CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: MONITORING (CDM-NMM)
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CONTENTS

SECTION A. Identification of methodology

A.1. Title of the proposed methodology:

CECL methodology for power generation for captive use, which is grid connected, using non-renewable and less GHG intensive fuels.

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

As per the scope of the project activity enlisted in the 'list of sectoral scopes and approved baseline and monitoring methodologies (version 02/28.11.03)', the project activity may principally be categorized in Scope Number 1, Sectoral Scope - Energy industries (renewable/ non-renewable sources).

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

The conditions under which this methodology would be applicable are as given below.

- the power generation is through a non-renewable and less GHG intensive fuel;
- the power generation is for captive use and the grid is used for wheeling the power;
- the fuel used for generating the power is not the only choice permitted by applicable regulations;
- the user of power is clearly identified through the crediting period;
- the user of power was drawing electricity from the grid before the CDM project activity;
- the capacity of captive power generation plant is less than 60MW altogether;
- captive power is supplied to a grid having deficit in power supply significantly more than the amount of power being produced by the captive power plant.

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

Potential strengths:

- Data acquisition is easy and transparent.
- Data used is conservative.

Potential weaknesses:

- Baseline, if calculated every year for operating margin, could result in increase in costs, and possibly uncertainties.

SECTION B. Proposed new monitoring methodology

B.1. Brief description of the new methodology:

This new methodology monitors the parameters necessary for estimating the emission reductions from any grid-connected captive power generating facility. The parameters which are considered here relate to the following:

- operating and build margin plants in the grid to which the captive plant will be connected, for estimating the baseline emissions,
- annual process parameters which can be used to calculate the process emissions, and
- potential leakages due to fuel transportation and power dispatch pattern.

The monitoring methodology is based on the baseline methodology developed for the same type of project.

B.2. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario:

B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
HR_f	Gross Heat Rate of the facility for Natural Gas fuel	Power plant records	kCal/MWh	c and e	As per plant requirements with respect to fuel purchase needs	Current year + Past 2 years average.	Electronic and Paper	--
PLF	Plant Load Factor (Monitored)	Power plant records	%	c and e	As per plant requirements	Current year + Past 2 years average.	Electronic and Paper	--

B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
PE_f	Annual project emissions	CDM project activity records	tCO_2	C	Annual	Annual	Electronic and Paper	--

B.2.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

This methodology considers solely the main sources of emissions due to fossil fuel consumption during project operation

The emissions from the project activity have two components:

(1) Emissions due to fossil fuel combustion, and
(2) Emissions during transportation of power generating fuel.

Emissions due to fossil fuel combustion

$PE_f = (PC * PLF * HR_f * EF_f * CF)$…….. (1)

where:

PE_f = Emissions due to "f" fuel consumption during operation of the project in an year (tCO_2)
PC = Installed Plant Capacity (MW);
HR_f = Heat Rate of the facility for Natural Gas as fuel "f"(kCal/MWh);
EF_f = Fossil fuel emission factor (approved IPCC emission factor- tCO2/TJ);
PLF = Plant Load Factor (expected/monitored)
CF = Conversion Factor of units (=365*24* $4.18/10^9$)

Emissions during transportation of power generating fuel

$PE_t = (L_P * P_{EF} * GWP\_CH4)$…….…… (2)

where:

PE_t = Emissions due to transportation of power generating fuel (tCO_2);
L_P = Length of pipeline to transport fuel to power plant (km)
P_{EF} = Emission factor for fuel (primarily comprising methane) per unit length of transporting pipeline used (tCH_4/KM);
GWP_CH_4 = Global warming potential of methane (tonnes of CO_{2e} per tonne of CH_4) i.e. 21, per km of pipeline

Emissions due to Project Activity

$PE_Y = PE_f + PE_t$..... **(3)**

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
OPERATING MARGIN								
AG: Electricity dispatched to the grid by power generating units in the operating margin	Annual Dispatch Electricity Generation Data of generation units dispatching to the local grid	Local regulatory authority	GWh	--	At the end of every Year	100%	Electronic/ paper	--
IC_OM: Installed capacity of the above power plants	Design data	Local regulatory authority	MW	--	At start of project activity.	100%	Electronic/ paper	--
Representative PLF_Y	PLF of the set of plants depending on capacity group	Local regulatory authority	%	--	At the end of every Year	100%	Electronic/ paper	--
PR: Performance Ratio	For merit order analysis	--	--	C	At start of project activity.	100%	Electronic/ paper	--

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
$EF_{OM,,Y}$	Emission from Operating Margin of the baseline set of plants	Calculated by the project proponent	tCO_2/GWh	C	At the end of every Year	100%	Electronic	Emission Factor calculation based on Least Merit Order Data Analysis of Operating Margin of selected grid.
BUILD MARGIN								
IC_BM: Installed capacity of the above power plants	Design data	Local regulatory authority	MW	--	At start of project activity.	100%	Electronic/ paper	--
Representative PLF_Y	PLF of the set of plants depending on capacity group	Local regulatory authority	%	--	At the end of every Year	100%	Electronic/ paper	--
$EF_{BM,Y}$	Emission Factor of the Build Margin of the baseline electricity system	Calculated by project proponent with requisite evidence for the power plants selected	tCO_2/GWh	C	At the end of every Year	100%	Electronic/ paper	Requisite evidence to be provided by project proponent on selection of the power plant for calculation of BM.

