CDM Methodologies: Eligibility, general rules, methodological tools, approved methodologies (EB25 Update, September 18th, 2006)
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0. Introduction

The development of the 'rulebook' for project activities eligible under the Kyoto Protocol's Clean Development Mechanism (CDM) is ongoing and all decisions and guidance can be found on the website of the United Nations Framework Convention on Climate Change (UNFCCC) website (www.cdm.unfccc.int). The World Bank Carbon Finance Unit continuously monitors regulatory developments concerning the CDM. The objective of this document is to increase accessibility to rules and guidance on CDM methodologies and methodological tools by grouping relevant decisions and guidance into one single easy-to-consult document. The focus of this document is on methodologies. Administrative CDM procedures are not considered.

This document is organized as follow: Section 1 summarizes the eligibility criteria for CDM project activities. Section 2 shows basic concepts and general rules for CDM methodologies. Section 3 gives an overview of basic methodological tools as they are used in approved methodologies for large-scale and small scale CDM project activities as well as for afforestation and reforestation project activities.

This document is based exclusively on information provided by the text of the Kyoto Protocol on the CDM (i.e. Article 12), the relevant decisions of the Conferences of the Parties on the CDM, the general guidelines and decisions issued by the Executive Board of the CDM and the approved methodologies for large-scale and small-scale CDM methodologies as well as the approved afforestation/reforestation methodologies. This document does not include any expression of opinion on approved methodologies or general rules and guidelines on the CDM.

This document will be updated regularly.

1. CDM Project Eligibility

Eligible greenhouse gases are anthropogenic emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). Global warming potentials (GWP) for these gases are different. They are defined in metric tons of CO_2 equivalence (CO_{2e}) per metric ton of gas and amount to: 1 for CO_2per definition, CH_4: 21, N_2O: 310, PFCs/HFCs: 11,700 (HFC-23), SF_6: 23,900.

By technology: Most technologies that contribute to climate protection are eligible under the CDM. Excluded are only projects related to nuclear energy, projects targeting natural (non-anthropogenic) greenhouse gas emissions and emission reduction projects in the field of international aviation and marine bunkers fuels (international aviation and marine bunker fuels are also outside the scope of the Kyoto Protocol). In terms of biological CO_2 removal projects (land use, land-use-change and forestry (LULUCF)), the CDM rules currently restrict eligibility to afforestation and reforestation projects for the first commitment period of the Kyoto Protocol (i.e. 2008-2012). So far there is no final decision on the eligibility of carbon capture and carbon storage (CCS) projects including geological sinks. Proposals for new methodologies for CCS projects can be submitted to the Executive Board but they cannot be approved before further decisions are taken by the Conference of the Parties to the UNFCCC (COP) and the Meeting of the Parties to the Kyoto Protocol (MOP).

By type of project: A CDM project activity is defined as a measure, operation or an action that aims at reducing greenhouse gases in the atmosphere. A project activity could be identical to a project undertaken or planned, or be a component or aspect thereof. This means that a project activity can be any type of economic activity like new investments, replacement investments, installation of end-of-pipe facilities, switches to products with improved greenhouse gas balances or modifications of the way to use existing equipment like fuel switch and energy efficiency improvements. Following the 23rd meeting of the Executive Board, training (e.g. bus drivers training) or know-how transfer (e.g. educating household on possible energy saving measures) cannot be CDM projects as such but the activities resulting from these measures can (e.g. monitored improvement in operating a bus or use of energy efficient bulbs). CDM project activities can take the form of stand-alone projects or bundles of individual measures. COP/MOP1 decided that local/regional/national policies and standards cannot be considered as CDM projects, but project activities under a program of activities can be registered as a single CDM project activity provided that approved baseline and monitoring methodologies are used.

Project participants can be governments of host countries, governments of Annex I countries (countries that have taken a quantitative target under the Kyoto Protocol) or public or private entities (also from third parties) authorized by these countries.

From a country perspective developing countries that have ratified the Kyoto Protocol are eligible to host a CDM-project. The current status of ratification of the Kyoto Protocol is available on the UNFCCC webpage (www.unfccc.int).

From a regulatory perspective a CDM project activity is only eligible if it is approved by the Designated National Authorities of the host country and of the Annex I country to which the certified emission reductions will be transferred. In the case of unilateral CDM projects, the Annex I country approval can be postponed until certified emission reductions are requested to be transferred. The host country Designated National Authority is required to confirm that any project activity being submitted as a potential CDM project assists the country in achieving sustainable development. A list of names and contact information for Designated National Authorities for the CDM can be found on the UNFCCC website (http://cdm.unfccc.int/DNA/).

All CDM project submissions must clearly describe the methodologies used for determining the emission reductions (and subsequent emission credits) associated with the proposed CDM project activity, e.g. methodologies for determining baseline emissions, monitoring plans, and project boundaries. These methodologies must be approved by the CDM Executive Board. The CDM Executive Board is the body mandated to supervise the CDM. It reports to the Parties to the Kyoto Protocol.

The correct use of an approved CDM methodology must be validated by designated operational entities (DOEs), which are accredited by the Executive Board, before they can submit the request for registration of the CDM project to the Executive Board. DOEs must also verify and certify emission reductions from CDM project activities, before they can request their issuance by the Executive Board.

2. CDM methodologies: basic concepts and general rules

2.1. Basic concepts of CDM methodologies

CDM Methodology: A CDM methodology is a procedure for baseline scenario identification, determination of additionality, calculation of emission reductions and monitoring of the relevant parameters.

Large-Scale, Afforestation/Reforestation and small scale CDM projects: The CDM process distinguishes between small-scale project activities, Afforestation/Reforestation (A/R) project activities and large-scale project activities. A definition of small-scale projects under the CDM can be found in section 2.6 of this document. Methodologies for large-scale CDM projects and Afforestation/Reforestation projects are developed through a bottom-up approach: it is the project sponsor who develops and submits (via a DOE) a new methodology (or a proposed modification of an existing approved methodology) to the Executive Board for approval. Methodologies for small-scale CDM project activities (including small-scale Afforestation/Reforestation project activities) are being developed through a top-down approach, and a list of predefined methodologies already exists. However project sponsors can also submit proposals for new small-scale CDM methodologies (or proposals for modification of approved small scale methodologies). Methodologies and procedures for small-scale projects are simplified. Examples for simplification are: small-scale projects can use simplified predefined baselines and simplified monitoring procedures; small-scale projects can be bundled together up to the size limit for small scale projects (COP/MOP1 decided that bundling shall also be available for large-scale CDM projects); the same DOE can validate, verify and certify small-scale projects and their emission reductions; procedures for submitting proposals for new small-scale methodologies or modifications of existing ones are simpler than for large-scale sized activities.

Baseline (scenario): “The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity” (Marrakesh Accords 17/CP.7). The baseline for a CDM project activity can only be established on the basis of a baseline methodology approved by the Executive Board of the CDM. In case of A/R projects, the baseline net greenhouse gas removals by sinks” is the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the afforestation or reforestation project activity under the clean development mechanism (CDM) (as per Decision 19/CP.9).

Crediting Period: A CDM project may choose from two alternative crediting period approaches (Marrakesh Accords 17/CP.7):
(a) A maximum of seven years which may be renewed at most two times, provided that, for each renewal, a designated operational entity determines and informs the Executive Board that the original project baseline is still valid or has been updated taking account of new data where applicable; or
(b) A maximum of 10 years with no option of renewal.

In case of a CDM A/R project, the two crediting period alternatives as per Decision 19/CP.9) are:
The crediting period shall begin at the start of the A/R project activity under the CDM and shall be either:
(a) A maximum of 20 years which may be renewed at most two times, provided that, for each renewal, a DOE determines and informs the Executive Board that the original project baseline is still valid or has been updated taking account of new data where applicable; or
(b) A maximum of 30 years.

Additionality: "A CDM project 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" (Marrakesh Accords Decision 17/CP.7). A project can only claim emission reductions which are additional to those that are already part of the baseline (e.g. because of business-as-usual progress in energy efficiency or legal requirements that are enforced).

Monitoring includes the collection and archiving of all relevant data necessary to calculate emission reductions from a CDM project activity. Emissions from the project should be measured or estimated and data have to be provided to determine emissions in the baseline scenario. Furthermore, procedures to periodically calculate emission reductions by the CDM project activity as well as to control and assure quality have to be established. For this purpose a monitoring plan has to be developed which uses a monitoring methodology approved by the Executive Board.

2.2. Determination of the baseline approach and selection of the baseline scenario

Eligible baseline approaches for emission reduction CDM project activities according to Marrakesh Accords, Para 48a-c are

(a) Existing actual or historical emissions.
(b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment.
(c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.

Eligible baseline approaches for Afforestation/Reforestation-CDM project activities are:

(a) Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary.
(b) Changes in the carbon stocks in the carbon pools within the project boundary land that represents an economically attractive course of action, taking into account barriers to investment.
(c) Changes in the carbon stocks in the pools within the project boundary from the most likely land use at the time the project starts.

Selection of a baseline approach: Among the three eligible baseline approaches, project participants are free to use the one deemed most appropriate for their project activity taking into account any guidance by the Executive Board. However, project participants must justify the appropriateness of their choice of baseline approach. For large-scale CDM project activities experience thus far indicates a tendency to use approach "a" for projects without capacity effects (efficiency measures without increases in capacity, replacement investments without capacity effects) and approach "b" for new investments and capacity additions. So far there is no approved baseline methodology using approach "c". Due to the use of predefined baseline scenarios in approved methodologies for small-scale CDM projects these do not include the possibility to select a baseline approach. This is also true for most of the approved methodologies to date for large-scale CDM project activities. Approved consolidated baseline methodologies typically have a broader scope than approved methodologies and include a baseline selection tool. The selection of a baseline approach is furthermore most relevant in the case of submitting a proposal for a new methodology for CDM projects activities. At present three Afforestation/Reforestation CDM methodologies have been approved, and all use approach "a" of the eligible baseline approaches for Afforestation/Reforestation CDM project activities.

Selection of a baseline (scenario): The selection of a baseline scenario should be done in a "systematic, step-by-step procedure for determining the most likely baseline scenario. This procedure should describe a process for identifying the options to be considered as plausible candidate baseline scenarios." (Executive Board Guidelines for completing CDM-Project Design Documentation (CDM-PDD), CDM-New Methodology: Baseline and Monitoring (CDM-NM). The Meth Panel of the Executive Board is currently developing a special baseline selection tool. However at the time of writing it is not clear what the relation between this tool and the already approved tool to determine additionality will be.

