The yellow highlighted text in this document shows the Meth Panel's response to the Board's request contained in paragraph 20 of the report of the forty-seventh meeting, and the green highlighted text shows the Meth Panel's response to the Board's request contained in paragraph 15 of sixty-second meeting.

Draft baseline and monitoring methodology AM00XX

"Waste gas based combined cycle power plant in a Greenfield iron and steel plant"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

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

- NM0292: "Baseline and monitoring methodology for new grid connected power plants using waste gas fired Combined Cycle Gas Turbine technology instead of more GHG intensive technology" proposed by ThyssenKrupp Steel AG.

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

- Tool for the demonstration and assessment of additionality;
- Tool to calculate the emission factor for an electricity system;
- Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period.

For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive 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".

Definitions

For the purpose of this methodology, the following definitions apply:

Rankine cycle mode of electricity generation. The Rankine cycle is a thermodynamic cycle used to generate electricity in a power station. Superheated steam is generated in a boiler, and then expanded in a steam turbine. The steam turbine drives a generator, to convert the work into electricity. The remaining steam is then condensed and recycled as feed-water to the boiler.

Open/single cycle gas turbine. Gas turbines are described thermodynamically by the Brayton cycle, where the ambient air is suctioned, mixed with the fuel that is combusted in a gas turbine, producing gases at a high temperature. The gas turbine extracts energy from a flow of hot gas produced by this combustion of gas or fuel oil in a stream of compressed air. In a Brayton cycle, a gas turbo-generator produces electricity and the waste gas/heat from the gas turbine is lost/vented to the atmosphere.

Combined cycle gas turbine. A combined cycle gas turbine combines two thermodynamic cycles (i.e. the Rankine cycle and the Brayton cycle) to result in improved overall efficiency of electricity generation. A gas turbo-generator produces electricity and the waste heat from flue gases of turbine is recovered in a waste heat recovery boiler to generate steam that further generates additional electricity in a steam turbine, the latter contributing to the overall increase in efficiency.

Waste Gas~~/Heat~~. A gaseous by-product ~~or heat~~ from machines and industrial processes with the potential to produce useful energy. Examples are blast furnace gas, coke oven gas, basic oxygen furnace gas.

Auxiliary fuel. The auxiliary fuel used in the steam and/or gas turbine for start-up of the power plant. The auxiliary fuel may be, *inter alia,* natural gas, fuel oil, or coal.[1]

Supplementary fuel. The supplementary fuel used to improve the performance of the cycle. Its consumption is associated with the Heat Recovery Steam Generator (HRSG) increasing the waste heat generated from the gas turbine and producing additional steam for use in the steam turbine.

Applicability

This methodology applies to project activities that construct and operate a captive or grid-connected combined cycle electricity generation power plant in a Greenfield iron and steel plant, using waste gas such as blast furnace gas, coke oven gas, and converter gas sourced from the same facility. The power generated in the project activity is used within the industrial facility and/or exported to the grid by the industrial facility.

The methodology is applicable under the following conditions.~~ if the power generated in the project activity is used within the industrial facility and/or exported to the grid by the industrial facility.~~

Specifications of coke oven and iron and steel plant has been determined before the project activity is considered. This condition is necessary to ensure that the expected production of waste gases from the iron and steel facility can be estimated with high certainty.

The project participants have to demonstrate that the level of use of waste gas for power production in iron and steel plant is same in absence of and after implementation of CDM project activity.

In addition, the applicability conditions included in the tools referred to above apply.

For project activities that involve retrofit of existing facilities with the conversion of single to combined-cycle power generation, project participants may use the ~~approved and~~ consolidated methodology ACM0007.

II. BASELINE METHODOLOGY PROCEDURE

Identification of the baseline scenario

For the identification of the most plausible baseline scenario, project proponents shall apply the following step-wise procedure.

[1] The auxiliary fuel is expected to represent less than 2% of energy input after the period of start-up of the iron and steel plant, when working under normal operational conditions.

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. how the electricity needs for the productive process of the power plant owner would have been provided in the absence of the project activity.

In the baseline scenario, the electricity demand of a specific industrial facility in the iron and steel sector shall be satisfied, as the main priority is to meet the internal demand of the facility (with a captive power plant). However, for some plant configurations (e.g. in cases where there are no hot or cold rolling activities on site), power surplus may be generated and supplied to the grid. The same rationale for baseline emissions is employed, in either case.

