CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: BASELINE (CDM-NMB)
Version 01 - in effect as of: 1 July 2004

CONTENTS

SECTION A. Identification of methodology

A.1. Proposed methodology title:

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Activities for the promotion of electricity efficiency, through the replacement of unitary equipment, by parties that are not the energy consumers.

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

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The UNFCCC CDM web site appears not to provide a list of categories of project activities, from which one might choose that applicable for this proposed new methodology. If one were to use the "Sectoral Scope" classification as applied to Designated Operational Entities, a possible category would be: (3) Energy demand.

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

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The methodology is intended for programmes that encourage the adoption of energy-efficient equipment such as lamps, ballasts, refrigerators, motors, fans, air conditioners, other appliances, etc. at many sites. These technologies may replace existing equipment or be installed at new sites. This methodology is applicable to programmes that promote the replacement of inefficient equipment in operation by high-efficiency new equipment meeting the same end-use.

In order to ensure that energy savings and emissions reductions are real, this methodology requires that the inefficient equipment be removed and disabled from further use.

The methodology would be applicable to the promotion of energy efficiency realized by organizations that are not the end users of energy. The methodology is applicable to electricity efficiency, where the emissions reductions correspond to power plants supplying the grid connected to the electricity users where the energy efficiency measures would be applied.

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

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The methodology is straightforward insofar as it is based on estimates of energy consumption, power plant emissions factor and transmission and distribution losses. Moreover, the emissions factor for power plant emissions is determined by an approved consolidated methodology (ACM0002).

SECTION B. Overall summary description:

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The methodology determines baseline energy use as the electricity consumption of the end-use equipment subject to energy efficiency improvement. This end-use specific energy consumption may be determined using one of the standard procedures commonly used in the end-use energy analysis and in evaluating energy efficiency programs[1]. For instance, for equipment with fixed power input during operation, energy consumption is given by the product of the number of equipment of a given power input (kW) and the

[1] See, e.g., G.S. Dutt and M.F. Fels, "Keeping score in electricity conservation programs" in *Electricity: Efficient End-Use and New Generation Technologies, and their Planning Implications*, (T.B. Johansson, B. Bodlund, and R.H. Williams, Eds.), Lund University Press, 1989, p. 353-388.

annual operating hours. Other procedures are applicable to unitary equipment with intermittent operation (e.g. refrigerators) and for equipment whose consumption depends on outside temperature (e.g. air conditioners). Alternative procedures for estimating baseline energy consumption of end use equipment are given in section D.5.

Emissions reductions are related to energy savings, emissions factor of electricity generation, as well as transmission and distribution losses from generation to the point of use.

Power plant emissions factor is determined using a previously approved methodology:

- Approved consolidated baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Transmission and distribution losses need to be obtained from a reliable data source, such as the electric companies involved.

This new methodology incorporates the following procedures:

- Consolidated tool for the demonstration and assessment of additionality (published as Annex 1 to EB 16 Report, Dec. 2004).

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:

? Existing actual or historical emissions, as applicable;

? 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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The approach chosen is applicable since the project activity may involve different technologies and combinations of technologies so that no single technology can be used as a reference, as required in the second option. For the same reason, each project within the proposed set of applicable project activities is likely to be unique and cannot be readily identified with "similar" project activities elsewhere. The first option "existing actual or historical emissions" involves data that are uniquely determined.

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 first step in determining the baseline scenario is to analyse all options available to project participants. These include the business-as-usual case, the project scenario, and any other scenarios that might be applicable. Since the project involves energy efficiency, the available scenarios might be:

- Continue with the use of inefficient equipment until the end of their useful life
- Replace inefficient equipment immediately with new equipment that meets minimum efficiency standards
- Replace inefficient equipment immediately with new equipment that meets an efficiency level higher than minimum efficiency requirements
- Other options available

We should mention that the baseline scenario will need to be selected from the available options for each specific project in its respective PDD, using by the additionality tests described in section D.3. Choice of baseline and project alternatives would be affected by legal requirements, economic and financial considerations, and barriers that may favour one or other alternative.

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

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The proposed methodology is largely based on two already approved methodologies and the approved Consolidated tool for the demonstration and assessment of additionality:

- Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. Appendix B 1 of the simplified modalities and procedures for small-scale CDM project activities (Version 30 June 2004). The sections specially relevant is one related to demand-side energy efficiency improvements:
  - II.C. Demand-side energy efficiency programmes for specific technologies
- ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"
- Consolidated tool for the demonstration and assessment of additionality

The elements added to these established procedures, within this proposed new methodology, are minimal and straightforward.