2.3. Rules on national policies and regulations in determining a baseline scenario

National policies and regulations have to be taken into account when developing a baseline scenario as it is assumed that they will affect the emissions path that would be realized in the "without project" case. Also, a project activity cannot be considered additional if it is a mandatory activity enforced by law (see section on additionality). However, project activities may still be eligible in situations where it can be demonstrated that policies and regulations are not enforced. Moreover, in order to avoid perverse incentives for policy makers (e.g. encourage poor enforcement simply to have a more intensive greenhouse gas baseline that would enable CDM projects to generate more certified emission reductions), the Executive Board of the CDM has developed guidance on the treatment of policies and regulations in determining a baseline scenario:

E- measures: National and/or sectoral policies and regulations that favor less emission-intensive technologies (referred to as E- measures) need not be taken into account in developing a baseline scenario if they were enacted after the adoption of CDM Modalities and Procedures on November 11, 2001. In other words, the baseline scenario should refer to a situation without the policies and/or regulations being in place. The 23rd meeting of the Executive Board clarified that this rule applies to Afforestation/Reforestation project activities as well as large-scale CDM project activities. However there are approved methodologies that stipulate that changes in national/sectoral policies should immediately (i.e. even within one crediting period) be taken into account for the baseline (e.g. the approved methodologies for decomposing HFC-23 or N_2O). It is not yet clarified what the relationship between the general Executive Board rules on national/sectoral policies and deviating procedures in approved methodologies is.

E+ measures: National and/or sectoral policies and regulations that favor more emission-intensive technologies or fuels (referred to as E+ measures) and that were put in place after the adoption of the Kyoto Protocol (December 11, 1997) should not be taken into account in the baseline scenario.
There has not yet been a practical example for the implementation of the guidance on E-/E+ measures. It is also not yet decided how the rules on E-/E+ policies would apply to the additionality assessment of a project.

Consideration of policies and regulations for the renewal of the crediting period: CDM projects with renewable crediting periods must reassess and possibly correct the baseline for each new crediting period taking into account any new binding national or sectoral regulation (20th meeting of the Executive Board). It is not yet decided what the relationship between this decision and the E-/E+ rule would be. For the consolidated methodology for landfill gas project activities (ACM0001) the 23rd meeting of the Executive Board clarified that the E- rule does not apply for the renewal of the crediting period.

2.4. Rules on changing activity levels in determining a baseline scenario

Baseline emissions can rise due to economic growth or fall due to technological progress, structural change or economic depression. These effects are in most cases independent of the considered project activity and common for the project and the baseline scenario. Emission reductions can then simply be calculated as the difference in the emissions path of the baseline and the project scenario. More complicated are cases where the activity level of the project scenario changes relative to the activity level of the baseline scenario.

This typically happens in situations where the project is the only investment alternative and the baseline scenario consists in the persistence of the status quo (e.g. doing one specific rural electrification project, possibly increasing service, or doing nothing at all) or in cases where the project consists of simply stopping a greenhouse gas emitting activity.

Activity decrease relative to the baseline: For CDM projects the Marrakech Accords (17/CP.7) state that the baseline shall be defined in a way that certified emission reductions cannot be earned for decreases in activity levels outside the project activity or due to force majeure. So far there is no further specification on what "outside the project activity" means.

Activity increase relative to the baseline: There is no restriction on increasing project activity levels beyond the initially projected levels. In fact, most CDM baseline methodologies approved and proposed so far use the project activity level to determine baseline emissions and emission reduction (difference in baseline and project emission factors (GREENHOUSE GAS emissions per unit of output or service) and the time activity level realized in the project scenario. However there is a tendency from the side of the Methodology Panel to distinguish cases of "supply constraints" ("suppressed demand") where an increase in emissions due to growth/development effects should be taken into account. Related to this are so-called "rebound effects". (Note that the terminology used here is not part of the CDM terms defined in the UNFCCC CDM glossary.) From an economic point of view, supply constraints are physical limitations on production due to a lack of capital or labor, whereas rebound effects are impacts on demand due to the effects on purchasing power of efficiency improvements.

2.5. Rules on project boundary and leakage

Project boundary: The project boundary shall encompass all anthropogenic emissions of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the CDM project activity. Guidance has not been developed to further define the terms "under the control of", "significant", and "reasonably attributable". It is up to the project participants to provide interpretations.

Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity. In the case of Afforestation/Reforestation CDM project activities leakage is defined as the sum of the changes in the carbon stocks in the carbon pools outside the project boundary that would occur in the absence of the proposed project activity and that are measurable and attributable to the project activity. There are different types of possible leakage effects due to a project activity. In general leakage can be negative (decreasing emission reductions) or positive (increasing emission reductions). With the exception of ACM0003 (Emission reductions through partial substitution of fossil fuels with alternative fuels in cement manufacture) positive leakage is used in approved methodologies only as a potential compensation for negative leakage.

Based on the different methodologies submitted and approved thus far by the CDM Executive Board, common examples of negative leakage effects are the following (the chosen terms are not part of the UNFCCC CDM terms and are used to simplify the presentation):

Leakage from upstream production are emissions due to the production in upstream industries of products or the supply by upstream suppliers of services that are used in a CDM project activity (e.g. emissions out of the production of the cement used to build a $dam in a hydropower project). These leakage emissions are in most cases not considered "significant"; they would only need to be highlighted, but not accounted for (i.e. not deducted from the emission reductions claimed by a CDM project activity). However, more significant upstream leakage effects have to be accounted for. Most important are methane emissions from the production and distribution of natural gas in fossil fuel switch projects. In the consolidated baseline methodology for industrial/district heating system fuel switching from coal or petroleum fuel to natural gas (ACM0009) this leakage effect can be set off against avoided methane emissions from the production and distribution of the fuel that would have been used without the project activity i.e. in the baseline scenario. However the net effect can substantially reduce the emission reductions out of a fossil fuel switch project.

Leakage due to crowding out: Crowding out can happen if equipment used in a CDM project activity is transferred from another activity or if resources are used which were formerly used in other activities. Those effects have to be considered in determining emission reductions. They are of particular importance for energy efficiency projects or projects using biomass.

Leakage due to crowding in can happen if equipment replaced due to the CDM activity is transferred to other activities or if the CDM project allows for an increase in the degree of utilization of existing equipment. This type of leakage is of particular importance for energy efficiency projects and projects in the transportation sector.

Leakage due to losses in transmission and induced transportation: Sometimes project activities induce emissions from transportation of material outside the project boundary that have to be counted as leakage. In power transmission and (gas) pipeline projects physical losses have to be considered as well as non-physical losses e.g. due to theft. The distinction between physical and non-physical losses can be an important issue for transmission line and (gas) pipeline projects.

General guidance on leakage in small-scale biomass project activities: In its 25^{th} meeting the executive board of the CDM issued further guidance on how to treat potential leakage in small-scale biomass projects. Three types of biomass related leakage were defined: (i) leakage due to shifts of pre-project activities (e.g. deforestation activities are shifted to land outside the project's boundary); (ii) leakage due to biomass production and (iii) leakage due to competing use for biomass (corresponds to what was previously referred to as leakage due to crowding out of biomass). The first type of leakage occurs when in the absence of the project the land would be used for planting new forests or used as cropland or wetland. The second type applies to all activities where waste biomass or biomass from existing forests are not used whereas the third type is only applicable to projects where waste biomass or biomass from existing forests is used.

2.6. Rules on bundling, methodologies for small-scale CDM project activities and CDM programs

Small-scale CDM activities are eligible for using the simplified modalities for small-scale CDM project activities, if they are one of the following three types of activities:
Type (i) project activities: renewable energy project activities with a maximum output capacity equivalent to up to 15 MW.
Type (ii) project activities: energy efficiency improvement project activities that reduce energy consumption, on the supply and/or demand side, by up to an equivalent of 15 GWh per year; or
Type (iii) other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilo tons of CO_{2e} annually and following an interim decision at the 24^{th} meeting of the Executive Board- where the annual emission reductions are lower than 25 kilo tons of CO_{2e}.
Small-scale Afforestation/Reforestation CDM project activities are those that are expected to result in net anthropogenic greenhouse gas removals by sinks of less than 8 kilo tons of CO_2 per year and are developed or implemented by low-income communities and individuals as determined by the host country.

Bundling of small-scale project activities: Bundling of small-scale CDM project activities is allowed. The aim of bundling is to reduce the transaction costs associated with the CDM modalities and procedures, and thus to lower barriers to the implementation of small-scale CDM project activities. Small-scale CDM project activities may be bundled at the following stages in the CDM project cycle: the project design document, validation, registration, monitoring and certification. The bundling rules allow using a single CDM baseline methodology and one monitoring methodology that would apply to several – but similar – bundled project activities. Existing rules on bundling only apply to small-scale CDM activities, up to a specified bundling limit.

Rules on bundling for small-scale CDM activities: The above mentioned thresholds apply to bundles of activities that use simplified baseline methodologies for small-scale CDM project activities. A bundle may be composed of activities corresponding to different types of small-scale CDM activities. In this case, each component (sub-bundle) shall meet the threshold criteria for the corresponding small-scale project activity type noted above. A single Project Design Document (PDD) for a bundle can only be submitted if all activities in the bundle belong to the same type, same category and technology/measure. Otherwise several PDDs corresponding to the different technologies/measures composing the bundle have to be submitted. To benefit from the small-scale bundling provisions, all individual bundled activities must use the same crediting period and the composition of the bundle shall not change over time (no activity can be added or taken out once the project is registered). The relevant threshold criteria must be met in each year of the crediting period. In the event that a project or bundle exceeds the threshold criteria in a given year, the emission reductions claimable in the corresponding year are capped at the ex ante estimated level for that year as given in the PDD. Furthermore project participants shall at registration provide a written statement that they agree to bundle their individual activities and that one of the project participants represents all in order to communicate with the Executive Board. The bundling rules also stipulate that in the case of projects submitting multiple PDDs all shall be made publicly available for comments at validation stage at the same time.