The realistic and credible alternatives should be determined regarding:

- What would be the **use of the energy** from the waste gas in the absence of the CDM project activity?
- How would **electricity** be provided to the iron and steel facility, in the absence of the CDM project activity?

When determining what would be the use of the energy (E) from the waste gas, alternatives to be analyzed should include, *inter alia*:

E1: The use of the energy for electricity generation only;

E2: The use of the energy for heat purposes only;

E3: The use of the energy for electricity generation and heat purposes;

E4: The energy is not recovered and no use is made of it.

When determining the possible use of the energy, project proponents shall consider the facility's energy demand, using, *inter alia*, energy flow diagrams of the industrial complex.

When determining how electricity would be provided (P), the alternatives to be analyzed should include, *inter alia*:

P1: The electricity is generated by a combine cycle (CGCT) captive power plant;

P2: The electricity is generated by a captive power plant with open/single cycle gas turbine(s) without energy recovery;

P3: The electricity is generated by a captive power plant with steam turbine(s) on Rankine cycle mode of electricity generation;

P4: Import of electricity from the grid or from connected grid systems, including the possibility of new interconnections.

Electricity consumed in the iron and steel facility will primarily be provided by the captive power plant; in case it cannot satisfy the demand, the facility will be supplied by the electric grid.

When establishing the possible combinations of scenarios, taking into consideration the alternatives for the use of the energy generated from waste gas and the alternatives for technologies of electricity generation, project proponents should clearly identify and document which type of fuel would be used in each of them, taking into account the requirements of the technology and the market practices within the relevant sector and selected region (i.e. host country).

These alternatives do not need to 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. base load power). It must be ensured 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.

Table 1 contains the possible combinations of baseline scenarios, considering the waste gas energy use (E) and the electricity provision (P).

Table 1: Combinations of baseline options and scenarios ~~applicable to~~ considered in this methodology

Scenario	Baseline Options		Description of the situation
	Energy use from waste gas	Electricity provision	
I	E1	P1	The energy from the waste gas is used for electricity generation in a captive power plant using CCGT technology
II	E1	P2	The energy from the waste gas is used for electricity generation in a captive power plant with a generation technology different from CCGT, such as gas turbine(s) on open/single cycle without energy recovery
III	E1	P3	The energy from the waste gas is used for electricity generation in a captive power plant using steam turbine(s) on Rankine cycle
IV	E2	P4	The energy from the waste gas is used for heat purposes only and electricity is imported from the grid or existing or new power plants connected to the grid
V	E3	P1	The energy from the waste gas is used for electricity and heat purposes and electricity is obtained from a captive waste gas-fired power plant using CCGT technology
VI	E3	P2	The energy from the waste gas is used for electricity and heat purposes and electricity is generated in a captive power plant, with a generation technology different from CCGT, such as gas turbine(s) on open/single cycle mode without energy recovery
VII	E3	P3	The energy from the waste gas is used for electricity and heat purposes and electricity is generated in a captive power plant with a generation technology different from CCGT, such as steam turbine(s) on Rankine cycle

VIII	E4	P1	The energy from the waste gas is not recovered and the electricity is generated by a captive power plant using other fuels with CCGT technology
IX	E4	P2	The energy from the waste gas is not recovered and the electricity is generated by a captive power plant using other fuels with a generation technology different than CCGT, such as gas turbine(s) on open/single cycle without energy recovery
X	E4	P3	The energy from the waste gas is not recovered and the electricity is generated by a captive power plant using other fuels with a generation technology different from CCGT, such as steam turbine(s) on Rankine cycle
XI	E4	P4	The energy from the waste gas is not recovered and electricity is imported from the grid or from existing or new power plants connected to the grid

Project proponents shall exclude baseline scenarios that are not in compliance with all applicable legal and regulatory requirements. If one or more scenarios are excluded, appropriate explanation and documentation to support the exclusion of these scenarios shall be provided.

Step 2

Project proponents shall eliminate the alternative scenarios that are not feasible. Those non-feasible scenarios may be clearly economically unattractive when compared with other alternatives. Step 2 and Step 3 of latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used as reference to compare the different alternatives.

Step 3

If more than one credible and plausible alternative scenario remains after the application of Step 2 and Step 3 of the "Tool for the demonstration and assessment of additionality", the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario.

