



**CLEAN DEVELOPMENT MECHANISM**

**PROPOSED NEW METHODOLOGY: BASELINE (CDM-NMB)**

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**SECTION A. Identification of methodology****A.1. Proposed methodology title:**

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NMB00XX: 'Baseline methodology for technological improvements in industry'

**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, 6-Construction, 7-Transport, 8-Mining/mineral production, 9-Metal Production, 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 technological improvements in industrial or manufacturing processes lead to the reduction in the level of GHG emissions per unit of industrial output. It follows the process outlined in the IPCC Guidelines for National Greenhouse Gas Inventories (1996), Volume 3 (Reference Manual), Chapter 2 (Industrial Processes). For example, the methodology is applicable to cement factories that introduce a new technology that reduces the amount of clinker needed to produce cement, thus reducing associated GHG emissions. It has to be noted that, if the proposed project activity leads to GHG emission reductions due to less electricity consumption from a grid, this will have to be calculated according to a suitable methodology.

**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 improvements of industrial or manufacturing activities, 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 the introduction of a new methodology to grind clinker in the cement production process (thus reducing its use and associated CO<sub>2</sub> emissions), 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, technological improvements could lead to a reduction in the amount of GHGs generated by these activities, reducing the carbon emissions per unit of industrial output. This methodology focuses on companies that are planning the introduction of new technologies that lead to the reduction of GHG emissions during industrial or manufacturing processes. Financial reasons or other barriers have traditionally prevented the use of such equipment or technology. For example, this methodology could be used by cement production companies using carbon finance to introduce new technologies to improve clinker production efficiency, reducing the amount of clinker needed for the production of cement and consequently the emissions associated with cement production. The methodology is applicable to a wide range of activities, including cement production, chemical production, or any other industrial or manufacturing project involving the reduction of GHG emissions previously associated with the production process. The elements of determination of additionality for this new baseline methodology were based on the approved additionality methodology published by the CDM Methodology Panel.

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. The methodology should use the option 2 related to investment analysis. 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 new clinker production equipment in cement factories) 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 be 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 *section D.1*).

<b>D.5. <u>Project boundary</u> (gases and sources included, physical delineation):</b>
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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. In the case that the technological improvement results in reduced electricity consumption from electricity grid, the boundaries will be extended to reflect the boundaries considered in the relevant methodology used to calculate the CEF of the grid.

The following GHG sources are typically inside the monitoring boundaries:

- Direct emissions: related to the production process (e.g., raw material transformation such as clinker and cement production 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<sub>2</sub>e that would be emitted during the production of the same amount of product using the different technologies ( $E_p$ ). After that, discount any leakage of emissions measurable and reasonable attributable to the project.

$$ER = E_b - E_p - L$$

**Equation 1**

Where:

**ER:** Emission Reduction (tonnes CO<sub>2</sub>e)

**$E_b$ :** Emissions in the baseline scenario (tonnes CO<sub>2</sub>e)

**$E_p$ :** Emissions in the project scenario (tonnes CO<sub>2</sub>e)

**L :** Leakage (tonnes CO<sub>2</sub>e)

Equations for  $E_b$  are, as follows:

$$E_b = (QP_b * EF_b) + (QF_b * EFF_b) \quad \text{Equation 2}$$

Where:

**$E_b$ :** Emissions in the baseline scenario (tonnes CO<sub>2</sub>e), for more details, see *section D.7*.

**$QP_b$ :** Amount of product produced in the baseline scenario (tonnes or unit). As in some cases the new technology may increase production efficiency and the level of production,  $QP_b$  should by definition be the same as in the project.

**$EF_b$ :** Emissions Factor of the baseline scenario (tonnes CO<sub>2</sub>e/tonnes or unit). This will be higher than in the project scenario.

**$QF_b$ :** Amount of fuel used in baseline scenario (volume or energy unit).

**$EFF_b$ :** IPCC emission factor for fuel used in baseline scenario (tCO<sub>2</sub>/ volume or energy unit).

While the parameter QP may fluctuate from year-to-year, the emission factor EF is expected to remain constant throughout the project lifetime. EF will be calculated as the GHG emission per tonne or unit of





product, times the GWP of the respective GHG. The GWP values used to calculate it will be based on the IPCC values.

For example, in the case of cement production, most process emissions come from the transformation of  $\text{CaCO}_3$  into lime ( $\text{CaO}$ ) which is added to other components to form clinker. According to the IPCC (1996), this process leads in average to the emission of 0.571 tCO<sub>2</sub> per tonne of clinker produced. In addition, this process requires heat that, if coming from fuel oil, would increase overall emissions to 0.782 tCO<sub>2</sub> per tonne of clinker produced. In general, cement production uses around 0.8 tonnes of clinker per tonne of cement produced, consequently leading to the emissions of 0.626 tCO<sub>2</sub>/t cement produced. One way of reducing the amount of emissions in the cement production process is to grind clinker to a finer grade, so that a smaller amount of clinker is used per tonne of cement produced. If this was reduced by 10 %, the new carbon emissions factor of this cement would be 0.563 tCO<sub>2</sub>/t cement 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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$$E_p = (QP_p * EF_p) + (QF_p * EFF_p) \quad \text{Equation 3}$$

Where:

**E<sub>p</sub>**: Emissions in project scenario (tonnes CO<sub>2</sub>e)

**QP<sub>p</sub>**: Amount of produced product in project scenario (tonnes or unit). By definition, this should be the same as in the baseline. Use QP<sub>p</sub> for calculations of both project and baseline emissions.

**EF<sub>p</sub>**: Emissions Factor in the project scenario (tonnes CO<sub>2</sub>e/tonnes or unit). In most situations, this will be lower than in the baseline, due to the technological innovations introduced in the production process.

**QF<sub>p</sub>**: Amount of fuel used in project scenario (volume or energy unit).

**EFF<sub>p</sub>**: IPCC emission factor for fuel used in project scenario (tCO<sub>2</sub>/ volume or energy unit).

After the implementation of a new equipment or technology, the GHG emissions associated with this new equipment will be calculated using Equation 3. The emissions factor will be calculated as the GHG emission per tonne or unit of product, multiplied by the GWP of the respective 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..

**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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$$\text{Leakage} = (D_p - D_b) * EF$$

**Equation 4**

Where:

**D<sub>p</sub>**: Demand of input material used in the project scenario (tonnes, units / year)**D<sub>b</sub>**: Demand of input material used in the baseline scenario (tonnes, units / year)**EF**: Emission factor of input material (CO<sub>2</sub>e/tonne, unit)

The Emissions Factor to be used will depend on the factors that 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.

**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 additionality 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 new technology to reduce 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. If production efficiency and level increase in the project scenario, this new production level will be used for the baseline scenario.
- 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 that reduces CO<sub>2</sub> emissions due to improved clinker and cement production 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 <sub>2</sub> e / 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 clinker production, it is 0.782 tCH <sub>4</sub> /t clinker produced (source:IPCC, 1996)
8	Product emission factor in project scenario	Tonne CO <sub>2</sub> e / 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	Input material in baseline	Tonnes, units / year	Leakage calculation	Project proponent data
11	Input material in project scenario	Tonnes, units / year	Leakage calculation	Project proponent data
12	Input material emission factor	Tonne CO <sub>2</sub> e / tonne, unit 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.
13	Global Warming Potential Factor (GWP)	Tonne CO <sub>2</sub> e / 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	Product emission factor in project scenario	Related to the technology, not location.
9	Input material or energy demand in baseline	Local
10	Input material or energy demand in project scenario	Local
11	Input material or energy emission factor	Related to the technology, not location.
12	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 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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