Draft approved baseline methodology AMXXXX

"Baseline methodology for electricity generation from utilization of waste heat from waste gases"

Source

This methodology is based on the OSIL - 10 MW Waste Heat Recovery Based Captive Power Project, India, whose baseline study, monitoring and verification plan and project design document were prepared by Experts and Consultants of OSIL. For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0031-rev: "OSIL - 10 MW Waste Heat Recovery Based Captive Power Project" on http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable."

Applicability

- The methodology is applicable to CDM project activities that are based on the use of in-situ waste heat streams, for the generation of electricity that (1) displaces imports of electricity from the grid to the industrial facility where the project is implemented, and (2) displaces alternative electricity generation system (e.g. captive power plant).
- The methodology applies to industrial facilities where no planned capacity expansions are anticipated with the project boundary for the duration of the crediting period of emission reductions.
- The methodology is applicable where information regarding fuel sources for power generation on the grid is available for use by the project participant and where the grid capacity and generation mix would not change much over the project crediting period.

This baseline methodology shall be used in conjunction with the approved monitoring methodology AMXXXX ("Monitoring methodology for electricity generation from utilization of waste heat from waste gases").

Project Activity

This baseline methodology is applicable for CDM project activities, which are based on use of in-situ waste heat streams for generation of electricity that displaces import of electricity from the grid or from any captive fossil fuel based electricity generation.

Project Boundary

The project boundary comprises waste gas sources, power generating equipment, electricity generation, captive consumption units, where the project participant has full control.

Project Emissions

Project Emissions are applicable only if auxiliary fuels are fired is given to waste gases for additional heat gain when waste gases burn in an After Burning Chamber (ABC) before entering the Waste Heat Recovery Boiler. As a result, there are additional emissions of CO_2 due to project activity. The Additional Heat Gain is mainly derived from auxiliary firing using other fuels in ABC.

Project Emission (tCO_2eq/yr) due to auxiliary firing:

$$PE = Q_f * C_f/100 * 44/12 \quad \textbf{(1)}$$

where:

Q_f = Quantity of Fuel used (t/yr)
C_f = Carbon Content of Fuel used (%)

Leakage

The following are possible leakages:
- Project construction and associated activities
- Transportation of equipment to the site

The main emissions potentially giving rise to leakage in the context of the proposed waste heat recovery based power project are emissions due to activities such as "power plant construction and associated activities" and "transportation of equipment to the site". These emissions may be considered as very negligible/low as compared to the baseline scenario and occur only during the setting up of the project infrastructure. It may also be noted that it is very difficult to quantify these emissions. Therefore project participants do not need to consider these emission sources as leakage in applying this methodology.[1]

Project baseline

The baseline methodology consists of two parts. Part I determines the baseline scenario and whether the proposed project activity is additional or is the baseline. The procedure on 'establishing baseline and additionality of project activity' is described below. This is drawn in part from the prescribed "Tool for the demonstration and assessment of additionality"[2]. The methodology suggests qualitative and/or quantitative criteria and tools for selection of the appropriate baseline scenario amongst the most likely baseline options. The methodology in Part II provides procedures for estimating emissions of the selected baseline scenario to calculate the baseline emission factor.

Part I: Establishing baseline scenario and additionality of the project activity

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

The baseline options would include all possible courses of actions in order to produce electricity for in-house consumption and/or sale to grid and/or other consumers. The project participant may exclude baseline options that:

(i) do not comply with legal requirements, and/or
(ii) encounter barriers related to availability of key resources such as fuels, materials, technology, or other circumstances that cannot be overcome.

The project participant would be required to provide supporting documents in order to exclude baseline options which meet the above mentioned criteria.

The project activity's output is electricity generation from use of waste heat, which otherwise would have been generated from other source of heat (fossil fuels) or purchased from the grid.