This methodology is only applicable if the most plausible baseline scenario is the construction of (a) baseline power plant(s) using the same fuel type and quantity as used in the project power plant, for electricity generation. Moreover, this methodology is only applicable if electricity generation in the baseline is identified to be ~~open/single gas turbine(s) cycle (without energy recovery) or~~ steam turbine(s) on Rankine cycle. (Scenario~~s II &~~ III of Table 1).

Additionality

Project proponents shall demonstrate additionality using the latest approved version of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board. The assessment of additionality comprises the following steps:

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

When applying Step 1 of the tool, project proponents shall use the same set of alternative scenarios identified in Step 1 of the procedure "Identification of the baseline scenario".

They will then proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). Project proponents may also select to complete both Steps 2 and 3.

Step 2: Investment analysis

Determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

Step 3: Barrier Analysis

Project proponents shall establish that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity.

~~***Step 4: Common practice analysis***~~

~~Project proponent should identify if there are other operational power plants in the host country that uses waste gas that are similar to the proposed project activity. If there are 20% or more iron and steel plants (apart from the plant where CDM project is implemented) found in the host country which have combined cycle based power generation or open gas-based cycle using waste gas, which are not registered under CDM, the project activity is not considered to be additional.~~

Project boundary

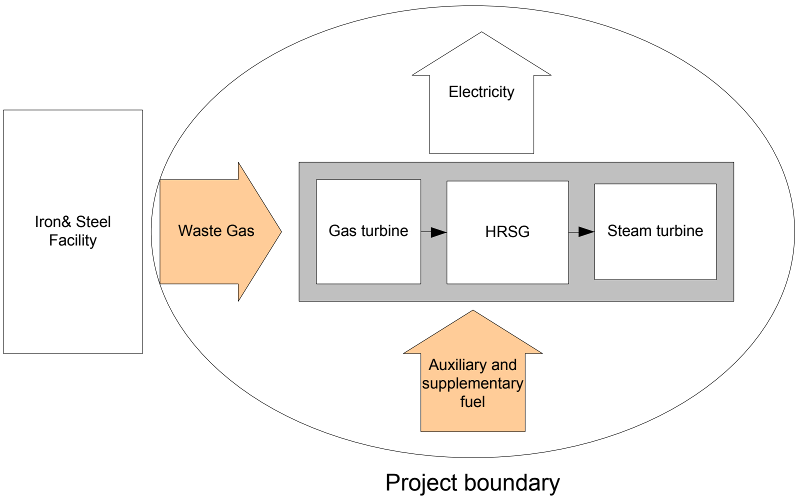

Figure 1: Project boundary of the project activity

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 ($EF_{grid,y}$).

In the calculation of project emissions, which are limited to emissions of CO_2, project proponents shall include the following emissions sources:

- CO_2 emissions from on-site auxiliary fuel consumption for operating the gas turbine; and
- CO_2 emissions from on-site supplementary fuel consumption associated to the HRSG in order to supplement the waste heat generated from the gas turbine and produce additional steam for use in the steam turbine.

The greenhouse gases included or excluded from the project boundary are shown in Table 2.

Table 2: Emissions sources included in or excluded from the project boundary

	Source	Gas		Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	On-site auxiliary fuel consumption to operate the gas turbine of project power plant	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	On-site supplementary fuel consumption to operate the steam turbine of project power plant	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small

Baseline emissions

Baseline emissions (BE_y) are calculated as the amount of additional electricity (MWh) generated by the project ($\Delta EG_{\Pr,y}$) in a given year multiplied by the CO_2 emission factor of the grid (tonnes CO_2/MWh) for the year y in which it is generated, as follows:

$$BE_y = \Delta EG_{\Pr,y} \times EF_{grid,y} \quad \textbf{(1)}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2)
$EF_{grid,y}$	=	CO_2 emission factor for the electricity interconnected grid (tCO_2 /MWh)
$\Delta EG_{\mathrm{Pr},y}$	=	Additional quantity of electricity generated by the project activity in year y (MWh)

The emission factor for the electricity displaced due to the project activity ($EF_{grid,y}$) should be calculated as the combined margin emission factor (CM) obtained applying the latest version of the "Tool to calculate the emission factor for an electricity system".

