Draft revision to the approved consolidated baseline and monitoring methodology ACM0013

"Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology"

I. SOURCE AND APPLICABILITY

Sources

This consolidated baseline and monitoring methodology is based on elements from the following proposed new methodologies:

- NM0215: "Baseline and Monitoring Methodology for Grid Connected High-efficiency Coal-fired Electricity Generation in Countries Where Different Power Expansion Plans are Formulated for Broadly Different Power Technologies and Where These Plans are Restrictive" prepared by Huaneng Power International, Inc., Global Climate Change Institute of the Tsinghua University and CDM Office of CWEME, China;
- NM0217: "Grid-connected supercritical coal-fired power generation" submitted by NTPC Ltd, India, whose baseline study and project design document were prepared by Perspectives Climate Change GmbH, Hamburg, Germany.

This methodology also refers to the latest approved versions of the following tools:

- "Tool to calculate the emission factor for an electricity system";
- "Tool for the demonstration and assessment of additionality".

For more information regarding the proposed new methodologies and the tools and their consideration by the CDM Executive Board (the Board) please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

Selected approach from paragraph 48 of the CDM modalities and procedures

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

and

"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".

Definitions

For the purpose of this methodology the following definitions apply:

Power plant. A *power plant* is a facility for the generation of electric power from thermal energy produced by the combustion of a fuel. In case where several power units have been installed at one site, each unit should be considered as a power plant.

Cogeneration plant. For the purpose of this methodology, a *cogeneration plant* is a plant that: (i) Simultaneously generates heat and power through combustion of fuels, and (ii) Provides useful thermal energy to end-users which use the heat for other purposes than power generation (e.g. industrial users, district heating, etc).

Fossil fuel category. The *fossil fuel category* refers to the following three categories of fossil fuels in Table 1.1 in Volume 2: Energy, Chapter 1, of the 2006 IPCC Guidelines: (i) LIQUID fuels (Crude oil and petroleum products), (ii) SOLID fuels (Coal and coal products), and (iii) GAS (Natural Gas).

Fossil fuel type. The *fossil fuel type* refers to the fuel types as defined in Table 1.1 in Volume 2: Energy, Chapter 1, of the 2006 IPCC Guidelines.

Reference year v. The *reference year v* is the most recent year prior to the date of submission of the PDD for validation of the project activity, for which the required data from the power plants to be included in the sample group for the emissions benchmark (as per guidance in the baseline emissions section hereunder) is available. In any case, the *reference year v* cannot begin more than 2 years prior to the date of submission of the PDD for validation of the project activity.

Applicability

The methodology is applicable under the following conditions:

- The project activity is the construction and operation of a new fossil fuel fired grid-connected electricity generation plant that uses a more efficient power generation technology[1] than what would otherwise be used with the given fossil fuel category;
- One fossil fuel category should be used as main fuel in the project power plant. In addition to this main fossil fuel category, small amounts of other fossil fuel categories can be used for start-up or auxiliary purposes[2], but they shall not comprise more than 3% of the total fuel used annually on an energy basis;
- The project activity does not include the construction and operation of a co-generation power plant;
- Data on fuel consumption and electricity generation of recently constructed power plants are available;
- The identified baseline fuel category is used in more than 50% of total generation by utilities in the geographical area within the host country, as defined later in the methodology, or in the entire host country.[3] To demonstrate this applicability condition data from the latest three years shall be used. Maximum value of same fossil fuel generation estimated for three years should be greater than 50%.

This methodology is only applicable to new electricity generation plants. For project activities involving retrofit of existing facilities with the installation of highly efficient technologies, project participants are encouraged to submit new methodologies. For project activities involving a switch to a less GHG intensive fossil fuel in existing power plants, project participants may use approved methodology ACM0011

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[1] A possible project activity could be, e.g. the construction and operation of a supercritical coal fired power plant.

[2] The DOE should verify that start-up or auxiliary fuels are only used during: the start-up periods of the power plant, or short periods of interruption in the supply of the main fuel due to technical or operational problems. This is to ensure that it is not a common practice, during the normal operation of the power plant, to fire or co-fire these categories of fuel as a multi-fuel power plant.

