors but is not likely to be available third party reviewers, because of commercial confidentiality concerns.

2.5.3 Multiple baselines

Under the multiple baseline approach, a number of different baseline scenarios are elaborated, and a weighted baseline is derived based on the estimated probabilities for the different scenarios.

2.6 Mixed approaches

Hamwey et al (1998) propose a mixed approach that integrates a comparison based approach with a method based approach. Under this approach, a benchmark could be defined based on the observation over time of "real-world" reference data. An example would be to derive a top-down baseline for the electricity sector based on data from the national energy statistics on fossil-fuel conversion efficiency. Compared to some of the other benchmarking methods this approach avoids having to make assumptions and is transparent, but it requires quite sophisticated data.

2.7 Existing approaches

Table 1 summarises project baseline determination approaches that have been suggested in guidelines by different organisations and in submissions to the UNFCCC Secretariat in the context of the AIJ pilot phase.

Table 1: Approaches to Baseline Setting

Organisation	Baseline determination	Type of approach
SGS Forestry, Eco Securities (1997)	The baseline is defined as historical precedent, performance required to meet existing legal requirements, likely future development, or a combination of the three.	Method based (benchmark)
DOE (1996)	The baseline is defined through a basic reference case, defined as reported historic emissions, or; a modified reference case, which is based on a hypothetical case that future emissions would have been higher than historic emissions if not for actions taken as response to climate change.	Method based (benchmark) Simulation based
USIJI	The baseline is a modified reference case based on a "without project" scenario.	Simulation based
WBCSD (1997)	The baseline is a modified reference case, including future changes induced by regulatory change, regional economic and technological developments.	Comparison, method based
World Bank	The baseline is based on a without project case and selection of a reference project according to agreed rules.	Simulation based
Submissions to AIJ pilot phase	According to the first synthesis report by the UNFCCC Secretariat, the description of project baselines in this report was often brief and different approaches were used. The majority of project descriptions referred to past and anticipated trends at the project-site (simulation-based). Some included more complicated financial and barrier analysis (simulation based), and the remainder were based on reference projects.	

Source: Vine and Sathaye (1997), Heister (1997)

2.8 Project-specific vs. aggregate baselines

Some baseline setting methods determine baselines on a project-by-project basis, others establish a standard baseline that can be applied to a number of projects once it has been agreed and the projects have been found eligible. Aggregate baselines have been proposed for two main reasons: to reduce transaction costs associated with baseline development; and to reduce the leakage possibilities that are inherent in project-by-project baseline development. All method-based approaches fall into the category of aggregate baselines whereas simulation and comparison based approaches are project-specific approaches.

2.9 Transaction cost implications

Some baseline setting approaches are geared towards the implementation of single, isolated projects while are others are geared towards the implementation of a large numbers of projects within the context of one national program. The Centre for Clean Air Policy (CCAP) examined the transaction cost implications of different baseline setting approaches (CCAP 1998a, 1998b). Table 2 shows that top-down baselines have very high up-front development costs but that the approval costs of individual projects under the top-down baseline are negligible. On the other hand, the use of the commercial test method requires little up-front development but places a high burden on the individual project developer. This indicates that countries need to make a strategic decision when setting up their national programs for participation in project-based mechanisms and selecting the baseline setting approach they plan to take. Table 2 gives a rough indication of costs to the government of developing and implementing different baseline setting approaches for a national program. The table also indicates the costs (per project) to project developers of obtaining from regulatory authorities the necessary confirmation on the validity of baselines under different baseline setting approaches.

