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EVALUATING EXPERIENCE WITH ELECTRICITY-GENERATING GHG MITIGATION PROJECTS

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FOREWORD

This document was prepared in November 2003 by the OECD Secretariat at the request of the Annex I Expert Group on the United Nations Framework Convention on Climate Change. 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. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the Annex I Expert Group. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

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Executive Summary

Greenhouse gas (GHG) mitigation projects are already underway or being developed for several national or international programmes or funds, as well as on a bilateral or unilateral basis. This paper outlines the current portfolio for proposed Clean Development Mechanism (CDM) or CDM-type electricity-generating projects and examines the ways in which additionality and baselines have been assessed for these projects.

While more than 130 such projects are in the process of being developed, detailed information is only available for a sub-set. This sub-set of 85 projects corresponds to approximately 2.8 GW of generating capacity and includes projects submitted to the CDM's Executive Board (EB) and developed under the Dutch CERUPT and World Bank's Prototype Carbon Fund schemes. These projects are expected to generate 9.7 million credits (i.e. avoid emissions of 9.7 million tons CO_2-equivalent) per year during the first commitment period.

A wide variety of projects are being developed, mainly in Latin America and Asia, but also in Central and Eastern Europe and Africa. Installed capacities per project range from less than 1MW to up to 200 MW (for a proposed wind and a proposed geothermal project). At present, the overwhelming majority of projects examined use renewable energy sources to generate electricity (or electricity and heat), with hydro and biomass/bagasse accounting for the largest number of projects and the largest expected shares of credits. There are also several wind-power projects under development. However, waste-to-energy projects using landfill gas seem to be increasingly popular. Some – often much larger-scale (up to 720 MW) – potential CDM projects involving use of natural gas have also been proposed.

Credits can be generated from "additional" CDM and JI project activities. However, additionality is difficult to assess as it can involve making subjective decisions about what would have occurred in the absence of a proposed project (i.e. the baseline scenario). Assessing additionality is further complicated for proposed CDM projects, as the text defining additionality in the Marrakech Accords is open to more than one interpretation. Thus, some proposed CDM projects include an assessment of whether that particular project would have occurred in the absence of the CDM, while other project proposals do not.

The projects examined in this paper use widely differing methods and arguments to demonstrate additionality. These include qualitative methods (e.g. an outline or assessment of technical, institutional or other barriers) and quantitative methods (e.g. economic or financial analysis, technology penetration rates, or comparing the expected emissions from a project to a baseline). Most CDM project proponents used more than one type of assessment (e.g. barrier analysis and an economic/financial argument) to indicate that their project activity was additional. Differences in approaches used to demonstrate additionality depend partly on:

- whether the project is being developed as a CDM or JI project (the additionality requirements are different for CDM and JI);

- whether the project is being developed as part of a programme which has set up its own guidelines on additionality or baselines (as these can vary between programmes); and

- when a project was developed or submitted to the CDM EB for approval. (The most recently submitted project activities have put greater emphasis on identifying one or more procedures to assess additionality than earlier submissions).

Proposed CDM/JI projects also contain considerable variation in the methods used to determine the emissions baseline. Projects examined include baselines based on several different variations of the

"operating margin", as well as on the "build margin" and "combined margin" methods. This variation highlights the subjective nature of determining what scenario would "reasonably represent" anthropogenic emissions in a sector with several plausible options to fulfil projected demand and demand growth. Different baseline scenarios and methods can significantly impact the level of emissions baseline, and consequently, the number of credits generated. For example, different baseline methods for a renewable electricity project in Chile lead to baseline values that could vary by more than a factor of ten. Two baselines based on different methods for a single project submitted to two different programmes varied by more than a factor of two.

The Marrakech Accords specify that one of three approaches can be used when developing a baseline methodology. Some of the "bottom-up" baseline methods used for electricity-generating projects map well onto one of these approaches. However, others do not, particularly those assessed as likely to give a more accurate representation of "what would have happened otherwise" (e.g. Kartha et al. 2002).

One of the clearest lessons learned in the first rounds of submitting new baseline methodologies to the CDM EB for approval is that documentation needs to be complete and accurate for desk reviewers (i.e. the CDM EB and its Methodology Panel) to be in a position to approve methodologies. Indeed, many of the first "new methodologies" submitted to the EB were not initially approved because they did not include a method by which to assess additionality, or did not assess why the proposed project would not have occurred as part of the baseline scenario. The process could be improved by using a template that provides a checklist of the latest requirements from the CDM EB and that encourages project participants to present relevant information in an appropriate way. Improvements in these areas have already occurred since the first round of submissions in April 2003, with later "new methodology" submissions (i.e. NM0017-NM0035) having fewer gaps in information than earlier submissions.

The process of reviewing and approving methodologies could also be improved if the applicant/designated operational entity were to analyse (rather than just forward) a proposed methodology submitted to the CDM EB. In the current process, the Methodology Panel provides the first external "quality check" for proposed methodologies. Any ambiguities or gaps found in a methodology have to be sent back to the project proponents, and cannot be reconsidered before the subsequent Panel meeting. Thus, these methodologies cannot be approved until the first CDM EB meeting immediately after that. Because the Methodology Panel and the CDM EB meet only sporadically, this iteration - if needed - causes a delay of at least three months.

CDM projects in the electricity sector, particularly those based on renewable energy, offer the potential to reduce emissions of greenhouse gases as well as contributing towards sustainable development. Two "new methodologies" for biomass and landfill gas electricity-generation CDM project activities were approved by the EB in October 2003 (six months after the initial versions of the methodologies were submitted). Two more methodologies, applicable to bagasse projects and to grid-connected systems under 60MW, have been recommended for EB approval in November 2003. Together, these four methodologies can be used for several other project activities in other locations using a variety of possible renewable energy sources and in different project contexts. Using an approved methodology can considerably reduce both the time and costs associated with developing a CDM project activity, and can provide greater certainty that proposed project activities will be approved by the CDM EB.

Clear, unambiguous guidance to project developers on what proposed methodologies should contain, and particularly on the scope of methodologies' generic procedures to assess additionality, should help reduce the time delay between submitting and approving proposed baseline methodologies. With the power sector in many non-Annex I countries growing rapidly, the availability of approved methodologies can therefore help encourage interest in developing electricity-generating plants that would assist in both reducing greenhouse gas emissions and helping the host country achieve sustainable development.

1. Introduction

Several programmes have been initiated to encourage the development of projects that mitigate emissions of greenhouse gases. Recent programmes have been undertaken at the national level, such as the Dutch five-track approach, including contracts with multilateral institutions, regional development banks, private banks, bilateral contracts with countries, participation in carbon funds and the ERUPT and CERUPT tenders, Japanese Clean Development Mechanism (CDM) feasibility studies, and the more recent Finnish, Austrian and Italian JI/CDM programmes. International programmes, such as the World Bank's Prototype Carbon Fund (and other WB carbon funds), have also been initiated. Individual projects not belonging to particular programmes have also been initiated under the pilot phase of "activities implemented jointly" (AIJ) under the United Nations Framework Convention on Climate Change (UNFCCC), or developed as CDM or Joint Implementation (JI) projects. Some CDM project activities have been formally submitted to the CDM's Executive Board (EB), who approved the first set of baseline and monitoring methodologies for CDM project activities in July 2003.

There is a large variety in the type of projects that have been put forward. These include energy, industry, forestry[1] and waste projects. This paper will focus on CDM-type projects that generate grid-connected electricity for several reasons:

- demand for electricity is growing rapidly in many potential host countries;
- many projects in the electricity sector have been developed as potential CDM and JI projects;
- assessing additionality and baselines is arguably more difficult for projects in the electricity sector (where a range of project types may occur as part of business-as-usual activities) than for end-of-pipe projects such as landfill gas capture and flaring or decomposition of F-gases;
- much work has been done on assessing appropriate methods to determine baselines in the electricity sector, at the theoretical and practical level.

The paper examines the experience to date with how baselines and additionality have been calculated or assessed for selected electricity-generating GHG mitigation projects. It will focus on CDM and CDM-type projects, including for projects that have been accepted or rejected by particular programmes (e.g. CERUPT) and projects where the associated baseline and monitoring methodologies have been submitted to the CDM's Executive Board[2]. Thus, it will focus on larger-scale (> 15MW) and grid-connected projects. The paper will also assess how the baseline methods for projects currently under development "fit" with the three baseline "approaches" outlined in the Marrakech Accords.

[1] The treatment of additionality, baselines and leakage for some re/afforestation projects was assessed in Ellis (2003).

[2] As yet, there have been no CDM projects registered (i.e. formally accepted) by the CDM EB. However, information on several projects that are proposing new baseline methodologies have been submitted to the CDM EB, and the EB has approved two such baseline methodologies to date (although neither are for electricity-generating projects). The approval process for baseline and monitoring methodologies is outlined in textbox 1 (section 2).

2. Brief overview of project activities

Electricity-generation GHG mitigation projects are being set up and brought forward in a multitude of different national or international schemes as well as on a bilateral basis. These include:

- projects submitted to the CDM's Executive Board;
- national tendering programmes such as those set up by the Dutch (ERUPT and CERUPT) and Finnish governments;
- regional programmes, such as the EU-funded CAPSSA (CDM Capacity Building Amongst the Private Sector in Southern Africa) and EU and UK-funded SUSAC (Start-Up CDM in Africa, Caribbean and Pacific Countries) programmes;
- carbon funds open to both governments and companies at the World Bank, such as the Prototype Carbon Fund (PCF) and the Community Development Carbon Fund (CDCF);
- trust-constructions with intermediary organisations such as the Netherlands Clean Development Facility (NCDF) with the IBRD, the IFC Netherlands Carbon Facility (INCaF), the CAF-Netherlands CDM Facility, the Rabobank-Netherlands CDM Facility and the EBRD-Netherlands JI Facility;
- national or international organizations such as United Nations Industrial Development Organisation (UNIDO), New Energy and Industry Technology Development Organisation (NEDO), Global Environment Centre Foundation (Japan);[3]
- multi-company programmes, such as the E7; and
- individual companies, such as the Electric Power Development Company (Japan).

These schemes have resulted in the development of more than 130 JI/CDM-type electricity-generating projects to date (including combined heat and power projects or waste-to-energy projects). Thirty-one such project activities have been submitted to the CDM EB as a proposed CDM project, of which 19 include an electricity-generation component.

In addition, some countries, such as Austria, Italy and Sweden, are starting JI and/or CDM programmes, and others have potential projects in the pipeline, such as Canada. Projects are also being developed for the Asian Development Bank's Clean Development Mechanism Facility, set up in August 2003, and the Spanish Carbon Fund. Several companies are also active in CDM project development, including MGM International, AES, Ecosecurities and Ecofys. There are also other funds being developed, such as the proposed "Asia Carbon Fund" and the BioCarbon Fund. In addition, more than 30 electricity-generating projects were registered under the pilot phase for Activities Implemented Jointly.

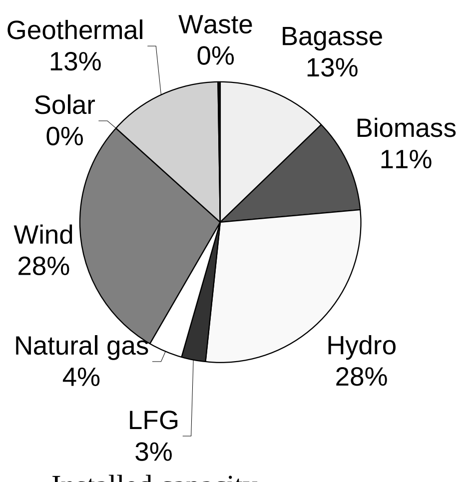
It is difficult to get an exact picture of what the CDM project portfolio is because publicly-available information is highly dispersed and information for many CDM projects is not publicly available and may remain out of the public domain until any submission to the CDM EB (e.g. for confidentiality reasons). Even for projects where some information is available, this information is often limited e.g. to a list of the host country and sector.