[1] Guidance has been taken the Approved Consolidated Baseline Methodology ACM0002 – Page 8.
[2] Please refer to: < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

The possible course of action in absence of project activity would be as follows:

- Status quo of the existing facility - the practice/s adopted by project participant in absence of project activity in order to meet the power requirements of the plant - (import of electricity from the grid)
- Alternative electricity production systems which may be locally available
  1. Coal based Captive Power Plant
  2. Diesel based Captive Power Plant
  3. Gas based Captive Power Plant
  4. Other options for Power Plant

In the event that 'Import of electricity from the grid' is the most appropriate baseline option and the project activity will either delay/displace equivalent electricity generation from the grid, the project participant is required to estimate the Baseline Emission Factor as per, the guidance provided below.

In the event that 'Import of electricity from the captive power plant' is the most appropriate baseline option, and the project activity will displace equivalent electricity generation from a fossil fuel based captive power plant, the project participant is required to estimate the Baseline Emission Factor and emission reduction as per the guidance provided below.

Step 2. Additionality

*The additionality of the project activity shall be demonstrated and assessed using the latest version of the **"Tool for the demonstration and assessment of additionality"** agreed by the CDM Executive Board, which is available on the UNFCCC CDM web site[3]. The identification of alternatives to the project activity already undertaken in the previous step of this methodology shall not be duplicated when applying the "Tool for the demonstration and assessment of additionality" (i.e. the propject proponent shall proceed with STEP 2 of the "Tool for the demonstration and assessment of additionality").*

Part II: Determining the baseline emissions

If the baseline scenario is electricity generation from a captive plant, the emission factor shall be based on the efficiency and the carbon content of the fuel used in this plant (see calculation of emission reductions, equation 13).

If the baseline scenario is the following: "electricity would have otherwise been generated by the operation of grid-connected power plants and/or by the addition of new generation sources", the project proponent shall first proceed with the choice of grid size affected by the project activity as this point is crucial.

Choice of the grid
For accurate baseline determination, and for its validation and verification it is important to select a realistic grid representing the factual scenario associated with the project activity. An isolated grid normally identified as a state, regional, national or sometimes transnational grid. The following points need to be considered while selecting the grid:

Size of the project activity: If the size of the project activity is too small to have significant impact on the grid (=<1% of the grid to which it is connected), in terms of changes in the generation and dispatch

[3] Please refer to: < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

system, then the lowest grid such as state or regional grid are to be selected. If the project size is big enough to alter the distribution pattern, then the next level of grid e.g. state/regional/national grid can be selected.

Connectivity of grid: If the inter-grid transmission of electricity is poor or restricted due to some reasons (e.g. policy, infrastructure) and the same can be verified then rather than taking larger grid (say national), an isolated grid should be selected.

It should be noted by the CDM project participants that, the bigger the size of the grid the more it is prone to errors in data assimilation and more costly for baseline determination and verification.
For project activities that modify or retrofit (but not expand the output of) an existing electricity generation facility, the guidance provided by EB08 shall be taken into account.[4]

A baseline emission factor (EF_y) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source (where available)[5] and made publicly available.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) based on one of the four following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

Each method is described below.

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[4] "If a proposed CDM project activity seeks to retrofit or otherwise modify an existing facility, the baseline may refer to the characteristics (i.e. emissions) of the existing facility only to the extent that the project activity does not increase the output or lifetime of the existing facility. For any increase of output or lifetime of the facility which is due to the project activity, a different baseline shall apply." (EB08, Annex 1, http://cdm.unfccc.int/EB/Meetings/).

[5] Plant emission factors used for the calculation of operating and build margin emission factors should be obtained in the following priority:

1. *acquired directly* from the dispatch center or power producers, if available; or
2. *calculated*, if data on fuel type, fuel emission factor, fuel input and power output can be obtained for each plant; if confidential data available from the relevant host Party authority are used the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon emission factor and the corresponding list of plants.
3. *calculated*, as above, but using estimates such as
   - default IPCC values from the *IPCC 1996 Revised Guidelines* and the *IPCC Good Practice Guidance* for net calorific values and carbon emission factors for fuels instead of plant-specific values (note that the *IPCC Good Practice Guidance* includes some updates from the *IPCC 1996 Revised Guidelines*);
   - technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply;
   - conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date; or
4. *calculated,* for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

Dispatch data analysis should be the first methodological choice. Where this option is not selected project participants shall justify why and may use the simple OM, the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter.