[3] For the purpose of demonstrating compliance with the applicability condition the geographical area has to be limited by the physical borders of the host country and cannot be extended to neighboring non-Annex I countries, even if such an extended geographical area is used for the calculation of a benchmark emission factor.

"Consolidated baseline methodology for fuel switching from coal and/or petroleum fuels to natural gas in existing power plants for electricity generation". For project activities involving construction and operation of a new power plant with less GHG intensive fossil fuel, project participants may use other approved methodologies.

II. BASELINE METHODOLOGY PROCEDURE

Identification of the baseline scenario

Project participants shall use the following steps to identify the baseline scenario:

Step 1: Identify plausible baseline scenarios

The identification of alternative baseline scenarios should include all possible realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity (including the proposed project activity without CDM benefits), i.e. all type of power plants that could be constructed as alternative to the project activity within the project boundary, as defined in the section "Project boundary" and in Step 2 of the section "Baseline emissions" below.

Alternatives to be analysed should include, *inter alia*:

- The project activity not implemented as a CDM project;
- The construction of one or several other power plants instead of the proposed project activity, including:
    - Power generation using the same fossil fuel category as in the project activity, but technologies other than that used in the project activity;
    - Power generation using fossil fuel categories other than that used in the project activity;
    - Other power generation technologies, such as renewable power generation.
- Import of electricity from connected grids, including the possibility of new interconnections.

In establishing these scenarios, project participants should clearly identify and document which category and type of fuel would be used in each alternative, taking into account the requirements of the technology.

These alternatives need not consist solely of power plants of the same capacity, load factor and operational characteristics (i.e. several smaller plants, or the share of a larger plant may be a reasonable alternative to the project activity), however they should deliver similar services (e.g. peak vs. baseload power). Note further that the baseline scenario candidates identified may not be available to project participants, but could be available to other stakeholders within the grid boundary (e.g. other companies investing in power capacity expansions). Ensure that all relevant power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans) are included as plausible alternatives. A clear description of each baseline scenario alternative, including information on the technology, such as the efficiency and technical lifetime, shall be provided in the CDM-PDD.

The project participant shall exclude baseline scenarios that are not in compliance with all applicable legal and regulatory requirements.

If one or more scenarios are excluded, appropriate explanations and documentation to support the exclusion of these scenarios shall be provided.

Step 2: Identify the economically most attractive baseline scenario alternative

The economically most attractive baseline scenario alternative is identified using investment analysis. The levelized cost of electricity production in $/kWh should be used as financial indicator for investment analysis. Calculate the suitable financial indicator for all alternatives remaining after Step 1. Include all relevant costs (including, for example, the investment cost, fuel costs and operation and maintenance costs), and revenues (including subsidies/fiscal incentives,[4] ODA, etc. where applicable), and, as appropriate, non-market cost and benefits in the case of public investors.

The investment analysis should be presented in a transparent manner and all the relevant assumptions should be provided in the CDM-PDD, so that a reader can reproduce the analysis and obtain the same results. Critical techno-economic parameters and assumptions (such as capital costs, fuel price projections, lifetimes, the load factor of the power plant and discount rate or cost of capital) should be clearly presented. Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial indicator, the risks of the alternatives can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents). Where assumptions, input data, and data sources for the investment analysis differ across the project activity and its alternatives, differences should be well substantiated.

The CDM-PDD submitted for validation shall present a clear comparison of the financial indicator for all scenario alternatives. The baseline scenario alternative that has the best indicator (i.e. the lowest levelized cost of electricity production) can be pre-selected as the most plausible baseline scenario.

A sensitivity analysis shall be performed for all alternatives, to confirm that the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions (e.g. fuel prices and the load factor). The investment analysis provides a valid argument in selecting the baseline scenario only if it consistently supports (for a realistic range of assumptions) the conclusion that the pre-selected baseline scenario is likely to remain the most economically and/or financially attractive.

