CLEAN DEVELOPMENT MECHANISM

PROPOSED NEW METHODOLOGY: BASELINE (CDM-NMB)

Version 01 - in effect as of: 1 July 2004

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SECTION A. Identification of methodology

A.1. Proposed methodology title:

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GHG Destruction in Industrial Processes Baseline Methodology

A.2. List of category(ies) of project activity to which the methodology may apply:

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4-Manufacturing industries, 5-Chemical Industries, 8-Mining/mineral production, 10-Fugitive emissions from fuels (solid, oil or gas), 11- Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride, 13-Waste handling and disposal, 15-Agriculture.

A.3. Conditions under which the methodology is applicable to CDM project activities:

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This methodology is applicable to project activities where the GHG is captured and destroyed, through combustion or other means, thus reducing or eliminating its greenhouse gas effect.

For example, the methodology is applicable to carbonization plants that introduce a new technology to prevent the release of methane during charcoal manufacturing.

A.4. What are the potential strengths and weaknesses of this proposed new methodology?

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Strengths: Simple and widely applicable methodology, cost reduction, realistic simulation of investment decision and applicable to a wide range of activities involving GHG destruction or modification, data required for calculations are usually available since most industrial processes are very well understood and all the data required is routinely collected by producers. Because this is a generic methodology, it can be used in a wide variety of situations.

Weakness: Because this is a generic methodology, applicable to a wide range of technologies and situations, it is more dependent than usual on judgment of the DOE to ensure the complete, transparent and conservative application of methodology. Examples are provided in this document about its use to the case study of reduction of methane from charcoal manufacturing activities, but this is meant to illustrate the use of the methodology only.

SECTION B. Overall summary description:

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Many industrial processes release greenhouse gases (GHG) to the atmosphere. In most cases, part of GHG originated from these activities is released to the atmosphere, but new alternative technologies are being developed to destroy GHGs or modify its global warming potential (GWP), mitigating their greenhouse effect (for instance through combustion of methane transforming it into CO2). This methodology focuses on companies that are currently emitting GHG and are considering GHG capture and destruction by the adoption of new equipment or technology. Financial reasons or other barriers have traditionally prevented the use of such equipment or technology. For example, this methodology could be used by charcoal production companies using carbon finance to introduce methane destruction devices in carbonization kilns, which traditionally released methane to the atmosphere. The methodology is applicable to a wide range of activities, including carbonization improvements, landfill projects, or any other project involving the capture and destruction of methane, N_2O, and HFCs. The elements of determination of baseline and additionality for this new baseline methodology were based on the "Draft consolidated tools for demonstration of additionality" released on the Eleventh Meeting of the CDM Meth Panel. The section on calculations of baseline emissions uses a new algorithm, proposed for the first time in this new methodology (for more details see Annex III section 6).

The methodology was divided in two phases: determination of baseline scenario and project additionality, and ERs calculations, as follows:

Determination of baseline scenario and project additionality

The baseline scenario and additionality are determined in a step-wise process to determine the financial barriers associated with the development of the project, based on approach of Art 48(b) of Marrakech Accords and following the "Draft consolidated tools for demonstration of additionality" released on the Eleventh Meeting of the CDM Meth Panel. For more details see section D.1 and D.3 of this document.

Calculation of emission reductions

After the baseline scenario and additionality determination, it is then necessary to calculate the emissions associated with this the baseline and project scenarios. The calculation procedures are described in sections D.6 and D.7 of this document.

SECTION C. Choice of and justification as to why one of the baseline approaches listed in paragraph 48 of CDM modalities and procedures is considered to be the most appropriate:

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C.1. General baseline approach:

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? Existing actual or historical emissions, as applicable;

X Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;

? 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.

C.2. Justification of why the approach chosen in 3.1 above is considered the most appropriate:

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Approach B is the most appropriate to define baseline and additionality of this type of activity in which project activities are usually prevented to occur due to financial reasons. After considering the national and sectoral policies in the definition of plausible scenarios, investor decisions are usually affected by their assessment of risks and investment returns. As risks related to new activities are difficult to measure, only qualitative assessments can be done. The investment return, on the other hand, is an easier option to simulate investor decisions in a quantitative assessment, resulting in a more precise evaluation of future scenarios.

