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EXPERIENCE WITH EMISSION BASELINES UNDER THE AIJ PILOT PHASE

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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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EXECUTIVE SUMMARY

This paper assesses the emission baselines used in Activities Implemented Jointly (AIJ) projects. It then draws out lessons that can be used when determining project-specific emission baselines for future AIJ projects and recommends ways to calculate and report these emission baselines so they can be made more consistent and transparent[1].

There are some similarities between AIJ and the project-based mechanisms outlined in Articles 6 and 12 of the Kyoto Protocol (Joint Implementation and the Clean Development Mechanism). This may mean that some lessons and recommendations from analysis of project-specific emission baselines used in AIJ projects are also applicable to JI and the CDM.

AIJ emission baselines are project-specific. Emission baselines are also difficult to validate, as by definition they never happen. Yet they are extremely important as they form the basis for determining emission reductions from AIJ projects, and may also form the basis for determining emission credits for JI and CDM projects. Emission baselines for JI and the CDM therefore translate into a means of assessing the potential environmental and financial performance of a proposed project.

There is currently no internationally agreed methodology on how to calculate emission baselines for AIJ projects. However, general guidance is available in some investor countries. Given this lack of centralised guidance, and inherent project-specific variations, it is therefore unsurprising that the methodologies used to calculate emission baselines in AIJ projects are highly diverse. The detail in which emission baselines were reported also varies.

Many AIJ project reports include a quantified emissions baseline. Some reports presented more than one possible baseline for the same project, and some reports did not present any, or only outlined the total projected emission benefits over the project lifetime. There may be many feasible options from which to choose when determining an emissions baseline. This is particularly true when considering emission baselines for "greenfield" (new) projects, where no direct comparison is available with pre-AIJ project parameters that are key determinants of emissions, such as fuel and technology type. However, even emission baselines for "replacement" projects are subject to significant uncertainties, although the range of feasible baseline possibilities is limited.

The variation in emission baselines between different AIJ projects could hardly be wider: some go down, others go up, many stay constant, and a few are a combination of all three. While some diversity in emission baselines is to be expected because of the wide variation in different AIJ project types, there is also significant variation even within similar projects. This is due to the importance of site-specific variations and to differences in key assumptions such as the time over which the project would generate emissions benefits. These variations mean that the anticipated environmental benefits from comparable projects sometimes vary considerably. It also means that many potential baseline shapes are valid for a

[1] "Project-specific emission baselines" is used in this paper to mean emission baselines that have been drawn up by examining a project on a case-by-case basis.

given project type. This does not facilitate inter-project comparison, but is unavoidable in a system where project-based emission baselines are used exclusively.

Where project-specific emission baselines are required in future, they could be made more consistent, comparable and transparent by setting out guidance on how they should be calculated and reported.

Any future methodological guidance on estimating project-specific emission baselines could address:

- the length of time over which different project types generate emissions benefits;
- the issue of uncertainty (possibly by requiring some sort of "safety margin" or environmental conservatism in baseline estimation);
- whether emission baselines should be calculated in the same manner for greenfield and replacement projects;
- how to deal with learning issues; and
- how to calculate the environmental benefits of energy efficiency measures.

Other site-specific information that influences the assumptions underlying the emission baseline estimation methodology should also be included, such as vegetation types for biotic projects, and distance of the project site from alternative fuel sources (e.g. electricity/gas grids) for energy projects.

Simple improvements to the current Uniform Reporting Format could improve the transparency and comparability of different project-specific emission baselines reports. These improvements could be applicable to future AIJ, JI and CDM reports, and would include providing:

- a more detailed disaggregation of current project classifications;
- separate reports for sub-projects;
- references to the availability of more detailed information elsewhere (if applicable); and
- an agreed accounting convention on the sign of emission benefits from projects.
- In addition, reports should distinguish between projects actually operating from those at the planning stage.

Other changes could also improve the reporting of project-specific emission baselines for AIJ, JI or CDM projects. These include:

- differentiated reporting requirements for different project types;
- including relevant and readily available data and information, and justification for these data;
- recommended units in which to present the total emissions benefits of the project; and
- independent verification/validation of data in the project report.

In the AIJ project reports examined for this paper, experience with emission baselines is limited to a project-specific (i.e. case-by-case) approach. Other, more standardised, means of drawing up emission baselines are also possible, and may need to be explored for use under JI and/or the CDM. These approaches could have both advantages and disadvantages when compared to the project-specific approach, and will be explored in future work.

Baseline rules are important, as they will influence the complexity and cost of setting up project-based mechanisms and therefore the number of JI and CDM projects in operation. Baseline rules will also determine the incentives available for certain project-based activities, and through this, their environmental integrity. Any future recommended baseline method(s) should be set up in such a way as to balance the encouragement of widespread use of project-based mechanisms with the need to ensure that their use does not undermine the ultimate objective of the FCCC.

1. INTRODUCTION

The concept of Parties meeting emission commitments "jointly" was set out in the United Nations Framework Convention on Climate Change (FCCC). The rationale behind jointly mitigating GHG emissions is that although the environmental effect of GHG emissions is equal irrespective of where they are emitted, the cost is not. The global cost of GHG emission mitigation could therefore be reduced if the most cost-effective emission mitigation options were pursued, regardless of location. Activities Implemented Jointly (AIJ) was established at the first Conference of the Parties (COP1) as a pilot phase of Joint Implementation.

AIJ is not the only project-based co-operative mechanism. Joint Implementation (JI) and the Clean Development Mechanism (CDM) will both operate under the Kyoto Protocol (Articles 6 and 12 respectively). The key difference between AIJ and JI or CDM is that under the latter two investors will be able to obtain some environmental credits in the form of "Emission Reduction Units" for JI and "Certified Emission Reductions" for CDM. Crediting is specifically excluded for AIJ projects for the duration of the pilot phase. The interest of potential investors in project-based co-operative mechanisms is therefore likely to focus in future on JI and CDM rather than AIJ.

1.1 Objective and approach

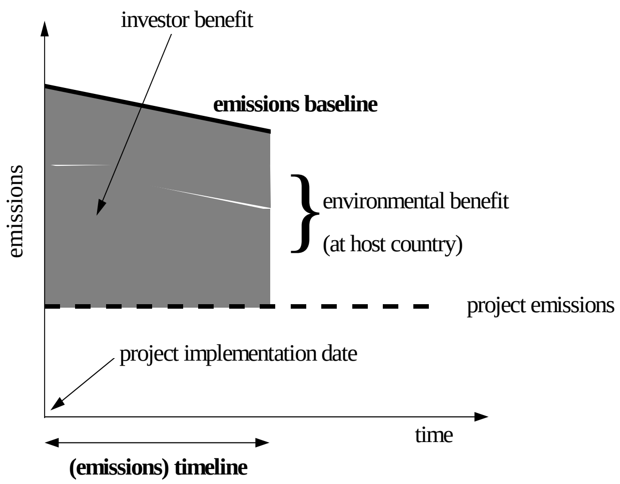
The objective of this paper is to analyse and assess emission baselines used in Activities Implemented Jointly (AIJ) projects. The paper then draws lessons from these baselines that can be used when determining emission baselines for JI and CDM projects.

This paper is based on information in the AIJ reports as submitted by participating countries to the UNFCCC, and on supporting information. Almost half of the 95 certified AIJ pilot project reports were examined in detail. The paper also draws on general analysis of baseline issues found in recent literature.

1.2 Terminology

The terminology used throughout this paper is outlined in this section and illustrated in figure 1.

FIGURE 1 TERMINOLOGY USED IN THIS PAPER



This paper examines the emissions baseline used in AIJ projects, defined as the estimated project emissions in the absence of AIJ. The time over which this baseline continues is called the emissions timeline.

Other issues that are important, although not treated in great depth in this paper are the:

- project emissions (i.e. GHG emissions from the AIJ project);
- project's environmental benefit in the host country (defined as the difference between baseline and project emissions); and
- investor benefit (defined as some proportion of the host country's environmental benefit).

1.3 Why do we need AIJ baselines?

AIJ projects are projects where investors fund all or part of a project that aims to mitigate greenhouse gas emissions in another country. AIJ projects are required to *bring about real, measurable and long-term environmental benefits related to the mitigation of climate change that would have not occurred in the absence of such activities* (UNFCCC 1995). AIJ projects therefore have to be additional, i.e. to have an environmental benefit over and above any climate mitigation activities that would have happened anyway[2]. "What would have happened anyway" therefore represents the project's emissions baseline.

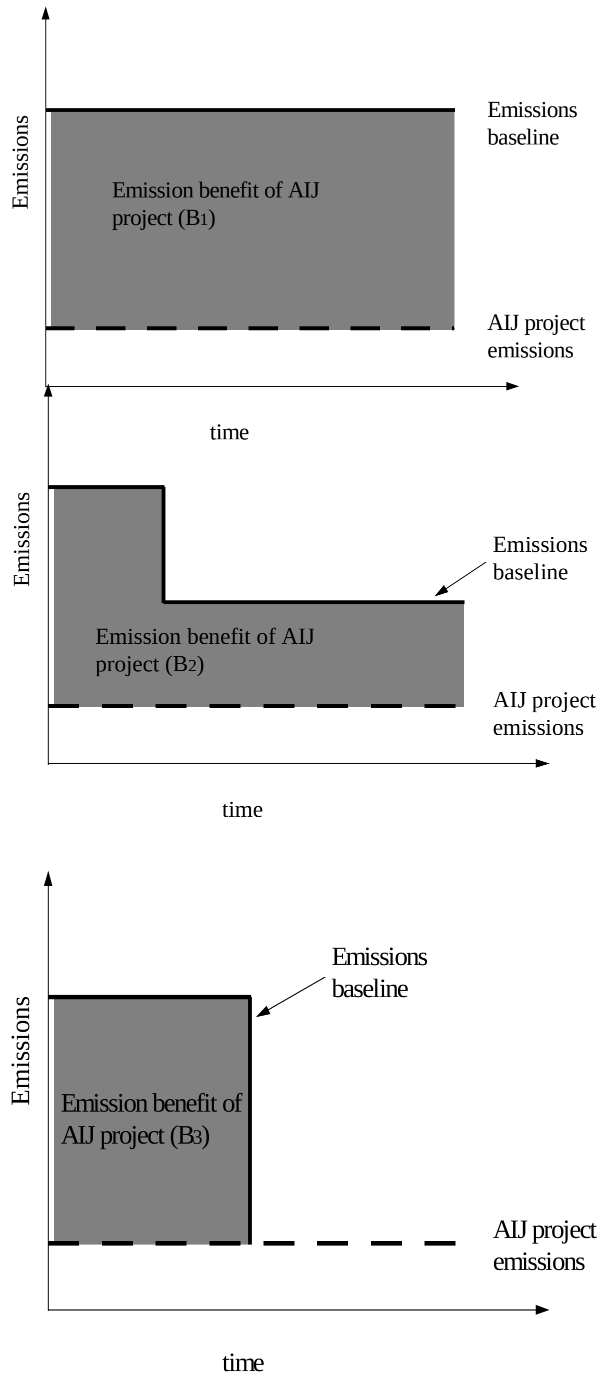
The decision of the first Conference of the Parties that established the pilot phase for AIJ (5/CP.1) does not include the word "baseline". However, the fact that AIJ projects have to result in *measurable* environmental benefits implies that there needs to be some sort of quantitative reference scenario against which to measure the environmental performance of an AIJ project[3]. It is also possible to allocate emission benefits from a project without the use of project-specific emission baselines. The advantages and disadvantages of one way of doing this are explored in section 5 of this paper.