If sensitivity analysis confirms the result, then select the most economically attractive alternative as the most plausible baseline scenario. In case the sensitivity analysis is not fully conclusive, select the baseline scenario alternative with the lowest emission rate among the alternatives that are the most financially and/or economically attractive.

If the type of power plant identified as the baseline scenario is different from the power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans), the project participants shall provide explanations to this apparent discrepancy between observations and what should be considered as rational economic behavior.

If the emission rate of the selected baseline scenario is clearly below that of the project activity (e.g. the baseline scenario is hydro, nuclear or biomass power), then the project activity should not be considered to yield emission reductions, and this methodology cannot be applied.

The methodology is only applicable if the most plausible baseline scenario is the construction of (a) new power plant(s) using the same fossil fuel category as used in the project activity. This means that if the most likely baseline scenario identified through the baseline identification procedure is the import of electricity or the construction of a new power plant(s) that (partly) use renewable energy sources, nuclear

[4] Note the guidance by EB 22 on national and/or sectoral policies and regulations.

sources or other categories of fossil fuels than the fossil fuel category fired in the project activity plant, then this methodology is not applicable.

Additionality

The latest version of the "Tool for the demonstration and assessment of additionality", agreed by the Board, should be applied to assess the additionality of the proposed project activity. Ensure consistency with the procedure to determine the most likely baseline scenario as provided above. In the case Option II (Investment comparison analysis) is applied in Sub-step 2b, it should be demonstrated that the baseline alternative is available to the project participant(s).

Project boundary

The spatial extent of the project boundary includes the power plant at the project site and all power plants considered for the calculation of the baseline CO_2 emission factor ($EF_{BL,CO2,y}$).

In the calculation of project emissions, only CO_2 emissions from fossil fuel combustion in the project plant are considered. In the calculation of baseline emissions, only CO_2 emissions from fossil fuel combustion in power plant(s) in the baseline are considered.

The greenhouse gases included in or excluded from the project boundary are shown in Table 1.

Table 1: Overview of emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Power generation in baseline	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activity	On-site fuel combustion in the project plant	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

Project emissions

The project activity is the on-site combustion of fossil fuels in the project plant to generate electricity. The CO_2 emissions from electricity generation in the project plant (PE_y) should be calculated as follows:

$$PE_y = \left[\sum_i FF_{i,y} \times NCV_{i,y} \right] \times EF_{FF,CO2} \quad \textbf{(1)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
$FF_{i,y}$	=	Quantity of fuel type *i* combusted in the project plant in year *y* (Mass or volume unit per year)
$NCV_{i,y}$	=	Weighted average net calorific value of fuel type *i* in year *y* (GJ per mass or volume unit)
i	=	Fossil fuel types used in the project plant in year *y*
$EF_{FF,CO2}$	=	CO_2 emission factor of the fossil fuel type used in the project and the baseline (tCO_2/GJ)

Baseline emissions

Baseline emissions are calculated by multiplying the electricity generated in the project plant from using fossil fuel types within the main fossil fuel category ($EG_{PJ,main\_FF,y}$)[5] with a baseline CO_2 emission factor ($EF_{BL,CO2}$), as follows:

$$BE_y = EG_{PJ,main\_FF,y} \times EF_{BL,CO2} \tag{2}$$

and

$$EG_{PJ,main\_FF,y} = EG_{PJ,y} \times \left[\frac{\sum_p \left(FC_{p,y} \times NCV_{p,y}\right)}{\sum_p \left(FC_{p,y} \times NCV_{p,y}\right) + \sum_q \left(FC_{q,y} \times NCV_{q,y}\right)} \right] \tag{3}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EG_{PJ,main\_FF,y}$	=	Net quantity of electricity generated in the project plant from using fossil fuel types within the main fossil fuel category in year *y* (MWh)
$EG_{PJ,y}$	=	Total net quantity of electricity generated in the project plant in year *y* (MWh)
$EF_{BL,CO2}$	=	Baseline emission factor (tCO_2/MWh)
$FC_{p,y}$	=	Quantity of fossil fuel type *p* consumed by the project plant in year *y* (Mass or volume unit)
$NCV_{p,y}$	=	Average net calorific value of the fossil fuel type *p* consumed by the project plant in year *y* (GJ/Mass or volume unit)
$FC_{q,y}$	=	Quantity of fossil fuel type *q* consumed by the project plant in year *y* (Mass or volume unit)
$NCV_{q,y}$	=	Average net calorific value of the fossil fuel type *q* consumed by the project plant in year *y* (GJ/Mass or volume unit)
p	=	Fossil fuel types that are used in the project plant and that belong to the main fossil fuel category
q	=	Fossil fuel types that are used in the project plant for auxiliary and start-up purposes)