[3] See http://www.eco-web.com/gg500/sacf_2003.html for more information.

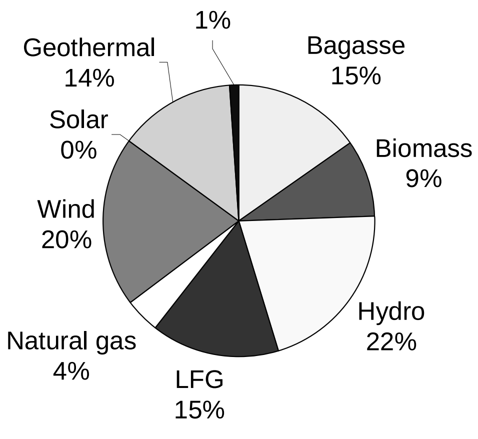
This paper draws on the sub-set of electricity-generating GHG mitigation projects for which data on project type, generating capacity, energy source and number of credits are available. This corresponds to 85 recent JI/CDM-type projects, including those submitted to the CDM EB as well as those accepted in the CERUPT, ERUPT and PCF programmes, some projects identified on the CDMWatch website[4] as well as four Finnish projects for which data was available, projects undertaken as part of the Japanese government programme on JI/CDM feasibility studies, some recently-proposed ERUPT projects and others (see Annex I for project names and details). These projects correspond to approximately 2.8 GW of generating capacity, and are expected to generate 9.7 million credits per year (i.e. avoid or reduce emissions of 9.7 million t CO_2-equivalent emissions per year). For project activities for which data is available, the World Bank carbon funds accounted for almost half of the total projected annual credits, the CERUPT scheme for 17%, and the ERUPT scheme for a further 11%.

As can be seen from figure 1, the vast majority of projects are based on renewable energy sources. Hydro, bagasse and other biomass projects accounted for the largest number of projects, the majority of capacity, and almost half the number of credits. Approximately a quarter of the capacity (but a lower proportion of expected annual credits, or of total project numbers) was based on wind power. There was only one (small) grid-connected solar project, and four geothermal projects, of which two were 100 MW or over. The global warming potential of methane (21) means that small capacities of landfill gas projects, which reduce emissions of CH_4 as well as of CO_2, can generate more credits than a similar capacity generator that displaces fossil-based electricity.

Figure 1: Project portfolio for selected electricity-generation CDM-type projects



Installed capacity



Expected annual credits

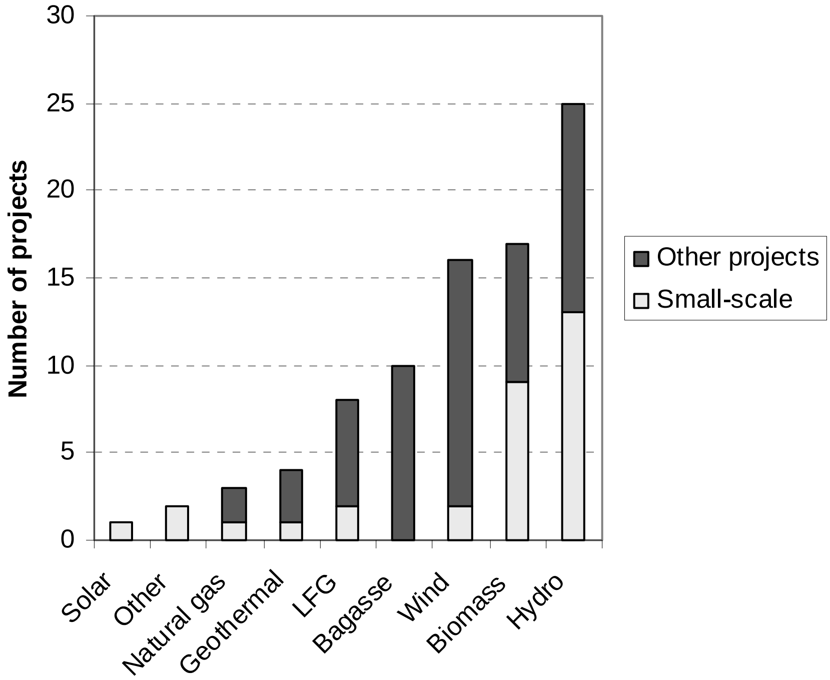
Sources: Project documentation from UNFCCC, PCF, C/ERUPT, Finnish JI/CDM programme, DNV,CDMWatch

In terms of the geographical spread of projects, Latin America and Asia dominate. Latin America accounted for the largest number of projects (35), and for 37% of yearly credits. Asia, including China – where there was only one project – accounted for 29 projects and 36% of the yearly credits. There were 10 projects in Africa, accounting for 11% of expected credits (predominantly from PCF-supported projects). There were 12 projects in Central and Eastern Europe, one in New Zealand (proposed) and none in the Middle East.

[4] Excluding feasibility studies.

The size of proposed JI/CDM projects varied from <1 MW to 200 MW. Half the hydro projects developed are small-scale, see Figure 2, and only three hydro projects were 100 MW or over (two developed for the CERUPT programme, and one being developed for INCaF[5]). However, all the bagasse projects, and most wind-powered projects involve capacities larger than 15 MW. Most of the landfill gas to electricity projects, while usually involving a small electricity generating capacity, would not qualify as "small-scale" CDM projects because of the number of credits they are expected to generate per year. Perhaps surprisingly, the largest project sizes were seen for geothermal projects (where two of the four proposed projects had capacities of 100 MW and 200 MW respectively). There is also a proposed 200 MW wind project.

Figure 2: Type of electricity-generation projects developed (by energy source and size)



Sources: Project documentation from UNFCCC, PCF, C/ERUPT, Finnish JI/CDM programme, DNV, CDMWatch

Although to date renewable energy projects dominate the picture of proposed CDM/JI projects (as submitted to the CDM EB, the World Bank carbon funds and the different Dutch schemes), there is also some interest from project developers in developing projects based on natural gas. These projects are often large, such as the proposed 720 MW and 660 MW oil to gas fuel switch at two power plants in Indonesia (PJB 2003) or the 450 MW natural gas combined cycle plant in Nigeria (PointCarbon 2003). (Large natural gas projects have also been accepted as AIJ projects, e.g. the 185 MW CAPEX project, as well as into the USIJI programme.) If these three gas projects alone were to be validated as CDM projects, natural gas would become an important part of the whole CDM portfolio, generating up to 4.95 million credits (i.e. reducing up to 4.95 million tons CO_2) per year, and accounting for 40% of the total capacity of proposed electricity-generating CDM projects.

[5] A further large hydro project, the 200MW hydro project at Bujagali, Uganda, was submitted to the CERUPT scheme but not accepted onto it.

3. Additionality

As credits from CDM project activities in non-Annex I countries can be used to offset emissions in Annex I countries, the requirement that CDM project activities result in "additional" emission reductions is key to ensuring its environmental integrity. The Kyoto Protocol outlines that CDM project activities are to result in GHG benefits that are "additional to any that would occur in the absence of the project activity". The definition of additionality for emission-reduction CDM projects is further outlined in the Marrakech Accords, i.e. "*A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity*"[6].

This section explores how the additionality of particular projects is described in project documentation and how this description has been assessed by third-party reviewers. It focuses on larger-scale projects for which detailed information was publicly available, particularly projects submitted to the CDM EB, but also including examples from PCF projects, CERUPT/ERUPT projects, and projects undertaken in other programmes validated by Det Norske Veritas.

3.1 What is additionality and how can it be assessed?

The Marrakech Accords' definition of additionality can be interpreted in more than one way (e.g. Ellis 2003, JIQ 2003). The difference in interpretation boils down to whether or not the additionality assessment needs to judge if a particular project activity proposed under the CDM would have occurred in the absence of the CDM.

The determination of additionality for a particular project activity is project-specific, and will be assessed by the operational entity. However, the CDM EB has outlined that for CDM projects, the baseline methodology needs to include generic procedures that a project proponent can use to assess additionality (UNFCCC 2003b and 2003e). Several of the 19 electricity-relevant baseline methodologies submitted to the CDM EB (particularly for the earliest methodologies submitted) did not include such procedures[7], and this was one of the major reasons for non-acceptance of these methodologies.

Given this early experience, the EB requested the Methodology Panel to provide further guidance on how additionality should be demonstrated in a new methodology (UNFCCC 2003c). Following this request, the Methodology Panel outlined four procedures that could be used to demonstrate additionality of a project. It also outlined two possible interpretations of the Marrakech Accords definition of additionality: one requiring project developers to question whether or not their proposed CDM project activity would have gone ahead anyway, and the other interpretation not requiring this step. The Methodology Panel also recommended that the first interpretation should be used (UNFCCC 2003d[8]).

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[6] JI projects are also meant to result in "additional" emission reductions, but additionality is not defined for JI projects in the Marrakech Accords since any generation of credits from JI projects does not, unlike emission credits from CDM projects, increase the total amount that Annex I Parties can emit and still achieve their emissions commitment under the Kyoto Protocol.

[7] The methodology submitted for one of the proposed CDM projects (NM9: AT Biopower) indicated that determination of additionality was beyond the scope of the methodology.

[8] Interpretation 1: "Without the ability to register under the CDM, the proposed project activity would be, or would have been, unlikely to occur. A baseline methodology evaluates a priori whether the project activity is the baseline scenario" (UNFCCC 2003d).

However, the EB did not issue any pronouncement on the guidance from the Methodology Panel. This means that although there is now more certainty as to how the Methodology Panel will assess the additionality portion of new methodologies submitted for their review, there is no certainty as to whether or not the EB will agree with the Methodology Panel's assessment (although they have done so in the past)[9]. Undoubtedly, it would provide more clarity to project developers and to validators if there was only one agreed interpretation of this important paragraph of the Marrakech Accords. Alternatively, clarity and certainty could also be given via top-down guidance on methods from the CDM EB (although the EB has not requested its Methodology Panel to work on such guidance).

The EB has, however, endorsed the recommended procedures to assess additionality for a proposed CDM project activity. These include (UNFCCC 2003e):

- A flow-chart or series of questions that lead to a narrowing of potential baseline options; and/or

- A qualitative or quantitative assessment of different potential options and an indication of why the non-project option is more likely; and/or

- A qualitative or quantitative assessment of one or more barriers facing the proposed project activity (such as those laid out for small-scale CDM projects); and/or

- An indication that the project type is not common practice (e.g. occurs in less than [<x%] of similar cases) in the proposed area of implementation, and not required by a Party's legislation/regulations.

Some of the more recent submissions (or re-submissions) of methodologies to the CDM EB for approval have taken up recent (July 2003) guidance by the EB on procedures that can be used when assessing additionality. For example, a flow chart is used in the methodology submitted for the Catanduva biomass project activity and a series of questions used to narrow down potential baseline options for Vale de Rosário bagasse co-generation.

3.2 Treatment of additionality in proposed GHG-mitigation projects

Proposed CDM project activities must present an argument to show why the activity is additional. Projects submitted to the CDM EB need to fill out the CDM project design document (CDM-PDD, or PDD). The objective of the PDD[10] is to present information on the project's location, characteristics and methods, and it includes a question on why the project is additional "and therefore not the baseline scenario". Information required on projects being developed as potential CDM projects under a national or international scheme is slightly different. For example, the Project Idea Note used to gather information on potential projects by the PCF or the Finnish JI/CDM programmes focuses on expected emission reductions from a project rather than asking explicitly about a project's additionality. CERUPT also focuses on assessing baselines rather than additionality [11]. Thus, the assessment of additionality is addressed

[9] However, while applying the approved procedures should reduce the potential for free riders, the additionality of each individual CDM project activity will still need to be verified by the designated operational entity.