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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The methodology proposed here recommends the use of the Consolidated tool for the demonstration and assessment of additionality (Annex 1 to the report of the 16th meeting of the CDM Executive Board, Dec. 2004).

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

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The type of activity involves the promote electricity efficiency. If the measures being promoted are mandatory by national and/or sectoral policies the proposed project activity may not be additional. Similarly if there are other pre-existing incentives to promote project activities similar to those proposed, again the

activity would not be additional. All these issues are taken into consideration in the Consolidated tool for the determination and assessment of additionality mentioned in section D.3. As a part of that determination, the project proponent is required to:

- Analyse legal requirements and obligations with respect to the project activities.
- Analyse national incentives to promote similar project activities.
- Analyse sectoral policies to promote similar project activities.

Note, however, that there is a contradiction in the requirements implied in the Marrakesh Accords and specified in the Consolidated tool for the demonstration of additionality on the one hand, and Annex 3 of the CDM Executive Board 16^{th} Meeting Report, on the other hand.

This Annex defines a type of national and/or sectoral policy:

> *Type E-: National and/or sectoral policies or regulations that give positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs).*

For this type, Annex 3 further states:

> *"Type E-" national and/or sectoral policies or regulations that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001)* ***may not be taken into account in developing a baseline scenario*** *(i.e. the baseline scenario should refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place).* (emphasis added)

In the present context, this suggests that, even if there were other measures to promote energy efficiency, a given project activity can set a baseline at a lower level, assuming that such measures did not indeed exist.

Given this contradiction, this methodology proposes the following:

1. Await further clarification from the CDM EB, and meanwhile:
2. Consider existing policies as setting the baseline. This is also the conservative approach.

Thus we will consider that existing minimum efficiency standards and other efficiency improvements through past national and /or sectoral policies to promote energy efficiency do, indeed, establish the baseline for the proposed project activity.

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

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The projects covered by this methodology may involve energy efficiency measures installed in a large diversity of places, all connected to an electric power grid. The project boundary should include the equipment where electricity is consumed, and whose users are participants in the project.

Given that the emissions affected are at power stations that are part of an interconnected power grid that supplies electricity to the users, additional project boundaries made up of the power grid must be taken into consideration. A country can have more than one interconnected power grid and it is possible that the users affected by the energy efficiency improvement are part of different power grids. Thus, each such power grid should be included in the additional frontiers of the project.

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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The baseline scenario is that existing equipment will continue to be used. The energy displaced is electricity so the energy baseline is calculated as follows:

Baseline emissions *BE* (expressed in tonne CO_2equivalent per year, tonne CO_2e/yr) are given by:

$$BE = \sum_k \left(\sum_i \left(n_i p_i o_i \right) \right)_k \cdot EF_{elec\ gen,\ k} / (1 - TDL_k)$$

where

i = type of technology that is proposed to be replaced (e.g. 40 W incandescent bulb, 5 hp motor

S_i = the sum over the group of "i" devices replaced (e.g. 40 W incandescent bulb, 5hp motor), for which the replacement is operating during the year, implemented as part of the project.

n_i = the number of devices of the group of "i" devices replaced (e.g. 40 W incandescent bulb, 5hp motor) for which the replacement is operating during the year.

p_i = the power input of the devices of the group of "i" devices replaced (e.g. 40 W, 5 hp). taking into account the variation from the efficiency throughout the time, the calculation of the consumed energy varies based on the type of technology. In the case of a retrofit programme, "power" is the weighted average of the devices replaced.

o_i = the average annual operating hours of the devices of the group of "i" devices replaced.

k = the number of interconnected systems that supply of energy the geographic area of the base line of the project activity (MWh)

$EF_{elec\ gen,\ k}$ = the emissions factor for power generation in grid k (e.g. kg CO_2e/MWh)

TDL_k = the transmission and distribution losses for the grid k (fraction)

Electricity purchases from each grid increases the requirement for generation at power plants supplying the grid by an amount that exceeds the magnitude of electricity consumed because of transmission and distribution losses (TDL). Values of TDL are determined for each grid involved in the project activity and summed to obtain total baseline emissions.

Note that the emissions factor for power generation $EF_{elec\ gen,\ k}$ is determined using the approved consolidated methodology ACM0002.

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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The project scenario corresponds to the case in which efficient equipment are in use, so that electricity consumption and emissions are lower than the values in the baseline scenario.