$EF_{BL,CO2}$ will be determined using the lowest value between (i) the emission factor of the technology and fuel type that has been identified as the most likely baseline scenario, and (ii) a benchmark emission factor determined based on the performance of the top 15% power plants that use the same fuel category as the project plant and any technology available in the geographical area as defined in Step 2 below.

Consequently, project participants shall use for $EF_{BL,CO2}$ the lowest value among the following two options:

Option 1: The emission factor of the technology and fuel type identified as the most likely baseline scenario under “Identification of the baseline scenario” section above, and calculated as follows:

$$EF_{BL,CO2} = 3.6 \cdot \frac{MIN\left(EF_{FF,BL,CO2}; EF_{FF,CO2}\right)}{\eta_{BL}} \tag{4}$$

[5] This methodology allows to claim emission reductions from using fossil fuels more efficiently for power generation, but does not account for any emission reductions from using less carbon intensive fuels. Given that the CO_2 emission factor and amount of any start-up/auxiliary fuels may differ between the project and the baseline, the crediting of emission reductions is limited to the electricity generated from the main fossil fuel only.

Where:

$EF_{BL,CO2}$	=	Baseline emission factor (tCO_2/MWh)
$EF_{FF,BL,CO2}$	=	CO_2 emission factor of the fossil fuel type that has been identified as the most likely baseline scenario (tCO_2/GJ)
$EF_{FF,CO2}$	=	CO_2 emission factor of the fossil fuel type used in the project and the baseline (tCO_2/GJ)
η_{BL}	=	Energy efficiency of the power generation technology that has been identified as the most likely baseline scenario
3.6	=	Unit conversion factor from GJ to MWh

Option 2: The average emissions intensity of all power plants *j*, corresponding to the power plants whose performance is among the top 15 % of their category, using data from the reference year v, and taking into account autonomous technical improvement that that would have occurred between the investment decision on the power plants *j* and the investment decision on the project activity, as follows:

$$\cancel{EF_{BL,CO2}} = \frac{\sum_j FC_j \cdot NCV_j \cdot EF_{FF,CO2}}{\sum_j EG_j}$$

$$EF_{BL,CO2} = \frac{EF_{FF,CO2}}{\left(\eta_{avg,j} + \Delta\eta \cdot d\right)} \cdot 3.6 \tag{5}$$

with

$$\eta_{avg,j} = 3.6 \cdot \frac{\sum_j EG_{j,v}}{\sum_j FC_{j,v} \cdot NCV_{j,v}} \tag{6}$$

Where:

$EF_{BL,CO2}$	=	Baseline emission factor (tCO_2/MWh)
$EF_{FF,CO2}$	=	CO_2 emission factor of the fossil fuel type used in the project and the baseline (tCO_2/GJ)
$\eta_{avg,j}$	=	Weighted average efficiency of power plants *j*
$\Delta\eta$	=	Average annual efficiency improvement for newly constructed power plants would likely have occurred due to autonomous technical development in the time between the investment decisions made for the power plants *j* and the investment decision made for the proposed project activity (1 / year)
d	=	Data vintage, expressing the time difference between the start of commercial operation of the proposed project activity and the middle point in time within the four year period preceding the reference year *v* in which the power plants *j* started commercial operation (years)[6]
$EG_{j,v}$	=	Net electricity generated and delivered to the grid by power plant

[6] An example for the determination of this parameters is provided in the section on "data and parameters not monitored".