SECTION D. Explanation and justification of the proposed new baseline methodology:

D.1. Explanation of how the methodology determines the baseline scenario (that is, indicate the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases (GHG) that would occur in the absence of the proposed project activity):

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The baseline scenario and additionality are determined in the step-wise process described in the "Draft consolidated tools for demonstration of additionality" released on the Eleventh Meeting of the CDM Meth Panel. Full details can be found in the original document.

D.2. Criteria used in developing the proposed baseline methodology:

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The following criteria were used in developing this methodology:

(a) Availability of information: The methodology permits the determination of a baseline scenario where financial information and analysis is available only for the proposed project.

(b) Reduction of transaction costs: No additional information must be produced.

(c) Realistic simulation of investment decisions: Investment decision for projects that are optional (such as the adoption of methane destruction equipment in carbonization kilns) are often made on the basis of a comparison with acceptable rates of return. The proposed methodology captures this investment rationale.

D.3. Explanation of how, through the methodology, it can be demonstrated that a project activity is additional and therefore not the baseline scenario (section B.3 of the CDM-PDD):

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See section D.1 for additionality definition.

D.4. How national and/or sectoral policies and circumstances can been taken into account by the methodology:

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The results of this comparative analysis between plausible scenarios should be evaluated in the context of sector trends, and incorporating the effects of any legislation and government policies that may affect this trend. This can be done by analyzing the policies (subsidies, laws, economic trends), as well as the behavior of companies involved in the same production sector in the region where the project will be

implemented (For more detail see *step 1* in the "Draft consolidated tools for demonstration of additionality").

D.5. Project boundary (gases and sources included, physical delineation):

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The definition of project boundaries used here are based on that used for the methodology AM0003. The project boundary, for the purpose of establishing the baseline scenario, defines where possible alternative scenarios to the proposed project are likely to be found. For investment projects applying the proposed methodology the physical site(s) of the business-as-usual activities and of the proposed project activity typically define the boundary.

The project boundary, for the purpose of monitoring and calculating emission reductions, defines where sources of GHG emissions are to be found that are under the control of project participants, significant, and reasonably attributable to the project activity, and conversely which GHG sources are outside of the boundary and may have to be treated as leakage. GHG emissions that occur from the same source and in the same amounts in baseline and project scenarios are usually not significant for the purpose of calculating emission reductions and may not be attributable to the proposed project activity. Such sources can be treated as insignificant and not attributable (in the sense of the above definition) and can therefore be excluded from the monitoring boundaries.

Consequently, the analysis leading to the definition of the monitoring boundaries should comprise all elements related to the production process, in the baseline and project scenarios.

The following GHG sources are typically inside the monitoring boundaries:

- Direct emissions: related to the production process (e.g., raw material transformation such as carbonization activities, electricity consumption, fossil fuel consumption, etc.).

The following GHG sources are typically excluded from the monitoring boundaries, because they are not under the control of the project participant, insignificant, or not attributable to the project activity:

- Indirect on-site emissions: Emissions from construction of the project (not significant and difficult to measure)
- Indirect off-site emissions: Transportation of raw material to the plant (not included since the emissions are the same in both scenarios).

D.6. Elaborate and justify formulae/algorithms used to determine the baseline scenario. Variables, fixed parameters and values have to be reported (e.g. fuel(s) used, fuel consumption rates):

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After determining the baseline and additionality, it is necessary to estimate the emissions in the baseline and project scenarios in order to calculate the emission reductions resulting from the project activity. The baseline and project emissions (E_b) can be calculated as the total amount of CO_2e that would be emitted during the production of the same amount of product using the different technologies (E_p).

The greenhouse gas emission reduction achieved by the project activity (ER) during a given year is the difference between the amount of GHG emitted in the absence of the project activity (Eb).and the amount of GHG actually emitted (Ep), considering the GHG that is captured and destroyed in this scenario. After that discount any leakage emission measurable and reasonable attributable to the project.

$$ER = E_b - E_p - L \qquad \textbf{Equation 1}$$

Where:

ER: Emission Reduction (tonnes CO_2e)

E_b: Emissions in the baseline scenario (tonnes CO_2e)

E_p: Emissions in the project scenario (tonnes CO_2e)

L : Leakage (tonnes CO_2e)

Equations for E_b is, as follows:

$$E_b = QP_b * EF_b *(1-(\% \ Destroyed_b)) \qquad \textbf{Equation 2}$$

Where:

E_p: Emissions in project scenario (tonnes CO_2e)

E_b: Emissions in the baseline scenario (tonnes CO_2e), for more details, see *section D.7*.