[10] The CDM-PDD is available on the UNFCCC website (http://cdm.unfccc.int/Reference/Documents) in all UNFCCC languages, but needs to be filled out in English.

[11] As outlined earlier, the most recent CERUPT baseline methods (revised for projects already accepted to the CERUPT scheme) submitted to the CDM EB now include a flow-chart to assess a project's additionality (Annex 1).

differently across the various schemes, and was more implicit for some projects than others[12]. An outline of how additionality was assessed for some selected projects is presented in Table 1 below.

There is a large variation in how the additionality of different proposed CDM projects are assessed, including:

- outlining that various barriers to the project exist, e.g. economic, financial, institutional, technological, prevailing practice or other;
- trend analysis, e.g. of fuel mix in the electricity-generating sector;
- economic or financial arguments relating to additionality, e.g. that the project is more costly than alternative options, and so would not be expected to proceed without the availability of carbon finance, including data on internal rates of return (IRR), net present value (NPV) etc;
- arguments that the project exceeded relevant requirements/standards (such as for gas capture from landfills);
- comparing the emissions of the project to that of a baseline (in turn determined by e.g. scenario or investment analysis);
- indication that a project was a first-of-a-kind project or that the penetration of technology used in the proposed project activity is very low;
- statements that the project would not have gone ahead in the absence of the CDM or that CDM registration offers the project some “soft” benefits such as good press; and
- a mixture (more than one) of the above.

Most project proponents used more than one assessment to indicate that their project activity was additional. Some of these additionality assessments are qualitative – such as technological or institutional barriers, trend analysis, or statements that the project would not have gone ahead in the absence of the CDM. Others are quantitative, and based on emissions or economic/financial data such as the project’s net present value (NPV) or internal rate of return (IRR),which may, for some projects, only be made available to the project validators. Subjective factors, such as what constituted an important barrier, whether a proposed project was economically attractive enough without revenues from credits, or what an appropriate discount rate is are included in many of the qualitative and quantitative additionality assessments[13]. For example, a project that involves installation of a CHP unit in an industrial facility (the Metrogas Co-generation project) outlines several qualitative and quantitative barriers, including the “significant institutional barrier” caused by the fact that the unit will be installed and run by a third party and will therefore need new management organisation. Another project that involves expanding CHP and electricity production from bagasse (the Vale de Rosário co-generation project) indicates that such a decision would be seen as high-risk by the private sector and “would require financial assistance like a governmental

[12] Addressing additionality differently across different schemes could be problematic if the resulting credits from these schemes are interchangeable. However, all methods developed for CDM projects are reviewed by the same bodies (CDM EB and the Methodology Panel), which should help achieve consistent results. The need for operational entities to be accredited should also help consistency in assessing the additionality of particular project activities.

[13] One case where the additionality of a project could be assessed objectively was in a project submitted to the USIJI, where a private company took the initiative of proposing an array of solar PVs as an alternative to a tender for a diesel turbine.

subsidy"[14]. Other examples of subjective additionality tests suggested or used by project developers include assessing whether a project is "taking risks under a difficult political situation" and/or "facing financial unattractiveness" (e.g. the La Vuelta and La Herradura hydro project) or whether the proposed project activity results in a return on investment which is "below normal and certainly below what is desired" (Yala rubber wood electricity-generating project).

Another difference between additionality assessments for different proposed electricity-generating CDM projects is that some project proponents (e.g. for the Durban landfill gas to energy, Metrogas cogeneration, La Vuelta and La Herradura hydro projects) outline why the individual project would not have been likely to go ahead in the absence of the CDM. Other proposed CDM project proponents (e.g. for the Peñas Blancas hydro project, Wigton wind project) did not provide any information in this area. Two of the project proponents that have re-submitted a "new methodology" to the CDM EB (AT Biopower, resubmitted as the Pichit rice husk project, and the Vale de Rosário co-generation project) include in their re-submissions an assessment of why the individual project would not have gone ahead in the absence of the CDM.

The procedure or tool used to assess the additionality of different projects also varied. For example, some projects (e.g. El Canadá hydro project) use one "test" (e.g. an assessment of long-run marginal costs for the project or an alternative form of electricity generation, such as from natural gas combined cycle plants) to assess additionality and another (e.g. existing plants likely not to be dispatched because of the project's output) to quantify the emission reductions from a project. Others (e.g. those developed for the CERUPT programme) use a baseline both to test for additionality and to quantify the extent of emission benefits. This approach is allowed for in the rules for small-scale projects agreed at COP8, and the Methodology Panel also recommended that it should be allowed for larger-scale projects (UNFCCC 2003d).

It can also be seen from table 1 that the assessment of additionality of individual project activities can vary significantly within a particular programme (although how projects and programmes assess additionality has changed significantly during the course of 2003 in order to take into account guidance on this issue from the CDM EB). For example, additionality for projects submitted to the CERUPT programme was initially determined by calculating a baseline scenario that represents the most likely future situation (either via scenario analysis[15] or investment analysis[16]), and comparing the GHG performance of the proposed project to that implied by the baseline scenario (Senter 2002). Following guidance from the CDM EB, the CERUPT methodology now also includes a generic flow-chart used to assess a project activity's additionality (see Annex 2). The Finnish JI/CDM programme[17] also uses scenario analysis to determine an emissions baseline, and then assesses a project's additionality by comparing its GHG emissions to the baseline.

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[14] Interestingly, one of the two phases of this project submitted as a CDM project activity has already been completed with unilateral (private) funding.

[15] In "scenario analysis" (used by e.g. CERUPT, PCF, Finnish JI/CDM programme) a series of possible technology/system development possibilities are outlined and arguments put forward as to why one such scenario (e.g. continued operation of a plant with the existing fuel/equipment, non-installation of wells to collect of landfill gas) is most likely. The emissions baseline associated with this baseline scenario is then calculated and compared to the project's emissions.

[16] "Investment analysis" involves a quantitative assessment of the proposed project to determine e.g. its NPV, IRR or - for power projects – the associated long-run marginal cost (LRMC). This figure is then compared to the cost, IRR, LRMC etc. of an alternative investment possibility (often in the same sector) to assess whether or not the proposed project represents an attractive investment (in the absence of income from any GHG credits).

[17] Excluding small-scale CDM projects, for which information is not available to the author.

The PCF assesses additionality by one of three methods (Heister 2003): economic/investment analysis (often used for grid-connected power projects), scenario/barrier analysis (used for the West Nile Hydropower, El Gallo and Jepirachi projects), or control groups[18]. The PDD developed for the Austrian JI/CDM programme requires an explanation of why the emission reductions would not occur in the absence of the proposed project activity as well as a description of the project's environmental (including GHG) benefits (Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2003). The USIJI programme required that projects are initiated "as a result of the USIJI or in reasonable anticipation thereof" (USIJI 1). Despite these differences, if projects developed under one scheme are approved as CDM or JI projects, all projects will generate emission credits which are interchangeable with one another as well as a Party's Assigned Amount Units.

Differences in approaches to assessing additionality between different programmes and projects may have emerged in part due to the long time delay (over 5 years) between the Kyoto Protocol's establishment of the CDM in 1997, agreeing on the framework for emission-reduction projects in the 2001 Marrakech Accords and setting up procedures by which proposed CDM projects could be submitted to the CDM EB (early 2003). This delay meant that work started on initiating several potential CDM projects before the definition of additionality in the Marrakech Accords was agreed. The Marrakech Accords allow "a project activity starting as of the year 2000 and prior to the adoption of [17/CP.7]" to apply for CDM status retroactively. However, when construction of a CDM project activity has started prior to its submission to the CDM EB, arguments that barriers would prevent it from being built in a BAU case are not always convincing[19]. (Nevertheless, this argument can hold in cases where the project sponsor guarantees carbon finance for the project's emission reductions even if these emission reductions are not validated as CERs/ERUs).

Previous analysis undertaken for the Annex I Expert Group (Kartha et al, 2002) suggests that a simple additionality screen should be used for mid-size renewable energy projects. However, different ways of assessing additionality can lead to different results when deciding whether or not a particular project activity is additional. For example, if the additionality assessment for a grid-connected renewable electricity project was based solely on a comparison of project emissions with the grid's operating, build or combined margin (which almost always contain fossil fuel plants), all renewable electricity projects would be found additional in almost all cases. This is of course not accurate. For example, India's wind electricity capacity grew from 1080MW at the end of 1999 to 1702 MW by March 2003[20]. This 622 MW increase is several times the combined capacity of the five proposed CDM wind projects in India, and thus most of the increase could be put down to business-as-usual (non-additional) activity. Basing additionality assessments solely on technology or energy-source penetration rates could, depending on the rate chosen, also lead to significant levels of free riding. Alternatively, the use of barrier analysis – although it can be tailored to different project contexts - can also be more subjective and less transparent (and therefore open to gaming).

[18] Using "control groups" involves identifying and monitoring the behaviour/actions/development of a peer group to see if/when they adopt the behaviour/technology etc. used in the proposed CDM project. This method is not often used for proposed power projects, but has been used to assess the baseline scenario for non-power projects submitted to the CDM,. For example, the V&M do Brasil "avoided fuel switch" project for charcoal-based steel production compared its fuel choice with the fuel choice trends of a group of steel producers in the same region in Brazil.

[19] For one proposed CDM project that has re-submitted its new methodology proposal (Vale de Rosario, NM1), the project design document indicates that although the project was unilaterally funded by the project owner/developer, and the co-generation unit has been in operation since June 2001, "it is clear that the economic benefits of the project without the sales of the CERs are not sufficient to overcome all the technical, institutional and financial barriers…".

[20] See http://www.expert-eyes.org/power/wind.html

Revised procedure for submitting new methodologies to the CDM EB

1. Applicant Entity or Designated Operational Entity (acting for project participant) forwards "without further analysis" proposed methodologies to CDM EB.

2. UNFCCC Secretariat checks for completeness.

3. When complete, Secretariat forwards to Methodology Panel.

4. Methodology Panel choose two experts from Roster of Experts.

5. Methodology Panel drafts preliminary recommendations based on own input and that of experts.

6. Preliminary recommendation forwarded to project participants (via AE/DOE).

6. If preliminary recommendations are to accept the methodology, or if no comments received from DOE/AE, recommendations are forwarded immediately to the EB, and published on UNFCCC website.

7. If DOE/AE submits clarifications to the Methodology Panel on technical issues (within a time limit), preliminary recommendations will not be forwarded to EB or made public until the Methodology Panel has re-considered the methodologies at its next meeting.