		j in reference year *v* (MWh)
$FC_{j,v}$	=	Amount of fuel consumed by power plant *j* in reference year *v* (Mass or volume unit)
$NCV_{j,v}$	=	Average net calorific value of the fossil fuel type consumed by power plant *j* in reference year *v* (GJ/Mass or volume unit)
j	=	The top 15% performing power plants (excluding cogeneration plants and including power plants registered as CDM project activities), as identified below, among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity

For determination of the top 15% performer power plants *j*, the following step-wise approach is used:

Step 1: Definition of similar plants to the project activity

The sample group of similar power plants should consist of all power plants (except for cogeneration power plants).

- That use the same fossil fuel category as the project activity. This should include power plants which use small amounts of fuels within another fossil fuel category than the main fuel for start-up or auxiliary purposes, but these other fuels shall not comprise more than 3% of the total fuel used annually by the sample power plant on an energy basis;
- That started commercial operation within the four year period preceding the reference year *v*~~have been constructed in the previous five years~~, where the last year of this 5 years period should be the reference year *v*;
- That have a comparable size to the project activity, defined as the range from 50% to 150% of the rated capacity of the project plant;
- That are operated in the same load category, i.e. at peak load (defined as a load factor of less than 3,000 hours per year) or base load (defined as a load factor of more than 3,000 hours per year) as the project activity; and
- That have operated (supplied electricity to the grid) in the reference year *v*.

Step 2: Definition of the geographical area

The geographical area to identify similar power plants should be chosen in a manner that the total number of power plants *N* in the sample group comprises at least 10 plants. As a default, the grid[7] to which the project plant will be connected should be used. If the number of similar plants, as defined in Step 1, within the grid boundary is less than 10, the geographical area should be extended to the country. If the number of similar plants is still less than 10, the geographical area should be extended by including all neighboring non-Annex I countries. If the number remains to be less than 10, all non-Annex I countries in the continent should be considered.

If the necessary data on power plants of the sample group in the relevant geographical area are not available, or if there are less than 10 similar power plants in all non-Annex I countries in the continent, then

[7] The grid boundary is defined as per the latest version of the "Tool to calculate the emission factor for an electricity system" approved by the Board.

data from power plants Annex I or OECD countries can be used instead for the remaining plants required to complete the sample group.

Step 3: Identification of the sample group

Identify all power plants *n* that are to be included in the sample group. Determine the total number *N* of all identified power plants that use the same fuel as the project plant and any technology available within the geographical area, as defined in Step 2 above.

The sample group should also include all power plants within the geographical area registered as CDM project activities, which meet the criteria defined in Step 1 above.

Step 4: Determination of the plant efficiencies

Calculate the operational efficiency of each power plant *n* identified in the previous step. The most recent one-year data available shall be used. The operational efficiency of each power plant *n* in the sample group is calculated as follows:

$$\eta_{n,v} = 3.6 \cdot \frac{EG_{n,v}}{FC_{n,v} \cdot NCV_{n,v}} \qquad \textbf{(7)}$$

Where:

$\eta_{n,v}$	=	Operational efficiency of the power plant *n* in the reference year *v*
$EG_{n,v}$	=	Net electricity generated and delivered to the grid by the power plant *n* in the reference year *v* (MWh)
$FC_{n,v}$	=	Quantity of fuel consumed in the power plant *n* in the reference year *v* (Mass or volume unit)
$NCV_{n,v}$	=	Average net calorific value of the fuel type fired in power plant *n* in the reference year *v* (GJ/mass or volume unit)
3.6	=	Unit conversion factor from GJ to MWh
v	=	Reference year *v*
n	=	All power plants in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity

Step 5: Identification of the top 15% performer plants j

Sort the sample group of *N* plants from the power plants in a decreasing order of the operational efficiency. Identify the top performer plants *j* as the plants with the 1st to J^{th} highest operational efficiency, where the *J* (the total number of plants *j*) is calculated as the product of *N* (the total number of plants *n* identified in Step 3) and 15%, rounded down if it is decimal.[8] If the generation of all identified plants *j* (the top performers) is less than 15% of the total generation of all plants n (the whole sample group), then the number of plants *j* included in the top performer group should be enlarged until the group represents at least 15% of total generation of all plants *n*.