Table 2: Baseline setting and transaction costs

Transaction costs	***Overhead/ development costs***	***Baseline per project costs***	***Total transaction costs***	
	Costs borne by project-site govt.	***Costs borne by developers***	***small number of projects***	***large number of projects***
Benchmarks	medium	low	*low*	*low*
Top-down	very high	negligible	*high*	*negligible*
Technology matrix	high	low	*medium*	*low*
Default baseline	medium	negligible	*low*	*negligible*
Comparison	medium	high	*high*	*high*
Barrier removal	low	medium	*medium*	*medium*
Commercial test	low	very high	*high*	*very high*
Multiple baselines	low	high	*high*	*medium*

Source: CCAP (1998a), own assessment

According to a review of five AIJ pilot projects in the Baltic countries it is estimated that using current approaches mostly based on simulation, transaction costs for small to medium-sized projects in the Eastern European region would amount to 12-19 per cent of the total costs of successful projects.[6] This figure consists of 3 per cent for the project preparation and the feasibility study, 8 per cent for administration costs, and between 1 and 8 per cent for the JI acceptance procedure. The latter part contains the costs of project applications, crediting, monitoring and verification, etc. In terms of transaction costs, the main challenge during the pilot phase seems to be to reduce the costs of the acceptance procedure to the figure of

[6] Nordic Council (1996). This does not take into account the costs of projects that were examined but not pursued.

1 per cent. This can be achieved by duplicating existing projects, and introducing detailed and generally applicable guidelines.

2.10 Baseline setting under different project-based mechanisms

All of the practical experience with baseline setting has been made in the context of the AIJ pilot phase. In the absence of crediting under the AIJ pilot phase, project sponsors as well as regulators had little incentive to impose strict rules and guidelines on baseline setting and the accounting of emissions. Only a few projects were actually implemented and a large share of lessons learnt was obtained through simulation studies. Both Article 6 (JI) and 12 (CDM) of the Kyoto Protocol permit the crediting of emission reduction units against the commitments of Annex I Parties. Crediting adds significant incentive to overstate project baselines and therefore overstate emission reductions.

Under JI, the introduction of national emission targets in Annex I countries both limits the extent to which inappropriate project baselines could lead to emission increases and changes the comparative feasibility of baseline setting methods. Emission reduction units from JI project activities come out of a country's assigned amount of greenhouse gas units for a commitment period. Emission reduction units that are transferred are subtracted from the assigned amount of the exporting Party and added to those of the importing Party. All emissions need to be accounted for in the national inventory, and Annex I Parties must keep or buy enough assigned amount to cover their emissions inventory at the end of the commitment period for compliance purposes. This means that governments who calculate baselines for JI on a project-by-project basis need to evaluate whether a project baseline is consistent with their national emission commitment rather than whether the project baseline is additional to another activity it replaces. Any difficulties related to JI project baseline setting under Article 6 do not reduce the environmental effectiveness of the Kyoto Protocol because these emissions are accounted for elsewhere in the system. However, inappropriate baselines might lead to distortions between projects or sectors within a country, because if some projects export more emission reduction units than is consistent with the national target, the rest of the economy will bear a greater burden to comply with the national emission commitment.

Under the CDM, the sophistication of baseline setting methods with respect to their additionality and the proper accounting of indirect effects and leakage has immediate effects on the integrity of the Kyoto Protocol. Considering that non-Annex I countries do not have a national emission budget, unmonitored emissions from CDM project activities could increase global greenhouse gas emissions. Project sponsors will seek to minimise transaction costs associated with meeting the regulatory requirements for participation in the CDM. The challenge is to balance environmental effectiveness with encouraging investments that will enhance sustainable development.

3. DIFFICULTIES AND POSSIBLE SOLUTIONS

Considerable difficulties remain for determining project baselines that are environmentally sound, have minimal transaction cost implications, and are politically feasible.[7] A number of possible solutions that have been suggested are discussed below. Unfortunately, practical experience of these is not yet available.

3.1 Defining project baselines

Defining additionality has been one of the most challenging issues in the implementation of the AIJ pilot phase. Project sponsors have repeatedly expressed their frustration with the difficulties encountered with the application of the additionality criterion in defining baselines and articulated how counterproductive this criterion has been so far. Other stakeholders, especially environmental non-government organisations, have repeatedly stressed the importance of this criterion for the environmental effectiveness of project baselines. Proposals to resolve these difficulties span a wide range.