The quantity of additional electricity generated by the project ($\Delta EG_{\mathrm{Pr},y}$) in a given year is equal to the total quantity of electricity generated by the project activity power plant[2] ($EG_{\mathrm{Pr},y}$) less the quantity of electricity that could be generated by the baseline scenario power plant ($EG_{BL,y}$).

$$\Delta EG_{\mathrm{Pr},y} = EG_{\mathrm{Pr},y} - EG_{BL,y} \tag{2}$$

Where:

$EG_{BL,y}$	=	Quantity of electricity generated by the baseline power plant in year y (MWh)
$EG_{\mathrm{Pr},y}$	=	Quantity of electricity generated by the project activity power plant in year y (MWh)

The quantity of electricity generated by the baseline power plant – i.e. running in ~~open/single or~~ Rankine cycle mode – ($EG_{BL\,y}$) is obtained by multiplying the quantity of waste gas used by the project power plant **(**$WG_{\mathrm{Pr},y}$**),** its net calorific value and the efficiency of the baseline power plant in year *y,* as follows, divided by a conversion factor (that converts Joule into MWh).

$$EG_{BL,y} = \frac{WG_{PJ,y} \times NCV_{WG,y} \times \eta_{BL}}{3.6} \tag{3}$$

Where:

$EG_{BL,y}$	=	Quantity of electricity generated by the baseline power plant in year y (MWh)
$WG_{PJ,y}$	=	Quantity of waste gas used for electricity generation by the project power plant in year y (~~Mass or volume unit~~ tonne)
$NCV_{WG,,y}$	=	Net calorific value of the waste gas consumed by the project power plant in year y (GJ/~~Mass or volume unit~~ tonne)

[2] The net quantity of electricity generated by the power plant is obtained by subtracting the consumption of the electricity that is necessary to run the power plant that would not occur in the absence of the project activity.

η_{BL}	=	Energy efficiency of the power generation technology that has been identified as the most likely baseline scenario
3.6	=	Conversion factor (1 MWh = 3.6 GJ)

The quantity of waste gas used for electricity generation by the project activity power plant in year *y* shall be equal to the quantity of waste gas used for electricity generation in the baseline power plant.

$$WG_{PJ,y} = WG_{BL,y} \quad (4)$$

Where:

$WG_{PJ,y}$	=	Quantity of waste gas used for electricity generation by the project activity power plant in year *y* (~~Mass or volume unit~~ tonne)
$WG_{BL,y}$	=	Quantity of waste gas used for electricity generation by the baseline power plant in year *y* (~~Mass or volume unit~~ tonne

The energy efficiency of the baseline power plant (η_{BL}) shall be determined, choosing the highest value between the two following options.[3]

Option 1: Efficiency shall be determined based on the average efficiency of the top ~~15~~ 20% of Rankine cycle based power plant in the iron and steel manufacturing industry using waste gases in the geographical region including power plants registered as CDM project activities.

For determination of the top ~~15~~ 20% efficient Rankine cycle based power plants, the following step-wise approach is used:

Step 1: ***~~Definition of~~ Criteria for selection of similar plants to the baseline power plant[4] for the geographical area***

The following criteria shall be used for selection of similar plants to the baseline power plant:

- The sample group of similar power plants for the geographical area shall consist of all power plants in the iron and steel sector, using similar technology and waste gas as fuel that the baseline power plant would use; and
- That have been built in the last five years prior the implementation of the project activity ; and
- That have comparable size to the baseline power plant, defined as a range from 50% and 150% of its rated capacity; and
- 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 baseline power plant.

[3] In case of non availability of data, Option 2 shall be used for calculating the efficiency of the baseline power plant.

[4] Baseline power plant, as identified in the baseline scenario identification procedure, is a Rankine cycle based power plant.

Step 2: Definition of the geographical area

The geographical area to identify similar plants to the baseline power plant should be chosen in a manner that the total number of power plants *j*, built in the last five years prior the implementation of the project activity, comprises at least 10 plants.

As a default, the electricity grid system where the project activity is implemented should be used as the geographic area. If the number of similar plants, as defined in Step 1, within the grid boundary is lower than 10, the geographical area should be extended to the host country.