Source: UNFCCC (2003)

Table 1: Additionality assessments for selected projects

Project	Additionality assessment
Vale de Rosario (NM 1rev)	• Targeted questions to assess whether a project activity would have happened under business-as-usual. • Barrier analysis, trends in policy and technology.
NovaGerar, CDM/NCDF (NM5)	• Low technology penetration: currently no landfill gas-to-energy operational in project-site country (Brazil). • Landfill gas capture not required by existing or planned regulations. • Economic/financial argument: project would not be economic (IRR negative) without carbon finance.
El Canadá, CDM/PCF (NM6)	• Economic argument: proposed project is not the least-cost expansion option so would not be the most likely baseline scenario.
Peñas Blancas, CDM/ CERUPT (NM 8)	• Economic/financial barrier: cost of capital means that host country government (Costa Rica) will need CER income to finance renewable energy projects. (Although contract signed in August 2000*). • GHG of “with-project” scenario (assessed using ‘key-factor’ analysis, further checked with a series of questions) lower than GHG of “without-project” scenario.
AT Biopower, CDM (NM9)	• GHG of “with-project” scenario lower than GHG of “without-project” scenario. • Low penetration of project type in the host country (Thailand).
Durban, CDM (NM10rev)	• Project exceeds requirements for methane capture (runs counter to BAU). • Economic/financial argument: the cost of electricity generated by project is greater than the price paid for the electricity, so the project would not occur without carbon finance.
Karnataka, CDM (NM11)	• Low penetration of proposed technology. • GHG of “with-project” scenario lower than GHG of “without-project” scenario.
Wigton, CDM (NM12)	• GHG of “with-project” scenario lower than GHG of “without-project” scenario. • First commercial scale wind farm development in host country (Jamaica).
Metrogas, CDM (NM 18)	• Institutional, technological barriers to project implementation (assessed via flow-chart). • Runs counter to BAU.
Pichit, CDM (NM19)	• Investment, technological and other barriers to implementation of particular project. • First-of-a-kind application of this technology to the project fuel (rice husks) in host country (Thailand).
La Vuelta…, CDM (NM20)	• Statement that the proposed project activity would not have gone ahead without the “show window” effect of the CDM. • Non-monetary benefits of the CDM.
La Vuelta…, CDM (NM20 rev)	• Three options given to assess additionality : economic/financial analysis (comparing the project activity’s NPV and IRR with those of non-project alternatives); a flow chart (covering i.a. different barriers, project plans, penetration rates); a barrier analysis.
El Gallo, CDM/PCF (NM23)	• Barrier analysis: identification of “prohibitive” financial, technical or institutional barriers. • Trend analysis: assess whether projects similar to the proposed CDM project activity are being carried out.
Jepirachi, CDM/PCF (NM24)	• Economic/financial argument: cost comparison between electricity system with and without proposed project. • Barrier analysis: identification of “significant barriers”.

Raghu Rama (NM25)	• No details given.
Catanduva, PCF/CERUPT (NM27)	• Assessment (via a flow-chart) of legal obligations, economically attractive course of action, barriers (investment, technological or other), comparison to business-as-usual trends.
Haidergarh CDM (NM30)	• Barrier analysis (investment, technology and other). • Assessment of whether the project activity represents a legal obligation or common practice.
OSIL, CDM (NM31)	• Barrier analysis (focusing on regulatory/institutional barriers). • Qualitative assessment of likely non-project options, and comparison of project GHG performance with non-project options.
TA Sugars, CDM/PCF (NM35)	• Economic/financial analysis: determination of least-cost electricity generating option. • Barrier analysis (especially financial).
Yala Rubber Wood, p-CDM	• Economic/financial argument (with more detailed, confidential, information given to the validators): return on investment is below "normal". • Barriers: more planning (i.e. human/financial resources) needed. • Low technology penetration: this is a first-of-a-kind project in the host country (Thailand).
Costa Rica Umbrella project PCF	• Economic argument: proposed project is not the least-cost expansion option so would not be the most likely baseline scenario.
West Nile Hydropower, PCF	• Risk-based development scenarios developed. Project emissions are lower than the least risky development scenario. (Project documentation indicated that investment analysis not appropriate as cost is not the primary driver for investments).
Kalpa Taru, CERUPT	• Low technology penetration: almost no renewable energy systems currently exist in the state (although some is planned). • Economic argument: electricity tariffs are lower than generation costs (and not always paid/collected) and this is an impediment to Independent Power Producers (IPPs). • Other barriers, e.g. doubts about the enforceability of power purchasing contracts. (This information is presented in the "baseline report" and not linked to additionality by the report's authors).
Slovakia Landfill, ERUPT	• GHG of "with-project" scenario lower than GHG of "without-project" scenario.
Paldiski, p-ERUPT	• Low technology penetration: no other modern windfarms have been established on a commercial basis in the project country. • Economic argument: wind energy cannot compete with the low-priced electricity from abundant domestic supply of oil shale.
Olkaria III, r-CERUPT	• GHG of "with-project" scenario lower than GHG of "without-project" scenario. • Project in line with host country government aims for more IPPs, use of indigenous energy forms, diversification from hydro.

Sources: Documentation for individual projects (see Reference section for details)

3.3 Experience with assessing additionality for CDM-type projects

As outlined above, the CDM EB, Methodology Panel, experts and the Designated Operational Entity/Applicant Entity (DOE/AE) are all involved in evaluating the additionality assessments for proposed new CDM methodologies and/or individual projects. However, this has proved extremely difficult because:

- there is more than one interpretation of the additionality definition included in the Marrakech Accords (discussed above);

- subjective judgements may be needed to determine which baseline scenario is the most likely and/or what the associated emission level of this baseline scenario is;

- assessing whether or not an individual project would have gone ahead otherwise is also a subjective area that depends on many project and context-specific factors including behavioural aspects of the project developer.

This subjective component of additionality testing has led to different people arriving at different conclusions as to whether a particular project activity is additional. This has happened for CERUPT projects, where NGOs disagreed about the additionality of the projects accepted as additional by the Dutch government into their CERUPT programme (CDMWatch 2003). It also occurred in the evaluation of proposed USIJI projects, where reviewers sometimes had differing opinions as to a project's additionality - particularly the "programme additionality" aspect - both for projects accepted and not accepted to the USIJI programme (Fitzgerald, 2003). The additionality of some AIJ projects has also been questioned (e.g. Michaelowa 2002), with one AIJ project report (UNFCCC 1998) indicating that “the project is economically viable without subsidies … the technique used … is standard practice in modern breweries in industrialised countries but is not yet wide spread in breweries in Eastern Europe and in Developing Countries….there is no effective capacity building…”.

This difficulty has also been seen when assessing the methodologies (and associated projects) submitted to the CDM EB for approval. Indeed, not all new methodologies submitted for CDM electricity-generating projects included an assessment of whether or not a particular project would have occurred as part of the baseline scenario (e.g. the Peñas Blancas and El Canadá hydro projects) although the EB had previously outlined that an explanation of “how … it is demonstrated that the project activity is additional and therefore not the baseline scenario” was needed (UNFCCC 2003b). The subjective aspect of such an assessment is also illustrated by the types of barriers to or benefits from participating in the CDM (or other programme) that have been identified by individual project participants, such as better public relations or increased portfolio diversity.

The delay between establishing the CDM and setting up a framework to assess proposed CDM projects has also caused difficulties for projects initially developed under schemes pre-dating the Marrakech Accords and later as proposed CDM projects to the CDM EB. Indeed, parts of the additionality assessments used by projects developed under the early-mover CERUPT and PCF projects were not accepted in their original format by the CDM EB. For example, the methodology used by the El Canadá hydro (PCF) project was criticised by the EB and Methodology Panel as not explicitly demonstrating that the project is not the baseline. The EB also require changes to the methodology used by the Peñas Blancas (CERUPT) hydro project, as it too does not currently substantiate enough that the project is not the baseline scenario.

4. Determining baselines

Another critical element of preparing CDM or CDM-type projects is determining the baseline that will be used to assess the number of credits generated by a project. The Marrakech Accords define the baseline for a CDM project activity as "*the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity*". Much analysis has been done on how to estimate this hypothetical scenario for electricity-sector projects including (e.g. Bosi 2000, Kartha et al. 2002, Heister 2003, WGB 2001, JIN 2003, Sathaye et al. 2003. This section outlines the different baseline scenarios and emission baselines that have been used for CDM, CDM-type and JI projects and assesses how these baselines "fit" with the three approaches laid out in the Marrakech Accords.

4.1 Treatment of baselines in proposed projects

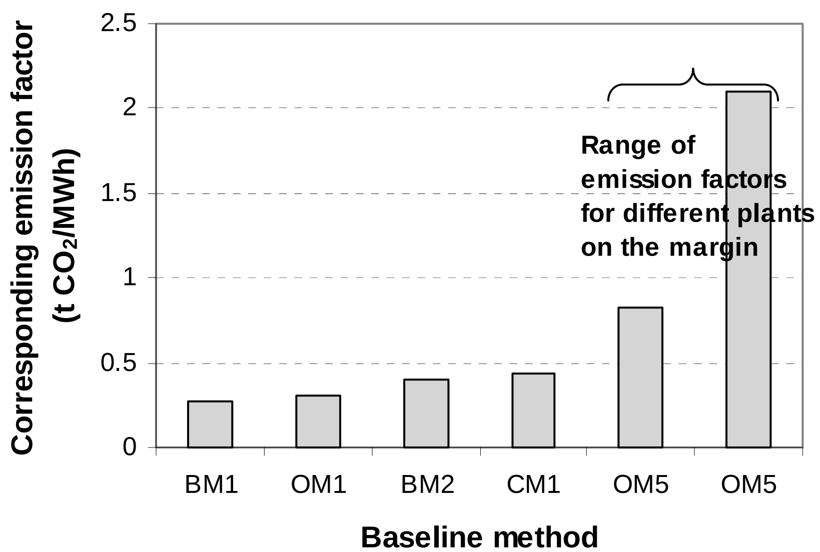
While the baseline scenarios for most electricity CDM projects are very similar (i.e. continued operation of grid without proposed project, expansion of grid as planned, least-cost expansion of grid), there is considerable variation in how emission baselines were determined for these projects. Emission baselines used in the projects outlined in table 2 included several based on operating margin (OM), build margin (BM) or combined margin (CM) methods, i.e.:

- OM1: Generation-weighted average emission factors for the grid (e.g. the Durban landfill gas-to-energy project);
- OM2: Displacement of electricity from a particular plant currently operating (e.g. the Paldiski wind project);
- OM3: *Ex ante* generation-weighted average emission factor for the grid, corrected *ex post* if value lower than projected (e.g. the Pichit rice husk project);
- OM4: Dispatch decrement analysis (i.e. project displaces generation from the marginal plant to be dispatched), as identified either by *ex ante* model (e.g. the Peñas Blancas hydro project) or
- OM5: by *ex post* dispatch analysis (e.g. the Chacabuquito hydro and Jepirachi wind projects);
- CM1: "Combined margin" emission factors where the operating margin excludes must-run hydro facilities (e.g. the El Gallo hydro project activity);
- CM2: Modified combined margin method (used in the final version of the Vale de Rosário bagasse co-generation project activity). In this method, the build margin is defined as the most recent 5 plants or the most recent 20% of plants built within a country/grid under 250 MW. The operating margin is the weighted average emissions intensity of all sources operating on the margin, as determined using a stacked load curve (per year).
- BM1: Weighted average emission factor for recent grid additions excluding recently-added renewables (e.g. the Wigton wind project), or recent and planned grid additions (Kalpa Taru), or planned additions including renewables (the Olkaria III geothermal project, PCF);
- BM2: Displacement of electricity from a "proxy" technology likely to be built (e.g. the Catanduva bagasse project).

Pros and cons of baselines developed using operating margin, build margin or combined margin methods have been examined in a previous analysis (Kartha et al. 2002). To date two baseline methodologies for electricity-generating projects have been accepted by the CDM EB (for the Vale de Rosário bagasse co-generation and Pitchit rice husk projects), and a further two recommended for EB acceptance by the Methodology Panel (see table 2). Two of these baseline methodologies use the grid average emission factor, while two use different modifications of the combined margin approach. Three are based on the baseline approach laid out in paragraph 48b of the Marrakech Accords, while one is based on paragraph 48a (see section 4.3 for the definition of these approaches). Thus, it seems that different baseline methodologies are judged appropriate for different project types.