QP_b: Amount of produced product in the baseline scenario (tonnes or unit). In most situations, this will be the same as in the project, as the level of production should not be altered by the introduction of the project activities.

EF_b: Emissions Factor of the baseline scenario (tonnes CO_2e/tonnes or unit). In most situations, this will have the same value as in the project, as the production of GHG should be similar, with only the % Destroyed differing between the scenarios.

% $Destroyed_b$: It is the amount of GHG emissions that is actually captured and destroyed in the baseline scenario, prior to the introduction of new or improved GHG destruction devices.

The equation 2 summarizes the baseline emissions calculation. It is the difference between the emissions generated during the production process, and what may be already captured and destroyed in the baseline scenario. If the baseline scenario has a GHG destruction fraction, it is expected that in the project scenario this fraction should be higher than that in the baseline scenario.

The only parameter expected to fluctuate along time is the quantity of product produced (QP). The parameters *emission factor*, and *% destroyed of baseline scenario* are expected to be constant during the project lifetime.

The emission factor will be calculated as the GHG emission per tonne or unit of product, times the GWP of the respectively GHG. The GWP values used to calculate it will be based on the IPCC values.

For example, the emission factor for wood carbonization for batch kilns is 0,054 tonne of CH_4/tonne of charcoal produced (USEPA, 1995). Transforming it to CO_2e (multiplying by the methane GWP, 21), 1,13 tonnes of CO_2e per tonne of charcoal produced.

D.7. Elaborate and justify formulae/algorithms used to determine the emissions from the project activity. Variables, fixed parameters and values have to be reported (e.g. fuel(s) used, fuel consumption rates):

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$$E_p = (QP_p * EF_p) * (1- (\% \text{ destroyed}_p)) \qquad \textbf{Equation 3}$$

Where:

E_p: Emissions in project scenario (tonnes CO_2e)

QP_p: Amount of produced product in project scenario (tonnes or unit). In most situations, this will be the same as in the baseline, as the level of production should not be altered by the introduction of the project activities.

EF_p: Emissions Factor in the project scenario (tonnes CO_2e/tonnes or unit). In most situations, this will have the same value as in the baseline, as the production of GHG should be similar, with only the % Destroyed differing between the scenarios.

% Destroyed$_p$: It is the amount of GHG emissions that is actually captured and destroyed by new or improved GHG destruction device introduced by the project, taking into account the efficiency of GHG destruction of this device.

After the implementation of a new equipment or technology, the GHG emissions associated with this new equipment will be calculated using Equation 3.

As in the baseline calculations, the only parameter expected to fluctuate along time is the quantity of industrial product produced (QP). The QP of baseline and project scenario are, by in most cases the same, since the new project improvement should not change the production line. The parameters emission factor and % destroye din the project scenario are expected to remain constant during the project .

The emissions factor will be calculated as the GHG emission per tonne or unit of product, multiplied by the GWP of the respectively GHG. The GWP values used to calculate it will be based on the IPCC values.

D.8. Description of how the baseline methodology addresses any potential leakage of the project activity:

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According to the UNFCC's CDM glossary, leakage is defined as: "…the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity". The approach used here is to estimate the amount of leakage in order to subtract it from the emissions reductions calculated for the project activity.
Leakage is calculated as the difference in the consumption of input materials or energy used for the production lines of the project and baseline scenarios, multiplied by the emission factors associated with these materials, energy or fossil fuels. To illustrate the leakage calculation, the example of the use of electricity in a production process is given (see below in *section D.9*).

Another possible source of leakage applies to situations where the GHG collected is transformed into another GHG of lower global warming potential (GWP). In this case, it is necessary to calculate the amount of this secondary GHG that is produced as part of the project, and deduct its CO_2e from the emission reductions calculation. An example is the combustion of methane, producing CO_2. In this case, it is necessary to determine whether the material that gave rise to the methane in the first place is from a renewable source or not. If it is (as in the case of renewable forests, agricultural products, biodegradable urban waste), there is no need to deduct this amount of CO_2 from the emissions reduction calculation (as

in the case of the approved methodology AM0003). As this is most likely the case of all applications of this methodology, this subject will not be dealt in further detail in this document.