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 baseline power 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:

$$\eta_{n,x} = 3.6 \cdot \frac{EG_{n,x}}{WG_{n,x} \times NCV_{WG,x}} \quad \textbf{(5)}$$

Where:

$\eta_{n,x}$	=	Operational efficiency of the power plant *n* in the year *x*
$EG_{n,x}$	=	Net electricity generated by the power plant *n* in the year *x* (MWh)
$WG_{n,x}$	=	Quantity of waste gas used for electricity generation by the power plant *n* in year *x* (~~Mass or volume unit~~ tonne)
$NCV_{WG,x}$	=	Net calorific value of the waste gas fired in power plant *n* in year *y* (GJ/~~Mass or volume unit~~ tonne)[5]
3.6	=	Conversion factor from GJ to MWh
n	=	Power plants in the defined geographical area that have a similar size, are operated at similar load and use the same fuel type as the baseline power plant
x	=	Most recent year prior to the start of the project activity for which data is available

[5] The sensible heat content of the waste gas is considered negligible.

Step 5: Identification of the top ~~15~~ 20% performer plants j

Sort the sample group of *N* plants from the power plants with the highest to the lowest operational efficiency. Identify the top ~~15~~ 20% performer plants *j* as the plants with the 1st to Jth 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~~ 20%, rounded down if it is decimal.[6] If the energy generation of all identified plants *j* (the top ~~15~~ 20% performers) is less than ~~15~~ 20% of the total energy generation of all plants n (the whole sample group), then the number of plants *j* included in the top ~~15~~ 20% performer group should be enlarged until the group represents at least ~~15~~ 20% of total generation of all plants *n*.

Step 6: Identification of the energy efficiency of the power generation technology that has been identified as the most likely baseline scenario

It is calculated as follows:

$$\eta_{BL,x} = \frac{\sum_{j} \eta_{j.x}}{J} \tag{6}$$

Where:

$\eta_{BL,x}$	=	Energy efficiency of the power generation technology that has been identified as the most likely baseline scenario
$\eta_{j,x}$	=	Operational efficiency of the top ~~15~~ 20% performer~~s~~ power plants *j* in the year *x*
J	=	The top ~~15~~ 20% performer~~s~~ power plants

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.

Option 2: The project participant shall identify all the versions of Rankine cycle based technology that are implemented in the host country and request at least three manufacturers to provide the data on the highest efficiencies of the most recent available version of ~~these~~ Rankine-cycle based technologies. The highest efficiency ~~among the technologies~~ of the Rankine cycle based power generation should be used as the efficiency for the baseline scenario.

~~In both Options 1 and 2, $\eta_{BL,x}$ is updated at the renewal of a crediting period.~~

Project emissions

Project emissions (PE_y) are the emissions from the auxiliary use of fossil fuel to operate the gas turbine ($PEGT_y$) and the emissions from the supplementary use of fossil fuel to operate the steam turbine ($PEST_y$).

---

[6] This is conservative as this limits the number of the top ~~15~~ 20% performer plants, which will always lead to exclusion of the least efficient plant among them.

$$PE_y = PEGT_y + PEST_y \tag{7}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
$PEGT_y$	=	Emissions from the auxiliary fuel to operate the gas turbine in year *y* (tCO_2)
$PEST_y$	=	Emissions from the supplementary fuel to operate the steam turbine in year *y* (tCO_2~~/yr~~)

The project emissions are calculated, as follows:

$$PEGT_y = \sum_i FGT_{i,y} \times NCV_i \times EF_{CO_2,i} \tag{8}$$

Where:

$PEGT_y$	=	Emissions from the auxiliary fuel to operate the gas turbine (tCO_2)
$FGT_{i,y}$	=	Auxiliary fuel *i* (~~Mass or volume unit~~ tonne) consumed to operate the gas turbine in the project power plant, in year *y*
NCV_i	=	Net calorific value of the auxiliary fuel *i* used (GJ/ ~~Mass or volume unit~~ tonne)
$EF_{CO2,i}$	=	CO_2 emission factor per unit of energy of the auxiliary fuel *i* (tCO_2/GJ)

And,

$$PEST_y = \sum_j FST_{j,y} \times NCV_j \times EF_{CO_2,j} \tag{9}$$

Where:

$PEST_y$	=	Emissions from the use of supplementary fuel, in year *y,* to operate the steam turbine (tCO_2)
$FST_{j,y}$	=	Supplementary fuel j (~~Mass or volume unit~~ tonne) consumed to operate the steam turbine in the project power plant, in year *y*
NCV_j	=	Net calorific value of the auxiliary fuel *j* used (GJ/~~Mass or volume unit~~ tonne)
$EF_{CO_2,j}$	=	CO_2 emission factor per unit of energy of the supplementary fuel *j* (tCO_2/GJ)

Project emissions include emissions from fossil fuel and electricity consumption.