The Simple OM method (a) can only be used where low-cost/must run resources[6] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normal for hydroelectricity production.

The average emission rate method (d) can only be used:

- where low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and
- where detailed data to apply option (c) above is unavailable.

(a) *Simple OM.* The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad \textbf{(2)}$$

where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports[7]to the grid,
$COEF_{i,j\,y}$ is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \quad \textbf{(3)}$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

[6] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

[7] As described above, an import from a connected electricity system should be considered as one power source j.

Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

- A 3-year average, based on the most recent statistics available at the time of PDD submission, or
- The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex post monitoring.

(b) *Simple Adjusted OM.* This emission factor ($EF_{OM,simple\ adjusted,y}$) is a variation on the previous method, where the power sources (including imports) are separated in low-cost/must-run power sources (k) and other power sources (j):

$$EF_{OM,simple\ adjusted,y} = \left(1-\lambda_y\right)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \lambda_y\cdot\frac{\sum_{i,k} F_{i,k,y}\cdot COEF_{i,k}}{\sum_{k} GEN_{k,y}} \qquad \textbf{(4)}$$

where $F_{i,k,y}$, $COEF_{i,k}$ and GEN_k are analogous to the variables described for the simple OM method above for plants k; the years(s) y can reflect either of the two vintages noted for simple OM above, and

$$\lambda_y\left(\%\right) = \frac{\text{Number of hours per year for which low - cost/must - run sources are on the margin}}{\text{8760 hours per year}} \qquad \textbf{(5)}$$

where lambda (λ_y) should be calculated as follows (see figure below):

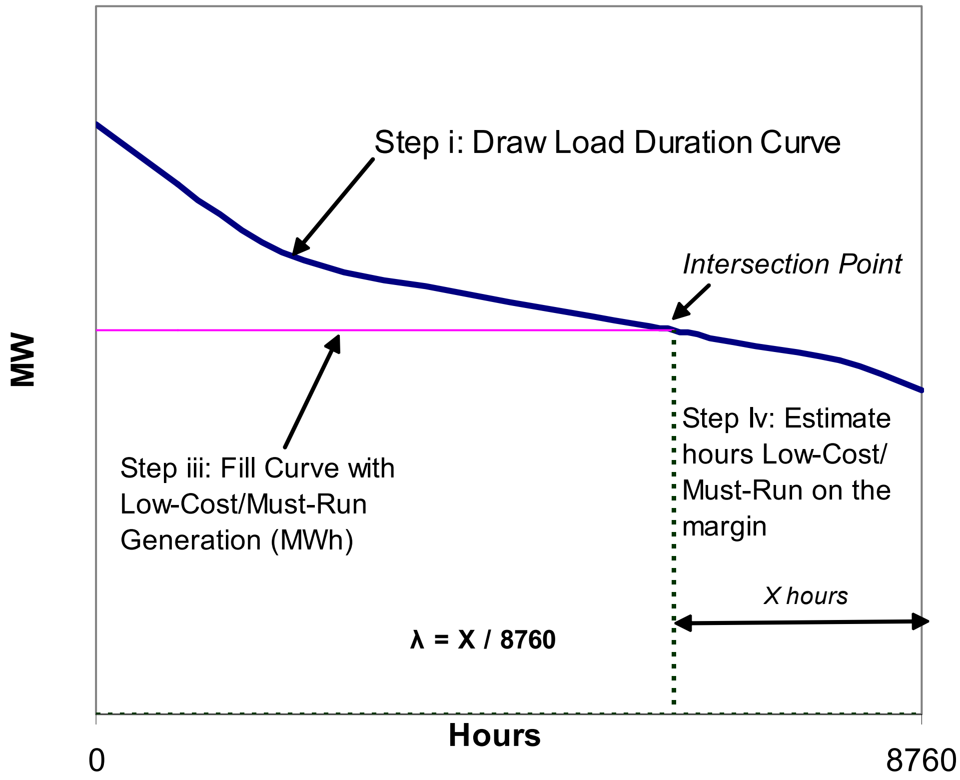
Step i) Plot a Load Duration Curve. Collect chronological load data (typically in MW) for each hour of a year, and sort load data from highest to lowest MW level. Plot MW against 8760 hours in the year, in descending order.