Researchers agree that from a methodological perspective, finding ways to make the additionality criteria operational in the baseline setting process is very important. Carter (1997) points out that in the AIJ context, many countries do not have explicit criteria requiring additionality. According to the UNFCCC Secretariat's first annual review of progress under the pilot phase of AIJ (UNFCCC 1996), only one reporting Party has an explicit criterion that emission reductions and carbon sequestration must be additional to those that would have occurred in the absence of the AIJ project. Other reporting Parties have not indicated that environmental additionality is a strict criterion in their programs. This fact is reflected in project reports, which show that environmental additionality is often difficult to determine. The one country with an explicit criterion, the United States, also noted that it was difficult to determine additionality. In guidance to project developers, the USIJI Evaluation Panel (1994) acknowledges the difficulty in seeking to gauge why participants might undertake projects or specific measures, since most projects will be done for multiple reasons. Since the first report a number of countries have changed their reporting rules to include additionality (Japan, Netherlands).

Parties can choose between two strategies to advance the development of project baseline setting guidelines for the CDM and JI:

- they can make an early decision on this issue, adopt interim guidelines and accept some trade-off between administrative feasibility, transaction costs and environmental effectiveness while the CDM and JI become active and relevant practical experience is gained, or
- they can delay such a decision, accumulate more practical experience from the AIJ pilot phase, and make a more informed decision at a later point.

There is a clear benefit for the former, because in the absence of stronger investment incentives in the AIJ pilot phase no significant practical experience will be forthcoming. A significant share of information and procedures from each baseline setting approach are relevant to others. Countries could use the experience

[7] Nordic Council's Ad-hoc Group on Climate Strategies in the Energy Sector (1996), UNFCCC: First synthesis of the AIJ pilot phase, Carter (1996), CCAP (1998b), Michaelowa (1997) and others.

from approaches that have low development costs towards moving to approaches with higher development costs.

3.2 Validity periods of baselines

The period for which baselines should be set is a difficult issue in the context of replacement investments, such as typical energy efficiency improvement projects. Chomitz (1998) considers that it is difficult to assess when an investment decision would be made in the absence of climate mitigation mechanisms. He lists a number of projects in the energy, waste management and forestry sector in which various factors could affect spontaneous adoption of new technologies. He suggests that this issue can be addressed by using a number of baseline setting approaches, including method, simulation and comparison-based approaches. IPCC (1996) and Michaelowa (1997) agree and add low-cost abatement green-field projects in the energy sector to this list, considering that such projects may be close to being profitable and, hence, may be carried out by the market itself in the near future. NEFCO (1996) adds that it is not always clear from its assessment whether local authorities of host countries would have carried out environmentally-sound investments at a later stage. They suggest limiting the validity periods of baselines for such projects to shorter periods, i.e. 5 years, and re-evaluate whether similar investments have been taken up by the market in the meantime (reference approach). However, investors might be unwilling to base their assessment of project viability on periods longer than the agreed baseline. This would effectively eliminate projects that would only be viable in the long-term and encourage shorter term projects that may be closer to no-regret options.

3.3 Guidelines for baseline setting

NEFCO (1996) finds that, depending on some critical assumptions that are made when selecting the baseline for a particular project, CO_2 emission reductions could fluctuate between 149,000 and 939,000 tons. CCAP (1998b) comes to the same conclusion from its analysis of four projects; the choice of method yields vastly different results in terms of net emissions reductions. The implication is that baseline setting approaches are vulnerable to exploitation of information asymmetries. This problem exists even in the more objective method based approaches to the extent that they rely on projected data.