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
$NETPOWER_Y$	Net power (i.e is the power received by the user industry from the CDM project, as certified by the local transmission utility, after wheeling (transmission) through the local grid) during any year 'Y'	Power used records	GWh	m	Annual	Daily	Electronic/ paper	Monitored by user/ receiving facility after the generated power is wheeled/ transmitted to it using the grid.

B.2.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

The baseline emissions in a year 'Y' are computed as:

$$\mathbf{BE_Y = EF_{CM,Y} * NETPOWER_Y}$$

Where:

$$\mathbf{EF_{CM} = (EF_{OM} + EF_{BM})/ 2} \quad \text{..... (4)}$$

EF_{CM} = Emission intensity of power generation in the Combined Margin (tCO_2/GWh)
EF_{OM} = Emission intensity of power generation in the Operating Margin (tCO_2/GWh)
EF_{BM} = Emission intensity of power generation in the Build Margin (tCO_2/GWh)

Calculations in the Operating Margin

The average OM emission factor ($E_{OM,average,Y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/GWh) of all generating sources serving the system, including low-operating cost and must-run power plants.

Merit Order Data Analysis Operating Margin calculations (based on performance ratio)
The dispatch data OM emission factor ($EF_{OM, DD}$) is calculated at the start of the project activity as per the following procedure. The performance ratio is calculated for all power plants operating in the applicable/relevant grid. In the case of projects under 60 MW, the State Electricity Board Grid is considered to be the relevant grid.

Performance Ratio (PR) = (Actual Power Generation) / (Design Capacity* Plant Load Factor) ……. **(5)**

The PRs for all plants in the operating margin are analyzed and then ranked in order (0 – 1, including fractional values) to select the worst performers (merit order analysis) who contribute about 10% of the total power generated in the grid.

The total power contributed by these plants will be $\mathbf{EG_{OM}}$ (in GWh).

The power generated from each of these power plants ($EG_{OM,p}$) is multiplied by the IPCC emission factor (per GWh) for the type of fuel used to calculate CO_2 contributed by each plant. The summation of CO_2 contributed by all plants provides the total CO_2 contributed by all the plants in the operating margin.

$\mathbf{E_{OM,Y} = \sum EG_{OM,p} * IPCC\ factor}$……..….**(6)**

Therefore, the OM emission factor (EF_{OM}) is calculated as:

$\mathbf{EF_{OM} = E_{OM,Y} / EG_{OM}}$ ..... **(7)**

Calculations in the Build Margin

This is calculated as the likely emission intensity (tCO_2/GWh) of following sample of power plants, whichever results in greater power generation:

✓ Five power plants that have been built most recently [including plants under construction], or

- ✓ Power plants capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently [including plants under construction].

EG_{BM} = Total power contributed by all the power plants from one of the options as above… (8)

To calculate CO_2 emissions from each of power plant in the BM, the installed capacity of individual plants ($EG_{BM,Y}$ in GWh) is multiplied by the IPCC emission factor (IPCC in tCO_2/GWh) for the type of fuel used such plant. The summation of CO_2 contributed by all plants provides the total CO_2 contributed by all the plants in the build margin given as following.

$$E_{BM,Y} = \sum (EG_{BM,Y} * IPCC) \quad \text{(9)}$$

The emission factor in the build margin is then calculated as:

$$EF_{BM} = E_{BM,Y} / EG_{BM} \quad \text{(10)}$$

The baseline emissions during any year 'Y' are computed as:

$$BE_Y = E_{CM,Y} * NETPOWER_Y \quad \text{(11)}$$

Where,

The net power, $NETPOWER_Y$, is the power received by the user industry from the CDM project, as certified by the local transmission utility, after wheeling (transmission) through the local grid

B.3. Option 2: Direct monitoring of emission reductions from the project activity:

Not opted for.

B.3.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

B.3.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable.

B.4. Treatment of leakage in the monitoring plan:

The leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases, which occurs outside the project boundary. For the power plant project, the leakage is identified as the activity, which contributes for GHG emissions outside the project boundary. Hence, the following can be considered as potential leakage scenario:

Transloss (GWh/year): Transmission losses if they are significantly different for the sections of the grid that is relevant for the CDM project activity.

B.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Transloss	Transmission	Plant	GWh/year	m	Annual	As required	electronic	--

B.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:								
ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	and distribution losses	records				by the power plant		

B.4.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Built into formulae for annual emission reduction.

B.5. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Annual Emission Reductions from the project activity:

$$ER = BE_Y - PE_Y \quad \text{.....} \quad (12)$$

B.6. Assumptions used in elaborating the new methodology:

The following assumptions have been made while developing the new monitoring methodology:

- The level of data (actual dispatch in the grid) to be used for dispatch analysis in the operating margin will be available in the public domain.
- The analogous plant(s) to be considered for emission calculation (in OM) should not be <10 years older than the given plant(s) in the BM.
- The formulae presented in the methodology suggest use of IPCC fuel emission co-efficients to calculate baseline and project emission factors. It is assumed that such universally accepted data is actual representation of the fuel characteristics for the purpose of emission calculations for the project activity.

B.7. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored:		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
HR_f (B.2.1)	Low	To be controlled under scheduled QA/QC protocols of the project proponent, and may be covered under the quality management system procedures. Hence, no separate QA/QC checks would be required.
EF_f (B.2.1)	Low	Same as above.
PLF (B.2.1)	Low	Same as above.

B.8. Has **the methodology been applied successfully elsewhere and, if so, in which circumstances?**

This is a new proposed methodology and is yet to be approved by the CDM EB/ Meth Panel. The same has been adopted for a case in India.

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