Emission baselines are highly project-specific, and are difficult to validate as, by definition, they never happen. However, they are extremely important as they form the basis for determining emission reductions from the AIJ project. The variation that differences in emission baselines would have on the emission benefits of an AIJ project is illustrated in Figure 2.

[2] This paper focuses on environmental additionality, and does not explore issues surrounding financial additionality.

[3] However, the Uniform Reporting Format, which was subsequently agreed upon as the means of reporting AIJ projects, includes reference to a baseline.

FIGURE 2 EFFECT OF EMISSION BASELINE ON GHG BENEFITS OF PROJECT-BASED MECHANISMS



The emission benefit from an AIJ project is the difference between the estimated baseline emissions and the actual project emissions. This difference is illustrated by the shaded parts B_1, B_2 and B_3.

This example could represent a project whereby part of a fossil-fuel fired system is replaced by biomass (but with some fossil fuel still used, e.g. for start-up).

The B1 scenario is drawn up assuming that the fossil fuel used before the AIJ project continues at the same level and that emission benefits from the AIJ project continue for the lifetime of that project.

The B2 scenario has similar lifetime assumptions but also assumes that there is a fuel switch (i.e. from coal or oil to gas) at some point in the project lifetime. The B3 scenario assumes that the initial fossil fuel continues to be used as before, but that emission benefits only accrue for a shorter time, e.g. the lifetime of the previous system.

All three baseline shapes are found in actual AIJ projects (see Figure 3). All three shapes could be valid choices (as could many other shapes not presented here). However, the size of the emission benefits that result from the AIJ project vary significantly depending on the baseline choice.

The emissions baseline influences the total projected emissions benefits from a project. It is therefore a crucial component in determining the projected greenhouse gas (GHG) mitigation cost of a project (e.g. in \$/t CO_2). To the extent that potential investors make their final investment decisions in potential projects based on the projected GHG mitigation cost of those projects, the baseline used may influence which projects are ultimately pursued.

2. BACKGROUND

Emission baselines are needed in order to determine the environmental benefits from AIJ, JI and CDM projects. In the AIJ pilot phase, project-specific emission baselines have been used to determine the environmental benefits from individual AIJ projects. Some of the difficulties in setting emission baselines will be the same for all three mechanisms. Thus, some lessons from the AIJ pilot phase should be applicable to JI and the CDM. However, not all questions relating to emission baselines for JI and the CDM can be answered by looking at AIJ experience to date because not all aspects of emission baselines have been thoroughly explored under the AIJ pilot phase.

2.1 Challenges involved in determining emission baselines

There may be many feasible options from which to choose when determining an emissions baseline. This is particularly true when considering sector-wide baselines, which aggregate several different emission levels and/or trends, and for emission baselines for "greenfield" (new) projects, where no direct comparison is available with pre-AIJ project parameters such as fuel type, technology type, and amount of heat produced.

An emission baseline for greenfield projects is not what emissions were *before* the project (zero), but what emissions *would become* in the absence of that project. Greenhouse gas mitigation from greenfield AIJ projects in the energy sector may therefore be lower than that of replacement AIJ projects since these projects actually increase emissions (although by less than they would have increased in the absence of the project). The importance of this uncertainty is limited in an AIJ context because of the small number of projects involved. However, it will potentially be much more important in future, especially under the CDM, because the growing demand for goods and energy in developing countries is likely to lead to a demand for new, rather than replacement, plant.

However, even emission baselines for projects where existing equipment is replaced or rehabilitated ("replacement" projects) are subject to significant uncertainties, although the range of feasible baseline possibilities is limited. The emissions baseline for all projects is by definition hypothetical and so cannot be accurately determined. This *ex ante* nature of baselines has been estimated by some analysts (Begg et. al. 1998) to be the largest potential source of errors in determining emission reductions from AIJ projects.

Although it is impossible to avoid all uncertainties in baseline determination, it is possible to reduce these uncertainties through a rigorous baseline-setting procedure. Such a procedure is likely to involve an extensive monitoring exercise in order to determine the pre-project emissions (if the proposed AIJ project involves replacing or upgrading an installation already in place). Further background information may also be needed, such as the availability or not of alternative fuel sources, the distance between the proposed project and gas/electricity grids, strength of transport communication with the proposed project site. It is likely that little of this type of information is readily available, so it would therefore have to be specifically researched for the AIJ project proposal.

Obtaining information needed to determine the emissions baseline for a project has time and cost implications. The more information is required, the greater the cost. The costs of determining baseline emissions are sunk, i.e. disbursed whether or not a proposed project is agreed to, or its impact assessed. This cost barrier may have been one of the reasons for the limited participation of the private sector in the AIJ pilot phase. Moreover, high costs for baseline determination can disproportionately penalise smaller scale projects, as these costs often represent a relatively high proportion of the expected benefits of these projects. One of the major challenges involved in setting up criteria for determining emission baselines (and emission benefits/credits) from AIJ, JI or CDM projects is therefore balancing the need for thorough, rigorous baselines with the need for relatively low costs in baseline determination (and emission monitoring).

3. CURRENT EXPERIENCE WITH SETTING EMISSION BASELINES

Emission baselines have been set within the context of the Activities Implemented Jointly (AIJ) under the UNFCCC. This section outlines the presentation of baselines used in different AIJ projects, and examines the approaches used to estimate and report these emission baselines.

There is currently no internationally agreed methodology on how to calculate emission baselines for AIJ projects, although some countries have set up or are preparing national guidelines that include guidelines for emission baseline determination. It is therefore unsurprising that the choice of method to determine the baseline varies substantially between AIJ projects - even between those taking place in the same sector.

However, there is an agreed "Uniform Reporting Format" (URF) for AIJ projects[4]. While this does not stipulate the choice of baseline methodology, it does increase the transparency of reporting baselines for AIJ projects, and explicitly indicates that emission estimations should be reported "without the activity (project baseline)" and "with the activity" (sections E.1 and E.2). There is no further indication given as to what information is required under these sections, and has resulted in a differing detail of baseline calculation being used and reported by different countries. AIJ projects involve baseline determination on a project-specific, case-by-case basis, and there is little or no AIJ experience with other approaches to setting baselines.

The information contained in AIJ projects reported via the URF to the UNFCCC is assessed in its second synthesis report on activities implemented jointly (UNFCCC 1998b). The findings of this report relevant to project baselines include that:

- brief descriptions of project baselines were provided in the URF reports, but
- only a small number of these reports provided sufficiently detailed data to allow the baseline calculation to be replicated (UNFCCC 1998b).

The majority of AIJ projects are "replacement" projects in the energy sector, i.e. where one technology or system is replaced with another that has lower emissions. There are also a number of AIJ projects in the industrial sector (e.g. cement production in the Czech Republic) which aim to reduce the greenhouse gas emissions per unit output, although emissions may actually increase due to increased production. In addition to these two project types, there are also a number of "greenfield" (new) AIJ projects in the energy and forestry sectors.

In addition to the 95 AIJ projects certified as such by the UNFCCC, there are other AIJ projects planned or underway. For example, an additional 18 AIJ projects are listed as accepted, approved and endorsed by their national authorities but not yet reported to the FCCC (JIQ 1998). Further AIJ projects, e.g. financed by Japan and the Netherlands, that have been set up have not yet been certified as AIJ projects due to delays in approval or endorsement from the host country governments or to delays in registering the

[4] This URF covers all aspects of AIJ projects and not just the emissions baseline.

project in the investing country. This paper only examines baseline calculations from AIJ projects that have been certified as such by the UNFCCC.

Overview of existing AIJ projects

By the time of the UNFCCC's second synthesis report on activities implemented jointly (UNFCCC 1998b), 95 projects were listed as AIJ projects. These 95 projects are located in 24 host countries. Seventeen Annex I Parties are involved in AIJ projects: nine as host countries, and eight as investor countries[5].

The geographical distribution of AIJ projects is extremely uneven at present. The majority of projects (68) are located in Annex I EIT countries, and 51 of these in Latvia, Lithuania and Estonia. Africa is particularly poorly represented, hosting only 1 of the 95 certified AIJ projects. This uneven geographical representation was one of the factors that led to a decision at COP4 to continue the AIJ pilot phase, in the hope that more countries will gain experience from a new round of AIJ projects.

The sectoral distribution of AIJ projects is also uneven. Forestry-related, renewable energy and energy efficiency projects account for approximately 90% of the certified AIJ projects. The largest number of projects are for renewable energy (often conversion of fossil-fired heating systems to biomass-based heating systems) and energy efficiency, together accounting for 76 of the 95 projects. However, the 11 forestry projects account for just over half of the projected emission reduction from all 95 AIJ projects.

Although the sectoral representation of AIJ projects is not even, it does cover a wide variety of project types. Not all of these project types may even be eligible to generate emissions credits under JI or CDM: there are currently differing interpretations of whether biotic (sinks) projects would be allowed under the CDM.

3.1 Country positions and guidance on AIJ

A number of investor and host country partners in AIJ projects have laid out their position on AIJ projects, and reported this to the UNFCCC or elsewhere. Different countries' objectives for participating in AIJ projects vary. These different objectives have influenced the geographical and sectoral distribution (see text box) of certified AIJ projects.

For some investor countries, such as Norway and the Netherlands, maximising learning from how AIJ projects could work in different countries and different sectors was a significant reason for the choice of their different AIJ projects. This is reflected in the distribution of these countries' AIJ projects, which are geographically diverse, and which involve different types of projects in both energy and non-energy sectors. Using AIJ to promote a broad range of projects was also one of the objectives of the US JI programme (Lile et. al.). Thus, the US AIJ projects cover a broad range of sectors and countries, although two-thirds of its 25 projects are located in Latin America[6].

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[5] Other potential investor countries have AIJ programmes, but do not have any certified AIJ projects at present, e.g. Canada, Japan and Switzerland.

[6] However, the geographical distribution of projects in the USIJI resulted from investor decisions, and was not explicitly determined by the US government.

On the other hand, Sweden, who alone is the investing party in more than half the certified AIJ projects, had political encouragement to concentrate its AIJ projects with its Baltic neighbours: the Swedish energy minister had decided in 1993 that Sweden would take action to increase the efficiency of energy use in the Baltic countries. In addition, Swedish criteria for choosing AIJ projects, as well as those laid out in Decision 5/CP.1, were that AIJ projects should be affordable, reliable and able to be implemented quickly. The result of this, and that the programme is run by the Swedish National Energy Administration, has meant that many AIJ projects to date are of a similar nature and all in the energy sector. This has reduced project transaction costs and thereby helped to increase the mitigation cost efficiency of such projects, although the lessons learned from such projects are less likely to be widely applicable elsewhere.

Some host countries have also publicly laid out criteria for considering AIJ projects in their country, in addition to the general specification that such projects are consistent with national and sub-national environment and/or development strategies. For example, Poland will only consider two categories of projects as AIJ: those that involve the technological development and upgrading of equipment, and those that directly reduce the generation of GHGs in the production of goods and services. In addition, Poland specifies that the emission reductions should be estimated before they occur, and monitored afterwards. Poland specifically excludes training/education projects as AIJ projects, although other countries do not[7].

Costa Rica has also laid out a number of criteria that need to be fulfilled in order for a proposed AIJ project to be officially accepted by the Costa Rican government. These criteria include that the level of "red tape" is minimised, and that the GHG abatement brought about by the AIJ project should be quantified, monetised and shared between the host and investing parties.

3.2 How have AIJ projects calculated and reported baselines?

Different AIJ projects show a large variation in the detail of reporting emission baselines in AIJ pilot phase projects, as well as a large variation in the different types of emission baselines used. Most AIJ reports outlined one quantified emissions baseline. A few reported more than one baseline, and some did not report any emissions baseline, or only reported total projected emission benefits over the project's life (rather than by year of project operation).