Debundling of small-scale CDM activities: A special rule on debundling ensures that large-scale CDM activities are not simply divided into several small scale projects and would then benefit from the simplified methodologies. A debundled activity is not eligible under small-scale rules. An activity is considered debundled, if there is a registered small-scale CDM activity, or an application to register another small-scale activity, with the same project participants, and in the same project category and technology and registered within the previous two years and whose project boundary is within one kilometer of the project boundary of the proposed small-scale activity at the closest point.

Bundling of large-scale CDM activities : COP/MOP1 decided that large scale CDM project activities can also be bundled. So far no guidance on bundling of large-scale project activities is available.

CDM programs: COP/MOP1 decided that policies and standards are not eligible CDM projects, but that project activities under a program of activities can be registered as a single CDM project activity provided that approved baseline and monitoring methodologies are used. So far no further clarifications on CDM programs are available.

2.7. Rules on Additionality

Additionality can be demonstrated in different ways:
- By demonstrating that the CDM project reduces anthropogenic greenhouse gas emissions below those that would have occurred in the absence of the registered CDM project activity;

- using an economic or financial analysis: the project is not the least cost or most attractive option);
- using a barrier analysis: without the CDM the project could not be realized due to lack of finance or non-availability of technologies or other resources or due to lack of appropriate incentives or information, or other barriers
- using a common practice test: there is evidence that the project is not common practice in the host country.

A priori, project participants are free to select an appropriate approach. The approved consolidated baseline methodologies and some of the approved methodologies include a pre-defined ‘Additionality tool’. However, COP/MOP1 confirmed that project participants can also propose alternative methods to demonstrate additionality. For Afforestation/Reforestation project activities, a similar approved additionality tool is available. It is presented in the following section together with the tool for large-scale projects highlighting the main differences. Small-scale CDM projects may use a simplified additionality assessment (see below).

The Additionality Tool is an approved method for demonstrating that a proposed project activity is additional (as per the Kyoto Protocol and the Marrakech Accords) and therefore not the baseline scenario. It is presented in five steps, as further described below:

Step 0: Preliminary screening based on the starting date of the project activity
This step applies only to projects that
(i) started between 1 January 2000 and 18 November 2004 - the date of registration of the first CDM project activity;
(ii) are submitted for registration before 31 December 2005 (this deadline was extended by COP/MOP1 decision by one year for projects that were submitted for validation before 31 December 2005 and for projects that submitted a new baseline methodology before 11 January 2006); and
(iii) claim a crediting period starting before the project’s date of registration. The purpose is to show that the incentive from the CDM was a serious consideration in the decision to implement the project activities.

In the case of Afforestation/Reforestation projects, activities starting after 1 January 2000 can be validated and registered after 31 December 2005, provided the first verification of the project activity occurs after the date of registration of the project activity, permitting the project to accrue the certified emission reductions from the start of the project since 2000.

The eligibility of non-forested lands for the Afforestation/Reforestation project also needs to be proven applying the host country’s national thresholds for forest definition under decision 19/CP.9 as communicated by the respective Designated National Authority. The eligibility of land should be demonstrated by presenting verifiable information on the land use prior to 1990 and thereafter, e.g. using aerial photographs, satellite imagery, land use maps, cadastral and ground surveys. Project participants should also provide evidence that the project activity is human-induced through planting, seeding and/or the human-induced promotion of natural seed or root stocks, and not a continuation of the pre-project spontaneous processes.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
In this step, project participants are requested to establish a list of “realistic” and “credible” alternative scenarios that comply with legal practice. The list must include the proposed project not undertaken as a CDM project and, if applicable, the continuation of the current situation. The alternatives should provide output or services with comparable qualities, properties and application area.

In case of Afforestation/Reforestation projects, national, sector, and local policies that influence the existing and alternative land use should be evaluated in compliance with the *sub-step la* of the Afforestation/Reforestation Additionality Tool. The project participants should also demonstrate the compliance with the national, regional and local laws and associated regulation as per the *sub-step 1b* of the Afforestation/Reforestation Additionality Tool. In case of non-compliance of the laws and regulation, the evidence on the widespread non-compliance of laws governing the land use and forest management should be presented.

Project Participants may choose between the following alternative Steps 2 and 3 or complete both steps.

Step 2: Investment analysis
This step is an alternative to step 3. It determines whether the proposed project activity is economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions. For the investment analysis the following guidance is given:
- In calculating the financial indicator, all costs and revenues must be taken into account including subsidies and fiscal incentives. There is no guidance how the rules on national policies and regulations relevant for determining the baseline scenario (cf. section 2.3 above) should be considered in this context.
- The financial indicator most suitable for the project type and the decision-making context shall be used.
- A sensitivity analysis must be undertaken to demonstrate the robustness of the result (except in the case where the activity produces no economic benefits other than CDM related income).

In the case of Afforestation/Reforestation projects, where applicable, externalities that highlight the non-market costs and benefits of the Afforestation/Reforestation projects undertaken by the public entities or public investors should be taken into account. It is recommended to conduct an economic analysis, in addition to the financial analysis, taking into account any externalities, in order to demonstrate the project additionality. Such externalities can take the form of e.g. costs due to loss of productivity from downstream reservoir siltation or fertilizer application required to restore the soil productivity; and the benefits in the form of soil and water conservation, landscape improvement offsite erosion control etc.

Step 3: Barrier analysis
This step is an alternative to step 2. It investigates barriers to the implementation of the project. Possible barriers include, e.g.: (i) investment barriers other than the economic/financial barriers in step 2, such as lack of funding resulting from unavailability of debt funding, or no access to international capital markets; (ii) technological barriers such as the lack of skilled labor to operate the projects technology or the lack of appropriate infrastructure; and (iii) barriers due to prevailing practice where the project is the first of its kind. Those barriers are only sufficient for demonstrating additionality if they prevent the project from being undertaken without the CDM (and if they don't prevent at least one of the alternatives to the project.) The existence of barriers

has to be demonstrated by documented evidence (e.g. legislation, industrial norms, market data, documentation from the side of the project developer, sectoral studies).
In addition to the above barriers, Afforestation/Reforestation projects face barriers that are specific to this class of projects. Such barriers include adverse local conditions of the degraded ecosystems (e.g. water/wind erosion, salination, etc.) and catastrophic natural and/or human-induced hazards such as land slides; barriers related to land tenure, ownership, inheritance, and property rights; social conditions that reflect demographic pressure, social conflict and illegal activities; local traditions and customs that impact the land use; barriers related to storage, transport and market access; lack of enforcement of legal restrictions on land use; and absence of skills and training in silvicultural practices. Project participants should demonstrate that the barriers identified would not prevent the implementation of at least one of the alternatives except the Afforestation/Reforestation CDM project activity proposed under the project.

Step 4: Common practice analysis
This step seeks to establish that the project is not already common practice in the relevant region or country. This test is a "credibility check" to complement the investment (step 2) or barrier analysis (step 3). If similar activities to the proposed project type are widely observed, it is necessary to demonstrate why the existence of these similar activities does not contradict the claim that the proposed project activity is financially unattractive or subject to barriers.

There is no requirement of a common practice test for Afforestation/Reforestation projects.

Step 5: Impact of CDM registration
Step 5 seeks to confirm that the CDM has an impact on the implementation of the project activity, i.e. this step explains how CDM registration will alleviate the financial or economic hurdles identified in Step 2 or the barriers identified in Step 3 and thus enable the project to be undertaken. Benefits and incentives include anthropogenic greenhouse gas emission reductions, the financial benefit from selling certified emission reductions, attracting new players who are not exposed to the same barriers or hurdles, attracting new players who bring the capacity to implement a new technology, reducing inflation or exchange rate risk affecting expected revenues.

In the case of Afforestation/Reforestation projects, project participants should demonstrate the impact of CDM registration on the project in terms of the incentives for investment from the sale of carbon credits, enhanced awareness of carbon sinks in the local and national economy, adoption of land use improvements, increase in the area brought under tree cover to restore the degraded lands and land use improvements from the Afforestation/Reforestation projects.

In sum, the Additionality Tool is designed to focus on the individual characteristics of a proposed project activity. It filters out the least cost options that are not prevented by an investment barrier. The Additionality Tool does not embrace"investment" additionality in the sense that a project must lack financial viability without the CDM. Instead, the Additionality Tool is satisfied with a demonstration that the proposed project is not the most attractive alternative available.

Additionality test for small-scale CDM projects: a simplified additionality test can be used to demonstrate that a small-scale CDM project would not have occurred without the CDM due to at least one barrier, including an investment barrier (i.e. a financially more viable alternative to the proposed small-scale project activity would have led to higher emissions). Other barriers can be used as well, such as, e.g., technological barriers or barriers due to prevailing practice.

2.8. Rules on the use of official development assistance (ODA)

Non-diversion of ODA means **"**that public funding for clean development mechanism projects from Parties in Annex I is not to result in the diversion of official development assistance and is to be separate from and not counted towards the financial obligations of Parties included in Annex I" (MA 17/CP.7). This non-diversion rule excludes the use of ODA for purchasing certified emission reductions, but does not prevent the use of ODA for project funding as long as such funding does not result in a diversion of ODA or a transfer of certified emission reductions.

ODA and additionality: There are no rules on treating ODA in the additionality assessment. The Additionality Tool states that, in calculating a financial indicator for the CDM project activity, all relevant revenues "excluding certified emission reduction revenues, but including subsidies/fiscal incentives where applicable" shall be considered with the remark that "this provision may be further elaborated depending on deliberations by the Board on national and sectoral policies".

2.9. Technical rules and definitions

Use of regression analysis in methodologies: Statistical significance shall be tested using valid statistical methods. Multicollinearity and autocorrelation tests should also be completed. The selection of independent variables should be made transparent. The use of statistical methods should lead to conservative estimation of emission reductions.

Negative emission reductions: Projects can temporarily increase emissions (when baseline emissions minus project emissions minus leakage are negative in a certain time period). In these cases proposed new methodologies should stipulate that any further certified emission reductions will only be issued when the emissions increase has been compensated for subsequent emission reductions.

Consideration of already registered CDM projects: Registered CDM projects need not be considered for the selection of the baseline scenario and the determination of baseline emissions, nor do registered projects serve as precedents for any subsequent project.