A number of different options could be pursued for reaching agreement on guidelines for baseline setting:

- simple and multiple approaches

  It may be feasible to start with simple as well as multiple or diverse guidelines that allow a different method depending on project type. This would encourage project implementation, and experimentation. Parties could then learn from experience and increase the complexity and accuracy of guidelines as institutional capacities in participating countries permits (CCAP 1998b). Limiting the variety of eligible baseline setting approaches might limit the range of investment opportunities unnecessarily. CCAP's analysis has examined four baseline setting methods in detail. CCAP finds that default methods can significantly overestimate or underestimate emission reductions, and that results improve when methods are developed and made specific to suit individual project circumstances. Chomitz (1998) suggests that quantity discounting strategies could be used. Under these strategies project sponsors could be allowed to choose between a high default baseline with low preparation costs and discounted credits or a more rigorous baseline method with higher preparation costs and a higher level of emission credits. This approach would produce the desirable results that developers of large or repeated projects would be likely to choose a more rigorous baseline setting process whereas small or one-off projects may have their baseline set through a less rigorous process. This would reduce the transaction costs per emission reduction

unit in both cases while also limiting the error margin of ERU estimation. Hamwey et al (1998) suggest that using multiple baselines, i.e. a sectoral approach together with a project-specific approach, would also increase the confidence in the baseline.

- a priori eligibility

  Carter (1996), CCAP (1998b) and others make the point that there might be project activities that could be considered additional a priori. Such a generic approach could be used for a number of predefined small project activities because a) the number of alternative baseline scenarios is limited, b) a default baseline could be set on the safe-side, and c) considering that baseline development costs are largely fixed and fairly independent from project size, more individual approaches might make small projects unsuitable for project-based co-operative implementation. There is little contradictory opinion to this in the literature.

  Trexler (1998) argues that additionality of biotic offsets is often completely assured, considering that the greenhouse gas offset is the main product and therefore the sole reason for implementing an activity. On the other hand, Michaelowa (1997) argues that certain biotic offsets might fall into the low mitigation cost category and can not therefore receive a priori status.

- using aggregate approaches.

  Chomitz (1998) and CCAP (1998a) suggest that top-down baselines would provide the highest objectivity and environmental effectiveness. In the JI context, national emission commitments form an aggregate top-down baseline at the national level. From an international perspective, the binding national emission commitment resolves the additionality problem and effectively addresses leakage. Any non-additional ERUs or leakage should be corrected by emission reductions elsewhere in the Annex I Party's economy. In the CDM context, the additionality issue still needs to be resolved but only once per aggregate system (instead of once per project). The project-site government can allocate baselines to individual projects without further additionality tests for project sponsors. Both authors recognise that the top-down approach in the CDM context might conflict with the basic idea of project-based mechanisms to avoid the difficulties associated with setting sector and national baselines[8]. However, a baseline is different from a commitment insofar as non-compliance with a baseline carries no compliance penalties but just a loss of rewards ("carrot without stick" problem). This should limit political opposition to this concept. In the author's assessment the benefits outweigh the costs when a country decides to use the CDM systematically as a regular element of its sustainable development.

3.4 Leakage and project boundaries

According to the standard definition given above, a baseline is defined as emissions from an activity that would have been implemented in the absence of climate mitigation activity. Reviewers of AIJ pilot projects have pointed to some difficulties with baseline system boundary issues. This is supported by a simulation study from CCAP (1998b) which finds that the potential error resulting from assuming inadequate system boundaries for the baseline activity is significant.

There are two errors that can be made:[9]

[8] There is a technical and a political conflict in choosing aggregate approaches. Monitoring needs under an aggregate approach might be not feasible for developing countries from a technical perspective whereas the implicit requirement ensuring leakage prevention through non-participants (in order to meet an agreed aggregate performance) might be perceived as politically not acceptable in developing countries.

[9] It should be noted that both errors can also work in both directions and either increase or decrease net benefits.

a) Wrong match: The baseline does not match the project emissions, which means the project sponsor has identified baseline emissions that are not replaced by their project. An example is a renewable energy project where the assumption for setting the baseline is that the renewable energy replaces emissions from a base-load coal-fired power plant. However if peak-load in the electricity system is supplied from hydro-based electricity, a peak-load renewable energy project would offset hydro and therefore would not generate greenhouse gas emission benefits.

b) Spatial leakage: The baseline project boundaries do not include all of the sources where net changes of greenhouse gas emissions occurred as result of project implementation. An example is a forest preservation project where the project boundaries are limited to the protected site, ignoring the fact that local forest users might increase the deforestation rate in unprotected local forests nearby, therefore offsetting the sequestration effects achieved on-site.