Leakage

The main emissions potentially giving rise to leakage in the context of the proposed projects are:

- CH_4 leakage in production, transportation and consumption of auxiliary fossil fuel (e.g. natural gas) consumed by the project activity.

$$LE_y = LE_{CH4,y} \tag{10}$$

Where:

LE_y	=	Leakage emissions during the year *y* (tCO_2)
$LE_{CH4,y}$	=	Leakage emissions due to fugitive upstream CH_4 emissions in year *y* (tCO_2e)

For the purpose of determining fugitive methane emissions associated with the production, transportation and distribution of the auxiliary fuel consumed in the project activity, project proponents should multiply the quantity of fossil fuel consumed in the project activity power plant with a methane emission factor for these upstream emissions, as follows:

$$LE_{CH4,y} = GWP_{CH4,y} \times \sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CH4,upstream,i} \tag{11}$$

Where:

$LE_{CH4,y}$	=	Leakage emissions due to fugitive upstream CH_4 emissions in the year *y* (tCO_2e)
$FC_{i,y}$	=	Quantity of fossil fuel type *i* combusted in the project activity power plant in year *y* (~~Mass or volume unit~~ tonne)
$NCV_{i,y}$	=	Net calorific value of fossil fuel type *i* in year *y* (GJ/~~Mass or volume unit~~ tonne)
$EF_{CH4,upstream,i}$	=	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of fuel type *i* (tCH4/GJ)
$GWP_{CH4,y}$	=	Global warming potential of methane valid for the relevant commitment period
i	=	Fossil fuel types used in the project activity power plant in year *y* (natural gas and, if applicable, auxiliary fuel consumption)

If available, project proponents can use default country specific values to calculate leakage. If not, project proponents shall use default values from the IPCC 2006, volume 2, Table 4.2.5.

The CH_4 emissions can be ignored while applying this methodology if project proponents demonstrate through estimation that these are a negligible fraction of the baseline emissions (less than 1% of baseline emissions).

Emission reductions

Emission reductions are calculated as follows:

$$\mathrm{ER_y = BE_y - PE_y - LE_y} \tag{12}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e)
BE_y	=	Baseline emissions in year *y* (t CO_2)
PE_y	=	Project emissions in year *y* (t CO_2)
LE_y	=	Leakage emissions in year *y* (t CO_2e)

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

Project proponents shall follow the requirement of the latest version of "Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period".

The following data shall be updated at the renewal of the crediting period:

- The efficiency of baseline power plant $\eta_{BL,x}$;
- Emissions factor for auxiliary and supplementary fossil fuels used in the project activity, based on any future revision or amendment of the 2006 IPCC Guidelines or national official sources;
- Net calorific value of auxiliary and supplementary fuel used in the project activity, based on any future revision or amendment of the 2006 IPCC Guidelines or national official sources.

Data and parameters not monitored

In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

ID number	1
Data / Parameter:	$\eta_{n,x}$
Data unit:	--
Description:	Operational efficiency of the power plant n in the year x
Source of data:	This parameter is determined as part of the baseline scenario selection procedure (Option 1)
Measurement procedures (if any):	--
Any comment:	--

ID number	2
Data / Parameter:	$EG_{n,x}$
Data unit:	MWh
Description:	Net electricity generated by the power plant n in the year x
Source of data:	This parameter is determined as part of the baseline scenario selection procedure (Option 1)
Measurement procedures (if any):	--
Any comment:	--

ID number	3
Data / Parameter:	$WG_{n,x}$
Data unit:	~~Mass or volume unit~~ tonne (t)
Description:	Quantity of waste gas consumed in the power plant n in year x
Source of data:	This parameter is determined as part of the baseline scenario selection procedure (Option 1)
Measurement procedures (if any):	--
Any comment:	--