Renewable biomass: Following the 23rd meeting of the Executive Board, biomass is considered as renewable if it is a residue from a production process and its use would not result in a decrease of carbon pools (e.g. bagasse from sugar production). Dead wood in a forest is however not considered as renewable biomass because its use would result in a decrease in carbon pools. Biomass originating from forests, croplands or grasslands can be considered as renewable if it is harvested in a sustainable manner i.e. in way that makes sure that the level of carbon stocks does not systematically decrease over time (but only temporarily due to harvesting). This includes that the relevant land area remains forests, croplands or grasslands and that any forestry, agriculture and nature conservation regulations are complied with.

3. Application of CDM methodologies for different categories of project activities

3.1. Classification of CDM methodologies

This section gives an overview of different types of CDM methodologies according to the criteria; sectoral scope, greenhouse gases and type of greenhouse gas abatement activity. The section is intended to provide assistance in navigating the basic concepts and tools of approved CDM methodologies.

Sectoral scope: This criterion is used by the CDM Executive Board to categorize methodologies. The predefined categories are: (i) energy industries (renewable-/non-renewable sources), (ii) energy distribution, (iii) energy demand, (iv) manufacturing industries, (v) chemical industries, (vi) construction, (vii) transport, (viii) mining/mineral production, (ix) metal production, (x) fugitive emissions from fuels (solid, oil and gas), (xi) fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride, (xii) solvent use, (xiii) waste handling and disposal, (xiv) afforestation and reforestation; and (xv) agriculture.

Greenhouse gases: The greenhouse gases covered by the Kyoto Protocol (and thus the CDM) are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and F-gases. CO_2 emissions represent about 70 percent of total greenhouse gas emissions globally. They are mainly associated with energy production and consumption, resulting from the combustion of fossil fuels. However, in some developing countries, the largest share of CO_2 emissions comes from land use and land use change activities (deforestation). CH_4 emissions mainly arise in waste management activities (e.g. landfills, manure, wastewater), mining activities and the exploitation of oil and natural gas. The dominant source of N_2O emissions is agricultural soil management. Moreover, the burning of fossil fuels generates small quantities of N_2O; manure management and the chemical industry also contribute to N_2O emissions. F-gas emissions (i.e. HFCs, PFC, and SF_6) are mainly emitted through activities in the chemical industry, aluminum industry, as well as power transmission (to some extent).

Type of greenhouse gas abatement activity: In the following overview approved CDM methodologies are classified according to the nature of the greenhouse gas abatement activities of CDM projects. The following categories are used (note: they are not part of the official UNFCCC CDM terminology): power generation/saving (section 3.2), end-of-pipe activities (section 3.3), energy efficiency (section 3.4), fuel switch (section 3.5), reduction of process related emissions (section 3.6), reductions of fugitive emissions through repair and maintenance measures (section 3.7) and sequestration through afforestation/reforestation (section 3.9).

3.2. Power generation and power saving activities

Basic concept: Emission reductions for projects producing or saving power can be calculated based on the difference in emissions factors (emissions of CO_2 per unit of power produced) in the baseline and in the project scenario. This delta (i.e. difference in emission factors) can than then be multiplied by the amount of power produced or saved in the project case to determine the emission reductions associated with the proposed CDM project activity. In some cases, leakage (as explained above and measured in tCO_{2e}) needs to be included in the calculation. So the basic equation to calculate emission reductions (measured in tCO_{2e}/MWH) resulting from a proposed project activity is:

$$ERs = MWh_{project} \times [(tCO_2/MWh)_{baseline} - (tCO_2/MWh)_{project}] - leakage$$

If a project activity consists of *modifying or retrofitting* an existing facility, the activity level of the project activity ($MWh_{project}$) is the amount of power that can be produced in addition to the power that would have been produced with the unmodified or non-retrofitted facility (baseline power production) until the existing equipment would have been replaced in the absence of the project activity. In the case of the approved consolidated methodology for renewable power (ACM0002), the baseline level of power production shall be determined as the average annual electricity generation over a historical reference period, spanning all data from the most recent available time period to the time at which the facility was constructed, retrofitted, or modified in a manner that significantly affected output (i.e., by 5% or more). A minimum historical reference period of three years (five years in the case of hydro facilities) is required in this context. The estimation of the point in time when the existing equipment would need to be replaced under a business-as-usual scenario (i.e. in the absence of the proposed project activity) can be done on the basis of the average technical lifetime of the equipment and common practices in the sector or common practices of the respective company. Once the business-as-usual replacement date is reached, the project activity is not supposed to generate anymore emission reductions, i.e. emission reductions can only be claimed before business-as-usual replacement of equipment would happen.

Whereas the emission factor of the project activity can easily be established and measured ex post (e.g. for most renewable power projects it will be zero) the determination of the baseline emission factor is more complex. Several methodologies have been approved that clarify the CDM Executive Board’s guidance for the development and calculation of baseline emission factors for power generation projects. The methodological guidance applies to specific types of project activities with particular criteria, as follows:

Single emission factor: If a project retrofits or modifies an existing power plant, the emission factor of the original plant may be used as the baseline emission factor up to the point of the pre-retroffited plant's power generation and its expected lifetime under a business-as-usual scenario (and another emission factor must be used to calculate any further emission reductions beyond that point). A single emission factor can also be used when an existing plant is replaced by the project activity provided that the replaced plant has sufficient capacity to provide the same output as the new one. This also applies to cases where the power generation of an identifiable single plant is (partially) replaced. Similarly, for fuel switch projects, the baseline emission factor can often be determined simply as the emission factor for the replaced fuel (i.e. the plant's pre-fuel switch emission factor). Finally a single factor is used in a number of approved methodologies for small-scale project activities (e.g. in the case of off-grid renewable power generation, an emission factor for diesel generation units is used). Note the term "single emission factor" is introduced here for convenience. It is not an official CDM term.

Weighted average emission factor: This emission factor represents the weighted average emissions of the current generation mix. Weights are determined by the amount of power produced by the different plants serving the grid. The average emission factor can be used for a number of methodologies for small-scale project activities and also in the framework of some approved methodologies for large-scale projects (see below).

Combined margin emission factor: A 'combined margin' seeks to reflect the combined emissions effect of a grid-connected power plant on (i) the operation of current or future plants in the short run (i.e. the operating margin), and (ii) on planned new facilities in the longer term (i.e. the build margin). A combined margin baseline methodology is applicable when the most likely baseline scenario is electricity production from sources other than the project feeding into the grid. The combined margin emission factor is to be calculated as the weighted average of the operating margin emission factor and the build margin emission factor where the weights are 50% by default (for solar power and wind power: 75% operating margin and 25% build margin). Alternative weights can be used as far as appropriate evidence justifying those weights is presented. The CDM Executive Board has approved several baseline methodologies that calculate combined margin emission factors. It is important to note that the Executive Board has also approved a consolidated baseline methodology for grid connected electricity generation from renewable sources (ACM0002) that specifies options when calculating a combined margin emissions factor. Furthermore guidance by the Executive Board exists for the use of different weights for the operating margin and build margin.

Operating margin (OM): ACM0002 specifies different ways to calculate the OM. However, if the necessary data is available, the operating margin emission factor should be determined by a dispatch analysis on an hourly basis. The operating margin emission factor is then calculated as the hourly generation-weighted average emissions in tCO_2/MWh of the set of power plants in the top 10% of the grid system dispatch order in each hour. In cases where no dispatch data is available the operating margin can also be calculated in a simplified way using one of the following approaches:

(i) Simple operating margin: The simple operating margin is calculated as the generation-weighted average emissions per MWh of all plants serving a grid, excluding low-operating cost and must-run power plants (e.g. hydropower plants). The simple operating margin is eligible if the low-operating cost/must-run resources constitute less than 50% of total grid generation in the average of the five most recent years or based on long-term normal figures for hydropower production.

(ii) Simple adjusted operating margin: Two operating margin emission factors are calculated: one excluding low-operating cost/must-run resources – analog to the simple operating margin approach – and one for low-operating cost/must-run resources. Then a weighted average is calculated where the weights are given by the part of the year when low-operating cost/must-run resources are on the margin and by the part when all other resources are on the margin. This approach must be used as an alternative to (i) in cases where low-operating cost/must-run resources constitute 50% or more of total grid generation.

(iii) Average operating margin: The average operating margin emission factor is calculated as the simple operating margin emission factor but including low-operating cost/must-run plants. This approach can only be used if low-operating cost/must-run resources constitute more than 50% of total grid generation and data to apply the simple adjusted operating margin is not available.

Build margin: The build margin is to be calculated as the weighted average emissions of recent capacity additions to the system. These are defined as the greater in MWh of (i) the most recently built 20% of existing plants, or (ii) the five most recent plants. For the first crediting period, the build margin can also be determined ex post. If one single plant contributed to more than 20% of the capacity additions, the total capacity addition of this plant has to be used.

Consideration of registered CDM projects: Power plant capacity additions registered as CDM project activities should be excluded from all calculations in ACM0002.

Guidance on weighting the operating and build margin: Following guidance from the Executive Board, a project can use a weight for the operating margin above 50%, if the power is mainly delivered in off-peak periods (e.g. solar power) or if the output is of an intermittent nature (e.g. wind power). The weight of the build margin can exceed 50%, if the power is mainly delivered in on-peak periods (e.g. air conditioning efficiency projects) or if conditions of suppressed demand exist and can be expected to persist through over half of the first crediting period. Neither weight should, however, exceed 75% during the first crediting period.

Treatment of electricity imports and exports

In the approved consolidated methodology ACM0002 (for grid-connected electricity generation from renewable sources), the CDM Executive Board provides clarifications on how to treat electricity imports (i.e. electricity transfers from connected electricity systems to the proposed project electricity system) and exports (i.e. electricity transfers to connected electricity systems).

According to the ACM0002 guidance, electricity imports are to be taken into account in the development of the baseline. However, if the power imported comes from another country, its emission factor is considered zero (tCO_2 per MWh). If power is imported from a connected grid within the same host country, the emission factor for the net imported power can be determined through one of the following options:

- 0 tCO_2/MWh,
- the emission factor(s) of the specific power plant(s) from which power is imported (only if the specific plants are clearly known)
- the average emission factor of the exporting grid if net imports do not exceed 20% of total generation in the projects power grid,
- if imported power exceeds the 20% threshold, the emission factor for the exporting grid has to be calculated as a combined margin emission factor.

Guidance from ACM0002 stipulates that electricity exports should not be subtracted from power generation data used for determining the baseline emission factor.