D.9. Elaborate and justify formulae/algorithms used to determine the emissions reductions from the project activity. Variables, fixed parameters and values have to be reported (e.g. fuel(s) used, fuel consumption rates):

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$$\textbf{Leakage} = (D_p - D_b) * EF \qquad \textbf{Equation 4}$$

Where:
D_p: Demand of input material or energy used in the project scenario (tonnes, units or MWh / year)
D_b: Demand of input material or energy used in the baseline scenario (tonnes, units or MWh / year)
EF: Emission factor of input material or energy (CO_2e/tonne, unit or MWh)

The Emissions Factor to be used will depend on the factors, which are identified as causing leakage, and will need to be referenced to internationally accepted data sources or from previously validated CDM projects. The appropriateness of the emissions factor used will need to be checked by the OE.

Example:

The leakage source of a carbonization improvement is the increase in electricity demand to pump the GHG from kilns to the destruction process. If the electricity comes from the grid or any other place outside the project boundary, it is considered Leakage. Otherwise it is defined as a direct project emission.

$$\textbf{Leakage} = (D_p - D_b) * EF_E$$

Where:
D_p: total amount of electricity used from grid in the project scenario (MWh)
D_b: total amount of electricity used from grid in the baseline scenario (MWh)
EF_E: total weighted average emission factor for the appropriate grid or plant (tonne CO_2e /MWh)

SECTION E. Data sources and assumptions:

E.1. Describe parameters and or assumptions (including emission factors and activity levels):

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The parameters and assumptions to determine the baseline scenario and project activity are listed below:

1) Determination of baseline scenario and addtionality was based on the following assumptions:

- Information on acceptable IRRs or discount rates for comparable investments with a similar risk profile in the relevant sector and country. Data source: various business statistics, expert judgment.
- Conservative calculation of IRR as explained above. To be checked by Designated Operational Entity (DOE).
- The level of production activity will be the same in the project and baseline scenarios. The installation of a device to destroy GHG emissions will not change the level of production activity, thus, the production are the same in both scenarios.
- The production efficiency may be different for the baseline and project scenarios. It will just be considered that if the project scenario is more efficient than the baseline, it will need a smaller number of units, or less raw material to produce the same amount of product as in the baseline. This will be incorporated in the investment analysis, considering the price of installations, as well as maintenance and operation costs in each scenario.

The results of this comparative analysis between possible scenarios should be evaluated in the context of sector trends, and incorporating the effects of any legislation and government policies that may affect this trend. This can be done by analyzing the policies (subsidies, laws, economic trends), as well as the behavior of companies involved in the same production sector in the region where the project will be implemented.

2) After determining the baseline scenario and additionality, the next step is to calculate the emissions of the baseline scenario and project activity. These are based on the following parameters and assumptions:

- The emissions will be calculated considering the same production in both scenarios.
- Emission factor, conversion factors or default data used for this analysis needs to be gathered from scientific publications, specialized institutions and consultants, the IPCC, or any other recognized sources, or from validated/documented data gathered by the project company. Full

references must be given for the sources of data used. These will need to be checked by Designated Operational Entity (DOE).

- The input demand can vary between the project and BAU scenarios. If this variation is significant, measurable, and reasonably attributable to the project activity and that results in an increase in the emissions it must be included as project emissions (if it is inside the boundary and under the control of the project proponent) or leakage (if it is outside the boundary and is not under the control of the project proponent. See section D.8 and D.9 for more details on leakage definition and calculation).

E.2. List of data used indicating sources (e.g. official statistics, expert judgement, proprietary data, IPCC, commercial and scientific literature) and precise references and justify the appropriateness of the choice of such data:

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This is a generic methodology applicable to a wide range of activities. The exact type and source of data needed will vary from project to project, but the table below specifies the type of data that will be required for the calculation of emissions for projects using this methodology.

The table below provides examples based on the case study of a project to reduce methane emissions during a charcoal manufacturing process.

Table 1: Data necessary to apply this methodology, including when the data is used.