Step ii) Organize Data by Generating Sources. Collect data for, and calculate total annual generation (in MWh) from low-cost/must-run resources (i.e. $\sum_k GEN_{k,y}$).

Step iii) Fill Load Duration Curve. Plot a horizontal line across load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from low-cost/must-run resources (i.e. $\sum_k GEN_{k,y}$).

Step iv) Determine the "Number of hours per year for which low-cost/must-run sources are on the margin". First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and λ_y is equal to zero. Lambda (λ_y) is the calculated number of hours divided by 8760.

Figure 1: Illustration of Lambda Calculation for Simple Adjusted OM Method



Note: Step (ii) is not shown in the figure, it deals with organizing data by source.

(c) *Dispatch Data Analysis OM*. The Dispatch Data OM emission factor ($EF_{OM,Dispatch\ Data,y}$) is summarized as follows:

$$EF_{OM,Dispatch\ Data,y} = \frac{E_{OM,y}}{EG_y} \tag{6}$$

where EG_y is the generation of the project (in MWh) in year y, and $E_{OM,y}$ are the emissions (tCO_2) associated with the operating margin calculated as

$$E_{OM,y} = \sum_h EG_h \cdot EF_{DD,h} \tag{7}$$

where EG_h is the generation of the project (in MWh) in each hour h and $EF_{DD,h}$ is the hourly generation-weighted average emissions per electricity unit (tCO_2/MWh) of the set of power plants (n) in the top 10% of grid system dispatch order during hour h:

$$EF_{DD,h} = \frac{\sum_{i,n} F_{i,n,h} \cdot COEF_{i,n}}{\sum_n GEN_{n,h}} \tag{8}$$

where F, $COEF$ and GEN are analogous to the variables described for the simple OM method above, but calculated on an hourly basis for the set of plants (n) falling within the top 10% of the system dispatch. To determine the set of plants (n), obtain from a national dispatch center: a) the grid system dispatch order of operation for each power plant of the system; and b) the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating (GEN_h). At each hour h, stack each plant's generation (GEN_h) using the merit order. The set of plants (n) consists of those plants at the top of the stack (i.e., having the least merit), whose combined generation ($\sum GEN_h$) comprises 10% of total generation from all plants during that hour (including imports to the extent they are dispatched).

(d) *Average OM*. The average Operating Margin (OM) emission factor ($EF_{OM,average,y}$) is calculated as the average emission rate of all power plants, using equation (1) above, but including low-operating cost and must-run power plants. Either of the two data vintages described for the simple OM (a) may be used.

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \tag{9}$$

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants m.

Project participants shall employ the following method:
For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually *ex post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated *ex-ante.* The sample group m consists of either

- the five power plants that have been built most recently, or
- the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

Power plant capacity additions registered as CDM project activities should be excluded from the sample group m.

STEP 3. Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \tag{10}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh. Alternative weights can be used, as long as $w_{OM} + w_{BM} = 1$, and appropriate evidence justifying the alternative weights is presented. These justifying elements are to be assessed by the Executive Board.[8]

Distribution and transmission losses
Transmission and distribution losses may be included for electricity imported and used within the project boundary.

$$EFy_{T\&D} = \left[\frac{EFy \times 100}{100 - T\&D}\right] - EFy \quad \textbf{(11)}$$

where:

- $EFy_{T\&D}$ - Baseline emission factor of transmission and distribution losses for imported electricity to plant
- T&D – Transmission & Distribution loss % (These losses include technical electrical energy losses that incur during transmission & distribution). [The value used should be supported by documentary evidence]

Emissions Reductions

Emission reductions are calculated as the difference between baseline and project emissions, taking into account any adjustments for leakage.