Large-scale grid-connected power generation projects that are not pure fuel switch projects or efficiency improvement/replacement projects can use the combined margin baseline methodology. The methodology can also be applied to large-scale projects with a power saving component (e.g. in AM0020 on water pumping efficiency improvements).

Variations of the combined margin approach

In some approved methodologies, the combined margin approach is used in a slightly different approach than in ACM0002. In AM0026 (methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid) the operating margin emission factor shall be determined exactly (not based on the top 10% of generation in the dispatch order) and the build margin emission factor can be determined by using an optimization model. However, for the build margin emission factor, cross checking is required in using the approach in ACM0002. If the ACM0002 approach would result in a build margin emission factor that is more than 20% lower than the one calculated following the procedure in AM0026, this lower value has to be used. Furthermore, in following AM0026 the emission factor from power imported from another country can be positive, if the relevant plants from which the power is imported can be identified (otherwise, their emission factor would be set at zero). This approach can be used for countries with a merit order based dispatch grid like Chile.

In the case of ACM0007 (consolidated baseline methodology for conversion from single cycle to combined cycle power generation) the share of the project in total power generation should be used to determine the plants for consideration in the dispatch analysis, but only if this share is above 10%. Otherwise 10% shall be used as in ACM0002.

For AM0029 (baseline methodology for grid connected electricity generation plants using natural gas) the baseline emission factor is the minimum of the combined margin emission factor using 50% weights, the build margin emission factor and the single emission factor of the most likely technology alternative to the construction of a natural gas fired power plant (the methodology is only eligible for green field projects).

Special issues relevant to some renewable power technologies:
Hydropower: If hydro power projects create reservoirs or enlarge existing reservoirs, resulting methane emissions have to be considered in calculating emission reductions (this is not the case for run-of-river plants). At its 23rd meeting the Executive Board decided that hydropower plants with power densities greater than $10W/m^2$ can use the currently approved methodologies and neglect emissions from the reservoir and that plants with power densities greater than $4W/m^2$ and up to $10W/m^2$ can also use the currently approved methodologies but have to count emissions from reservoirs as project emissions in using an emission factor of 0.09kg/kWh. Hydropower plants with power densities less or equal to $4W/m^2$ however cannot use current methodologies.

Geothermal power projects: Fugitive emissions of methane and CO_2 from non-condensable gases contained in geothermal steam and CO_2 emissions from combustion of fossil fuels required to operate the geothermal power plant should be taken into account.

Biomass power plants: the potential crowding out of the use of biomass for other purposes (e.g. for heating) has to be taken into account. In cases of abundance of unused biomass, this issue is not relevant. Biomass can be considered as abundant if at least 25% or more is available than is currently used. There is a consolidated methodology on power generation from biomass residues (ACM0006).

Simplification for small-scale CDM methodologies: Small-scale CDM projects (i.e. those with a capacity lower than 15 MW) can use either the combined margin emission factor as specified in ACM0002 or the average emission factor. This simplification applies to a number of methodologies for small-scale project activities (e.g. on-grid renewable power generation and energy efficiency project activities) and also to some approved methodologies for large-scale projects that include power producing capacity additions below the 15 MW threshold or low levels of power consumption (e.g. AM0025).

3.3. End-of-pipe project activities

3.3.1 Bio-methane capture project activities

Basic concept: The decomposition of organic material under anaerobic conditions generates methane. Important sources of organic methane emissions are landfills, manure from cattle, wastewater lagoons. Capturing and burning of methane destroys it:
$CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$
The CO_2 resulting from this process is not to be considered in the calculation of emission reductions, because it originates from biomass and is therefore neutral to the atmosphere. Enforced laws and regulations as well as contractual requirements to abate (a part of) the methane emissions have to be considered in establishing the baseline. The possibility also

exists to both flare and use the methane for producing energy. In this case CO_2 emission reductions from power displaced or from thermal energy displaced can be considered. Given that a ton of methane has a 21 times higher greenhouse gas potential than a ton of CO_2, the basic approach to determine emission reductions from a methane capture project is:

ERs = (tCH_4 destructed by project – tCH_4 mandatory destruction) x 21 - leakage
+ tCO_2 from energy displacement (if part of project)

Mandatory methane destruction: If regulatory rules or contractual arrangements require a certain level of methane destruction in the baseline scenario, then this figure should be used. If no such requirements exist, a percentage of the destructed methane (adjustment factor) should be used in lieu of mandatory methane destruction. This adjustment factor should reflect the most likely outcome of the regulation in terms of mandatory methane destruction. Relevant regulations shall be monitored and the volume of mandatory methane destruction shall be periodically revised on the basis of the monitoring results.

Methane destroyed by project: The methane destroyed by the project will be determined ex post by monitoring the quantity of methane flared or used to generate energy. However, an ex ante estimation of emissions reductions must also be provided.

Leakage or project emissions: CO_2 emissions due to fuel combustion for operating the project technology.

3.3.2. Capturing methane from coal mining activities

Basic concept: Coal seams include methane. This methane is of fossil origin and therefore different from bio-methane. Mining can release methane to the atmosphere. If this methane is captured and flared or destroyed by being used to generate energy, methane emissions are avoided. However, in contrast with the destruction of bio-methane, the resulting CO_2 emissions (burning a ton of methane generates 2.75 tons of CO_2) can not be considered climate neutral, because they are of fossil origin and therefore they must be deducted from the emission reductions. Achieving additional emission reductions is possible if the methane is not flared but used for energy generation and can therefore displace fossil fuels that would have been used otherwise. However mining activities often already partially use methane for energy generation and this has to be considered in establishing a baseline scenario. Furthermore methane extraction from coal seams can not always be fully attributed to mining activities. Non-mining related methane extraction constitutes basically natural gas extraction and has to be considered as a different type of project activity.

CBM and CMM:
Coal bed methane (CBM) and coal mine methane (CMM) can be distinguished according to the extraction method of the methane from coal seams. CBM is drained from surface boreholes before mining takes place. CMM is captured in a working mine, basically for safety reasons. CBM emissions can only be attributed to the mining activity, if it can be

shown that at a later point in time mining affects methane emission from a CBM surface borehole. This is possible even in cases were the mining takes place within a distance of 100 meters to the borehole or more. In the approved consolidated methodology ACM0008 (Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring) CBM is treated in a different way for baseline emissions and project emissions: CO_2 emissions due to CBM destruction have to be counted to 100% in the project case even for those CBM emissions not related to mining. In the baseline case only the emissions of methane as CBM due to mining can be counted. However this allows for retrospective counting. If a CBM borehole is affected by mining starting in year four, the methane emissions in the previous three years can be included in the baseline and they can also be counted in year four together with the CBM emissions in that year. CBM drainage wells can further result in leakage if the surface boreholes in the project activity are not cased and there are no boreholes for CBM in the baseline scenario. In ACM0008 the default value for considering this source of leakage is a 10% discount of all emission reductions achieved with the project.

Use of CBM and CMM to generate energy:
If CMM and eligible CBM is used to generate power or heat or will be used as fuel in vehicles or supplied to a gas grid, avoided CO_2 emissions due to displaced energy generation in the baseline scenario can be claimed in addition to emission reductions due to methane destruction. However, displaced methane used to generate energy that would have occurred in the baseline scenario is considered as leakage in ACM0008.

3.3.3. Decomposition of Nitrous Oxide

Basic concept: End-of-pipe technologies to destroy N_2O can be used in the chemical industry where N_2O is a byproduct in nitric acid production and in adipic acid production. These products are used e.g. for producing fertilizers and plastics. N_2O emissions from manure, wastewater, agricultural soil and from burning fossil fuels can generally not be treated by end-of-pipe installations, but they can be avoided as a result of changing processes or switching fuels.

Decomposition of N2O from adipic acid production: Decomposition of N_2O as a by-product from adipic acid production in existing plants is covered by the approved methodology AM0021. Baseline emissions are calculated as the emission coefficient times output level, where the emission coefficient is expressed as tN_2O/t adipic acid and the output level is the project case in terms of t adipic acid produced. In order to avoid perverse incentives the methodology is only eligible for production capacity (measured in tones of adipic acid per year) installed before 2005. Furthermore the emission coefficient which has to be determined from the characteristics of the production process is capped at 0.27. Any new regulation governing N_2O decomposition shall be immediately taken into account by reducing baseline emissions for the amount of N_2O that has to be destroyed. In the project activity, saturated steam is produced and fed into the existing steam network of the plant. Thus, the baseline will also include emissions from steam replaced by the project, calculated as steam generated in the project activity times the CO_2 emission factor for the existing steam generation system. Project emissions include N_2O which is not decomposed and emissions from natural gas used to fire the decomposition facility. Leakage consists of emissions due to power and steam consumption of the decomposition facility.

Decomposition of N_2O from nitric acid production: The approved methodology AM0028 covers N_2O decomposition in existing nitric acid plants. The methodology is only applicable for capacity installed before 2006. Baseline emissions are directly determined by measuring the amount of N_2O flowing in the destruction facility under the project activity. This amount is however capped corresponding to the nameplate capacity for the nitric acid production and it is discounted by mandatory N_2O abatement if there is any. Changing regulations have to be immediately take into account, i.e. even within one crediting period. If the actual production of nitric acid exceeds nameplate capacity the baseline N_2O emissions (capped at nameplate capacity) is no longer determined by measurement but calculated in using the nameplate capacity production of nitric acid and a N_2O emission factor per unit of nitric acid determined on the basis of historical plant data. These procedures apply however only if the operating conditions of the nitric acid plant remain in a normal range defined in the methodology. If not baseline N_2O emissions per unit of nitric acid are capped by an IPCC default of 4.05kgN20/t nitric acid. This is to avoid perverse incentives for plant operators to manipulate baseline emissions. Project emissions include N_2O not decomposed and possible CO_2/CH_4 emissions due to the operation of the destruction facility and related to ammonia or hydrocarbon input. Leakage is only relevant in the case of additional energy use for decomposing N_2O, i.e. in cases where no waste heat can be used for that purpose. The approved methodology AM0034 is similar to AM0028 but based on a different abatement technology: catalytic reduction of N_2O inside ammonium burners. Emission reductions are calculated by from the output of nitric acid under the project scenario (capped at the design capacity of the plant) and the specific N_2O emission factors per ton of nitric acid produced under the baseline scenario and under the project scenario. The emission factors are measured.