The difference in value (level) of emission baselines calculated using these various methods can be significant, depending on the area in which the potential CDM or JI project is located. For example, in the Sistema Interconectado Central (SIC) grid in Chile, the total generation is dominated by hydropower and gas-fired power: 68.3% and 19.4% respectively of total generation in 2000, (Bosi and Laurence 2002). The relative importance of hydro and gas are inversed if recent capacity additions (1996-2000) in the same grid are examined (27% and 56% respectively, PCF 2001). Thus, in this case, a build margin method would give a higher value for the emissions baseline – and more credits – than a baseline based on an average operating margin. However, a baseline for the PCF's Chacabuquito project feeding electricity into the same grid uses "dispatch decrement analysis" (OM5), which is expected to show that coal-fired power generation is displaced at all times, as coal-fired plants are on the margin (PCF 2001). The difference in number of credits that a renewable electricity project could generate by using these different baseline methods could vary by almost a factor of ten (figure 3).

Figure 3: Range of possible baseline values in Chile SIC grid

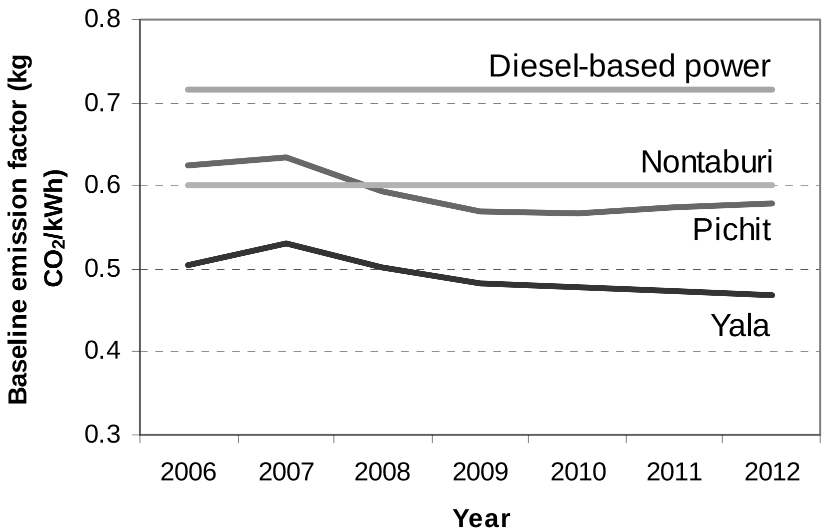


Sources: data from Bosi and Laurence 2002, PCF 2001

Large variations in the level of emission baseline have been seen for CDM projects under development. A geothermal project in Kenya, Olkaria III, has been submitted as a potential CDM project to both CERUPT and the PCF, but with substantially different baselines. The baseline used in the CERUPT submission assumed that output of the project would displace currently operating "stop-gap" diesel plant or to-be-retired oil plants, and resulted in emissions benefits of 260 kt CO_2/year for a crediting period of 10 years (Ecosecurities 2002). However, this project was not accepted into the CERUPT programme. The baseline under consideration in the PCF submission assumes that output of project will displace weighted average carbon emissions for projected capacity additions, i.e. including hydro and geothermal plants, and results in estimated emissions benefits of 113 kt CO_2/year (with a crediting period of 21 years).

Variations are also seen in the baselines drawn up for three different potential CDM projects in Thailand: Yala rubber wood project, the Pichit rice husk project, and the Nontaburi landfill gas-to-energy project (figure 4). The Pichit and Yala projects use the same baseline method (weighted average grid emission factor). The documentation for the Pichit project outlines that that this choice results in a conservative emissions baseline (for the Thailand grid, which is gas-dominated) as the most likely source of electricity to be displaced by the project is the more GHG-intensive diesel-based power. However, the projected emissions intensity per year varies by approximately 20% (EPDC 2002, Mitsubishi Securities 2003). (This difference is partly due to the use of updated data for the Pichit project. Further differences are not important, as both projects will adjust the baseline downward if *ex post* calculations indicate a lower emissions baseline than that projected *ex ante*. However, it does indicate that significant variations in baseline level – and therefore projected credits - can occur when using the same baseline method but different vintages of data). The Nontaburi project uses a constant emissions factor as the baseline (and the English translation of the project documentation, Obayashi 2003, does not indicate the rationale behind the factor taken).

Figure 4: Emission factors used in different projects in Thailand



Sources: UNFCCC, EPDC 2002, Obayashi 2003

Two different bagasse projects that feed electricity to the South/South-East grid in Brazil also have different emission baseline methods and values. The method used in the Catanduva sugarcane project (UNFCCC 2003f) assumes that the baseload electricity generated by the project would displace a single proxy technology, in this case the least-GHG intensive fossil fueled technology (natural gas combined cycle, with an emission factor of 0.401 t CO_2/MWh)[21]. The Vale de Rosário cogeneration project uses the combined margin method (excluding minimum baseload hydro, i.e. over 90% of hydro generation), and an emission factor of 0.604 t CO_2/MWh. The differences between these different emission factors used are significant, and would mean that the Vale de Rosário plant would generate up to 45000 fewer credits per year than if it used the method and emission factor used for the Catanduva project. This would mean a reduction in income from credits of almost USD 225,000 per year (at $5/t CO_2). If either project used a grid average emission factor, such as that used for the projects in Thailand above, the emission factor would be much lower, (0.275 kg CO_2/kWh) because of hydropower generates a greater proportion of electricity in the Brazilian electricity grid.

There may be excellent reasons for using one baseline method over another for a particular project (e.g. lack of data on recent additions to the grid, lack of data on grid dispatch, little recent capacity additions). However, the examples above illustrate the subjective nature of deciding what the electricity generation by a proposed CDM project would displace, and the significance that this can have in terms of credit and revenue flows from a project.

4.2 Review of approved baseline methodologies

In October 2003, the CDM EB approved two methodologies to determine baselines and additionality for proposed electricity-generating CDM project activities (see Table 2). Two further methodologies to determine baselines and assess additionality for electricity-generating project activities have been recommended for approval by the Methodology Panel. This section outlines these methodologies, which have been developed for different project types (electricity-generation, co-generation and landfill gas-to-energy) and contexts.

[21] However, it does not take into account that almost half of the power plants under construction in the host country are hydropower stations (Bosi and Laurence, 2002). Previous versions of the project design document, using the same baseline methodology, indicated that the corresponding emission factor would be approximately 20% higher, i.e. 0.502 t CO2/MWh).

Table 2: Characteristics of EB-approved and Methodology Panel-recommended methodologies

Project, location	Project type and energy source	Additionality assessment	Baseline methodology used	Comment
Methodologies approved by the EB				
Picthit	Electricity generation using rice husks.	Barrier analysis	Operating margin (average grid).	Applicable to project activities using biomass. Use of average grid emission factor gives a conservative baseline.
Durban	Landfill gas-to-energy.	Economic analysis of project activity and BAU.	Operating margin (average grid).	Applicable to project activities capturing landfill gas beyond BAU activities.
Methodologies recommended to the EB for approval by the Methodology Panel				
Vale de Rosário, Brazil (rev2)	Bagasse co-generation, grid export of electricity.	Targeted questions, barrier analysis.	Modified combined margin (see section 4.1 for details).	Applicable to bagasse project activities operating in hydro-dominated systems.
El Gallo, Mexico	Hydroelectric.	Barrier analysis, comparison to BAU.	Combined margin excluding low-cost/must-run sources.	Applicable to grid-connected projects up to 60 MW when low-cost/must-run systems (e.g. hydro, nuclear) are not dominant.

Sources: Submissions to CDM EB

It can be seen from this table that methodologies approved, or recommended for approval, cover a variety of project contexts and potential fuels. However, further methodologies will need to be approved in order to apply to project activities that e.g. generate electricity in hydro-dominated systems (other than by biomass); use natural gas; and/or are larger than 60 MW. Methodologies currently submitted to the CDM EB, but not yet recommended for approval, cover some of these project contexts.

4.3 Experience with implementing Marrakech Accords' guidance on baselines

Both the Kyoto Protocol (KP) and the Marrakech Accords (MA) give some general guidance on how to assessing the emissions benefits of a particular project. The KP indicates that emission reductions should be "real, measurable and long-term" and the Marrakech Accords indicate that baselines "shall" be developed in "a transparent and conservative manner". However, these two instructions may sometimes pull project developers in different directions. For example, the baseline methodology chosen could reflect the implicit ranking by the project developer of e.g. "measurable" over "conservative". This is the approach taken by the PCF, who indicate that detailed monitoring of the actual system operation with CDM projects (e.g. *ex post* emission factors based on hour-by-hour dispatch analysis data) can give "more accurate clues" about the baseline, and that the required level of conservativeness can therefore be lower (Heister 2003).

The Marrakech Accords (paragraph 48, 17/CP.7) also indicate that project participants "shall select … one" of the baseline approaches outlined below:

- "existing actual or historical emissions, as applicable" (paragraph 48a);
- "emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment" (paragraph 48b); and
- "the average emissions of similar project activities undertaken in the previous five years, in similar … circumstances, and whose performance is among the top 20 per cent of their category" (paragraph 48c).

Further, a "new methodology" needs to identify which one of these three baseline approaches it is based on. To date, the electricity-generating projects submitted to the CDM EB for consideration have indicated that they use only approaches outlined in 48a and 48b. Two projects indicate that they use both of these approaches. The baseline methodologies used for projects submitted to the EB illustrate that some methods "fit" well with the approaches laid out in paragraph 48 of the Marrakech Accords (see above). For example, methods OM1 and OM3 are based on the existing average actual emissions of a system and method OM2 (used for a potential JI project) is based on the existing actual emissions of a particular plant. These three methods map onto the approach outlined in 48a (although they are not necessarily the most accurate baseline methods, Kartha et al. 2002). Method BM2 – a "proxy" technology – can easily "fit" approach 48b.

However, it is not always easy to see the relationship between the baseline methods that have been used for some proposed CDM projects and the three "approaches" outlined by the Marrakech Accords. For example, a baseline method focused on a more "build margin" approach would seem to fit either under approach 48b (if the baseline is focused on the performance of one particular technology type, such as for the Cantanduva project) or approach 48c (if the performance of actual plants recently added to the grid is used as a control group). However, the Wigton wind project which uses a modified build margin baseline that reflects emissions from a sub-sector of recently installed plants indicates that it is using approach 48a, with "existing actual … emissions".

The baseline methods for the Kalpa Taru biomass and Olkaria III hydro projects are also based on the build margin, but do also not fit exactly into the approaches outlined in paragraph 48 a, b or c, as they include planned plants (presumably if a project is "planned" it cannot already be "undertaken"). The La Vuelta and La Herradura hydro project indicates that its baseline methodology uses approach 48a ("actual or historical"), although the method involves a model-based simulation (i.e. a projection) of the system's emissions with and without the proposed project. Although the combined margin approach has been approved as a potential baseline methodology for small-scale projects, it does not map well onto one of the three approaches as it is based on actual emissions as well as on emissions from planned plants. The combined margin approach is nevertheless seen as a robust approach to setting baselines because it reflects a project's short-term effect on the operating margin and longer-term effect on the build margin.

The text in paragraph 48b "emissions from *a* technology …" (emphasis added) has also been interpreted in different ways. The Pichit rice husk project interprets this text as meaning emissions from a particular technology, already in place, that would have generated electricity in the absence of electricity generated by the project. The PCF interpret 48b as defining an economic baseline method (Heister 2003), where a project's emission reductions can be assessed by e.g. dispatch analysis. (This may result in the baseline reflecting emissions from more than one technology if *ex post* analysis shows that the project output displaced electricity generation from more than one plant or plant type). The methodology outlined in the

Peñas Blancas PDD also indicates that 48b is used to refer to "technolog*ies*" that represent an economically attractive course of action.