In the event of import of electricity from the grid:

Emission Reduction (kg CO_2eq/yr) = **(12)**
{Net Electricity generated (E_{NET}) x Baseline emission rate (EF_y+ $EFy_{T\&D}$)} – Project Emission (PE)

where:

$E_{NET} = E_{GEN} – E_{AUX}$
E_{NET} = Net Electricity generated by the project (MWh/yr)
E_{GEN} = Total electricity generated of the project (MWh /yr)
E_{AUX} = Auxiliary power consumption within the boundary (MWh /yr)
EF_y = Baseline emissions factor ((tCO_2eq/ MWh)
PE = Project Emission as calculated above (tCO_2eq/yr)

In the event of import of electricity from the captive power plant:

Emission Reduction (kg CO_2eq/yr) = **(13)**
{E_{NET} (MWh/yr) x 860(kcal/kWh)/Eff_n} x IPCC emission factor[9] (kgCO_2eq/kcal) – Project Emissions (PE)

where:

Eff_n is power generation efficiency of captive power plant n, use of the average of the annual efficiencies in the recent three years prior to project implementation.

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8 More analysis on other possible weightings may be necessary and this methodology could be revised based on this analysis. There might be a need to propose different weightings for different situations.
9 Refer IPCC, 1995 for standard values for fuel used for captive power generation.

Draft approved monitoring methodology AMXXXX

"Baseline methodology for electricity generation from utilization of waste heat from waste gases"

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Applicability

- The methodology is applicable to CDM project activities that are based on the use of in-situ waste heat streams, for the generation of electricity that (1) displaces imports of electricity from the grid to the industrial facility where the project is implemented, and (2) displaces alternative electricity generation system (e.g. captive power plant).
- The methodology applies to industrial facilities where no planned capacity expansions are anticipated with the project boundary for the duration of the crediting period of emission reductions.
- The methodology is applicable where information regarding fuel sources for power generation on the grid is available for use by the project participant and where the grid capacity and generation mix would not change much over the project crediting period.

This monitoring methodology shall be used in conjunction with the approved baseline methodology AMXXXX ("Baseline methodology for electricity generation from utilization of waste heat from waste gases").

Monitoring Methodology

The methodology requires monitoring of the following:

- Flow rates of waste gas, air, stack gas sent back;
- Temperatures of waste gas, air, stack gas sent back;
- Auxiliary fuels used for Heat Gain;
- Carbon content of the fuels;
- Net calorific value of the fuels;
- Electricity generation from the project activity;
- Auxiliary electricity use of the project activity;
- Data needed to recalculate the operating margin emission factor, if needed;
- Data needed to recalculate the build margin emission factor, if needed.

The electricity generation is measured by power meters at plant, the monitoring and verification system mainly is comprised of these meters. Accurate measurement of electricity in kWh/year is to be done, as this is proportional to the reduction in CO_2 emissions. The monitoring and controls will be the part of the Distributed Control System (DCS) of the entire plant. All monitoring and control functions will be done as per the internally accepted standards and norms and are to be verifiable.

The waste gas parameters and the amount of secondary fuel (if any) are to be monitored as it gives the estimation of project emissions, if any, and also an estimation of generation of power (operational correlation of gas and power generation). The monitoring will be carried out periodically at the inlet and outlet points. All monitoring and control functions will be done as per the internally accepted standards and norms and are verifiable.

Frequency of monitoring

As the emission reduction units from the project are determined by the number of units generated (and then multiplying with appropriate emission factor) it becomes important for the project to monitor the net production on real time basis. It would be advisable for an on-line monitoring system in place. This also ensures the smooth operation of the plant.

Reliability

The amount of emission reduction units is proportional to the net energy generation from the project. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result, all measuring instruments must be calibrated by third party/government agency once a year for ensuring reliability of the system. Since the kWh meter reading is the final value from project side, the relevant electricity grid utility verifies the reliability of the meter reading; thereby ensuring the monitored results are highly reliable. According to the state electricity board's (grid operator) regulations, also the annual calibration and verification of electricity meters is mandatory for all power generating units. We may therefore conclude that the reliability of the results will be ensured by the project participant both as a statutory requirement and for the project activity. Moreover, the net electricity generation value is included in the financial audit report (statutory requirement) that is published in the annual report of the company.