3.3.4. Decomposition of chlorine free F-gases

Basic concept: Chlorine free F-gases were introduced by the chemical industry as a substitute for ozone depleting chlorofluorocarbons. Both types of gases have a high global warming potential but only F-gases are included in the Kyoto Protocol. This is because a global step-by-step phase out of any application of chlorofluorocarbons has been agreed on under the framework of the Montreal Protocol (an international treaty designed to protect the ozone layer). F-gases like chlorofluorocarbons are mainly used in refrigeration and air-conditioning. Emissions of F-gases occur from leakage and decommissioning of cooling facilities. They are also emitted as waste gases in chemical production processes. Those waste F-gases can be decomposed with end-of-pipe facilities. So far only one hydrofluorocarbon (HFC) related methodology (AM0001) has been approved and this is for the decomposition of HFC-23.

Decomposition of HFC-23: HFC-23 is produced as a byproduct (waste gas) in the production of chlorodifluoromethane (HCFC-22). The latter falls under the Montreal Protocol and must be phased out by 2030. HFC-23 has a global warming potential of 11,700 (1 ton of HFC-23 has the global warming potential of 11,700 tons of CO_2). Waste HFC-23 is typically released to the atmosphere since it is a waste stream generated by the production of HCFC-22. The thermal destruction process converts the carbon in the HFC-23 to CO_2 which is then released to the atmosphere. The baseline for a HFC-23 decomposition project is the quantity of HFC-23 released, since it is generally assumed that, in the absence of regulations, HFC-23 will not be captured. The emission reduction achieved by the project activity is therefore the quantity of waste HFC-23 destroyed less the greenhouse gas emissions generated by the destruction process less leakage. Furthermore, emissions from the project occur because fossil fuels are used to run the incinerator used to decompose the HFC-23. Leakage includes the greenhouse gases emitted from the production of purchased energy and the CO_2 emissions from project induced transport of sludge to a landfill. As in landfill gas projects, emission reductions can be directly monitored by measuring the amount of waste gas, in this case HFC-23, destroyed corrected by emissions due to the use of energy in the destruction process and due to leakage.

Avoidance of perverse incentives: The revenues from generating certified emission reductions through destruction of HFC-23 are (at certified emission reduction prices observed thus far in the market) typically higher than the revenues from the sale of HCFC-22. Therefore, in order to avoid incentives to produce more HCFC-22 purely for gaining certified emission reductions that can be earned from HFC-23 destruction, the methodology is restricted to existing production facilities with at least three years of operating history between the beginning of the year 2000 and the end of the year 2004. This prevents projects from earning carbon credits for new capacity built after the end of 2001. It also prevents project developers claiming credits for an increase in generation of HFC-23 from their existing plants. The amount of HFC-23 generated can be expressed as an output (tons of HCFC-22) multiplied by an emission coefficient (tons of HFC-23 per ton of output). In other words, the waste stream of HFC-23 can be expressed as a ratio of HCFC-22 production. The quantity of certified emission reductions that can be claimed is capped since the ratio must be defined according to the historical maximum in the last three years prior to the project implementation and may not exceed an absolute maximum of 3% or 0.03. If no data is available to calculate the annual emission factors in the last three years a default value of 0.015 shall be used. Any regulation requiring the avoidance of HFC-23 emissions has to be taken into account by reducing baseline emissions in line with the legal requirements, i.e. baseline emissions are the emission reductions minus any reductions required by law.

COP/MOP1 decided that “new HCFC-22 facilities” are defined as capacity addition to existing facilities with an operating history of at least three years between the beginning of 2000 and the end of 2004 where existing capacity is defined by the maximum historical production level each year. The output of facilities that do not have this operating history is considered completely as “new HCFC-22 facility”. So far no further clarification is available on the possibility to claim certified emission reductions from “new HCFC-22 facilities”, but the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC has been asked to prepare a proposal by the next COP/MOP meeting.

3.4. Energy efficiency

Basic concept: Energy efficiency is measured as reductions in the energy input per unit of output produced. This translates into lower emission coefficients i.e. lower CO_2 emissions per output unit. A complication is that in developing or transitional countries energy efficiency measures are often not undertaken to produce the same amount of output with less energy input but to increase production without using more energy. In this context, energy efficiency improvements are alternatives to improving the utilization of existing capacity or to undertake capacity increasing investments. As a result it is appropriate to determine emission reductions on the basis of the difference in emission coefficients and the monitored activity level in the project scenario. Considering potential leakage the basic approach to determine emission reductions for energy efficiency measures is therefore:

$$ERs = (\text{emission coefficient}_{\text{baseline}} - \text{emission coefficient}_{\text{project}}) \times \text{output}_{\text{project}} - \text{leakage}$$

This approach follows the methodologies for power sector projects and is in line with the general rules on changing activity levels in CDM project activities (cf. 2.4).
As for power sector methodologies the methodologies for energy efficiency measures can be characterized by the way the baseline emission coefficients are established (project emission coefficients can be determined based on ex post measurement).

Status quo emission coefficient approach: In a general decision, the Executive Board (at its 8th meeting) stated: “If a proposed CDM project activity seeks to retrofit or otherwise modify an existing facility, the baseline may refer to characteristics (i.e. emissions) of the existing facility only to the extent that the project activity does not increase the output or lifetime of the existing facility. For any increase of output or lifetime of the facility which is due to the project activity, a different baseline shall apply.” This decision only allows the use of the emission coefficient of the status quo technology or existing facility up to the output level which can be achieved by it. However, the Executive Board has also allowed projects where the degree of utilization of an existing plant increases and therefore where output is increased to be eligible for the historic emission coefficient approach. This includes replacement investments up to the capacity of the replaced facility.

Standard emission coefficient approach: Following this approach, a benchmark is used to determine the baseline emission coefficient. This benchmark can be derived from a set of similar investments that were recently undertaken under comparable circumstances (control group) or it can be a technical efficiency standard. The standard emission factor approach is appropriate for new investment projects (Greenfield projects) or for capacity expansions.

Note: Emission coefficients can change over the crediting period if it is plausible to assume changes in efficiencies or fuel switch measures for the operation of the existing facilities or the control group or the efficiency standard in the baseline scenario. In the case of power electricity saving due to energy efficiency projects, baseline emission factors and project emission factors can be determined following the approved methodologies for power sector projects.

Leakage: In the case of pure retrofitting or optimization measures in existing facilities leakage is generally not an issue. Leakage has to be considered if replaced equipment is still to be used (leakage due to crowding in) or if equipment is transferred from another activity (leakage due to crowding out).

Demand side energy efficiency activities and approved methodologies: So far three approved methodologies for large-scale demand side energy efficiency projects are available: AM0017, AM0018 (both on steam efficiency improvements in industrial facilities) and AM0020 (water pumping efficiency improvements). These methodologies follow the basic concept outlined above but they are limited to cases without increasing capacity or production.

Supply side energy efficiency activities and approved methodologies: On the supply side five approved methodologies are available: ACM0004, ACM0007, AM0014, AM0024 and AM0032. These methodologies deal with efficiency improvements in power generation including cogeneration, use of waste gas or waste heat and conversion from single cycle to combined cycle power generation. Furthermore there is a tool included in ACM0002 to deal with retrofitting/modification of renewable power plants. All of these methodologies are following the same logic as the approved methodologies for power generation (cf. 3.2).

3.5. Fuel switch activities

Basic concept: A fuel switch can occur in an existing installation, including replacement investments that do not increase the capacity of the old plant, or in new capacity investments. In most cases, CDM fuel switch activities will be switches to natural gas or to renewable biomass. In general fuel switch activities do not affect the planned activity level. In particular cases where a fuel switch is undertaken to increase the supply of products or services it is done as an alternative to capacity increasing investments or to measures to increase the degree of utilization of given installations. For this reason it is appropriate to determine baseline emissions on the basis of the monitored project activity level and the baseline emission factor. The basic approach to determine emission reductions for fuel switch activities and considering leakage is therefore:

ERs = (emission $\text{factor}_{\text{baseline}}$ – emission $\text{factor}_{\text{project}}$) x activity $\text{level}_{\text{project}}$ - leakage

It is important to note that the activity level and the corresponding emission factors can be defined in terms of output units or in terms of fuel consumption.

Calculation based on output units: Often fuel switch activities have an energy efficiency component (e.g., in order to undertake the fuel switch, boilers have to be replaced, and the new boilers will in general be more efficient than the old boilers). In this case not only the ratio CO_2 emission per energy unit is improved but also the ratio fuel consumption per output unit. Both effects can be captured in basing the calculation on output-related emission factors. The approved methodology AM0007 (Analysis of the least-cost fuel option for seasonally-operating biomass cogeneration plants) is using this approach. However AM0007 is only applicable for existing equipment.

Calculation based on fuel consumption: This alternative is of particular relevance in cases where fuel consumption and output production is to some degree disconnected (e.g. in some industrial processes, kilns are used which have to be fired even in periods without production). If this option is used, the volume of fuel consumed in the project scenario has to be expressed in energy units (e.g. in Joule) and the emission factors in terms of tCO_{2e} per energy unit taking into account differences in fuel efficiencies. This approach is used in ACM0003 (Emission reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture) and in the consolidated methodology ACM0009 (Consolidated baseline methodology for industrial fuel switching from coal or petroleum fuel to natural gas).

Leakage: Relevant sources of leakage can be emissions from fuel production and emissions due to fuel transportation. Fuel switch to natural gas may have to consider leakage due to fugitive methane emissions from gas exploitation and methane leaked from pipelines. ACM0009 includes a procedure to calculate leakage out of those sources. Biomass projects have to deal with leakage due to potential crowding out of alternative biomass use. A procedure to deal with this type of leakage is described in ACM0006 (Consolidated baseline methodology for grid-connected electricity generation from biomass residues).

Carbon balance approach: In some cases, it is difficult to identify the installations where the fuel switch finally occurs. An example is the recovery and utilization of natural gas from oil wells that would otherwise be flared and which is delivered to different users in the project case. In the case where the recovered gas displaces only natural gas or fuels with a higher carbon content, baseline emissions can be determined simply in assuming that all carbon in the gas is converted into CO_2 (through flaring), which will replace at least an equal amount of CO_2 resulting from burning other fuels. Typically emission reductions will be underestimated, when using this carbon balance approach to determine baseline emissions, because the flaring process in the baseline case will not completely destroy the methane content of natural gas as is assumed, and because the use of the gas to create energy will also displace fuels with a higher carbon content. The advantage of the approach is that the gas may be used for different purposes and displace different fuels without making it necessary to undertake an emissions analysis for the displaced activities. The carbon balance approach is used in the approved methodology AM0009 (Recovery and utilization of gas from oil wells that would otherwise be flared).