There is no guidance on this issue in SBSTA's uniform reporting format and national AIJ programs address this issue only in part as shown in Table 3. This table lists national guidelines related to "matching" project boundaries of the actual and baseline project and leakage.

Table 3: The treatment of system boundary issues in selected national AIJ programs

Country	**Matching**	**Leakage**
Japan	*program*: no specific requirement, *project*: no official submissions	*program*: proposed projects shall not cause greater increase in greenhouse gas emissions in other areas compared with the reduction of greenhouse gas emissions expected from the project
Norway	*program*: no specific requirement, *project*: no discussion of this issue in the context of a coal-to-gas conversion project in Poland	*program*: no specific requirement, *project*: indirect effects are accounted for downstream and not upstream (without discussion of fitting issues as indicated)
USA	*program*: no specific requirement, *project*: no discussion in the context of a forest preservation and fugitive gas capture project.	*program*: sponsors need to provide adequate assurance that greenhouse gas emissions reduced or sequestered over time will not be lost or reversed

Source: UNFCCC Project and Program Activities Reported by Parties

Researchers propose a number of techniques to address leakage:

- the expansion of the system boundaries of the monitored system by using top-down or sector baseline setting approaches in the JI and CDM context,
- adjusting the baseline for a context specific leakage uncertainty and taking precautionary action to limit leakage further, i.e. by involving local forest users in project designs (see above example), and
- setting default leakage adjustment factors for a number of well defined, project activities.

There is some support in research that the first option might be a suitable leakage control option for large project activities in the AIJ and CDM contexts, considering that there is no other control mechanism and that the second option might be suitable for large projects in the JI context, considering that accounting activities for the national inventory provide added control in case of errors. The third option might be appropriate for small project activities in general.

3.5 Baseline Dynamics

Researchers have discussed a number of issues related to baseline dynamics:

- mechanisms for the continuation of JI baselines from one budget period to the next

  The Kyoto Protocol provides no guidance related to the quantification of emission limitations for Annex I countries in the second (or subsequent) budget periods. A JI baseline assigns rights on assigned amounts (to a JI project developer), which creates a linkage between a national budget and a JI baseline. It seems unrealistic that a country would approve baselines that last longer than the currently defined budget period considering the uncertainty related to the size of the future emission limitation. The author is not aware of any research on this issue for the time being. At a minimum, it would be useful to ensure that inter-period adjustments of national emission budgets and/or project baselines are transparent.

- the validity period of project baselines

  According to the first review of the AIJ pilot phase, the methodological elements used by project sponsors and developers to calculate the life-time of baselines are neither consistent nor replicable. The uniform reporting format contains no guidance on the validity periods of baselines. NEFCO (1997) suggests that energy baseline life-time should be set on a short-term basis as long as significant baseline uncertainties prevail, with the option to extend the period of validity after review. Trexler (1998) argues that project baselines for biotic offsets should be long to ensure the permanence of net benefits. As pointed out above, investors might be unwilling to base their assessment of project viability on periods longer than the agreed baseline leading to discrimination against projects that are only viable in the long-term.

- periodic review of project baselines for existing projects and of project baseline guidelines for new projects

  The uniform reporting format for AIJ in the pilot phase allows for the adjustment of baseline assumptions for ongoing projects. While this approach is useful to improve the quality of the additionality criteria in the project baseline, it might harm investors' confidence. However, NEFCO (1997) and CCAP (1998b) have come to the conclusion that baseline reviewing for existing projects is not problematic when it is an integral part of the baseline setting method. NEFCO (1997) uses a future scenario based approach for the determination of project baselines that allows for the verification and adjustment of certain key variables in one to three year periods. CCAP (1998b) refers to a reference scenario approach with a dynamic baseline that needs to be reviewed on periodically. According to project sponsors, companies can accept uncertainties related to real-world changes as long as the regulatory rules are clear. The AIJ uniform reporting format also addresses the possibility of changing the guidelines for baseline setting in order to allow integration of lessons learnt. It is not clear whether revised guidelines would affect projects that have already been implemented.