The procedure for determining project emissions is very similar to that used for determining baseline emissions. Project emissions *E* (tonne CO_2e/yr) are given by:

Project emissions *E* (tonne CO_2e/yr) are given by:

$$E = \sum_k EP_k \cdot EF_{elec\ gen,\ k} / (1 - TDL_k)$$

where

EP_k	is the total electricity purchased by all participants from the grid k, in the project scenario (e.g. MWh)
$EF_{elec\ gen,\ k}$	is the emissions factor for power generation in grid k (e.g. kg CO_2e/MWh)
TDL_k	are the transmission and distribution losses for the grid k (fraction)

Electricity purchases from each grid increases the requirement for generation at power plants supplying the grid by an amount that exceeds the magnitude of electricity consumed because of transmission and distribution losses (TDL). Values of TDL are determined for each grid involved in the project activity and summed to obtain total emissions.

For equipment with a fixed power input, total electricity purchase is given by the product of equipment quantity, power input, and no. of operating hours per year. Project emissions are given by:

$$E = \sum_k \left(\sum_i (n_i pn_i o_i) \right)_k \cdot EF_{elec\ gen,\ k} / (1 - TDL_k)$$

Where the variables have the same meaning as in section D.6, except for:

pn_i = the power input of the efficient devices of group "i" (e.g. 18 W compact fluorescent lamp, high efficiency 5 hp motor), taking into account the variation of efficiency over time; the calculation of energy consumption varies based on the type of technology. In the case of a retrofit programme, "power input" is the weighted average of the new devices.

Note that the emissions factor for power generation $EF_{elec\ gen,\ k}$ is determined using the approved consolidated methodology ACM0002.

Note that the only difference with respect to baseline emissions is in *electricity use*, since the emissions factor for power generation as well as transmission and distribution losses are the same as in the baseline scenario.

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

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Leaks could be present in case the equipment installed in the project came from other locations, where the efficient equipment removed is replaced by inefficient ones. However, this methodology is limited to the case where all equipment installed in the project activity is new, and where the inefficient equipment removed is removed and disabled from further operation, so that the project activity does not increase the energy consumption elsewhere and therefore does not increase emissions outside the project. Thus, we could state definitely that there are no leaks.

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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The emissions reduction ER by the project activity is given by the difference between baseline and project emissions, since there is no leakage to be considered:

$$ER = BE - E$$

expressed in tonnes of CO_2 equivalent per year (tCO_2e/yr).

The values of BE and E are estimated as explained in the previous sections.

Emissions reduction would accrue for the project life. Since the project involves replacement of existing equipment, project life is the remaining life (RL, years) of the equipment that would be replaced. Since the remaining life may be difficult to determine, a conservative, low, project life should be assumed, unless (a) it is possible to ascertain equipment age with precision, and (b) studies exist that relate the remaining life to equipment age with reasonable accuracy. In most cases, the life of new equipment (L) will be longer than the remaining life of the equipment to be replaced. Thus, it is the value of RL, and not L, that will limit project life.

SECTION E. Data sources and assumptions:

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

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The main emissions factor is that for grid-connected electricity generation and needs to be estimated using the procedures outlined in ACM0002. This factor, in turn, depends on the emissions factor for the combustion of the fuels used to generate electricity, the efficiency of thermal power plants, and the contribution of these plants to the power grid, both in operation and in construction.

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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The CO_2 emission factors for fuel combustion need be determined from official, national data sources wherever possible. Methane and nitrous oxide emissions factors for combustion may be based on standard values reported by IPCC.

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

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We do not expect changes in the emissions factors for the fuels. However, there may be changes in the emissions factor for electricity generation due to changes in the contribution of different types of power plants to meet the electricity demand and because of differences in the power plants built over the years. The procedures for updating the emissions factor are explained in ACM0002.

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

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The type of project contemplated in this methodology may cover a region or an entire country. The emissions factor for grid-connected power generation will depend on the particular grid or grids involved in the project. Thus, an emissions factor should be determined for each grid involved in project participants

where energy savings are to be realized. This emissions factor should be used for those participants. Similarly, transmission and distribution losses are likely to be different for different grids, and the appropriate values used in the calculations.

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

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The most important components of emissions depend on electricity consumption by the participants prior to and following project implementation. The accuracy will therefore depend on the accuracy with which the energy consumption is determined. These are discussed in the monitoring methodology.

The emissions and emissions reduction also depend on the emission factor of grid-connected power generation. The methodology proposed here to determine this emissions factor is the approved consolidated methodology ACM0002. This ACM includes multiple options for determining the emissions factor for grid-connected electricity. The result is likely to be sensitive to the option chosen.

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

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All equations that make up the determination of baseline emissions are straightforward and transparent.

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