3.6. Reduction of process related emissions

Process related emissions are greenhouse gas emissions from chemical processes other than oxidation. Process related emissions occur in the iron and steel industry, the aluminum industry and in the cement industry as well as in decay processes of waste biomass.

3.6.1. Bio-methane avoidance through extraction activities or combustion

An alternative to the capturing and burning of methane from decomposing biomass is the extraction of methane in a closed digester and the use of this biogas to produce energy (biogas installations). As in methane capturing activities, the source of emission reductions are avoided methane emissions and the resulting CO_2 can be considered as climate neutral. What is different is that the emission of methane in the baseline scenario cannot be determined by the methane destroyed through the project activity, because the extraction activity generates different amounts of methane than would otherwise be produced in the decomposition process. Instead baseline emissions have to be determined on a theoretical basis by computing how much methane would have been released had the equivalent amount of waste been disposed off differently, e.g. landfilled. Combustion of biomass avoids the production of methane from decay processes. In this case baseline emissions have to be theoretically determined. This estimation can be done on the basis of parameters describing the composition of waste and its methane generation potential. For wastewater digestion, the calculation can be done on the basis of the oxygen demand of effluent entering lagoons.

3.6.2. Bio-methane avoidance through composting of biomass

Composting is the aerobic decomposition of biomass. It produces almost no methane and to a smaller extent also less N_2O than anaerobic decomposition. Instead more CO_2 emissions are generated, but those are climate neutral because of their biological origin. Composting is an option for biomass that would otherwise be left to decay, such as organic waste in landfills or organic waste produced in agriculture. So far there is one methodology for small-scale project activities (AMS III.F) and one methodology for large-scale projects (AM0025) approved for composting and biomethanation projects. Both methodologies require using a first order decay model to estimate avoided methane emissions form the landfill corrected for mandatory and business-as-usual methane destruction or by a discount of 10% for conservativeness. Project emissions include N_2O emissions (default emission factor 43g N_2O/t compost), CH_4 emissions due to parts of waste decomposing under anaerobic conditions in the composting process and energy related emissions. Project emissions and leakage (due to increased off-site transportation) can be assumed to be 1% of baseline emissions if measurement in the first year of operation of the project confirms that these emissions are not higher. Approved tools for determining emission reductions from composting are also available in the framework of the approved methodologies for manure management measures in agriculture (AM0006, AM0016). Both methodologies have been placed on hold since EB23 and it is anticipated that they will be consolidated at EB26.

3.6.3. Manure management projects in agriculture

Basic concept: Animal waste is an important source of methane and N_2O emissions. Emissions depend on the way manure is stored (solid, dry, liquid, in pits, deep litter) or treated (anaerobic digesters, composting, aerobic treatment). Transitions between these alternatives can reduce methane and N_2O emissions. Baseline and project emissions have to be calculated separately to determine emission reductions (no direct monitoring of emission reductions possible). Emissions are determined based on livestock population and characteristics, waste flows and parameters describing their chemical properties.

Leakage: Potential sources of leakage are: use of power for manure treatment, methane and N_2O emissions due to disposal of the treated manure to the environment. These types of leakage have to be considered in calculating emission reductions.

3.6.4. Increasing the blend or the raw material mix in cement production

Basic concept: The production of cement is energy intensive, causes energy related CO_2 emissions and results in CO_2 emissions due to calcinations (heating of limestone to drive off carbon dioxide), which are process related emissions. Cement is produced out of clinker. Clinker is an artificial rock made by heating limestone and other raw materials to a high temperature in a kiln. Cement is produced by grinding clinker. Decreasing the share of clinker in cement by adding additives like fly ash, gypsum, slag etc. allows for reducing process related emissions due to calcinations. Blending also reduces energy related emissions in the clinker production.

Another way to reduce calcinations related emissions in cement production is to substitute raw material for clinker production by non-carbonated calcium sources. In this case the share of clinker in the cement remains unchanged but CO_2 emissions from clinker production decrease.

CDM projects that increase the blend in the cement production can use the approved consolidated methodology ACM0005. However this methodology does not allow emission reductions to be claimed by energy efficiency and fuel switching activities that result in reduced CO_2 emissions per unit of clinker. Only avoided emissions due to a decrease in the share of clinker per unit of cement can be claimed. The methodology is based on a benchmark approach to identify the share of clinker in the top 20% (in terms of shares of additives) of the total production of blended cement in the relevant domestic market (two other options to define the benchmark are also available). Cement that is exported to another country is not covered by ACM0005.

CDM projects that substitute raw material in clinker production can use the approved methodology AM0033. This methodology is only applicable if the project doesn’t result in any change of the quantity or quality of output or in an increase of energy related emissions. Emission reductions are calculated on the basis of the clinker production under the project scenario and the difference in the calcination related CO_2 emission factors per ton of clinker in the baseline case and in the project case. Both emission factors are determined through lab analysis.

3.6.5. Substitution of fossil/mineral CO_2 in chemical processes

Basic concept: In some chemical processes CO_2 is used as a raw material to produce a final product. Even if the CO_2 is completely released to the atmosphere when the product is used, there remains a potential for reducing greenhouse gas emissions, if CO_2 from fossil or mineral origin is substituted by CO_2 from renewable sources like biomass waste. Emissions of biogenic CO_2 are neutral to the atmosphere and do not count as emissions, whereas CO_2 emissions from fossil or mineral origins are not neutral. In the case where the CO_2 is not released to the atmosphere due to the way the end product is used, CO_2 can be stored and the project activity can result in negative project emissions.

The approved baseline methodology AM0027 (substitution of CO_2 from fossil or mineral origin by CO_2 from renewable sources in the production of inorganic compounds) covers the emission reductions effect due to substitution of non-neutral CO_2 as an input in chemical processes by neutral CO_2 as well as the potential carbon storage effect. In both cases baseline and project emissions are determined by multiplying the amount of the end product by an emission factor that reflects the CO_2 content of the end product based on the relevant stoichiometric equation.

3.6.6. Reduction of perflurocarbon emissions in aluminum production

Basic concept: Aluminum production includes the reduction of aluminum oxide to aluminum through electrolysis. The electrolytic bath contains fluorides. A so-called anode effect happens when fluorides combine with carbon to perflurocarbons (CF_4 and C_2F_6) that are greenhouse gases with high global warming potentials of respectively 6,500 and 9,200. Changes in the electrolytic process that reduce the anode effect can avoid the emissions of perflurocarbons and therefore contribute to greenhouse gas mitigation.

The approved baseline methodology AM0030 (PFC emission reductions from anode effect mitigation at primary aluminum smelting facilities) can be used for this type of CDM project. The methodology is restricted to existing capacities (potlines) in facilities that have started operations 2003. It is furthermore only applicable up to the end of the lifetime of the potlines. Only emission reductions from anode effect mitigation can be claimed excluding possible emission reductions due to improved energy efficiency. Baseline emissions and project emissions are determined by multiplying the aluminum output observed under the project scenario with the appropriate emission factors. For the baseline case the aggregated emission factor for CF_4 and C_2F_6 in tons of CO2e per ton of aluminum is measured prior to project implementation and capped at 0.65. For the project case the corresponding emission factor is measured.

3.7. Reduction of fugitive emissions through repair and maintenance measures

Basic concept: Fugitive emissions of greenhouse gases are mainly methane emissions from mining, oil and gas production and transportation of natural gas through pipelines. Fugitive greenhouse gas emissions can also consist of F-gases and N_2O in industrial processes. In most CDM project activities, fugitive emissions are treated in end-of-pipe facilities and/or are used to produce energy (see above). Another possibility is to avoid fugitive emissions via repair and maintenance measures. An example is the detection and repair of leaks in gas pipelines and/or pipeline compressor and gate stations.

Repair of leaks in gas transportation: Emission reductions due to the repair of gas leaks can by determined as avoided gas losses through leaks. These gas losses can be measured prior to the project implementation. The losses constitute the baseline emissions that correspond directly to the emission reductions because there are typically no project emissions due to repair and maintenance measures. In order to show the additionality of the repair and maintenance activities, a detailed analysis of the business as usual mode of operation of the gas transportation system has to be done, including consideration of the normal replacement cycle of the relevant equipment. So far only one approved methodology AM0023 for leak reduction from natural gas pipeline compressor or gate stations is available.

3.8. Reduction of greenhouse gas emissions in the transport sector

Basic concept: In road, air or water based transportation fossil fuels (gasoline, diesel, kerosene) or power (e.g. for trains, trams, metro lines) are used. Fuel or power saving activities or fuel switching activities allow for greenhouse gas emission reductions (mainly in terms of CO_2 but also in terms of CH_4 and N_2O related to fossil fuel use in engines). These activities can be energy efficiency improvements in existing vehicles (e.g. improved maintenance and repair, drivers training) the replacement of vehicles by less emitting units, modal shift (reducing emissions per person kilometer traveled) or infrastructure measures reducing the distances or number of trips (e.g. new roads or improved agglomeration planning). So far two methodologies for the transport sector have been approved: a methodology for small-scale activities on the introduction of low-greenhouse gas emitting vehicles and a methodology for large-scale activities for bus rapid transit projects.

Introduction of low-greenhouse gas emitting vehicles: The approved methodology for small-scale activities introduces low-greenhouse gas emitting vehicles AMS.III.C covers energy efficiency and fuel switch measures (including switching to electro vehicles). Emission reductions are calculated on the basis of the transport service level provided in the project case and the difference in the relevant emission factors (e.g. CO_2 emissions per kilometer driven by a private car in the baseline case and in the project case). The use of AMS.III.C is limited to activities up to a total of 15 kilotons direct project emissions per year. Furthermore emission reductions are capped at 25 kilotons per year.
Bus rapid transit projects: The approved methodology AM0031 covers the replacement of an existing urban public transport system by a rapid bus transport system (e.g.

replacement of old bus fleet by a new one and construction of exclusive bus lines). The methodology is not applicable if bio-fuels are used in the baseline or in the project scenario (up to 3% bio-fuel additive permitted). Furthermore replaced vehicles need to be retired. Emission reductions are calculated based on the number of passengers transported under the project scenario. Surveys are used to find out what vehicle type (bus-car-taxi-motorcycle) these passengers would have used in the absence of the project. Baseline emissions are then calculated using data on the volume and composition of the baseline activity level and the corresponding baseline emission coefficients (based on sampling or on conservative default values). An ex ante determined efficiency improvement factor as well as changes in fuel types used and in trip distances are considered. Project emissions are calculated on the basis of total fuel consumption of the new buses or alternatively on the basis of distances traveled by the buses and appropriate emission factors.