- the integration of pre-commitment period certified emission reductions from CDM activities (credit for early action)

  Art. 12 of the Kyoto Protocol establishes that certified emission reductions (CER) obtained from certified project activities from the year 2000 onwards can be used for compliance purposes. The accumulation of CER eight years prior to the first compliance period is unproblematic from an environmental integrity perspective, as long as the guidelines for setting project baselines ensure that emission reductions are greater than those that may have occurred without the project.

– the permanence of reductions from certain project activities

  Various authors raise the issue of permanence of emission benefits at the end of a baseline's life. The issue of reversibility seems to be of particular importance in the context of sequestration projects. Current research examines ways to address this issue from a methodological perspective (i.e. adjusting the baseline) and from a practical perspective (i.e. stakeholder integration into project design to ensure buy-in).

3.6 Institutional Issues

Chomitz (1998) points out that baseline determination depends not just on methodology, but on a set of institutions that keep the methodology's application reasonable and honest. He adds that third party verification, as suggested in Article 12 on "operational entities" may not by itself yield unbiased results. For comparison, the United States system of demand side management (DSM) incentives has used panels of public interest representatives to provide less biased results. Operational entities for the CDM could potentially include such panels for verification of emission reductions or project eligibility.

The practical use of baseline setting methodologies is also tied to some strategic considerations and planning on the part of the project-site government. An Annex I country might be very reluctant to agree to a JI project baseline without a national climate mitigation strategy in place. Otherwise it would be difficult to assess the portion of assigned amounts it can authorise for export without risking national compliance problems.[10] The construction of a national JI program also needs to take into account what the agreed baseline setting rules are, and how to integrate baseline setting into sector planning and relevant legislation. In addition, countries need to be prepared to strengthen their monitoring and reporting capabilities, depending on their choice of baseline setting methods, and the gases, sources and sinks that are included in the JI program.

3.7 Baselines for carbon sequestration projects

According to conclusions drawn by Trexler (1998), methodological baseline issues in carbon sequestration projects are poorly understood outside the group of experts. His paper argues that for this reason the cutting-edge research on this is not yet properly reflected in the UNFCCC language: the uncertainty related to additionality, leakage, indirect effects and permanence usually associated with carbon sequestration projects in general only exists for a particular set of project types and not at all for other project types. Trexler also argues that there are many more methodological similarities between sequestration and emission reduction projects than is often assumed. Trexler recommends focusing future work on better dissemination of existing work on the critical issues of methods to reducing uncertainty, leakage, ensuring the permanence of biotic offsets and assessing indirect effects in the context of biotic offset projects.

[10] This is based on the assumption that the non-compliance penalty outweigh the benefits of exporting assigned amounts.

4. POSSIBLE FUTURE WORK

4.1 A view on areas for future work

A recent UNFCCC Expert workshop has summarised a number of key issues for future consideration by Parties related to developing methodologies for AIJ in the pilot phase.

Box 1: Work on Baseline related Issues According to UNFCCC Experts

Additional work may be needed in the following areas (not in order of priority):

(a) Development of guidelines: (i) at a level of specificity which needs to be determined; (ii) with respect to system boundaries and consideration of leakage; (iii) for the preparation of sector-specific and technology-specific baselines; and (iv) to prevent systematic errors in the determination of AIJ baselines;

(b) Identification of sectors and technologies which are to be given priority in this process of methodological work and identification of indicative criteria for these sectors and technologies;

(c) Definition of narrow categories of projects that could be assumed on an a priori basis to provide additional environmental benefits;

(d) Consideration of activities in which estimated emissions in the project case reach or exceed the level of estimated emissions in the baseline;

(e) Establishment of appropriate procedures and mechanisms for third-party verification (Such work might be enriched by drawing upon lessons learned from the Helsinki Process on Tied Aid.);

(f) Further exploration of the issue of "perverse incentives" and their implications;

(g) The operational determination that environmental benefits are real and are long-term;

(h) The possibility of earning credits in the future for focused capacity-building activities; and

(i) The problem of how to value benefits other than greenhouse gas emissions reductions or sequestration.