The AIJ projects reported in the UNFCCC's Uniform Reporting Format are typically 10-20 pages long. On average, relatively little space is devoted to the issue of emission baselines. Some reports outline their methodology and rationale for emission baseline calculation in a few lines. This methodological information rarely extends to more than a few pages. Most reports examined supplement this methodological information with a timeline of emission reductions/sequestration expected throughout the lifetime of the project. However, the bulk of AIJ project reports is often taken up with administrative or procedural information, such as contact points of the different actors involved in each project, or with qualitative descriptions of the project and its benefits.

When examining emission baselines from AIJ projects, it is important to remember the context in which AIJ operates, namely that *no credits shall accrue to any Party as a result of greenhouse gas emissions reduced or sequestered during the pilot phase...* (UNFCCC 1995). While AIJ projects have to bring *real, measurable and long-term environmental benefits related to the mitigation of climate change*, once investors had demonstrated this qualitatively there are only academic and methodological incentives under

[7] The AIJ project between the Solomon Islands and Australia is a pilot DSM project whose emphasis is on education/training and improved technology maintenance. Technology input for this project is limited to installing timer switches on air conditioners. Another AIJ on solar-based rural electrification aims to make solar energy "known, available and affordable" via demonstration and training programmes.

the AIJ pilot phase to spend time and effort accurately quantifying emission baselines. (Although of course the role of the emissions baseline will become more important under any project-based mechanism that can generate emission credits for the investor). In addition, there is no UNFCCC guidance on which methodologies should be used to calculate baselines for which project types. It is therefore unsurprising that different investing Parties have spent differing efforts on the quantification and reporting of the emission baselines used in their AIJ projects.

However, a number of countries, e.g. the US, the Netherlands, have set out official national guidelines for AIJ projects that include indications on what information is expected in calculating the emission baseline of such projects. The Dutch JI Registration Centre manual (JIRC 1997) states that a specific requirement for AIJ projects is that the GHG mitigation from these projects should be quantified *from a broad study ... making [a] plausible case for the stated starting situation with regard to emissions, and estimates of the emissions of greenhouse gases during the course of the project*. The USIJI objectives include testing and evaluating methodologies for measuring, tracking and verifying benefits of the AIJ project, and one criterion for acceptance of an AIJ project in the US is that the project description *provides data and methodological information sufficient to establish a baseline of current and future greenhouse gas emissions* (Lile et. al. 1998) with and without the AIJ project. It is unsurprising that reports of AIJ emission baselines are often more complete and transparent when the projects have been undertaken by countries who have set up project criteria that include emission baseline development.

A summary of different issues found when comparing emission baselines in different AIJ projects is presented below. These issues are explored further in the remainder of this section.

The methodology by which emission baselines were calculated was not always clear. For example, where the baseline had been calculated by a model, the assumptions of this model were generally not presented (perhaps because of lack of space, or because this information was not explicitly asked for).

Justification of the methodology used to calculate the emission baseline was not routinely presented. For example, no justifications for the continuing *status quo* were given in some Swedish boiler conversion projects.

The calculation of many emission baselines was not transparent: not enough information was reported to enable a third party to reconstruct the baseline (or reference scenario) calculations. For example, AIJ projects in the energy sector frequently presented an emissions baseline, but did not state underlying data from which these emissions would have been calculated such as the quantity of fuels used before and after the project, the efficiency of a system before or after the AIJ project or the emission factors of different fuels used before or after the AIJ project. In one project that involved fuel switching, the fuel used prior to the AIJ project was not even mentioned.

Data presented in emission baselines were not always justified or referenced. References to the source of forest carbon density were rarely presented, and the justification for the choice of one figure from a range was also often missing. In addition, the carbon density of different forest types was commonly presented to three significant figures, even though there are significant variations within each forest type. Many AIJ projects presented assumptions for deforestation rates or autonomous energy efficiency improvements which were not fully explained.

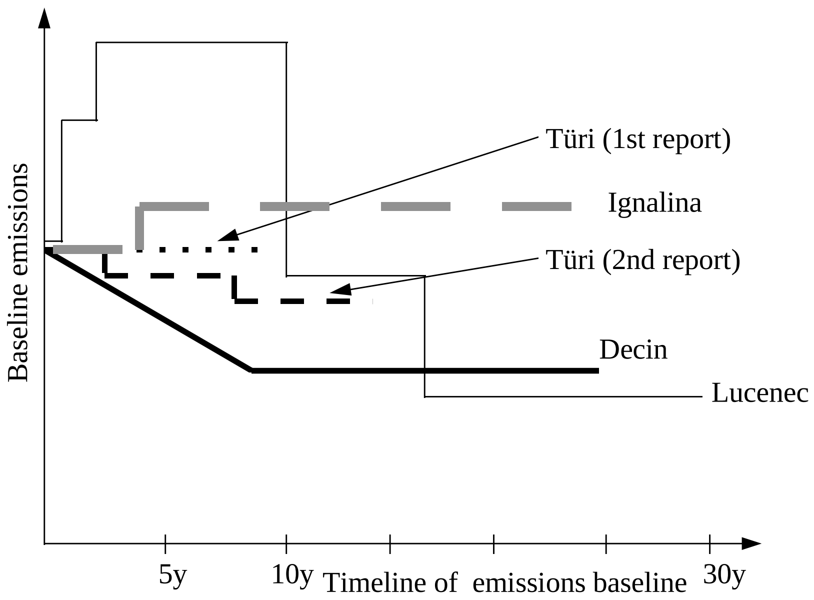
There was a wide variation in the time over which an AIJ project generated emission benefits for the investing party (the “timeline”), both within and between sectors. This of course has a significant impact on the total emission reductions brought about by an AIJ project, and on the emission mitigation cost of that project. However, the rationale behind the choice of timeline used was often absent.

The choice of system boundary for AIJ projects greatly affects project baselines, but was not always presented or explained. For example, the forest preservation projects examined commonly presented an emissions baseline that assumed that the deforestation avoided in the AIJ project area would not occur elsewhere. However, the validity of this assumption would vary depending on the amount and layout of the AIJ project relative to other forested areas in the country.

3.2.1 Emission baselines used in AIJ projects

Different AIJ project reports used different emission baselines. There is no general rule for the shape of an emissions baseline: some go down; others go up; many stay constant, and a few are a combination of all three. Different shapes of some of these diverse emission baselines are illustrated and explained in Annex A. While some diversity is to be expected because of the wide variation in different AIJ project types, the variation seen is nevertheless significant even within similar projects. For example, Türi, Ignalina, Decin, and Lucenec (figure 3) are all projects that involve fuel switching in heating plants. However, the shapes of the emission baselines for all projects are different. Moreover, the lifetime of the different projects also varies considerably, between 10-30 years.

FIGURE 3 EMISSION BASELINES USED IN FUEL SWITCH AIJ PROJECTS
(not to scale)



Just because projects of a similar type have different shapes of baselines does not mean that one baseline shape is “wrong” and another is “right”: the different situation of host countries, and the location of the different plants, all affect the choice of baseline. For example, the location of a heating plant relative to the natural gas grid is an important determinant of whether or not a coal or oil-fired plant could feasibly be connected to the gas grid in future, but this information is rarely given in AIJ project reports. Other assumptions also have a strong influence on the baseline shape. For example, the relative output of goods and/or energy before and during the AIJ project; whether or not the pre-AIJ equipment would have been rehabilitated; and whether any demand-side energy-efficiency measures are undertaken. This potential validity of different baseline shapes does not facilitate inter-project comparisons, but is unavoidable if project-specific baselines are used.

As well as differing assumptions concerning the likelihood and timing of fuel switching, the timeline of emissions benefits also varies considerably in the projects examined. Variation in assumptions could be narrowed if guidelines were agreed. For example, rules could be established whereby emission benefits are only available for a certain number of years not dependent on the lifetime of the AIJ (or other co-operative mechanism) project. This would avoid the situation where an old system was partially rehabilitated, and emissions benefits assumed for the lifetime of the new equipment, as was the case for some of the AIJ projects analysed.

It is clear from examining the AIJ reports that the UNFCCC's reporting instructions on baselines (contained in its Uniform Reporting Format) have sometimes been misunderstood. The current instructions include a table in which emissions from the baseline scenario (A) and the project activity scenario (B) are reported. The emissions effect of the project is also reported as A-B. However, some reports only provide quantitative detail on the estimated effect of the project, rather than outline the projected emissions with and without the project. Other AIJ reports have indicated that the "baseline scenario" emissions are zero (including projects where the baseline is described as continued operation of an oil-fired boiler), and that the "project activity scenario" are negative. (This is obviously not possible for energy sector projects).

Most AIJ projects examined focused on the reduction of CO_2 emissions[8]. Some reports (e.g. Hon/US bio-gen power project) explicitly stated that only CO_2 emission reductions would be estimated, while others just quantified CO_2 emission reductions but stated that other GHG emissions would also be reduced. However, some AIJ project reports did present quantified emission reduction estimates for other gases, e.g. the Dutch micro-hydel project in Bhutan quantifies emission reductions of CO_2 and CH_4, and presents the total estimated emission reductions in terms of CO_2 equivalent.

The remainder of section 3.2 focuses on the way in which emission baselines have been calculated and reported.

3.2.2 Categorising AIJ emission baselines

The AIJ projects described in submissions to the UNFCCC contain many different baseline types. Some of the project descriptions specifically label the emission baseline scenario chosen, e.g. as "status quo". Other reports refer to model simulation results. Most reports examined present a short (few sentences) description of the expected baseline scenario without labelling it in a particular manner.

The literature surrounding emission baselines includes many labels for different project types. Recent OECD analysis (Puhl 1998) distinguishes these into four types:

- **method-based**, i.e. generally-applicable guidelines independent from the specific conditions of an individual project, e.g. benchmarking or top-down baselines;
- **comparison-based**, i.e. based on a "real world" reference project or control group;
- **simulation-based**, i.e. assessing what would have happened in the absence of the proposed activity; or
- **mixed**, i.e. a mixture of the above.

These types could be further sub-divided, e.g. into static or dynamic baselines.

[8] Most AIJ projects to date are in the energy or forestry sectors, and so have a larger impact on CO_2 than on other gases. The emphasis on CO_2 is therefore not surprising.

Descriptions of AIJ emission baselines do not always fall neatly into the first three categories. For example, a common means of determining the baseline for energy supply type AIJ projects was to estimate the current emissions from that particular system (which could be categorised as a method-based approach) and then to modify this slightly to take into account expected efficiency gains and/or fuel switches. This modification falls into the "simulation" category.

Other AIJ projects have used more than one approach in calculating their emissions baseline. For example, the Dutch micro-hydel project in Bhutan includes three baselines, one of which is based on a comparison-based approach, i.e. the developments in a nearby, representative, village; one on a "best guess" approach; and one on the *ex ante* situation.

Still other AIJ project reports may present only a summary of more fuller baseline information available to the investor. For example, the Dutch AIJ guidelines requirements on baseline determination mean that more information is available than has been submitted to the UNFCCC. Alternatively, the emission baseline presented may represent one of several possible baselines that were elaborated by the investor (e.g. for the Slovakia/Norway project, see Yager and Mydske 1998). Some of the information submitted in calculating the emission baseline may be considered confidential, and therefore not reported to the UNFCCC. One case has been reported of an AIJ project where alternative emissions baselines were elaborated but then not made public (Michelowa 1998 account of the Russia/US Rusafor project).

One area on which most project reports were consistent was on possible revisions to an emissions baseline during the project's lifetime. Almost all AIJ emission baselines were fixed at or near the project start date to cover the whole emissions timeline of the project. Only one of the AIJ project reports examined (Czech/France cement production) indicated that the emissions baseline would be revised during the project's lifetime.