A "new methodology" will be reviewed by different groups (see text box in section 3.2) and is open for public comments before it is approved. However, there is no guidance to the reviewers as to how strict (or otherwise) they should be in assessing whether the proposed new methodology fits with one of the approaches laid out in the Marrakech Accords. Moreover, baseline methods likely to be more representative or accurate (Kartha et al. 2002), such as those incorporating the performance of a range of planned or recently installed plants (e.g. CM1, BM1, OM4) are those that fit the least well onto one of the three approaches outlined in the Marrakech Accords. While the label attached to a particular baseline methodology is not important, it would be helpful for project developers to know how much flexibility they have in developing "bottom-up" baseline methodologies (i.e. whether or not a proposed new methodology could be rejected because it does not map to one of the three approaches). Experience to date would indicate that interpretations of these approaches can be relatively wide.

Experience has also shown that reviewers of proposed baseline methodologies for electricity sector CDM projects often request revision to a proposed methodology. Some methodology reviews have argued that a proposed methodology may not be appropriate in a particular circumstance (e.g. that a baseline based on the operating margin should not be used in a grid where there is unmet demand, such as in the Karnataka co-generation project, or that excluding all hydro electricity from operating margin calculations is not appropriate in a grid dominated by hydropower, such as in the methodology initially suggested for the Vale de Rosário co-generation project). However, revisions to proposed baseline methodologies have not been requested by the CDM EB *solely* because they do not "fit" with an approach outlined in the Marrakech Accords. If the true test for a methodology is whether it is appropriate for the particular project and context in which it is applied (rather than whether it maps easily onto the approaches outlined in the Marrakech Accords) then the door is left open for project developers to add some useful methodological variations to those laid out in the original guidance.

Table 3: Baseline scenarios and expected emission reductions for selected projects

Project	Baseline scenario	Emission reductions from project	Approach used*
Vale de Rosario (NM1/rev1) (Rev2 outlined in Table 2)	Continued operation of grid, non-construction of proposed CDM project.	Displacement of grid electricity (using a "combined margin" emissions factor, where the operating margin excludes 92% of hydro generation as this is classified as "minimum baseload" hydro).	48a+b (rev1) 48a (rev2)
El Canadá, CDM/PCF (NM6),	Least cost capacity expansion of grid.	Displacement of thermal electricity generation in reverse dispatch order (which plant(s) are affected are identified by dispatch analysis).	48b
Peñas Blancas, CDM/ CERUPT (NM 8)	Continued expansion of grid as planned.	Displacement of thermal electricity generation in reverse dispatch order (which plant(s) are affected are identified by dispatch analysis).	48a + b
AT Biopower (NM9)	Continued operation of grid – project would not get built.	Displacement of grid electricity (using weighted average carbon emission factor for grid).	48a
Durban, CDM (NM10/rev1)	Continued operation of landfill with existing equipment: limited collection/flaring or venting of CH_4.	CO_2-equ. of CH_4 captured, displacement of electricity (average intensity of grid, based 90% on coal).	48b
Karnataka, CDM (NM11)	Continued operation of grid, non-construction of proposed CDM project.	Displacement of grid electricity. Emission factor used is weighted average carbon emissions factor for all sources except large hydro.	48a
Wigton, CDM (NM12)	Continued operation of grid	Displacement of fossil fuel electricity from the grid. Weighted average emission factor for additions to grid between 1992-2001.	48a
Metrogas, CDM (NM18)	Project would not get built.	(Methodology does not specify how the emission factor will be calculated).	48a
Pichit, CDM (NM19)	Project would not get built. Grid would continue to operate and expand as planned.	Displacement of marginal electricity production (i.e. operating margin) judged most appropriate, but a more conservative "grid average" generation used. *Ex post* monitoring to ensure that if emission factor is lower than that projected *ex ante*, the *ex post* emission factor will be used.	48b
La Vuelta…, CDM (NM20)	No alternative option would have been developed instead of the proposed project.	Displacement of thermal and hydro generation (Some hydro will be on the margin, partly because all thermal electricity cannot be displaced "due to transmission capacity", MGM 2003.)	48a
El Gallo, CDM/PCF (NM23)	Ongoing operation and expansion of the electricity system	Displacement of electricity from plants currently operating and plants expected to be built (calculated via a "combined margin" methodology)	48b
Jepirachi, CDM/PCF (NM24)	Least-cost expansion of electricity system.	Project expected to displace a mixture of gas and coal-fired power. (To be assessed by assessing dispatch data).	48b
Raghu Rama, CDM (NM25)	Continued operation of existing plants, and construction of planned (large) power plants. Project would not be built.	Project output expected to displace average emissions by all projects in the grid (excluding operation of low-cost/must-run sources).	48a
Catanduva, CDM/ CERUPT (NM27)	Expansion of electricity system as based on the Power Expansion Plan.	Single proxy technology baseline: CCGT with emission factor 0.4 t CO_2/MWh. (Gas accounts for 90% of planned fossil fuel capacity expansion in host country).	48b

OSIL, CDM (NM31)	Project-site plant would have continued to source its electricity from the grid.	Displacement of grid electricity (using a "combined margin" method, where operating margin is defined to exclude low-cost hydro).	48a
TA Sugars, CDM/ PCF (NM35)	Plants' off-season co-generation operation or expansion would be fuelled by fossil fuels, not biomass.	Exported electricity would displace grid-connected fossil fuel power plants.	48b
Chacabuquito, PCF	Least-cost expansion of electricity system.	Project expected to displace coal-fired power. (To be assessed by assessing dispatch data).	
WNHPP, PCF	Continued growth of small-scale private diesel and petrol-based generation.	Displacement of diesel or petrol-based generation.	n/a
Olkaria III, PCF	Electricity not generated by the project would be generated according to the national supplier's least cost expansion plan (diesel, geothermal and hydro).	Weighted average carbon emissions factor for projected capacity additions (113 kt CO_2/y emission reductions expected).	
Olkaria III, r-CERUPT	Electricity not generated by project would be generated by diesel or fuel-oil fired power.	Project to displace currently operating "stop-gap" diesel plant or to-be-retired plants (260 kt CO_2/y emission reductions expected).	
El Encanto, r-CERUPT	Scenario analysis.	Electricity from project expected to displace thermal electricity generation in reverse merit order (i.e. where SRMC highest).	
Esti, CERUPT	Grid expands as per "corrected" expansion plan.	Will offset thermal generation from existing and future plants. Emission factor used varies between 0.74 – 0.63 t CO_2/MWh.	
Kalpa Taru, CERUPT	Recent and expected capacity additions will occur as planned. Imports from elsewhere in the Northern grid will be 10% at the end of the crediting period (10y) compared to 2% export at start of project. Little IPP expected as there has been none in the state at present.	Average carbon intensity of projects commissioned, implemented, proposed or announced in the project state (930 t CO_2/GWh), dropping to 898 t CO_2/GWh with increased imports of lower GHG-intensive electricity.	
Lebork, Finnish JI/CDM program	Continued operation of plant.	Displacement of grid electricity. Baseline used is grid average emission factor for electricity (in host country, 99% of grid electricity from coal).	
Yala rubber wood	Continued operation of grid.	Displacement of grid electricity (weighted average emission factor for grid, adjusted *ex post* if *ex ante* projection too high).	
Paldiski, p-ERUPT	Continued operation of current electricity system (>90% oil shale, approx 0.2% renewables). Plant that proposed project will displace output from will be partially renovated and partially close, as per current plans.	Emission reductions from equivalent production of electricity from a particular plant (There are only two major electricity-generating plants in the host country Estonia).	

Sources: Documentation for individual projects (see Reference section for details).

5. Other lessons learned

As well as the methodological lessons learned on additionality and baselines, other lessons can be drawn from experience to date with establishing CDM projects, including on transaction costs, process issues and learning-by-doing. These are outlined below.

5.1 Developing a CDM project takes significant time and cost

The time and cost associated with developing a CDM project (e.g. for project preparation, baseline and monitoring plan development, completing the project design document etc) can be considerable. For example, the PCF indicate (PCF 2003) that this process takes 10 months and 265,000 USD for a CDM project that is not small-scale. Verification and certification are expected to add another USD 20-45,000. With CDM transaction costs of approximately 300,000 USD and at $5/t CO_2 and a 10% discount rate, a project will need to generate approximately 8600 credits per year (for 10 years) just to break even on the carbon aspect of the project's transaction costs. Although the PCF expect the corresponding transaction costs associated with small-scale CDM projects to be lower, estimated at 110,000 USD, they still represent a considerable barrier. Transaction costs are of particular concern as the majority of these costs are incurred up-front, while CDM revenue is generated only after the project has been implemented and approved as a CDM project.

There may also be expensive delays once a project has been developed. For example the Finnish JI/CDM programme has noted a delay in obtaining endorsement from the host country (MOFA 2003). Similarly, the CERUPT programme indicates delay can stem from obtaining financial closure (de Jonge 2003b). Moreover, there can be further delays in obtaining approval of the proposed methodology from the CDM EB (e.g. if revisions are required, see below).

These high up-front costs, combined with both the Kyoto-risk (i.e. the risk that the Kyoto Protocol may not enter into force), the CDM-risk (i.e. the risk that the project may not be accepted as a CDM project by the CDM EB), and the project risk (i.e. that the project may fail for non-CDM reasons) may be the reason why programmes such as PCF and CERUPT usually do not provide capital up-front for a proposed project.

5.2 Incomplete or incorrect submissions will delay projects

Perhaps one of the clearest lessons learned from the first round of submitting proposed CDM projects to the EB is that the role of the templates provided and how the documentation is filled in is very important. The EB and Methodology Panel are tasked with assessing methodologies that are explained in an agreed template. Thus, it is crucial that the templates are user-friendly and consistent with EB requirements. Moreover, they also need to be completed in a manner that is easy to follow for those who are required to base their judgement solely on the documentation provided.

However, some of the first proposed new methodologies submitted to the CDM EB:

- were incomplete. For example, the baseline methodologies for several projects (e.g. NM9, 11, 12, 14, 15) did not include a procedure for determining whether or not a project was additional, although this had been explicitly asked for by the CDM EB prior to the deadline for submitting new methodologies. Other methodologies submitted (e.g. NM25) listed which procedures could be used to assess additionality, but then did not give any details of how this could be done in practice. One "new methodology", currently pending assessment (NM0013), did not include a new monitoring methodology at all, and another (NM33) does not include a monitoring methodology, but points to a reference in which the proposed monitoring methodology is described.

- were intrinsically linked to an individual project, rather than being broadened to allow for more generic use. For example, one proposed new methodology (NM0002) included the name of the project in the methodology title as well as project-specific information and assessments throughout the methodology description[22] and another included host country-specific data sources and trends (NM0012). (While it is not necessarily simple for a project developer to broaden a method that may have been developed especially for a particular project, it is something that is required of a new methodology).

There were also "smaller" reasons, such as ambiguities, small errors, or filling the forms in incorrectly, why some proposed methodologies could not be accepted in the format initially submitted the CDM EB. For example, some methodologies (e.g. as submitted in the initial version of the NovaGerar landfill gas-to-energy project, and the Wigton windpower project activity) did not include relevant information in the methodology description even though this information was available (and included elsewhere in the documents submitted). Other submitted methodologies included errors, such as referring to NOx (nitrogen oxides) rather than N_2O (nitrous oxide), or ambiguities – such as outlining more than one procedure to assess a project's additionality, but then not indicating whether a methodology should use one or all of these procedures.

Although these issues could often be quickly and easily corrected by the applicant or designated operational entity or project participant (but not necessarily by the Methodology Panel or CDM EB), the Applicant Entities/Operational Entities have been instructed (UNFCCC 2003) to forward proposed new methodologies to the CDM EB "without further analysis". Thus, the first external "quality check" for methodologies is provided by the Methodology Panel. However, while the Methodology Panel can recommend to the EB that minor errors are corrected or that minor changes to the proposed methodology are made, neither the Methodology Panel nor the CDM EB can necessarily resolve a proposed methodology's omissions or ambiguities. Moreover, because the Methodology Panel and the CDM EB meet only sporadically, any changes to proposed methodologies required by these bodies means that acceptance of a proposed methodology is delayed by months. Thus, the first electricity-relevant baseline methodologies (for the Pitchit and Durban project activities) were accepted by the CDM EB in October 2003: six months after initially being forwarded for approval.