ID n°	Data	Unit	When is used	Source
1	List of plausible scenarios	-	Baseline and additionality definition	To be elaborated by the project proponent for the PDD
2	Baseline IRR	%	Baseline and additionality definition	To be elaborated by the project proponent for the PDD
3	Project IRR without CERs revenues	%	Baseline and additionality definition	To be elaborated by the project proponent for the PDD
4	Project IRR with CERs revenues	%	Baseline and additionality definition	To be elaborated by the project proponent for the PDD
5	Discount rate	%	Baseline and additionality definition	To be indicated by the project proponent and checked by DOE
6	Baseline (or project, both are the same) Production level	Tonnes or units / year	Baseline and project emission calculation	Project proponent data
7	Product emission factor in baseline	Tonne CO_2e / tonne or unit produced	Baseline emission calculation	Scientific publications, specialized institutions and consultants, the IPCC, or any other recognized sources, or from validated/documented data gathered by the project company. To be checked by DOE. For example, in the case of the carbonization, it is 0,054 tCH_4/t charcoal produced (source:USEPA, 1995)
8	% GHG Destroyed in Baseline	%	Baseline emission calculation	Equipment manufacturer, Scientific publications, or any other recognized sources. To be checked by DOE.
9	Product emission factor in project scenario	Tonne CO_2e / tonne or unit produced	Project emission calculation	Scientific publications, specialized institutions and consultants, the IPCC, or any other recognized sources, or from validated/documented data gathered by the project company. To be checked by DOE.
10	% GHG Destroyed in project scenario	%	Project emission calculation	Equipment manufacturer, Scientific publications, or any other recognized sources. To be checked by DOE.
11	Input material or energy demand in baseline	Tonnes, units or MWh / year	Leakage calculation	Project proponent data
12	Input material or energy demand in project scenario	Tonnes, units or MWh / year	Leakage calculation	Project proponent data
13	Input material or energy emission factor	Tonne CO_2e / tonne, unit or MWh demanded	Leakage calculation	Scientific publications, specialized institutions and consultants, the IPCC, or any other recognized sources, or from validated/documented data gathered by the project company. To be checked by DOE.
14	Global Warming Potential Factor (GWP)	Tonne CO_2e / tonne of GHG	Emission factor conversion	IPCC

E.3. Vintage of data (e.g. relative to starting date of the project activity):

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The project should aim at using the most recent data sources available at the time of construction of the baseline.

E.4. Spatial level of data (local, regional, national):

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Table 2: Spatial level of data necessary to apply this methodology.

ID n°	Data	Spatial Level
1	List of plausible scenarios	Local
2	Baseline IRR	Local
3	Project IRR without CERs revenues	Local
4	Project IRR with CERs revenues	Local
5	Discount rate	National or local
6	Baseline (or project, both are the same) Production	Local
7	Product emission factor in baseline	Related to the technology, not location .
8	% Destroyed in Baseline	Related to the technology, not location .
9	Product emission factor in project scenario	Related to the technology, not location.
10	% Destroyed in project scenario	Related to the technology, not location.
11	Input material or energy demand in baseline	Local
12	Input material or energy demand in project scenario	Local
13	Input material or energy emis sion factor	Related to the technology, not location.
14	Global Warming Potential Factor (GWP)	International

SECTION F. Assessment of uncertainties (sensitivity to key factors and assumptions):

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The application of the methodology described in the "Draft consolidated tools for demonstration of additionality" released on the Eleventh Meeting of the CDM Meth Panel can lead to an erroneous baseline scenario in the following situations:

- The set of plausible alternatives is incomplete. A careful analysis of possible and plausible alternatives and confirmation by a DOE of the validity of the analysis and the conclusions drawn from it is imperative in order to mitigate risks and to ensure credibility of the result.
- The financial analysis is not conservative. The DOE must carefully control and check all assumptions used in order to ensure a conservative result.

With relation to the quantification of emission reductions, there are two sources of uncertainty. The first one relates to the quality of data used. In this regard, the use of quality control and management systems, such as ISO 9000 and ISO 14000, would help to ensure that data used for the quantification of emissions and emission reductions are consistent and of appropriate quality.

The second source of uncertainty relates to the quality of emission factors collected from literature. The literature source, the reliability of the data, and the appropriateness to the project's circumstances must be checked by DOE.

SECTION G. Explanation of how the baseline methodology allows for the development of baselines in a transparent and conservative manner:

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The proposed baseline methodology is transparent and conservative because:

- It uses the conventional understanding of why a proposed course of action is not economically attractive.
- It can be applied in a transparent manner as it relies on conventional financial analysis that can be checked by an auditor to ensure completeness, correctness, plausibility and conservative assumptions (as defined above).
- It can be applied in a conservative manner provided the conditions for its use, as described above, are followed.

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