The description in the UNFCCC reports of the emission baseline methodologies used in different AIJ projects is often patchy or not fully representative of the methodology actually used. Since the aim of this paper is to analyse the baseline emissions used, the subject of categorising different methodologies for calculating the emission baselines for AIJ projects will not be explored further.

3.2.3 Activity data

Different AIJ project types will need different data points to calculate an emissions baseline. For example, energy sector projects will often need data on fuel use, fuel emission factors, combustion efficiency (and others) to calculate CO_2 emissions from fossil fuel combustion. Additional data, such as the amount of electricity generated or heat produced from an system before and after its certification as an AIJ project will also be needed to ensure that emissions from a system are reduced through *bona fide* means e.g. via fuel switching or energy efficiency improvements, and not just by displacing output elsewhere.

However, the UNFCCC's Uniform Reporting Format does not have a specific place in which activity data can be reported. Where activity data are reported, they are often spread throughout the project report, although most are concentrated in the section calculating baseline scenarios.

The amount of activity data given in the URFs for different AIJ projects varies significantly. However, very few baseline scenario descriptions reported to the UNFCCC included enough data for the baseline to be recalculated by a third person. The calculation of emission baselines in AIJ projects is therefore not transparent in most cases.

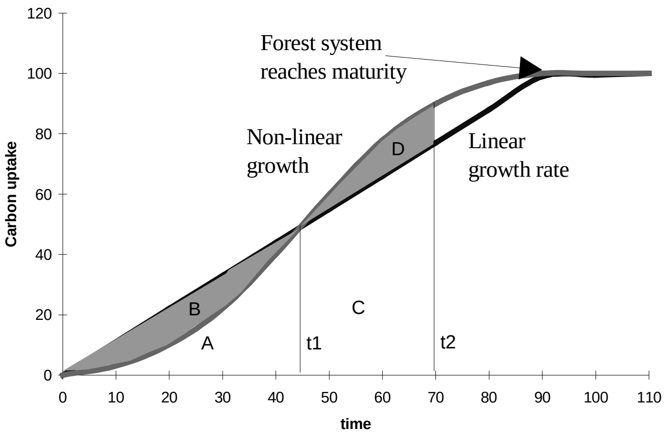
Much of the data needed to calculate an emissions baseline may already be collected, at least for replacement AIJ projects, even if these data are not publicly available or reported. Using the example of a plant generating electricity or heat, there are likely to be records at the plant of the type and quantity of fuel bought and of the quantity of heat or electricity that was sold. However, other data that would only be needed for AIJ projects, such as emission factors and combustion efficiencies, may be less available and would need to be collected specially.

Calculation of an emissions baseline for a biotic project requires a different set of data and assumptions. Most important are the area over which a biotic project is occurring and the carbon density of the land before, during and after the project. However, calculating the carbon density (or carbon content) of the land involved in the AIJ project is subject to a considerable uncertainty[9], because of the natural variations in vegetation cover and moisture content (WBGU 1998). Moreover, there is no agreed definition of what is included as biomass carbon. This should therefore be explicitly stated for transparency purposes, i.e. which above-ground, below-ground, forest floor and soil carbon contents does the emission baseline calculation take into account?

3.2.4 Emission factors and sequestration rates

Another important factor that influences baseline calculation is the growth rate assumed for re- or afforestation projects. This is most significant when, as is the case for most AIJ projects examined in this report, the lifetime of the AIJ project is less than the time taken for the forest to reach maturity. This is illustrated in Figure 4.

FIGURE 4 CARBON SEQUESTRATION RATES



The areas under the curve/line represent the carbon sequestered. The rate of carbon uptake assumed can affect the estimated GHG benefits of the project, particularly if the AIJ project lifetime is significantly lower than the time the forest system takes to reach maturity.

In this schematic example, a project lifetime of t_1 would result in a lower estimated carbon uptake at a non-linear growth rate (represented by area A) than a linear growth rate (represented by areas A+B). At t_2, the different approaches would result in an estimated carbon uptake of either A + C + D (non-linear growth) or A + B + C (linear growth). The relative difference between the two approaches is likely to decrease as the lifetime of the project approaches the time taken for the forest to reach maturity (t_3). The time taken for forest systems to reach maturity is typically 100-120y and that for plantations may be 50-60y. Both are significantly longer than the timelines presented in some biotic AIJ projects. Estimating carbon uptake is further complicated by the fact that the carbon uptake rates are different for above-ground and below-ground biomass.

The timelag between planting and carbon sequestration may also need to be taken into account. This affects the time distribution of emission benefits from an AIJ project rather than the total benefits from this project, but may be important for accounting purposes. An example of where a timelag was introduced

[9] However, even the surface area covered by an AIJ project may be subject to some uncertainty. The second report for one AIJ project examined had revised the area of the project by almost 5% from the first report (although the project itself was unchanged).

into a baseline calculation is in the Costa Rica/US Klinki forestry project, where seedlings planted in year in sequestered carbon in year (n + 1).

Emission factors (or biomass content per area, for biotic projects) may also vary significantly even within categories. This variation is particularly important for biotic systems, and may be of the order of 30% within each mature forest type. Estimating carbon contents for systems not yet at maturity are, in addition, subject to variations caused by growth rate assumptions, as outlined above. Moreover, estimating the carbon uptake by forests (needed to estimate the total carbon uptake caused by the AIJ project) is subject to a number of uncertainties and/or variations. For example, sample plots used for carbon uptake estimates need to be representative and visible yet not subject to any special treatment, measurements need to be carried out at a similar time each year to minimise the effect of seasonal variations in carbon content. Measurements also need to be carried out in a similar manner (e.g. measurement of tree diameter at the same height) each year to avoid inconsistencies, and estimates of carbon content per unit of biomass need to be representative.

These uncertainties may be reduced by combining on-ground estimates with other estimation types, such as via remote sensing. However, increased monitoring will increase the cost of a project. (Accurately measuring the carbon uptake by biomass is only possible with destructive monitoring).

3.2.5 Timelines

The number of years over which an AIJ project (or potential JI or CDM projects) generates emission benefits for the investor is of crucial importance. Emission benefits for the investor will generally be greater if they can accrue over a longer period of time[10]. Greater projected emission reductions from a proposed project will reduce the projected per unit emission mitigation cost for that project, and may increase the likelihood of that project attracting funds.

There are currently no commonly-agreed international guidelines that can be used by project developers when deciding the timeline over which their project is valid. The UNFCCC's Uniform Reporting Format for AIJ does include a space in which the "activity starting date", "activity ending date", and "lifetime of activity if different from ending date" can be reported. However, an examination of different AIJ reports using the URF clearly shows that different countries understand different things from these categories. For example, different AIJ project reports have indicated emissions baselines that are shorter, equal or longer than the lifetime of the systems installed by the project[11]. The UNFCCC's second synthesis report of a review of progress under the AIJ pilot phase indicated that *clear guidance is ... required concerning definitions of the [activity] starting and ending dates and their lifetime.*

This guidance would be facilitated if a clear distinction was made in the URF between the different timelines for an AIJ project. Since many AIJ projects involve a loan as well as a grant, there is both a financial and an emissions timeline, and the current URF is not clear about which one it refers to. Even

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[10] This may not always be the case, e.g. for a project with a dynamic baseline that assumes that the energy-efficient technologies introduced would be introduced in N years anyway even in the absence of AIJ. In such a case, emission benefits would only be accrued for N years, even if the life of the technologies introduced under the AIJ project is greater than N.

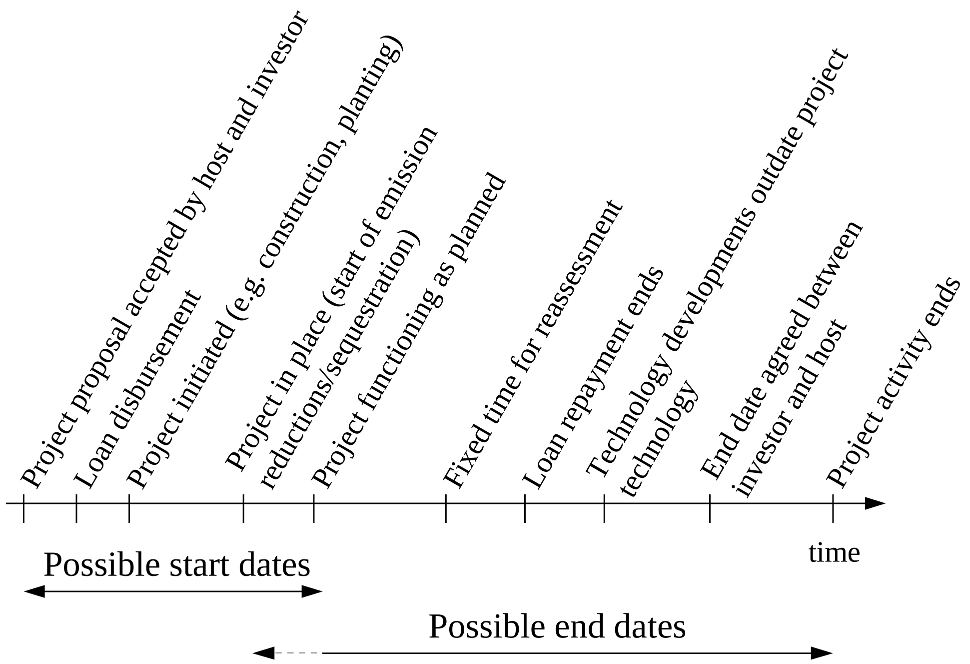
[11] For example, the Aerogenería wind energy project only calculates carbon benefits for the first five years of the project (although the life of the wind turbines will be much longer) because of the host government's policy aim of generating all its electricity from renewables by 2001. This aim means that this dynamic baseline evolves from one partially based on fossil fuels to one based wholly on renewable electricity.

when considering the emissions timeline, there are many possible start and end dates. These are outlined in Figure 5.

The timelines used to calculate emission baselines in current AIJ projects varies significantly, both between and within different project types. The shortest AIJ baseline presented was for two years (for a German-financed gas transmission network upgrade). This seemed to correspond to the length of time needed to upgrade the network, although the lifetime of the transmission network (and therefore of the emission reductions brought about by the project) is substantially longer. The longest AIJ baseline presented was for 99 years for a Dutch-financed forest preservation project, even though the project description suggested that there would be no net changes in carbon stocks of the preserved forest after year 60. However, the majority (76 out of 95) of AIJ projects outlined in the UNFCCC's second synthesis report had baselines between 10 and 30 years (UNFCCC 1998b). Almost all renewable energy and energy efficiency projects fell into this category.

The different biotic AIJ projects have widely varying baselines. For example, the five reforestation pilot AIJ projects have baselines of 25, 25, 30, 40 and 60 years, and the seven[12] forest preservation projects had baselines of 16, 24, 30, 40, 40, 50 and 99 years. The only afforestation project has a lifetime of 40 years. The documentation of biotic AIJ projects was generally silent on how the emissions timeline had been chosen.

FIGURE 5 POSSIBLE CHOICES FOR START AND END DATES OF AN EMISSIONS TIMELINE



There was also a wide range in the emission timelines used for energy efficiency projects, ranging from 2-30 years in 35 projects (one further energy efficiency project did not quantify the emissions timeline of the project). Justifications for the choice of timeline were presented in some cases. The timeline chosen often reflected the technical life of equipment installed under the AIJ project. For example, the Russia/Netherlands Tyumen project on improved greenhouse-heating technologies and practices indicated

[12] The UNFCCC synthesis report lists six projects in this category, but one of these six projects is an aggregation of two projects for which separate reports are available.

that the emissions timeline for the project would be the same as the lifetime of the new greenhouses installed under that project. The Mexico/Norway Illumex project which increased the deployment of energy efficient bulbs in Mexico used a conservative estimate of the lightbulb's lifetime as the basis for the emissions timeline.