However, the task for project developers of proposing and describing a new methodology could also have been made easier if the project design document (CDM-PDD) had included questions that mapped clearly to the EB instructions of what a new methodology should contain. This was not the case for the projects submitted to date. Thus, for the first three rounds of new methodology submissions, project participants needed to look at more than one document to obtain complete instructions on what should be included in the description of a proposed new baseline methodology[23]. In addition, the methodology evaluation form was based on the EB's description of what a new methodology should contain rather than on the CDM-PDD, so it was not surprising that several of the early methodologies examined were found to have gaps. Moreover, as many methodology descriptions cross-referenced project-specific information outlined elsewhere in the PDD, it was not laid out clearly enough that a methodology description, once approved, would become a stand-alone document. This has also now been corrected in the latest version of the CDM-PDD. Both of these issues are being remedied, and a draft of consistent, stand-alone documents should be finalised by early 2004.

[22] This was corrected in a subsequent methodology submission (NM0029) for the same project activity.

[23] These were 1) the new methodology annex of the CDM-PDD, and 2) the outcomes of EB08, outlining what a new methodology should contain.

5.3 Learning-by-doing

Another lesson learned is that increased awareness and learning-by-doing at a company level can be a positive experience that encourages further development of climate mitigation projects. An example of this is the Empresas Públicas de Medellin ESP ("EE.PP.M"). EE.PP.M were involved in the development of a USIJI project (La Sierra: increased efficiency of gas-fired power), a PCF project (Jepirachi wind power) and a CDM project (La Vuelta and La Herradura hydro project). AES have also developed several project proposals.

The process by which investors can encourage interest in potential JI or CDM-type projects can also benefit from learning-by-doing. For example, the Dutch have pursued several different ways of generating interest in developing potential CDM projects, and have decided they prefer using intermediaries such as national or international banks to identify GHG mitigation projects in non-Annex I countries and negotiate the price/quantity of credits associated with such projects, rather than use a public tender (e.g. CERUPT) which does not. Denmark has chosen to follow this route, while Finland and Sweden have chosen to use a public tender.

There have also been some examples of difficulties that nevertheless provide useful learning-by-doing experiences. For example, the EB has requested revisions to baseline methodologies developed even by programmes that were early movers and therefore amongst the most experienced. This may be partly because of early difficulties found in "mapping" methodologies and documents developed before agreement of the Marrakech Accords to the baseline approaches included in it, or its definition of additionality. Including relevant information from programme-specific project documents into the CDM-PDD has also proved difficult in some cases (see above).

Projects developed early, and/or with publicly-available project documentation, have also come in for some heavy criticism, even if they are not much different from other projects where less information is available. For example, the PCF's Plantar project has been widely criticised by NGOs (e.g. CDMWatch 2003) although these claims have been refuted by the PCF. In contrast, the very similar V&M do Brasil project has generated very little public comment[24]. The CERUPT portfolio has also been criticised by NGOs (e.g. CDMWatch 2003) particularly on its approach to assessing additionality, although some of these criticisms could apply equally to other proposed CDM projects.

Concern to avoid such very public criticism may be one of the reasons why information on CDM projects approved by both the project developer and project investor is not always available. While detailed information is available on several projects developed for the PCF, or validated by Det Norske Veritas (DNV) is available, information on projects developed for other carbon funds (e.g. NCDF) or validated by some other applicant entities (SGS, TÜV) is less accessible. (It is less surprising that documentation for projects under development, where e.g. both the price and quantity of CERs are under negotiation, is not available). However, restricting information flow on non-confidential issues – and the methodological lessons that could be drawn from another's experience in developing e.g. baselines – will not help reduce the transaction costs associated with developing CDM or JI projects (although it might reduce potential criticism of individual projects).

[24] The V&M do Brasil project documentation was available on the UNFCCC website (http://cdm.unfccc.int) during the examination of the new baseline/monitoring methodologies it proposed. However, this information is no longer available (or for other projects whose baseline/monitoring methodologies were not approved).

6. Conclusions and implications for the future

This paper briefly outlines the current JI/CDM project portfolio for electricity-generating projects and examines the ways in which additionality and baselines have been assessed for several proposed CDM/JI projects.

While more than 130 such projects are in the process of being developed, detailed information is only available for a much smaller number. However, information on 85 projects currently planned or underway show that a wide variety of projects are being developed, mainly in Latin America and Asia, but also in Central and Eastern Europe[25] and Africa. These projects represent 2.8 GW of generating capacity and are distributed between small (< 1MW) and large-scale projects (up to 200 MW). The projects mainly use renewable energy sources, with hydro and biomass/bagasse accounting for the largest number of projects and the largest expected shares of credits. Wind electricity projects also account for a significant proportion of total capacity and credits. However, waste-to-energy projects using landfill gas, and natural gas projects have also been proposed or are underway. Although the waste-to-energy projects account for only a small percentage (4%) of installed capacity, they seem to be becoming increasingly popular, and account for a much larger proportion of credits because of the global warming potential of methane. There is also increasing interest in the development of large electricity-generating CDM projects that use natural gas.

Additionality

To date, there has been a large variation between different projects in how additionality is assessed and whether such assessments are qualitative or quantitative. This may occur because a proposed CDM project was originally developed for a programme which had slightly different additionality requirements to those that eventually emerged for the CDM through the Marrakech Accords. Additionality assessments between projects also vary according to whether the focus is on showing that the performance of a project was better than a baseline, or indicating that a project would not have occurred in the absence of the CDM. Additionality assessments used to date in proposed electricity projects include:

- barrier or trend analysis;
- economic or financial arguments or analysis;
- indications that a project went beyond business-as-usual activities, legislation or regulations;
- penetration rates of the technology or energy source of the project activity;
- comparisons of the project and baseline emissions; and
- statements that the project would not have occurred in the absence of the CDM.

Several project participants use two or more methods to demonstrate the additionality of a particular project activity. These different methods contain varying levels of subjectivity. Subjective additionality assessments such as what a particular developer would have done otherwise, what constitutes a significant barrier, and what is an attractive rate of return are difficult to verify.

Another difficulty in assessing the additionality of proposed CDM projects is that there is no agreed interpretation of the ambiguous definition for additionality found in the Marrakech Accords. Guidance

[25] New Zealand is also a potential host of JI projects.

from the EB on how to interpret this definition would greatly reduce the uncertainty for project developers and validators in assessing whether or not a proposed project is additional. It would also help to reduce the risk that proposed projects or methodologies are not approved by the EB.

Baselines

Considerable variation also exists in the methods used to determine emission baselines for proposed CDM/JI projects. This highlights the subjective nature used to determine what scenario would "reasonably represent" anthropogenic emissions in a sector which can have several plausible options to fulfil projected demand and demand growth. The effect of different choices for baseline methods can be influenced by different factors including availability of data and models and the relative importance put by the project developer on instructions for "measurable" emission reductions and "conservative" baselines. These choices can significantly impact the level of emissions baseline, and consequently, the number of credits generated. For example, different baseline methods for a renewable energy project in Chile lead to baseline values that could vary by more than a factor of ten, and two different baseline methods used for the same project (submitted to two different programmes) varied by more than a factor of two.

The Marrakech Accords outline that one of three approaches can be used when developing a baseline methodology. While some of the "bottom-up" baseline methods used for electricity-generating projects map well onto one of these three approaches, others do not – particularly those assessed as likely to give a more accurate representation of "what would have happened otherwise" (see e.g. Kartha et al.). Furthermore, different project developers have varying interpretations of what baseline methods can be developed under a particular "approach". It would also be helpful if the EB provided guidance to project developers as to how much flexibility they have in developing "bottom-up" baseline methodologies.

Other lessons learned

One of the clearest lessons learned in the first rounds of submitting new baseline methodologies to the CDM EB for approval is that:

- a template which was consistent with the latest requirements from the CDM EB would have helped project participants present the relevant information in an appropriate way, and

- documentation needs to be complete and accurate if the methodologies presented are to be approved by reviewers (such as the EB, Methodology Panel and experts) who are required to base their opinion solely on the project documentation.

Improvements in these areas have already occurred since the first round of submissions in April 2003, with recent new methodology submissions (i.e. NM0017-NM0035) having fewer gaps than earlier submissions. Moreover, the CDM-PDD is being revised so that it more clearly asks for all the information that the EB indicated should be included in a new methodology. There is also positive evidence of learning-by-doing from project developers, such as those who have developed GHG mitigation projects for more than one scheme (e.g. USIJI, PCF, CDM) and from project investors, who are setting up arrangements or tenders by which to process project proposals.

Modifying the process that has been set up to review methodologies could make methodology approval quicker if the applicant/designated operational entity were to analyse (rather than just forward) a proposed methodology before it was submitted to the CDM EB. In the current process, it is the Methodology Panel that provides the first external "quality check" for proposed methodologies. Any ambiguities or gaps found in a methodology have to be sent back to the project proponents, and cannot be reconsidered before the subsequent Panel meeting. Thus, these methodologies cannot be approved before the first CDM EB meeting immediately after that. Because the Methodology Panel and the CDM EB meet only sporadically, this iteration causes a delay of at least three months.

Detailed methodological information on projects under development is often unavailable, even for some verified projects or projects submitted to a tender. This may reflect a wish by project participants to reduce possible criticisms of the projects or methods used to test additionality and establish baselines. However, restricting information flow on non-confidential issues will not help methodological learning-by-doing and associated transaction costs of developing CDM or JI projects.

The first two “new methodologies” for renewable electricity-generation CDM project activities were approved by the EB in October 2003 (six months after the initial versions of the methodologies were submitted). Two more, applicable to grid-connected systems < 60 MW and to bagasse co-generation projects, have been recommended for EB approval in November 2003 by the Methodology Panel. Together, these four methodologies are applicable to a variety of possible renewable energy sources and different project contexts and can be used for several other project activities in other locations. Using an approved methodology can considerably reduce both the time and cost associated with developing a CDM project activity, and can provide greater certainty that proposed project activities will be approved by the CDM EB.

Clear, unambiguous guidance to project developers on what proposed methodologies should contain, and particularly on the scope of methodologies’ generic procedures to assess additionality, should help reduce the time delay between submitting and approving proposed methodologies that are applicable in further project contexts. With the power sector in many non-Annex I countries growing rapidly, the availability of approved methodologies can therefore help encourage interest in developing electricity-generating plants that would help to both reduce emissions and help the host country achieve sustainable development.