All steps should be documented transparently, including a list of the plants identified in Steps 3 and 5, as well as relevant data on the fuel consumption and electricity generation of all identified power plants.

For the determination of $\Delta\eta$, project participants may choose between the following options:

[8] This is conservative as this limits the number of the top 15% performer plants, which will always lead to exclusion of the least efficient plant among them.

Option A: Calculation based on historical autonomous technical improvements observed in the applicable geographical area. Determine $\Delta\eta$ based on an average annual improvement in the efficiency of newly constructed power plants observed over a period of ten years in the applicable geographical area by applying a regression analysis. This option can only be used if the regression analysis provides a value for $\Delta\eta \geq 0$ and the coefficient of determination $R^2 \geq 0.7$. Apply and document in the CDM-PDD the following steps:

- Identify all power plants *m* within the applicable geographical area, as determined in step 3 above,
  - that use the same fossil fuel category as the project activity. This should include power plants which use small amounts of fuels within another fossil fuel category than the main fuel for start-up or auxiliary purposes, but these other fuels shall not comprise more than 3% of the total fuel used annually by the sample power plant on an energy basis;
  - that started commercial operation within the ten year period preceding the reference year v (i.e. that started commercial operation within the years *v*-10 to *v*-1);
  - that have a comparable size to the project activity, defined as the range from 50% to 150% of the rated capacity of the project plant;
  - that are operated in the same load category, i.e. at peak load (defined as a load factor of less than 3,000 hours per year) or base load (defined as a load factor of more than 3,000 hours per year) as the project activity;
  - that have operated (supplied electricity to the grid) in the reference year *v*.
- Determine for each plant *m* the operational efficiency $\eta_{m,v}$ in the year *v*, by applying equation (7) in step 4 above for all power plants *m*, and the year in which the plant started commercial operation.
- Plot the efficiency of all power plants *m* over the date in which the power plants started commercial operation and apply a linear regression analysis and determine the average annual efficiency improvement $\Delta\eta$ as a function of the date of construction using the method of least squares.
- Determine the data vintage *d*, expressed in years, as the time difference between the start of commercial operation of the proposed project activity and the middle point in time within the four year period preceding the reference year *v* in which the power plants *j* started commercial operation.

Option B: Use a conservative default value. Use for $\Delta\eta$ a conservative default value of 0.5%.

Leakage

No leakage emissions are to be considered.

Emission reductions

To calculate the emission reductions the project participant shall apply the following equation:

$$ER_y = BE_y - PE_y \qquad \textbf{(8)}$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2)
BE_y	=	Baseline emissions in year *y* (tCO_2)
PE_y	=	Project emissions in year *y* (tCO_2)

Changes required for methodology implementation in 2nd and 3rd crediting periods

At the renewal of a crediting period, project participants should assess whether the baseline scenario is still valid by applying the procedure to select the most plausible baseline scenario, as described above. Moreover, the baseline emission factor ($EF_{BL,CO2}$) should be updated, applying both Options 1 and 2 and choosing for the subsequent crediting period again the lower value among the two options. For Option 1, the most likely power plant technology identified in the application of the procedure to select the baseline scenario should be used. For Option 2, the baseline emission factor should be updated based on the most recent available data at the time of renewal of the crediting period.