Registration and reporting

Registration of data is on-line in the control cabin through a microprocessor. However, hourly data logging must be there in addition to software memory. Daily, weekly and monthly reports are prepared stating the generation.

Key parameters and data sources considered and used

The key parameters considered in developing the methodology and their sources are summarized in the Table 2 below.

Table – 2: Key Parameters with their data sources

	Key Parameters	**Data Sources**
Baseline Option – Import of electricity from the grid		
1.	**Generation data** for all plants in each grid area for a recent year ($kWh_{generated}$). [Net plant generation, i.e. net of plant own use or parasitic losses as most typically reported, rather than gross, should be used.]	Published Literature from: • National ministry • State ministry • Relevant electric utility or system operator
2.	**Specific fuel consumption,** heat rate or efficiency (kJ_{fuel}/kWh) of the plants in the grid, often reported	Published Literature from: • National ministry

	as total fuel consumption by plant, which can be divided by generation. Estimates such as following may be used in absence of actual efficiencies of power generation. - Technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources. (This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply). - Conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date.[10]	• Relevant electric utility/system operator/grid companies • International sources
3.	**Emission Factor of the fuel used in the Grid Mix** (tCO_2eq/TJ)	Published Literature from: • National ministry • Relevant electric utility or system operator • Fuel suppliers • IPCC National Inventory Guidelines
4.	**T&D loss factor** ($kWh_{generated}/kWh_{delivered}$), calculated at the grid level	Published Literature from: • National ministry • Relevant electric utility or system operator • International data

Data Sources for other project activity related information:

- Published literature as mentioned in the reference list
- Government records on planning and future capacity additions
- Published documents by grid companies on the electricity supplied to the grid and other parameters
- Details of the power sector from other references as mentioned in the reference list for determination of additionality
- UNFCCC and IPCC documents
- Project related data, project report, technical analysis etc.

[10] Guidance has been taken from the Meth Panel Recommendation to EB regarding the NM0031-rev methodology (Date of Meth Panel meeting: 5-6 September 2004) and the Approved consolidated baseline methodology ACM0002 – Page 4.

Parameters to be monitored

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1.	quantitative	Waste gas flow rates across waste gases (including air and stack gasses) before ABC	M^3/Hr	measured	continuously	100%	electronic/ paper	Credit period + 2 yrs	To be measured before project activity. Used for estimation of project emissions.
2.	quantitative	Average temperature across waste gases (including air and stack gasses) before ABC	Degree Celsius	measured	continuously	100%	electronic/ paper	Credit period + 2 yrs	To be measured before project activity. Used for estimation of project emissions.
3.	quantitative	Waste gas flow rates across waste gases (including air and stack gasses) after ABC	M^3/Hr	measured	continuously	100%	electronic/ paper	Credit period + 2 yrs	To be measured after project activity. Used for estimation of project emissions.
4.	quantitative	Average temperature across waste gases (including air and stack gasses) after ABC	Degree Celsius	measured	continuously	100%	electronic/ paper	Credit period + 2 yrs	To be measured after project activity. Used for estimation of project emissions.

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
5. Q_f	quantitative	Volume of the auxiliary fuel used in the ABC	M^3	measured	continuously	100%	electronic/ paper	Credit period + 2 yrs	To be measured and used for estimation of project emissions.
6. Cf	quantitative	Carbon Content of fuels used	%	measured	monthly	random	electronic/ paper	Credit period + 2 yrs	To be measured and used for estimation of project emissions.
7. NCV_f	quantitative	Net Calorific Value of Fuel used for Auxiliary Firing (if any)	kcal/kg	measured	monthly	random	electronic/ paper	Credit period + 2 yrs	To be measured and used for estimation of project emissions.
8. PE	quantitative	CO_2 emissions from project due to auxiliary firing using other fuels	tCO_2eq/ yr	calculated	continuously	100%	electronic/ paper	Credit period + 2 yrs	Calculated from the above measured parameters. Algorithm for project emission calculations given in baseline methodology.