Emission timelines that were shorter than the technical life of equipment installed under the AIJ project were also widely used for energy-efficiency projects. For example, initial reports from the many Swedish-financed district heating boiler conversions in Estonia, Latvia and Lithuania indicated an emissions timeline identical to that of the loan repayment period (10 years). However, reports have been updated for some of these projects, and indicate that emission reductions can be expected for the lifetime of the plant: estimated at 10, 15 or 25 years depending on the amount of original equipment replaced or modernised by the AIJ project. The Russia/German gas transmission network optimisation project also indicated an emissions timeline that was substantially shorter than the technical lifetime of the network.

3.2.6 System boundary

The system boundary chosen for a project will affect emission reduction baseline for that project. Determining the system boundary is therefore an important part of the baseline determination. However, there is no international guidance on where exactly the boundaries should be set.

Most AIJ projects examined assumed that the system boundary stopped at the project edges. For example, forest preservation projects explicitly assumed that the land covered by this project would not be deforested but did not consider the potential displacement or acceleration of deforestation activities in adjacent areas. Fuel switching projects generally calculated the emissions benefit of the project as the difference between fuel combustion emissions at the project site before and after the AIJ project implementation, but did not consider changes in emissions that were indirectly affected by fuel switching (such as from fuel extraction and transport).

The choice of the physical project boundary as the system boundary is probably because most of the AIJ reports examined had estimated a baseline specific to the project, rather than to a sector (or country). In addition, the project boundary is easily defined, while setting limits on the system in which a project operates is more difficult. Using a coal to gas fuel switch as an example, should the system boundary be drawn in such a way as to include any or all of: reduced methane emissions from coal mining, reduced emissions from coal transportation, the (one-off) emissions associated with producing any new equipment installed under the AIJ project, the (one-off) emissions associated with transport and disposal of the old equipment, and increased emissions from the extraction, transport and distribution of natural gas? While emissions associated with most of these activities[13] would be included in national inventories, the effect on global emissions would be different if the countries involved had emission commitments or not.

Greater emissions of other greenhouse gases, such as CH_4 and N_2O, from increased biomass combustion are often excluded from the quantified emission baseline even if the project is expected to affect the emissions of these other gases. However, some AIJ projects do not include all CO_2 benefits from their project. Examples include the modernisation of a cement plant in the Czech Republic and solar-based rural electrification in Honduras, both of which exclude the CO_2 benefits of reduced electricity demand brought about by the project.

[13] Emissions associated with the fuel used to transport coal by sea (a method commonly used by some of the biggest coal exporters, e.g. Australia, South Africa and Indonesia) would, however, be counted as emissions from "marine bunkers" and would therefore not be included in any national total.

3.2.7 Other issues

Risk

AIJ projects include some element of risk, as do other investments. However, the risk in an AIJ project has both a financial and an environmental component[14]. The environmental risk is twofold: firstly that the project may not deliver the emission reductions initially anticipated. Secondly, if emission reductions are lower than anticipated, this may result in global GHG emissions being higher than expected.

Reduced emission reductions from a project may occur for a number of political, economic, technical or other reasons. For example, natural disasters such as hurricanes may uproot trees and thereby reduce the amount and timeline over which a reforestation/afforestation AIJ project generates GHG emission benefits[15]. Natural climate variations, e.g. in rainfall or wind patterns, will affect the amount of electricity produced by renewable energy AIJ projects, and will thereby affect the GHG benefits from these projects if the renewable electricity generated was assumed to displace fossil-fuelled electricity. Changes in land ownership may result in altered land-use (and carbon sequestration) patterns. Changes in a country's energy prices either through subsidy or other policy reform can alter the pattern or level of energy demand. An economic recession may lower demand for goods or energy produced under an AIJ project, and reduce the projected emission reductions from this project[16]. Technical failures that require an AIJ project to be temporarily halted for repair or maintenance can also reduce the projected emission benefits from this project[17].

Many other factors that may or may not be influenced by the project developers will also result in variations in GHG benefits from that project. The significance of some of these variations, and the large scale of some emission mitigation projects, means that an annual *ex post* assessment of emission reductions could help to reduce the possibility that the emission benefits assumed by investors were significantly larger than the emission benefits actually achieved. However, the analysis of risk was usually very limited in AIJ project reports.

Environmental conservatism

Some AIJ project reports infer explicitly or implicitly that they err on the side of environmental caution. For example, the Costa Rica/US Klinki forestry project states that the project developers expect that the soil carbon stocks would decline without the project. However, the actual baseline assumes that soil carbon stocks remain constant. Biodiversifix, another Costa Rica/US forestry project, states that it uses a conservative (i.e. high) estimate of carbon stocks to determine the reference carbon stocks. The French project of improving energy efficiency at a cement manufacturer in the Czech Republic implicitly errs on the side of environmental caution, when assessed per unit output, by only taking into account CO_2

[14] Although financing is crucial to AIJ projects, this paper is focusing on the emissions aspect of AIJ projects. Therefore this paper will not deal with financing issues in more detail even though the financial risks associated with an AIJ project will influence whether or not it actually goes ahead, and the total costs of the project will determine the emission mitigation cost of that project.

[15] As an example, it is likely that the emission benefits of many Honduran AIJ projects will be lessened due to the effects of hurricane Mitch.

[16] This issue is rarely addressed in the AIJ reports examined, although one report (Decin) notes an agreement between the US and the Czech Republic that any emission reductions achieved will not be reversed were the project to be abandoned at some point.

[17] Very few of the AIJ reports examined address the issue of technical outages/maintenance, with the implicit assumption that the technology will be fully available. One of the AIJ project reports examined (Fiji/Australia PV project) acknowledges that this assumption is an optimistic one.

reductions from improved efficiency of the heat exchanger used in the project, not of the gains associated with reduced electricity consumption. However, the figures given in the report are on the basis of per unit output, even though the stated aim of the plant owner is to increase production (which would therefore increase absolute emissions from the plant).

Validation and verification of URF reports

There are other issues that may need to be addressed as the quantification of emission baselines takes on greater importance. For example, who will check reports for inconsistencies, mistakes (or even for bias)? At present, there is no international verification or validation on the content of reports, and some AIJ reports are internally inconsistent (e.g. report different project lifetimes in different parts of the URF), contain arithmetical errors (e.g. in the estimated emission reductions from the AIJ project) or contain other possible inconsistencies. There may also be inconsistencies in general policy/data information in the reports of two different projects carried out with the same investor and host parties.

3.3 Sensitivity of emission baselines

The variation noted above in the different assumptions used in different emission baselines illustrates the difficulties of drawing up an emissions baseline. However, the emissions baseline is often either directly proportional or extremely sensitive to these different assumptions.

This is illustrated in an example below, where the emission baseline of an actual AIJ project is compared with the emission baseline that would have applied if this project baseline had applied assumptions similar to those found in other AIJ projects.

Sensitivity analysis: Daugavriva boiler conversion

This Swedish-financed project converted a heat-producing boiler from gas/diesel oil to biomass. Two reports have been submitted to the UNFCCC for this project, with total emission mitigation of the project estimated at 130 kt CO_2 (1st report) and 195 kt CO_2 (2nd report). **This difference of 50% in emission mitigation potential of the project was solely due to a different time horizon** used in the two projects: the first estimated a 10-year emissions timeline, and the second estimated a 15-year timeline.

The assumptions included in the most recent Daugavriva report include: output from the plant to remain constant, a lifetime of the AIJ project of 15 years, and no fuel switching to take place. Other AIJ projects of a comparable nature present different assumptions in their baseline calculation, e.g.:

- fuel switch to from original fuel to gas (between 2-10 years after the project start),
- project lifetime of 30 years,
- energy demand growing, with the increased demand being met by the AIJ project and with the AIJ project mitigation benefits increasing in line with increased energy production.

Applying these assumptions to the Daugavriva project gives a range of projected GHG mitigation of the project between 130 kt CO_2 and 477 kt CO_2 (details outlined in Annex B).

The factor to which the calculated mitigation effect is most sensitive is the projected timeline of the project. However, other *ex ante* assumptions could be plausible, and could increase the variation in expected emissions benefits of projects even more. For example, if the plant owners were to switch to biomass in the absence of an AIJ project 7 years after the AIJ project started, the emissions benefit of the project would be reduced to 91 kt CO_2 as the emissions benefit of the project drops to zero in year 8.

Actual and projected emission benefits of a project could also be substantially different, for example in the case of technical failure. This outlines the need for *ex post* verification/validation of the emission mitigation of projects.

Other project types will be sensitive to other parameters. For example, the mitigation effect of forest preservation projects is dependent on the rate of deforestation that is assumed in the baseline case. The effect of greenfield renewable electricity generating projects and on energy-efficiency projects that reduce electricity demand is very sensitive to the type of electricity (i.e. hydro, fossil or a mixture) that it is assumed to displace. The timeline assumed for emissions mitigation effects of the project is important in all projects.

4. LESSONS AND RECOMMENDATIONS

Although COP4 did agree to continue the pilot phase, the future of AIJ is likely to be limited. Even in the event of the pilot phase continuing to the first commitment period (2008-2012), the Kyoto Protocol's JI and CDM are likely to be the focus of many investors, as both these mechanisms can generate emissions benefits. However, since project-specific emission baselines may be needed under JI and CDM, it is important to see where lessons can be drawn from the AIJ pilot phase, and if these lessons can help in setting up recommendations or FCCC-agreed guidelines for calculating such baselines under JI and the CDM[18].

Nevertheless, not all experience from project-specific emission baselines used in AIJ projects is relevant to JI and the CDM. Some AIJ project types such as forest preservation are not explicitly recognised by the Kyoto Protocol and may therefore not be considered eligible for JI projects. Project eligibility under the CDM, and specifically the question of whether or not sink projects could be eligible, is yet to be clarified.

The lessons from determining emission baselines under the AIJ pilot phase that could be applied to JI and the CDM are in two types: methodological and reporting. These are discussed below. The reporting lessons and recommendations are divided into two. The first section outlines some simple clarifications or improvements to the Uniform Reporting Format that could increase the transparency and compatibility of baselines with little or no effort. New reporting practices that may be more resource-intensive, or areas in which reporting guidance or recommendations could further improve the comparability and transparency of project-specific emission baselines, are outlined in section 4.2.2.

4.1 Methodological lessons and recommendations

There are many methodological issues that need to be resolved if project-specific emission baselines are to be used in determining emission benefits for project-based co-operative mechanisms. This section focuses on measures that could improve the consistency and transparency of project-specific emission baseline calculations. However, it does not suggest whether or not these measures should be mandatory or just

[18] Of course, if JI and CDM projects and activities receive emission credits by a mechanism that does not use project-specific emission baselines, some of these recommendations may no longer be necessary.

encouraged as part of "good practice". Some of these recommendations will only be applicable to projects if a project-specific emissions baseline is required.

1) **Emission baselines for AIJ projects are highly project-specific**, so detailed project-specific baselines are likely to vary from one another in shape and length, even for projects of a similar nature. Expert judgement has played an important role in setting emission baselines to date, and is an important source of the variation noted in them: baselines are often directly proportional, or highly sensitive, to underlying assumptions.

➨ Detailed, project-specific technical and policy data are needed to reduce the uncertainties inherent in determining emission baselines, if these emission baselines are to be drawn up at the project level. However, expert judgement is likely to remain an important component of baseline determination even if detailed data are available to the project developers.