Data and parameters not monitored

Data / Parameter:	$EF_{FF,BL,CO2}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the fossil fuel type that has been identified as the most likely baseline scenario
Source of data:	IPCC default values for the respective fuel type at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	η_{BL}
Data unit:	-
Description:	Energy efficiency of the power generation technology that has been identified as the most likely baseline scenario
Source of data:	This parameter is determined as part of the baseline scenario selection procedure
Measurement procedures (if any):	-
Any comment:	As a conservative approach, the efficiency should be determined as the efficiency at optimum load, e.g., as provided by the manufacturers

Data / Parameter:	$FC_{j,v}$ and $FC_{n,v}$
Data unit:	Mass or volume unit
Description:	Amount of fuel consumed by power plant *j* or *n* in the reference year *v*, where: • *j* are the top 15% performer plants among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Step 2 under "Baseline emissions" section; • *n* are all power plants (including power plants registered as CDM project activities) in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area,

	as defined in Step 2 under "Baseline emissions" section
Source of data:	Measurements of the fuel consumption in each power plant *j* or *n*, e.g. provided in statistics from central-/regional regulatory authorities
Measurement procedures (if any):	-
Any comment:	The DOE should verify that the data on fuel consumption is based on first-hand measurements of the actual quantity of fuel consumed by each power plant, and is not based on second-hand calculations or estimations

Data / Parameter:	$NCV_{j,v}$ and $NCV_{n,v}$
Data unit:	GJ/Mass or volume unit
Description:	Average net calorific value of the fossil fuel type consumed by power plant *j* or *n* in the reference year *v*, where: • *j* are the top 15% performer plants among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Step 2 under "Baseline emissions" section; • *n* are all power plants (including power plants registered as CDM project activities) in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Step 2 under "Baseline emissions" section
Source of data:	Use plant-specific data if available (e.g. from national energy balances if the fuel consumption of the plant is provided on an energy basis). Otherwise use well-documented and reliable regional or national average values. If such data are not available, IPCC default values may be used
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$EF_{FF,CO2}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the fossil fuel type used in the project and the baseline (tCO_2/GJ)
Source of data:	IPCC default values of the fuel type used in the project plant at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. In the case that several fuel types may be used in the project plant according to the may be are technology provider's designs, use the fuel type with the lowest IPCC default value at the lower limit of the uncertainty
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$EG_{j,v}$ and $EG_{n,v}$
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant *j* or *n* in the reference year *v*, where: • j are the top 15% performer plants among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Step 2 under “Baseline emissions” section; • *n* are all power plants (including power plants registered as CDM project activities) in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Step 2 under “Baseline emissions” section
Source of data:	Electricity generation statistics, e.g. from central-/regional regulatory authorities
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$\Delta\eta$
Data unit:	1 / year
Description:	Average annual efficiency improvement for newly constructed power plants would likely have occurred due to autonomous technical development in the time between the investment decisions made for the power plants *j* and the investment decision made for the proposed project activity (1 / year)
Source of data:	Determined as per option A or option B above.
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	d
Data unit:	years
Description:	Data vintage, expressing the time difference between the start of commercial operation of the proposed project activity and the middle point in time within the four year period preceding the reference year *v* in which the power plants *j* started commercial operation (years)
Source of data:	Documented evidence on the planned start of commercial operation of the proposed project activity
Measurement procedures (if any):	-
Any comment:	For example: A project is scheduled to start commercial operation on 1 July 2012. The reference year *v* is 2008. The four year period in which power plants j started commercial operation then corresponds to 1 January 2004 to 31 December 2007. The middle point in time within this period is 1 January 2006. The vintage is then 6.5 (the difference expressed in years between 1 July 2012 and 1 January 2006).

III. MONITORING METHODOLOGY

All data collected as part of monitoring plan should be archived electronically and be kept at least for 2 years after the end of the last crediting period. One hundred per cent of the data should be monitored if not indicated otherwise in the comments in the tables below. All measurements should use calibrated measurement equipment according to relevant industry standards.

Data and parameters monitored

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Total net quantity of electricity generated in the project plant and fed into the grid in year *y*
Source of data:	Measurements by project participants
Measurement procedures (if any):	Electricity meters
Monitoring frequency:	Continuously
QA/QC procedures:	The metered net electricity generation should be cross-checked with receipts from sales
Any comment:	Ensure that $EG_{PJ,y}$ is the net electricity generation (the gross generation by the project plant minus all auxiliary electricity consumption of the plant)

Data / Parameter:	$FC_{p,y}$
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fossil fuel type *p* consumed by the project plant in year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions
Monitoring frequency:	Continously
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Any comment:	Fossil fuel types *p* are those used in the project plant and that belong to the main fossil fuel category