Note :
1. Flow measured in M^3/Hr is converted to kg/hr (using gas density).
2. Volume in M^3 is converted to kg
3. Parameters 5,6,7, and 8 would be applicable to project activity where the ABC has a built in provision of introducing secondary fuel for auxiliary firing

For Electricity Generation by Project Activity

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
9. E_{GEN}	quantitative	Total Electricity Generated	MWh/ yr	online measurement	continuously	100%	electronic	Credit period + 2 yrs	Monitoring location: meters at plant and DCS will measure the data. Manager In-charge would be responsible for regular calibration of the meter.
10. E_{AUX}	quantitative	Auxiliary Electricity [11]	MWh/ yr	online measurement	continuously	100%	electronic	Credit period + 2 yrs	Monitoring location: meters at plant and DCS will measure the data. Manager In-charge would be responsible for regular calibration.
11. E_{NET}	quantitative	Net Electricity exported	MWh/ yr	calculated	continuously	100%	electronic	Credit period + 2 yrs	Calculated from the above measured parameters. Algorithm for project emission calculations given in baseline methodology.

[11] This will include electrical energy utilized by the electrical equipments in the project boundary, which includes the ABC, WHR based CPP, ESP and stack.

For Baseline emission factor

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
12. EFy	emission factor	CO2 emission factor of the grid	tCO2eq /MWh	calculated	Simple OM BM	yearly	100%	electronic	During the crediting period and two years after	Calculated as a weighted sum of the OM and BM emission factors
13. $EF_{OM,y}$	emission factor	CO2 Operating Margin emission factor of the grid	tCO2eq /MWh	calculated	Simple OM	yearly	100%	electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
14. $EF_{BM,y}$	emission factor	CO2 Build Margin emission factor of the grid	tCO2eq /MWh	calculated	BM	yearly	100%	electronic	During the crediting period and two years after	Calculated as [∑i Fi,y*COEFi] / [∑m GENm,y] over recently built power plants defined in the baseline methodology
15. $F_{i,j,y}$	fuel quantity	Amount of each fossil fuel consumed by each power source / plant	Mass or volume/yr	measured	Simple OM BM	yearly	100%	electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
16. $COEF_{i,k}$	emission factor coefficient	CO2 emission coefficient of each fuel type and each power source / plant	tCO2 / mass or volume unit	measured	Simple OM BM	yearly	100%	electronic	During the crediting period and two years after	Plant or country-specific values to calculate COEF are preferred to IPCC default values.
17. $GEN_{j,y}$	electricity quantity	Electricity generation of each power source / plant	MWh/ yr	measured	Simple OM BM	yearly	100%	electronic	During the crediting period and two years after	Obtained from the power producers, dispatch centers or latest local statistics.
18. Eff_n	efficiency of captive power plant	Energy efficiency of captive power plant	%	measured	Simple OM BM	yearly	100%	electronic	During the crediting period and two years after	To be measured after project activity. Used for estimation of project emissions. If completely replaced by project activity, efficiency to be based on historic data.

Quality Control (QC) and Quality Assurance (QA) Procedures

Data	**Uncertainty level of data (High/Medium/Low)**	**Are QA/QC procedures planned for these data?**	**Outline explanation why QA/QC procedures are or are not being planned.**
Data 1. to 8.	Low	Yes	This data will be required for the calculation of project activity energy
9. to 11	Low	Yes	This date will be used for the calculation of project electricity generation.
12. to 17.	Low/Medium	Yes	This data will be required for the calculation of baseline emissions (from grid electricity).
18.	Low	Yes	This data will be required for the calculation of baseline emissions (from captive power plant electricity).

Note: The medium uncertainty level is applicable where the grid or captive power plant data is not readily available
Note on QA/QC: The parameters related to the performance of the project will be monitored using meters and equipments. The QA/QC issue with these meters and equipments is their timely calibration and record keeping. The calibration is to be followed using standard practices (which is some times country specific