Annex I: General characteristics of selected electricity-generating projects

Project	Country	Scheme*	Expected credits (kt CO_2/y)	Capacity (MW)	Other
Vale de Rosário (NM1)	Brazil	CDM	142.9	65	Cogeneration with bagasse
Karnataka (NM11)	India	CDM	99.2	26	Cogeneration with bagasse
Metrogas Package Cogeneration (NM18)	Chile	CDM	11.53	2.99	Cogeneration with natural gas
The Pichit Project (NM19)	Thailand	CDM, Japanese feasibility study	83.59	22	Biomass (rice husk) + reduction of CH_4 from rice husk decomposition
La Vuelta and La Herradura Hydroelectric Project (NM20)	Colombia	CDM	76.54	31.5	Hydro
Peñas Blancas (NM8)	Costa Rica	CDM, CERUPT	80.7	35.4	Hydro “day peak”
Wigton (NM12)	Jamaica	CDM, CERUPT	52.5	20.7	Wind
Nova Gerar (NM5)	Brazil	CDM, NCDF	562	12	Landfill gas to energy
El Canadá (NM6)	Guatemala	CDM, PCF	144.2	43	Hydro “day peak”
Durban (NM10)	S. Africa	CDM, PCF	457.7	50	Landfill gas to energy
Jepirachi (NM24)	Colombia	CDM, PCF	55.6	19.5	Wind
El Gallo (NM23)	Mexico	CDM, PCF	70.5	30	Hydro
Lucknow (NM32)	India	CDM, PCF	101.8	5.6	Municipal solid waste
Haidergarh (NM30)	India	CDM	93.6	20	Bagasse CHP
TA Sugars (NM35)	India	CDM, PCF	608.8	49	Bagasse CHP
Raghu Rama (NM25)	India	CDM	81.2	18	Biomass
Zafarana (NM36)	Egypt	CDM	126	120	Wind
Bumibiopower	Malaysia	p-CDM	24.5	6.3	Biomass
Barreiro	Brazil	p-CDM	33.8	12.9	Blast furnace gas from charcoal
Benito Juarez	Mexico	PCF	40.8	15	Hydro
Chilatán	Mexico	PCF	51.8	15	Hydro
Trojes	Mexico	PCF	22.8	8	Hydro
Catanduva Sugarcane Mill (NM27)	Brazil	CDM, CERUPT	19.6	19.5	Increased capacity, use of bagasse from existing sugar mill.
Suzlon	India	CERUPT	34	15	Wind
Fortuna	Panama	CERUPT	22.4	0	Increase generation at existing 300 MW hydro plant (no capacity increase).
Sankaneri	India	CERUPT	0.34	15	Wind
Tamil Nadu	India	CERUPT	27.2	14.45	Wind
AyP	Bolivia	CERUPT	35.3	30	Gas
El Salvador Geothermal	El Salvador	CERUPT	10	5.1	Geothermal

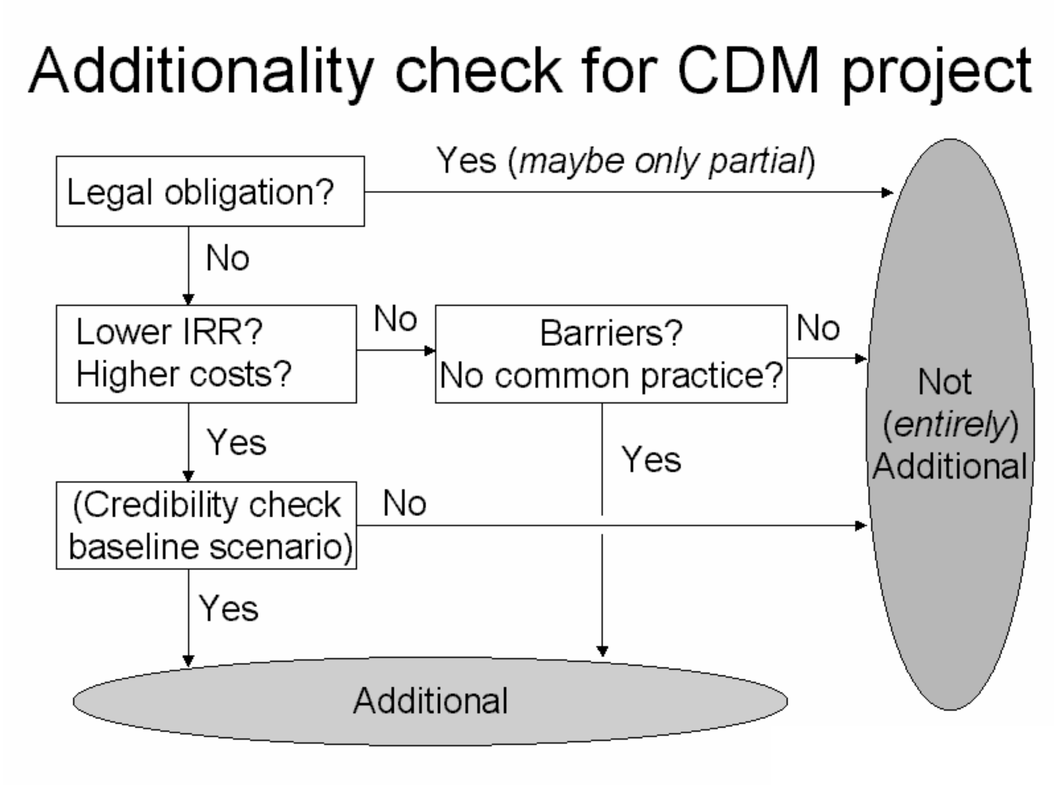
Esti	Panama	CERUPT	339.7	116	Hydro ROR
Huitengxile	China	CERUPT	60.6	34.5	Wind
Wayang Windu	Indonesia	CERUPT	543.2	110	Geothermal
Bayano	Panama	CERUPT	40.7	104	Hydro
SARET Rio Azul	Costa Rica	CERUPT	94.8	3	Landfill gas to energy
Enercon	India	CERUPT	47.6	30	Wind (two sites)
Ind-Barath	India	CERUPT	30	6.5	Biomass
Kalpa Taru	India	CERUPT	115	20	Biomass (mustard crop residue, other wastes)
Portile de Fier	Romania	ERUPT	217.8	58.5	Hydro: modernisation to increase capacity
Srobotowo	Poland	ERUPT	116.7	60	Wind
Borsod	Hungary	ERUPT	150	27	Biomass (wood)
Surduc	Romania	ERUPT	122.5	55	ROR hydro at partially constructed site
Landfill gas recovery	Slovakia	ERUPT	110.2	n/a	Landfill gas to energy
Lwakela	Zambia	Finnish JI/CDM	0.01	2	Hydro
Esperanza	Honduras	Finnish JI/CDM	41.2	12.8	Hydro plant
Electrica del Norte	El Salvador	Finnish JI/CDM	10	(no capacity increase)	Use of sugar cane leaves and residuals in sugar factory.
Pakri	Estonia	Finnish JI/CDM	53.8	20	Wind
Sindi	Estonia	Finnish JI/CDM	15.918	1.4	Small hydro
Lebork	Poland	Finnish JI/CDM	52	20	Biomass (straw fired CHP)
Nontaburi	Thailand	Japanese feas. Studies	55	1.07	Landfill gas to energy
n/a 1	South America	INCaF	n/a	100	Hydro
n/a 2	Central America	INCaF	n/a	25	Bagasse
Gemina	Nicaragua	PCF	10.11405	11.2	Biomass (rice husk)
Chacabuquito	Chile	PCF	133.9	26	Hydro ROR
Waste incineration	Mauritius	PCF	133.3	11.2	Landfill gas
			630	18	Wind
Umbrella project	Costa Rica	PCF	204	6.3	Hydro
Svilosa	Bulgaria	PCF	99.7	14	Woodwaste to partially replace coal CHP
Liepaja	Latvia	PCF	51.04	1	LFG to energy
West Nile hydropower	Uganda	PCF	94.2	6.6	Hydro
Paldiski, Pakri	Estonia	p-ERUPT	146.1	50.6	Wind
Te Apiti	New Zealand	p-ERUPT	196	82.5	Wind
n/a 3	Latin America	p-INCaF	n/a	70	Biomass
n/a 4	Latin America	p-INCaF	n/a	40	Bagasse
Victorias	Philippines	p-PCF	256.2	50	Bagasse
First Farmers	Philippines	p-PCF	128.9	30	Bagasse
CarbonTrade wind project	Honduras	p-PCF	116	49.5	wind power
Hungary Pannonpower	Hungary	p-PCF	340	72	Replacement of some firing heads + addition of

					a 72 MW gas turbine
Fuerza Eólica	Mexico	p-PCF	214	51	Wind
INELEC	Mexico	p-PCF	204.07	72	Hydro
Tangiers and Tarfaya	Morocco	p-PCF	111.6	200	Wind
Dan Chang cogeneration	Thailand	p-PCF	141	36	Bagasse
Olkaria III	Kenya	p-PCF, r-CERUPT	113	51	Geothermal
Rio General hydroelectric project	Costa Rica	PCF	43.5	39	Hydro
Webuye Falls	Kenya	n/a	0.238095	n/a	Hydro
Yala Rubber Wood	Thailand	EPDC	60.7	23	Rubber wood
Osborne Dam	Zimbabwe	p-CDM	20	3	Hydro (at existing irrigation dam)
Aquarius hydroelectric project	Brazil	EPDC	14.942	4.2	Hydro
Hidroelectrica Candelaria hydroelectric project	Guatemala	EPDC	24.04762	4.3	Hydro
Balrampur biomass project	India	n/a	50.48705	19.55	Biomass
Micro-hydro project	Indonesia	n/a	5.565	1	Hydro
Unocal's Sarulla geothermal project	Indonesia	n/a	692.01	200	Geothermal
Palm oil waste power plant	Indonesia	n/a	56.5	10.3	Waste
Sewerage plants project	Zimbabwe	n/a	15.958	0.15	Sewage plant
Air Hitam landfill gas capture project	Malaysia	n/a	9.86	2	LFG to energy
PV/LPG hybrid with biomass option	Philippines	n/a	0.044	n/a	Solar
Panay	Philippines	n/a	41.9	4	Rice Husk
Bioenergy project in palm oil mill	Malaysia	Denmark	39	10	Biomass
Co-generation project	Malaysia	Denmark	7	23	Biomass
El Encanto	Costa Rica	r-CERUPT	18.4	7.5	Hydro ROR
Huanza	Peru	r-CERUPT	215.9	90.6	Hydro ROR
			41.1	13	Wind
Rameswaram	India	r-CERUPT	n/a	2	Biomass
Bujagali	Uganda	r-CERUPT**	586.42	200	Hydro

* “CDM” projects are those submitted to the CDM EB. Projects proposed to a scheme are labelled with p, e.g. p-ERUPT. Projects rejected from a scheme are labelled with r, e.g. r-CERUPT, and are not included in Figure 1 and 2.

Annex 2: Netherlands' proposed flow chart to assess the additionality of a CDM project activity

The Netherlands have developed the following simplified decision tree for the establishment of additionality of a proposed CDM project activity:



Source: VROM, 2003.

Further explanations on how to use this flow chart are detailed in the CERUPT methodology for landfill gas recovery and the CERUPT Alternative Investment Analysis (outlined in the project design document and its annexes for the Catanduva biomass project and the Onyx Landfill Gas Recovery Project, available from http://cdm.unfccc.int/methodologies/process).

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- Prototype Carbon Fund projects: http://www.prototypecarbonfund.org

- CERUPT and ERUPT projects: http://www.carboncredits.nl

- Finnish JI/CDM projects: http://global.finland.fi/

- projects with a validation report from DNV: http://www2.dnv.com/certification/ClimateChange/

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Glossary

AE	Applicant Entity
BAU	Business as usual.
BM	Build margin
CDM	Clean Development Mechanism
CERUPT	Netherlands Certified Emissions Reduction Unit Procurement Tender (for CDM-type projects). ERUPT for JI-type projects.
CH_4	Methane
CM	Combined margin
CO_2	Carbon Dioxide
DOE	Designated Operational Entity
EB	The CDM's Executive Board
GHG	Greenhouse gas
GW	Gigawatt (10^9 watts)
INCaF	IFC Netherlands Carbon Facility
IPP	Independent Power Producer
IRR	Internal Rate of Return
KP	Kyoto Protocol
LRMC	Long-run marginal cost
MA	Marrakech Accords
MWh	Megawatt hour (i.e. 1000 kWh)
NGO	Non-governmental organisation
NM	New methodology (as submitted to the CDM EB)
NPV	Net Present Value
OM	Operating margin
PCF	Prototype Carbon Fund
PDD	Project design document
UNFCCC	United Nations' Framework Convention on Climate Change
USIJI	United States Initiative on Joint Implementation