2) **Environmental conservatism** in drawing up baselines would help to improve the global greenhouse gas mitigation potential of project-based co-operative mechanisms, although it also has a cost implication for the investor. A few AIJ reports examined indicated that some of the assumptions presented in the report were environmentally conservative, i.e. that the total emission benefits estimated were at the low end of a possible range. This could be interpreted as a tacit acknowledgement of:

- the uncertainty that surrounds an individual emissions estimate, or
- the wish of the investor/host party to maximise the chances that the project will be "environmentally effective" (i.e. that leakage is minimised from the project).

Increasing the environmental effectiveness of projects could also be achieved by periodically revising the emissions baseline (downward) once the project is in place in order to take e.g. unexpected technical improvements into account. However, such adjustments would increase the uncertainty of investor benefits, and is therefore likely to reduce investor interest in AIJ projects significantly.

➨ Emission baseline calculations may need to include a "safety margin". For example, recommendations could be made that the calculations of the emissions baseline and emission benefits should err on the side of environmental caution (e.g. by taking a low estimate for the emissions timeline or the low end of a range when calculating the emission mitigation potential of a project). This would be particularly important when the uncertainty in emission reductions from that project is large, for example in biotic projects, and/or where *ex post* emission monitoring is limited.

3) **The rationale behind choosing the emissions timeline is rarely explained**, although the timeline is a crucial component of the emissions baseline and in determining the environmental benefits from (and potentially, credits for) a project. Possible methodological guidelines for setting timelines are explored in e.g. Michelowa 1998.

Erring on the side of environmental conservatism may require long baselines for biotic projects, but shorter baselines for other projects. Long baselines for biotic projects will help e.g. to ensure that carbon sequestration from that project continues far into the future, although this would need to be complemented by assurances from the host country that the sink created by the project would not be lost. Long baselines may also be justifiable for projects that improve transmission/distribution infrastructure, e.g. for the transport of gas or heat, as such networks have long lifetimes.

However, long baselines are not necessarily most appropriate for projects introducing new technology, even if this has a long lifetime. In this case, a long emissions baseline may result in substantially over-estimated emission reductions if independent technological advances reduce the emission mitigation potential of the project equipment before the end of its useful life.

➨ Recommendations on how to determine the emissions timeline would help improve consistency in emission baselines between different projects of a similar nature.

4) **Host country policies that might affect emission baselines are rarely presented**, although policies e.g. of improving the efficiency of power generation, facilitating a switch to renewables, or to introduce large-scale gas use would all have significant impacts on the choice of shape and timeline for emission baselines. Third party validation of emission baseline choices would be facilitated if sources of such policy information was referenced[19]. This should be neither difficult nor time-consuming since the host country government have to approve the AIJ project, and are best placed to state their policy goals.

➨ Key methodological assumptions should be reported to make transparent the validity of the emission baseline scenario. (This sort of information could be presented in the current URF section on "compatibility with economic development and socioeconomic and environmental priorities": current reporting in this section is extremely brief in many AIJ projects).

5) **Little experience has been gained from "greenfield" AIJ projects**, especially for non-renewable energy sector projects. However, it is likely that greenfield projects will form a large proportion of proposed CDM projects and that some of these projects in the energy sector will use fossil fuels as an energy source. Determining emission baselines for "greenfield" projects may be subject to greater uncertainties than determining emission baselines for "replacement" projects, because there is no direct reference in a greenfield project to major factors that determine its greenhouse gas emissions (such as the fuel and technology used)[20]. More experience of, and information exchange on, determining the emission baseline for greenfield projects would be useful before any guidelines are agreed on calculating emission baselines for such projects.

In addition, the environmental effectiveness of greenfield and replacement projects may be different. Similar project types may therefore have very different environmental impacts if they were replacement or greenfield, and the investor benefit from greenfield projects may need to be calculated in such a way as to reflect this, e.g. via guidelines on the length of emissions timeline.

➨ Methodological work is needed on how to calculate emission baselines from greenfield projects.

6) **Learning effects may lower expected emission reductions at the start of a project,** especially when this project involves introducing a new, lower-emitting technology. The limited data available on expected versus actual benefits for AIJ projects shows that this is indeed frequently the case in the first few years of a project. Thus, while the technology users are learning how to use or manage the new, the performance of the project is likely to be sub-optimal and the emission reductions lower than anticipated. This means that if emission reductions from project-based co-operative mechanisms are allocated on an *ex ante* basis and not subsequently verified, emission reductions could be over-estimated.

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[19] However, although a statement of the host country's general policy objectives are useful, it is nevertheless not always possible to extrapolate the effects of such policies to individual projects. For example, if the host country has a policy of increasing biomass-generated electricity to X% in year Y, who could determine whether a particular coal-fired electricity plant would be closed down, converted, or its output reduced in order to reach this goal? Nevertheless, some policies do set a clear end-point on the emission benefits from electricity-generating AIJ projects, such as the Costa Rican objective of totally phasing out all non-renewable electricity generation by 2001.

[20] However, emission baselines from replacement projects are also subject to considerable uncertainty, including the emissions timeline.

Some pilot phase AIJ projects in the energy sector (e.g. Russia/Germany) have acknowledged this possible over-estimation of emission benefits by explicitly including a learning effect into their calculation of the emission baseline for a project. In other words, the emissions baseline assumes that it takes time for the emission reductions from a project to reach their maximum.

➨ Learning effects should be factored into emission baseline calculations for JI and CDM projects if emission crediting for these projects is allocated on an *ex ante* basis and are not subsequently verified.

7) **Calculating emission benefits from energy efficiency measures is difficult for grid-connected electricity systems.** Some AIJ projects have generated emission reductions by reducing the demand for electricity, or the demand for fossil-generated electricity, e.g. via greater use of waste heat, or by introducing renewable electricity systems. In grid-connected systems where one fuel type is used for baseload generation, and another for shoulder/peak load, the emission reduction from the AIJ project will depend on whether it is baseload or peak electricity that is displaced. However, calculating emission reductions from a project that reduces electricity demand other than by a pro-rata emissions reduction by using an average system emissions factor per kWh would be extremely complex, data-intensive and time consuming.

The assumptions used in calculating emission benefits from "negawatts" (displaced or reduced fossil fuel-generated electricity) varies in different AIJ projects. For example, the Czech Republic/US project in Decin assumes that the environmental benefit per kWh displaced would be equal to the average, whereas the Fiji/Australia PV project assumes that it is only diesel electricity (from a diesel/hydro fuel mix) that is displaced.

➨ Recommendations are needed on how to calculate emission benefits from energy efficiency measures in project-specific emission baselines. Alternatively, other means of calculating emission benefits from a project, e.g. via technology-based emissions credits, may make the need for such guidelines redundant.

8) **There is no agreement on the system boundary** for GHG mitigation from AIJ projects, with little attention currently placed on reporting what the system boundary actually is.

➨ Guidelines may be needed on where to set boundaries for emission baselines. Countries may also like to consider whether any such boundaries should be the same for each of these Kyoto mechanisms, or whether the fact that the system boundary for calculating CDM project baselines should be different, reflecting the fact that CDM projects effectively increase Annex I Parties' allowed emissions in the first commitment period.

4.2 Reporting lessons and recommendations

If future estimations of project-specific emission baselines are to be clear, consistent and transparent, the way in which they are reported will need to change. The challenge is to balance the need for data and information that are required to estimate an emissions baseline in a rigorous manner with the need to limit the cost and time spent on estimating and reporting it. However, at least for energy supply-type projects, much of the information that would be needed to make emission baseline calculations clearer is already routinely collected for other purposes, and is unlikely to be subject to any confidentiality constraints. Including this information in the AIJ project description would help to raise the transparency of the baseline calculation. If a standardised table requesting such information was included in a revised Uniform Reporting Format (see Annex B for an example), it would also help improve consistency in baseline calculation between different projects of the same type.

The following sections outline different ways in which the reporting of emission baselines could be improved for AIJ project reports. These recommendations could also be applicable when designing guidelines or criteria for project-specific emission baselines for JI and CDM projects. Indeed the importance of consistent, transparent and accurate baselines is arguably higher for JI and the CDM, than for AIJ, as the former project types allow emission reduction units or certified emission reductions to be transferred to the investing party.

4.2.1 Improving the existing Uniform Reporting Format

The AIJ pilot phase is still ongoing and the number of AIJ projects will continue to grow, at least in the short term. Lessons from current reporting of AIJ emission baselines could be used to make simple improvements to the UNFCCC's URF that would help improve the transparency of emission baseline reporting and the comparability in future AIJ project reports. These suggested improvements are outlined below.

1) **AIJ projects are currently reported under very broad categories:** afforestation, agriculture, energy efficiency, forest preservation and reforestation, fuel switching, fugitive gas capture, and renewable energy. The UNFCCC's URF suggests that IPCC definitions for sectors are used. However, an examination of the projects listed shows that these sectoral classifications, while potentially useful for comparison and transparency purposes, need to be refined and clarified. For example, while most projects that involve converting a fossil-fuel fired boiler to one fuelled by biomass are listed under the "renewable energy" category, some are listed under "energy efficiency". (None are listed under the "fuel switching" category, however). Also, the current reporting guidelines for AIJ projects aggregate demand-side energy efficiency projects, supply-side energy efficiency projects, and energy transmission/distribution infrastructure upgrades into "energy efficiency" although they are all of a very different nature.

Project comparisons and assessments would be facilitated if all projects listed within a category are similar in nature. This is not currently the case. This lack of heterogeneity within project classification types is due to:

- the multi-faceted nature of some AIJ projects: many AIJ projects contain more than one component and cannot be accurately represented by one broad classification.
- the definition of categories is not clear, especially for biotic projects. This is a problem unlikely to be resolved until the special IPCC report on land-use change and forestry is finished in 2000.
- the aggregate nature of some of the present categories. For example, the current classification system does not make any distinction between demand or supply-side energy efficiency projects, nor between capital stock or infrastructure projects.

➨ Greater sectoral disaggregation is needed as this would facilitate comparisons between similar project types, increase transparency and help verification/validation exercises. A greater disaggregation would not be more time-consuming, and would also help centralised (e.g. UNFCCC) classification, compilation and synthesis exercises as well as any centralised verification or validation procedures. A more detailed disaggregation may also facilitate setting up and applying guidelines to determine the emission baseline for different project types.

➨ Emission baselines from sub-components of AIJ projects should be reported separately. This will increase the transparency of emission baselines, as some AIJ projects include sub-projects of a different project type (e.g. agriculture and forestry) or of the same type but with different technical or other parameters (e.g. conversion of boilers at two separate sites to renewable energy).

2) **Not all registered AIJ projects have in fact been implemented**. For example, some of the AIJ projects included in the UNFCCC's compilation and synthesis of AIJ projects have not yet obtained the necessary finance in order to start construction and may never become operational. Including the GHG mitigation effects of planned AIJ projects with that of actual AIJ projects confuses any analysis on the aggregate economic and environmental effects of these projects.

➨ AIJ (and, in future, JI and CDM) projects that are in operation should be reported separately from those that are planned. This is even more important for JI and CDM projects than for AIJ, since international reports of JI and CDM projects may be used for verification purposes should any disagreement occur about the transfer or acquisition of emissions credits.

3) **There is often more detailed information on the emission baseline available**, although this may not be reported in the URF.

➨ AIJ project reports should state if there are additional, more detailed, information on the methodology or rationale behind the emission baseline calculation. The report should also state whether or not this information is publicly available on request, or whether it is confidential. If this additional information is publicly available, the report should state the language in which it is written, and a contact point from which the information could be obtained.