The methodology accounts for annualized upstream leakage from the construction related emissions (bus lanes), emissions from the production of new buses and emissions fromthe production and transportation of fuels. Furthermore the possibility for reduced occupancy of taxis and conventional buses is considered as well as impacts due to reduced congestion and increased average speed.

3.9. Removal through afforestation/reforestation activities

During the first commitment period of the Kyoto Protocol, only afforestation and reforestation activities are eligible under the Kyoto Protocol. A Non-Annex I Party may host an Afforestation/Reforestation CDM project activity only if it has selected and reported to the Executive Board through its Designated National Authority the definition of forest for the CDM within the thresholds of a minimum land area of 0.05-1.0 hectares with tree crown cover of more than 10% to 30% and a tree height of 2-5 meters at maturity in situ. The land should not be temporarily unstocked as a result of harvesting or natural causes, nor should it be covered by young natural stands or plantations with potential to revert to forest.

For the first commitment period, reforestation activities will be limited to reforestation of the lands that did not contain forest as on 31 December 1989. In case of afforestation activities, the land should not have been forested for a period of at least 50 years. In order to demonstrate the eligibility of land, the project participants should provide one or more sources of evidence comprising aerial photographs, satellite images, ground surveys, land use-maps, cadastral and other information that demonstrates that the land is not forested and is therefore eligible as per the land eligibility criteria of the Afforestation/Reforestation projects.

Basic concept:
Baseline net greenhouse gas removals by sinks is the sum of the changes in the stocks of the carbon pools within the project boundary that would have occurred in the absence of the Afforestation/Reforestation CDM project activity. Decision 19/CP.9 covers the carbon stock changes in the five pools: above-ground biomass, below-ground biomass, deadwood, litter, and soil organic carbon. The project participants may choose to

disregard one or more carbon pools if they provide transparent and verifiable information indicating that the choice will not increase the expected net anthropogenic greenhouse gas removals by sinks. The AR-AM0002 considers changes in the all five carbon pools, whereas, AR-AM0001 and AR-AM0003 consider the changes in two carbon pools – above ground biomass and below ground biomass.

The baseline scenario is selected from amongst the plausible scenarios using step-by-step procedure and analytical steps. The continuation of an existing activity and the implementation of the proposed Afforestation/Reforestation CDM project activity should be among the plausible scenarios.

Different elements such as national/sectoral policies, technological improvements, past land use, and issues related to investment and other barriers should be taken into account in the analysis of plausible scenarios and in the selection of the baseline scenario.

As per the decision of EB 24, project proponents shall justify the method used to assess the baseline rate of afforestation/reforestation and the assessment of additionality shall include justification that the increased rate of afforestation/reforestation would not occur in the absence of the project activity. The GHG emissions occurring outside the project boundary and attributable to the AR activity shall need to be considered both in the baseline and the project situations.

Project participants may choose between two crediting periods: (i) A fixed crediting period with a length of up to a maximum of thirty years and with no possibility of renewal or extension after the Afforestation/Reforestation CDM project activity is registered. (ii) A renewable crediting period, which permits the determination of the first crediting period up to a maximum of 20 years, and which can be renewed for two further crediting periods for a maximum of 60 years, provided that at each renewal, the designated operational entity determines the validity of the original baseline or an adjusted project baseline.

Project participants can request issuance of certified emission reductions in the units of one metric ton of carbon dioxide equivalent under temporary certified emission reductions (tCERs) or long-term certified emission reductions (lCERs). A tCER expires at the end of the Kyoto commitment period subsequent to the one in which it was issued, and it can then be reissued. In contrast, lCER expires at the end of the project's crediting period. In any case, tCERs and lCERs have to be replaced when they expire.

The baseline methodology should cover the steps such as the definition of project boundary, ex-ante stratification of carbon pools, choice of the baseline scenario from amongst the plausible scenarios, ex-ante calculation of the baseline net greenhouse gas removals by sinks, demonstration of additionality, ex-ante estimate and ex-post calculation of the actual net greenhouse gas removals by sinks, and leakage. It should also present the steps associated with the determination of uncertainty associated with the estimates.

Additionality: The additionality of the project should be demonstrated using a step-by-step approach taking into account the land eligibility, national and sector policies governing the land use, investment analysis or barrier analysis, and the assessment of the expected impacts of registration of the project under the CDM (see 2.7). The additionality test of A/R projects do not require subjecting an A/R project to the common practice test, contrary to the additionality tool requirement of the CDM projects to test for the common practice.

Leakage: Leakage represents an increase in the greenhouse gas emissions by sources outside the boundary of an Afforestation/Reforestation CDM project activity, and which is measurable and attributable to the Afforestation/Reforestation CDM project activity. As per the decision 19/CP.9, the sources of leakage should be identified, and the emissions from each source should be calculated and subtracted from the actual net project greenhouse gas removals by sinks together with the baseline emissions in order to estimate the net anthropogenic greenhouse gas removals by sinks. Positive leakage should not be counted and thus cannot offset the leakage associated with the project.

The major sources of leakage associated with Afforestation/Reforestation projects include the collection of fuelwood, fodder, and other forest products; grazing; clearance of land and vegetation, and transport of project personnel and products. AR-AM0003 identifies grazing as the source of leakage.

Where leakage occurs from the collection of fuel wood or similar activities, only the gathered volume of wood that is non-renewable shall be considered as an emission by sources if forests are not significantly degraded due to this activity. The "not significantly degraded" refers to the area outside the project in which emissions from fuelwood collection range from 2% and 5% of net actual greenhouse gas removals by sinks. If the extracted wood volume results in emissions below 2% of the net actual greenhouse gas removals by sinks, such leakage can be ignored. AR-AM0001 and AR-AM0002 are applicable to those projects in which leakage is not significant and the proposed project activities continue to provide at least the same amount of goods and services so that agricultural or pastoral activities will not be displaced from the project sites to other locations as a result of the A/R CDM project activity.

Leakage from the displacement of one or more project activities that result in emissions greater than 5% of net actual greenhouse gas removals by sinks should be considered significant. Such leakage should be monitored through household surveys and/or rapid appraisal methods by selecting up to 10% of households and conducting surveys to capture the data on land use to estimate the leakage emissions. Leakage resulting from the transport of project personnel and products to areas outside of the project should be calculated based on data collected from monitoring of the project operations.

Monitoring: Monitoring methods and procedures should include ex-post methods implemented in the measurement and calculation of changes in each carbon pool.

Permanent sample plots are established within the project boundary to monitor the changes in biomass pools at 5-year intervals, and permanent or temporary plots can be used to monitor the changes in soil organic carbon at 10 to 20 year intervals.

The monitoring methodology should outline the steps used in monitoring such as e*x-post* stratification of project area, sampling and inventory methods proposed, whether or not the baseline is monitored, and if the baseline is monitored, and the procedures to be followed for monitoring. The approved methodologies AR-AM0001, AR-AM0002 and AR-AM0003 suggest that the accounting of CH_4 and N_20 from biomass burning in the project be from either site preparation or from natural fires. The approved methodologies also require that N_2O emission from fertilizer application are considered. It should also outline the methods, data, algorithms and key assumptions in the calculation of *ex-post* actual greenhouse gas removal by sinks, project emissions, and leakage.

Small-scale afforestation and reforestation project activities are those that result in the net anthropogenic greenhouse gas removals by sinks of less then eight kilo tons of CO_2 per year. The small scale Afforestation/Reforestation activities are expected to be implemented by low-income communities and individuals as determined by the host Party.

A simplified baseline methodology for small-scale Afforestation/Reforestation CDM project activities is currently available. However, it is not applicable to cropland or grassland that has been ploughed before the project and nor to project activities that result in the displacement of households or economic activities that result in emissions greater than 50% of the actual net greenhouse gas removals by sinks.

The simplified methodology for small-scale Afforestation/Reforestation projects follows the baseline approach outlined in paragraph 22(a): existing or historical, as applicable, changes in carbon stock in the carbon pools within the project boundary. The methodology provides guidance on the assessment of changes in two carbon pools: above-ground biomass and below-ground biomass.

To assess the leakage under the small-scale methodology, project participants should use indicators such as (a) percentage of families/households in the community involved in or affected by the project activity and displaced due to the project activity; and (b) percentage of production of the main produce (e.g. meat, corn) of the project displaced due to the CDM Afforestation/Reforestation project activity. If the value of these two indicators results in emissions lower than 10% of the actual net greenhouse gas removals by sinks, the leakage can be ignored. If the value is between 10% and 50%, then leakage should be assumed to be 15% of actual net greenhouse gas removals by sinks and accounted in the project.

Relationship between A/R CDM project activities and non-A/R CDM activities: For the purpose of conservativeness, the decreases in carbon stocks due to non-Afforestation/Reforestation CDM project activities (e.g. deforestation due to creation of reservoirs or hydropower projects) should be considered in determining the emission reductions. However, the increases in carbon stocks from such activities should not be accounted for. Emission reductions from Afforestation/Reforestation components of non-Afforestation/Reforestation CDM projects can only be claimed if those Afforestation/Reforestation components are designed as separate Afforestation/Reforestation CDM projects.

As per paragraph 38, EB25 on double counting of emissions involving energy and A/R projects, all project activities using biomass for energy should account for emissions associated with the production of biomass. However, a project activity using biomass for energy, which uses biomass originating from a registered A/R project activity (i.e. through contractual agreement for procurement of biomass) need not account for emissions related to biomass production.

Where an Afforestation/Reforestation project activity and a non-Afforestation/Reforestation CDM project activity are related, and the Afforestation/Reforestation project activity does not seek to obtain tCERs or lCERs, but can result in a net decrease in carbon pools compared to what would occur in the absence of the project activity, such changes should be taken into account in the calculation of emission reductions subtracting the corresponding quantities from emission reductions of the non-Afforestation/Reforestation CDM project.