Data / Parameter:	$FC_{q,y}$
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)

Description:	Quantity of fossil fuel type *q* consumed by the project plant in year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions
Monitoring frequency:	Continously
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Any comment:	Fossil fuel types *q* are those used in the project plant and that belong to another fossil fuel category than the main fossil fuel category (i.e. auxiliary and start-up fuels)

Data / Parameter:	$FF_{i,y}$
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type *i* combusted in the project plant in year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions
Monitoring frequency:	Continuously
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Any comment:	-

<table>
<tr><td>Data / Parameter:</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Data unit:</td><td>GJ per mass or volume unit (e.g. GJ/ton or GJ/m³)</td></tr>
<tr><td>Description:</td><td>Weighted average net calorific value of fuel type i in year y</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr>
<tr><td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (a) is not available

These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).</td></tr>
<tr><td>(d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a) and (b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
</table>

Monitoring frequency:	For (a) and (b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated
	For (c): Review appropriateness of the values annually
	For (d): Any future revision of the IPCC Guidelines should be taken into account

QA/QC procedures:	Verify if the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards
Any comment:	-

Data / Parameter:	$NCV_{p,y}$
Data unit:	GJ per mass or volume unit (e.g. GJ/ton or GJ/m³)
Description:	Average net calorific value of the fossil fuel type *p* consumed by the project plan in year *y*
Source of data:	The following data sources may be used if the relevant conditions apply:

Data source	**Conditions for using the data source**
(a) Values provided by the fuel supplier in invoices	This is the preferred source if the carbon fraction of the fuel is not provided (Option A)
(b) Measurements by the project participants	If (a) is not available
(c) Regional or national default values	If (a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).
(d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If (a) is not available

Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards

Monitoring frequency:	For (a) and (b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated
	For (c): Review appropriateness of the values annually
	For (d): Any future revision of the IPCC Guidelines should be taken into account

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	can comply with similar quality standards
Any comment:	Fossil fuel types *p* are those used in the project plant and that belong to the main fossil fuel category

Data / Parameter:	$NCV_{q,y}$
Data unit:	GJ per mass or volume unit (e.g. GJ/ton or GJ/m³)
Description:	Average net calorific value of the fossil fuel type *q* consumed by the project plan in year *y*
Source of data:	The following data sources may be used if the relevant conditions apply: **Data source** — **Conditions for using the data source** (a) Values provided by the fuel supplier in invoices — This is the preferred source if the carbon fraction of the fuel is not provided (Option A) (b) Measurements by the project participants — If (a) is not available (c) Regional or national default values — If (a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances). (d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If (a) is not available
Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards

Monitoring frequency:	For (a) and (b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated
	For (c): Review appropriateness of the values annually
	For (d): Any future revision of the IPCC Guidelines should be taken into account

QA/QC procedures:	Verify if the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards
Any comment:	Fossil fuel types *q* are those used in the project plant and that belong to another fossil fuel category than the main fossil fuel category (i.e. auxiliary and start-up fuels)

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History of the document

Version	Date	Nature of revision
03	EB 53, Annex 7 26 March 2010	The revision concerns mainly the determination of the emission factor under the baseline and under the project scenario to ensure that emission reductions are limited to those resulting from the higher efficiency of the power generation technology used in the project activity as compared to the baseline.
02.1	EB 46, Annex 8 25 March 2009	The methodology was editorially revised: • To correct error in the unit in equation 2 and 3; • To correct unit conversion factor from GJ to MWh in equation 4; • To include $EF_{FF,PJ,CO2,y}$ in the monitoring table under 'data and parameters monitored'; and • To correct other unit inconsistencies and editorial errors.
02	EB 39, Annex 6 16 May 2008	The methodology was revised to clarify that in the fourth applicability condition the geographical area has to be limited by the physical borders of the host country and as such cannot be extended to neighboring non-Annex I countries.
01	EB 34, Annex 2 12 September 2007	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		