4) **Current reports indicate different accounting conventions are being used** for emission reductions/carbon sequestration. Some energy-related AIJ projects report avoided fossil fuel emissions as negative emissions, while others report this as a positive amount of emission reductions. Some biotic AIJ projects report carbon sequestration as negative emissions, while others report it as a positive amount of carbon sequestration.

➨ Agreement is needed on how to report the sign of emissions benefits from AIJ projects: The IPCC emission inventory reporting guidelines state that the sign for emissions uptake should be negative, and that for emissions should be positive. Parties could consider whether a revised URF should state that this IPCC reporting convention should be used.

5) **Biotic projects do not always state which carbon stocks are included in the emissions baseline.**

➨ Biotic projects should report whether the carbon stock calculations include above-ground, below ground, forest floor and/or soil carbon. They should also indicate which month *ex post* monitoring of carbon stocks takes place (seasonal variations lead to changes in both the actual and relative carbon content of each category, so any monitoring should occur at the same time of year).

4.2.2 Other reporting lessons and recommendations

In addition to the recommendations for changing the URF described above, analysis of the project-specific emission baselines presented in AIJ projects points towards areas in which reporting could be improved, other than by simple modifications to the URF. These recommendations are outlined below.

1) **The data and supporting information needed to calculate an emissions baseline depends on the project type.** For example, land area is an important component in determining the emission baseline for a biotic project but not for projects in the energy sector.

➨ Different project types should be required to report different information and the information required should be clearly laid out to the project developer (see Annex B for possible examples).

2) **These data are often readily available,** although not always reported upon in the URF. For example, plants producing electricity/heat are likely to have records of the type and quantity of fuel bought (per year), and the quantity of electricity or heat sold. Reporting this information would greatly increase the transparency of emission baseline calculations. (The cost of fuel inputs would also be useful when estimating the economic benefits of potential projects, although commercial confidentiality and sensitivity would mean that information of this sort would not be publicly released.)

➨ Where relevant data are readily available, they should be reported and/or referenced.

3) **Expected mitigation effects are not always presented in comparable units**. This hinders comparisons of emission benefits between different projects.

➨ Emission mitigation effects should be reported in comparable units, e.g.

- t CO_2 (or CO_2 equivalent if emissions of other gases are affected) per year for energy and forestry projects,
- t CO_2 (or CO_2 equivalent) per product output and CO_2 or CO_2 equivalent per year (for industry projects).

4) **Some AIJ project reports contain arithmetical errors**. The importance of errors in quantitative emission estimates of AIJ benefits is limited since AIJ projects do not generate emission credits. However, the importance of any errors would be higher for JI and CDM projects as these would affect the emissions added or subtracted to a Party's "assigned amount" under the Kyoto Protocol.

➨ Independent validation and verification may be needed of the emission baseline and/or supporting information contained in project reports[21].

[21] Participants in AIJ projects may not be disposed towards this if it entails extra costs. However, independent verification and/or validation may be more feasible under JI and CDM, both of which generate credits for the investor.

5. CONCLUSIONS

Information on the methodology and assumptions used in calculating emission baselines for AIJ projects is neither complete nor transparent in many of the AIJ project reports submitted to the UNFCCC. In fact, many reports contain surprisingly little information on the emission baseline assumed in that project, and on the means by which this baseline was arrived at.

There are inherent uncertainties involved in estimating counter-factual emission baselines. Moreover, valid baseline assumptions can vary significantly at different sites, with different technologies, and under different climatic conditions. Project-specific measurements are therefore needed to set up project-specific baselines, although even baselines based on detailed, project-specific data are likely to contain a significant component of expert judgement.

Determining how emission baselines are calculated and reported, and how any emission credits are allocated, will have a significant impact on the total costs involved in setting up an AIJ, JI or CDM project. Rules surrounding emission baseline calculation and reporting, and emission crediting will also influence the cost and environmental effectiveness of such projects.

Guidelines on calculating and reporting project-specific emission baselines could help to increase the transparency of, and consistency between, emission baseline calculations in different AIJ projects. Many of these guidelines would also be applicable to setting out project-specific emission baselines for JI and CDM projects.

Any future methodological guidance on estimating project-specific emission baselines could address:

- the length of time over which different project types should generate emissions benefits;
- the issue of uncertainty (possibly by requiring some sort of "safety margin" or environmental conservatism in baseline estimation);
- whether emission baselines should be calculated in the same manner for greenfield and replacement projects;
- how baseline assumptions could be validated (e.g. by referencing relevant host country policies);
- how to deal with learning issues; and
- how to calculate the environmental benefits of energy efficiency measures.

Other site-specific information that impacts the assumptions underlying the emission baseline estimation methodology should also be included, such as vegetation types for biotic projects, and distance of the project site from alternative fuel sources (e.g. electricity/gas grids) for energy projects.

Simple reporting measures, if taken, could improve the transparency and comparability of different project-specific emission baselines. These recommendations are applicable to future reports of AIJ, JI and CDM projects, and include modifying the current Uniform Reporting Format for AIJ projects so that it provides:

- greater disaggregation of current project classifications;

- separate reporting of sub-projects;
- references to the availability of more detailed information elsewhere (if applicable);
- an agreed convention to account for emission benefits from projects; and

In addition, reports should distinguish between projects actually operating from those at the planning stage.

Other changes could also improve the reporting of project-specific emission baselines for AIJ, JI or CDM projects, such as:

- differentiated reporting requirements for different project types;
- including relevant and readily available data and information, and justification for these data;
- recommended units in which to present the total emissions benefits of the project; and
- independent verification/validation of data in the project report.

In the AIJ project reports examined for this paper, experience with emission baselines is limited to a project-specific (i.e. case-by-case) approach. This is not the only means by which baselines could be calculated: other approaches, such as those based on benchmarking or technology types may need to be explored for use under JI and/or the CDM. These more streamlined approaches could have both advantages and disadvantages when compared to the project-specific approach, and will be explored in future work.

Fundamental questions need to be answered about the issues given priority in setting up rules, modalities and guidelines for project-based co-operative mechanisms. Should maximum environmental effectiveness per project be emphasised, and rules set up for emission baseline determination and/or emission crediting that err on the side of environmental caution? Should strict criteria be applied that limit the project types eligible to be included as one of the project-based co-operative mechanisms? Should any environmental benefits be credited only following *ex post* verification and validation of emission mitigation? Should any rules and guidelines distinguish between greenfield and replacement projects; uncertain and more certain emission reductions; and emission reductions easy and difficult to monitor?

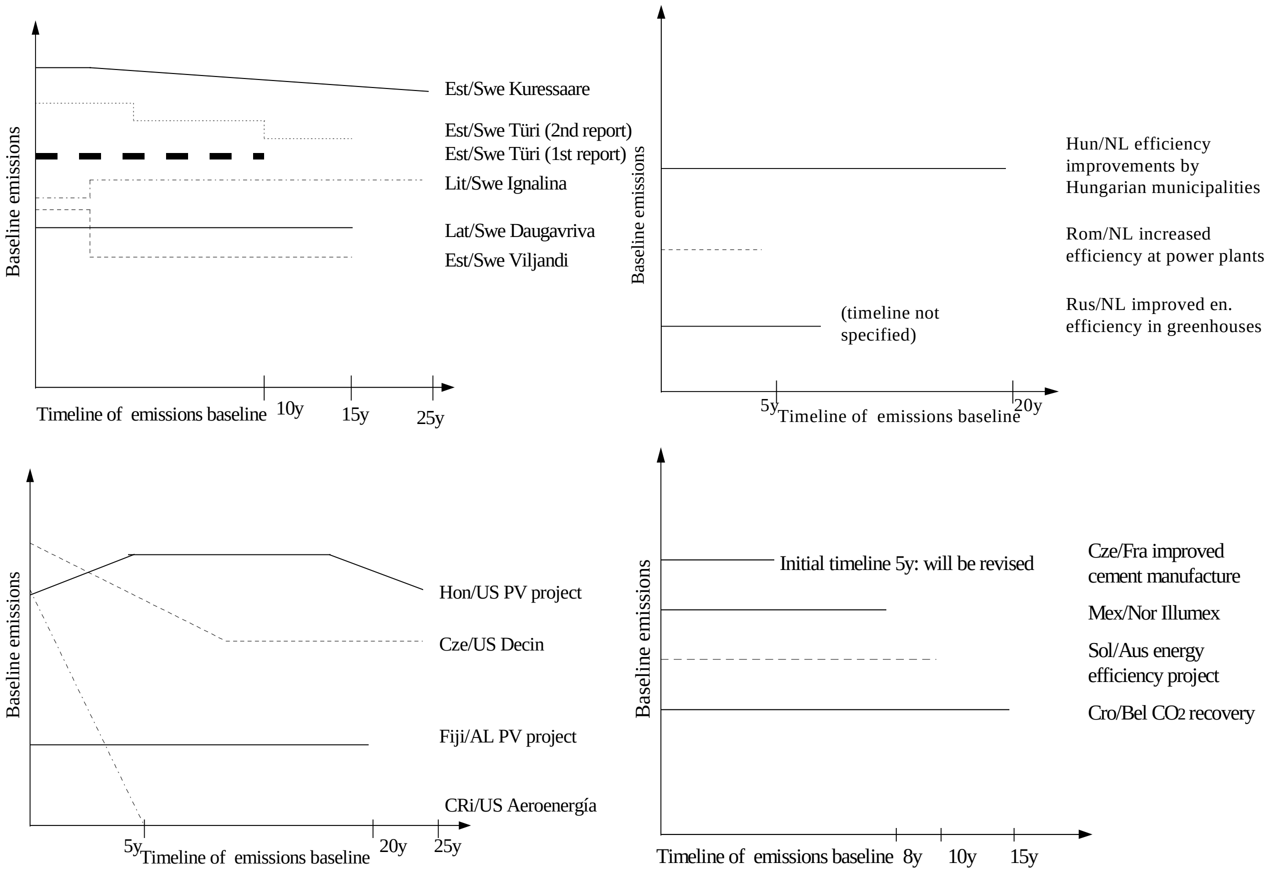
Or should the aim be for a simple, clear and transparent system that governs eligibility, environmental additionality and crediting? Is the widespread use of AIJ, JI and the CDM, and the associated technological and developmental benefits that these mechanisms could bring, more important than ensuring the environmental effectiveness of each and every project?

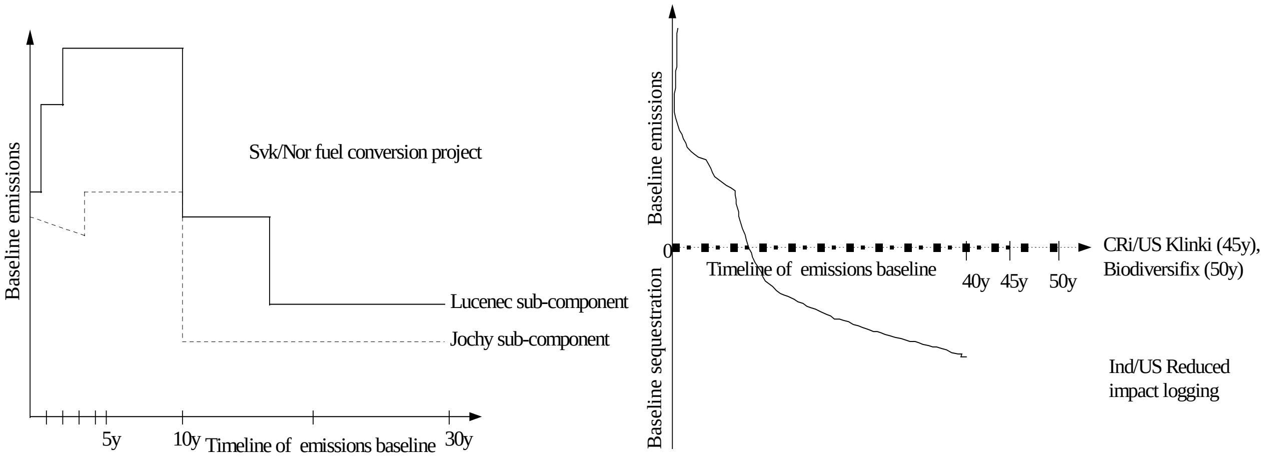
If project-based co-operative mechanisms are to contribute significantly towards greenhouse gas mitigation, JI and CDM projects will need to become more widespread than AIJ projects are at present. This means that more private sources of finance, i.e. industry, will be needed. This is unlikely to be forthcoming if the benefits of project-based co-operative mechanisms are variable and uncertain and transaction costs are high. A balance therefore needs to be reached between requiring the rigorous monitoring and reporting efforts that would be needed to ensure the environmental effectiveness of project-based mechanisms, and obtaining cost-effective and predictable emission benefits via simple procedures that would encourage the uptake of these projects. An approach to setting emission baselines that was conservative but streamlined could be one way of reaching that balance.