Most of the items on this list address future work on guidelines for baseline setting which will not only be relevant in the AIJ context but the JI and CDM contexts as well. This list is well balanced across different methods, signalling that there will not be a single approach but a menu of options, that take into account the regulatory capacity and national strategy for participation (for reasons outlined below) and the suitability of methods for different project types. Future work in this area should examine the decisions that are needed to start activity under the CDM and JI and therefore facilitate meaningful project investment. Early decisions should allow for research on baseline methodologies to continue and for new experience to be built into the design of the respective mechanisms at a later stage. An initial decision

could establish default baselines and fix the baseline validity period for certain standard projects. There might be additional non-controversial areas ready for early decision-making.

4.2 Comprehensive baselines

In their submission on preparatory work needed for COP 4, Canada and Switzerland emphasise the need to determine credible JI criteria/principles for a comprehensive baseline that could be used for relevant projects, but that is not too onerous for private sector engagement. They also emphasise the elaboration of modalities and procedures for determining project eligibility, including how criteria for real long-term benefits and additionality can be devised so that they do not serve as a disincentive for private sector investments.

The Nordic Council of Ministers' report recommends the establishment of international guidelines for determining the reference case, for emissions crediting, and for the validity period of baselines.

Considering the potential contribution of sector-based/top-down baselines to systematic investment, future work in this area should focus on assessing the effects of JI and CDM project implementation geared towards contributing to technology transfer. Experts have expressed the need to ensure that baseline setting should not lead to giving incentives to remain in energy inefficient situations in order to score high reductions from climate mitigation activities under the Kyoto Protocol. In addition, certain baseline setting approaches do not hold the promise of practical applicability. Such approaches should be identified and eliminated from the list of approaches receiving attention in the future.

4.3 Consistent review of existing experience

A number of researchers have requested that a consistent evaluation of the AIJ pilot phase be conducted. While the AIJ pilot phase has delivered some valuable experience in developing methodologies for baseline setting, Palmisano (1996) considers that little useful information on JI projects other than public relations material is put out by most JI sponsors and national governments and that there are real questions as to the environmental benefits associated with JI projects. Only through a thorough evaluation of JI and AIJ projects can potential generators of AIJ projects and potential purchasers of post-2000 JI projects understand what, if anything, JI offers them.

A number of researchers have suggested at recent expert meetings that a number of pre-selected baseline setting methods on existing projects should be applied to existing projects in order to compare the results. This analysis would need to be sensitive to whether a project is implemented under JI or the CDM. Important design differences between these mechanisms need to be considered, in particular, the existence of national emission commitments in the JI context. Such analysis is expected to deliver very useful information on the accuracy, commercial attractiveness and other practical issues of different baseline setting methods.

4.4 Less researched sources and gases

There is little experience with AIJ pilot projects in the industrial, petrochemical and transport sector. It could be that there are issues associated with such project types that are not important for classic project types but prove to be key for these sectors. One such issue could be the very diverse nature of industrial output which might make it more difficult to match an appropriate baseline project to a proposed activity, especially in the case of green-field investment. Future work should address these project types. A number of industrial projects are currently under preparation that could serve as case-studies.

4.5 Institutional issues

Sathaye (1997) recommends clarifying, at the earliest possible date, the accepted roles and responsibilities of national governments, private businesses, non-government organisations, and international organisations in the joint implementation accreditation process. Considering the legal implications of baseline setting as a performance contract between two parties, a clearer definition of property rights would reduce the monitoring, reporting and verification costs, by focusing on the correct parties at an early point in time. In addition, national implementation of relevant procedures could begin. This might include streamlining the baseline setting process into the environmental impact statements needed for most infrastructure investments, and requiring analysis of baseline activity levels in natural laws governing foreign investment.

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