ANNEX A: EMISSION BASELINES IN SELECTED AIJ PROJECTS

Some of the emission baselines used in different AIJ projects are illustrated and explained in the following figure and table.

FIGURE A1 EMISSION BASELINES USED IN SELECTED AIJ PROJECTS
(indicative only: not to scale.)




Baseline emissions
Svk/Nor fuel conversion project
Lucenec sub-component
Jochy sub-component
5y
10y
Timeline of emissions baseline
30y
Baseline emissions
0
Timeline of emissions baseline
40y 45y 50y
CRi/US Klinki (45y),
Biodiversifix (50y)
Baseline sequestration
Ind/US Reduced
impact logging

Project	Host/investor country	Rationale for baseline choice
Kuressaare	Estonia/Sweden	Assumed emission reductions from rebuilding two boilers and partly rebuilding the distribution network would only be possible from energy efficiency measures, as natural gas is not available.
Türi	Estonia/ Sweden	The first report, like many other first Swedish reports, assumed that the baseline would be "status quo" operation of the heat-producing plant for the duration of the loan used to finance the majority of the new equipment. (In fact, the baseline in the first report was mis-accounted for as zero, with emission reductions accounted as negative emissions). The second report assumes a more efficient boiler replacement within three years, and improved energy efficiency measures. (However, only a few data points are given, so the exact shape of the baseline is difficult to determine).
Ignalina	Lithuania/Swe.	Mix of heavy/light oil estimated to change after 2y: shift to heavy fuel oil.
Daugavriva	Latvia/Sweden	Assumes continued use of heavy fuel oil at same efficiency.
Viljandi	Estonia/Sweden	Assumes a switch from heavy fuel oil to natural gas after two years.
Efficiency improvements	Hungary/ Netherlands	Assumes that existing installations would not have been replaced during the technical lifetime of the new equipment.
Increased eff.	Romania/Neth.	Assumes that the plants would not have been modified.
Improved eff.	Russia/Neth.	Assumes unit output emissions would remain constant without the AIJ project.
PV generation	Fiji/ Australia	Assumes that the PV produced by the project displaces diesel electricity (from a diesel/hydro system).
PV generation	Honduras/US	Assumes the indefinite continuation of the current situation.
Decin	Czech Republic/ US	Assumes that energy demand decreases to year 8 and then stabilises, and that fuel and efficiency of heat production remains unchanged.
Aeroenergía	Costa Rica/ US	Assumes that host government policy of phasing out fossil-fuelled electricity sources is achieved by 2001. The baseline therefore falls to zero at this point.
Cement manufacture	Czech Republic/ France	Assumes that the plant output would be constant, and that the per output emissions would have declined approximately 10% from recent measurement.
Illumex	Mexico/ Norway	Assumes that the use of normal lightbulbs would have continued in the absence of loans to purchase energy-efficient lightbulbs.
Energy efficiency	Solomon Is./ Australia	Implicitly assumes a continuation of the status quo.
CO_2 recovery	Croatia/Belgium	Assumes continued operation of plant as before.
Jochy/ Lucenec	Slovakia/ Norway	The stepped baseline seen is a reflection of the timing of certain actions. The timeline appears to be an reflection of the life of new equipment (but this is not stated in the report). Jochy: Efficiency will improve in existing boilers, but then emissions will increase because of increased demand. Fuel switching to gas will reduce emissions after year 10. Lucenec: stepped increases in emissions due to increased energy demand. Stepped decreases due to rehabilitation/increased efficiency of boilers.
Klinki	Costa Rica/US	Assumes biomass and soil carbon stocks remain constant throughout project.
Biodiversifix	Costa Rica/ US	Marginal cropland, abandoned pasture or otherwise unused land which has been deforested between 100-400y ago is expected to remain unchanged.
Reduced impact logging (RIL)	Indonesia/ US	The baseline shown is the sum of the two sub-project baselines. The assumptions for these baselines are that RIL reduces logging damage by "as much as 50%". Following harvest in 1st year, different biomass decays at various rates. No post-harvest silviculture treatments or forest fires.

ANNEX B: SUGGESTED REPORTING REQUIREMENTS FOR TWO PROJECT TYPES

Energy sector: replacement or refurbishment of electricity/heat production facilities

General information

- name of project site;
- address, country

What is the distance of the proposed plant from:

- the nearest gas grid;
- the nearest district heating system?

Is the plant currently connected to the electricity grid?

Old plant		Retrofit/converted plant	
Fuel(s) used*	>	Fuel(s) used*	>
Emission factor(s) (t C/TJ)	>	Emission factor(s) (t C/TJ)	>
Average annual quantity of fuel used in old plant (TJ or toe**)	>	Projected annual fuel use in retrofitted plant (TJ or toe**)	>
Average annual energy production at old plant:	> (electricity) > (heat)	Projected annual energy production at modified plant:	> (electricity) > (heat)
Age of plant (years)	>	Size and/or type of new equipment	> (size, MW) > (type, e.g. boiler)
Expected life of plant at construction (years)	>	Is this new equipment added or is it replacing other eqpt.?	>
Description of plant technology.	-	Expected life of retrofit plant	>

* If more than one fuel used, state approximate proportion of each

** It is important that this figure is expressed in terms of energy units in order to be consistent with the expression of the emission factor, and for comparison (transparency) purposes.

Forestry: re/afforestation projects (from MacDicken, 1997)

General information: Local name of project site
Address, State, Country
Latitude
Longitude
Elevation (m)
Species (before and after project)

Site history since last inventory: (description of significant changes in management, pest and disease problems, harvesting or other mortality).

1. Month of inventory determination

Carbon pool	Area (ha)	Mean carbon density (Mg/ha)	Total carbon (Mg)	Confidence interval (Mg)
Reference case Above-ground Below-ground Forest floor Soil to depth of 30cm Total- reference case	NA			
Project case Above-ground Below-ground Forest floor Soil to depth of 30cm Total- project case	ha			
NET CARBON STORED				

ANNEX C: ALTERNATIVE EMISSION BASELINES FOR ONE PROJECT

e.g. Daugavriva boiler conversion (from gas/diesel oil to biomass).

Year	Daugavriva 2nd report	Daugavriva 1st report	Scenario 1	Scenario 2	Scenario 3	Scenario 4
1	13000	13000	13000	13000	13000	13000
2	13000	13000	13000	13000	13000	13000
3	13000	13000	9846	13000	13000	19500
4	13000	13000	9846	13000	13000	19500
5	13000	13000	9846	13000	13000	19500
6	13000	13000	9846	13000	13000	19500
7	13000	13000	9846	13000	13000	19500
8	13000	13000	9846	13000	13000	19500
9	13000	13000	9846	13000	13000	19500
10	13000	13000	9846	13000	13000	19500
11	13000		9846	9846	9846	14769
12	13000		9846	9846	9846	14769
13	13000		9846	9846	9846	14769
14	13000		9846	9846	9846	14769
15	13000		9846	9846	9846	14769
16					9846	14769
17					9846	14769
18					9846	14769
19					9846	14769
20					9846	14769
21					9846	14769
22					9846	14769
23					9846	14769
24					9846	14769
25					9846	14769
26					9846	14769
27					9846	14769
28					9846	14769
29					9846	14769
30					9846	14769
Total avoided emissions (max.)	195000	130000	153998	179230	326920	477380

Scenario 1: conversion to gas after 2 years (with gas emitting 25% less per unit energy than gas/diesel oil)
Scenario 2: idem as Scenario 1, but conversion to gas at year 10
Scenario 3: idem as Scenario 2, but assuming a 30 year life for project equipment.
Scenario 4: fuel switch to gas after 10 years, lifetime 30 years, 50% demand increase from year 2.

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In addition, the Uniform Reporting Format for the following AIJ projects were consulted:

Adzai (Lva/Nld), Aeroenergía (CRi/USA), Ainazi (Lat/Ger), Aluksne (Lat/Swe), Biodiversifix (CRi/USA), Birzai (Lit/Swe), Bucharest (Rom/Nld), Carfix (CRi/USA), Cizkovice (Cze/Fra), Daugavgriva (Lat/Swe), Decin (Cze/USA), Grid-connected PV (Fij/Aus), Honiara (Sol/Aus), Hungarian municipalities efficiency improvement (Hun/Nld), Ignalina (Lit/Swe), Ilumex (Mex/Nor), Jochy/Lucenec (Svk/Nor), Jurmala (Lat/Swe), Kilung-Chuu Micro Hydel (Bhu/Nld), Krkonose (Cze/Nld), Kuressaare (Est/Swe), Liepa (Lat/Swe), Limbazi (Lat/Swe), Mustamäe (Est/Swe), Mustamäe2 (Est/Swe), Oaxaca (Mex/USA), Orisssaare (Est/Swe), Private Forestry Project (CRi/Nor), Reduced Impact Logging (Ind/USA), Rio Bravo (Blz/USA), Rusagas (Rus/US), Saldus (Lat/Swe), Solar-based rural electrification (Hon/USA), Sustainable Energy Management (BFa/Nor), Talsi (Lat/Swe), Tartu (Est/Swe), Tegucigalpa (Hon/USA), Türi (Est/Swe), Tyumen (Rus/Nld), Ushgorod (Rus/Ger), Valga (Est/Swe), Vändra (Est/Swe), Viljandi (Est/Swe), Võru (Est/Swe), Zagreb (Cro/Bel)

These reports are available at http://www.unfccc.de/fccc/ccinfo/aijact/

GLOSSARY

AIJ	Activities Implemented Jointly
CDM	Clean Development Mechanism (defined in Article 12 of the Kyoto Protocol)
CH_4	Methane
CO_2	Carbon dioxide
COP	Conference of the Parties
EIT	Countries with Economies in Transition
FCCC	United Nations' Framework Convention on Climate Change
GHG	Greenhouse gases
Greenfield projects	New projects, e.g. those taking place at a new site and increasing the host country's capacity for heat output, electricity generation etc..
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation (outlined in Article 6 of the Kyoto Protocol)
KP	Kyoto Protocol
kt	thousand tons
N_2O	Nitrous oxide
OECD	Organisation for Economic Co-operation and Development
project-specific	Project-specific emission baselines are those that have been drawn up by examining projects on a case-by-case basis.
PV	photovoltaic
Replacement projects	Projects in which existing equipment is upgraded or replaced
Technology-based emissions credits	.. A possible means of calculating the GHG mitigation benefits of AIJ, JI or CDM projects
URF	Uniform Reporting Format (form on which countries submit AIJ project-specific information to the UNFCCC)