ID number	4
Data / Parameter:	N
Data unit:	--
Description:	All power plants in the defined geographical area that have a similar size, are operated at similar load and use the same fuel type as the baseline power plant
Source of data:	This parameter is determined as part of the baseline scenario selection procedure (Option 1)
Measurement procedures (if any):	--
Any comment:	--

ID number	5
Data / Parameter:	$\eta_{j,x}$ and η_{BL}
Data unit:	--
Description:	Energy efficiency of the Rankine cycle based 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 (Option 1 or/and Option 2)
Measurement procedures (if any):	--
Any comment:	--

ID number	6
Data / Parameter:	$EF_{CO2,i}$
Data unit:	~~Tonnes~~ t CO_2 /GJ
Description:	CO_2 emission factor per unit of energy of the auxiliary fuel i
Source of data:	The source of data shall be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values shall be used only when country or project specific data is not available or difficult to obtain
Measurement procedures (if any):	--
Any comment:	IPCC guidelines/Good practice guidance for default values where local data is not available

ID number	7
Data / Parameter:	$EF_{CO_2,j}$
Data unit:	~~Tonnes~~ t CO_2 /GJ
Description:	CO_2 emission factor per unit of energy of the supplementary fuel j
Source of data:	The source of data shall be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values shall be used only when country or project specific data is not available or difficult to obtain
Measurement procedures (if any):	--
Any comment:	IPCC guidelines/Good practice guidance provide default values where local data is not available

ID number	8
Data / Parameter:	$GWP_{CH4,y}$
Data unit:	--
Description:	Global warming potential of methane
Source of data:	The source of data should be the IPCC 2006 guidelines.
Measurement procedures (if any):	--
Any comment:	--

ID number	9
Data / Parameter:	$EF_{CH4,upstream,i}$
Data unit:	~~Tonnes~~ t CH_4/GJ
Description:	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of the fuel type *i*
Source of data:	The source of data shall be the following, in order of preference: country specific data or IPCC default values. As per guidance from the Board, IPCC default values shall be used only when country or project specific data is not available or difficult to obtain
Measurement procedures (if any):	--
Any comment:	IPCC guidelines/Good practice guidance provide default values where local data is not available

III. MONITORING METHODOLOGY

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

Project proponents shall describe and specify in the CDM-PDD all monitoring procedures, including the type of measurement instrumentation used, the person responsible for monitoring and QA/QC procedures that will be applied. Where the methodology provides different options (e.g. use of default values or on-site measurements), specify which option will be used. All meters and instruments should be calibrated regularly as per industry practices.

The quality manual necessary under the above mentioned QA/QC standards shall include a section describing the elements of the CDM related monitoring procedures and how to assure and control their quality. A quality management representative from the project proponents shall ensure that the monitoring procedures are established and that they meet the requirements as specified in this methodology.

Project proponents should establish a system to monitor the amount of all types of fossil fuel combusted. On-site fossil fuel consumption for the operation of the power plant should be metered through flow or volume meters or respectively with an energy balance over the year, considering stocks at the beginning and at the end of each year. Where possible, project proponents should cross-check these estimates with fuel purchase receipts. The following table lists the data to be collected or used in order to monitor emissions from the project activity.

Monitoring of the inputs required for calculating baseline and project emissions include:

- Annual fuel(s) consumption in the project activity;
- Annual electricity generated in the project activity;
- Annual electricity required to run the project activity power plant;
- Net Calorific Value of fuel(s) used in the project activity;
- Emission factor(s) of the auxiliary and supplementary fuel(s) used in the project activity.
- Grid Emission Factor.

If applicable, this shall be based on a combination of bills of lading records or measurements records, in accordance with the measuring instruments available at the power plant. The documented amounts serve as a QA/QC instrument to a cross-check the monitoring parameters as defined in the following section.

Data and parameters monitored

Data / Parameter:	$EF_{grid,y}$
Data unit:	t CO_2/MWh
Description:	CO_2 Combined Margin emission factor electricity interconnected grid in a year *y*
Source of data:	As per the “Tool to calculate the emission factor for an electricity system”
Measurement procedures (if any):	--
Monitoring frequency:	Yearly
QA/QC procedures:	--
Any comment:	--

Data / Parameter:	NCV_{WG}
Data unit:	GJ/~~Mass or volume unit~~ tonne
Description:	Net calorific value (energy content) per ~~Mass or volume unit~~ tonne of the *waste gas* used in the power plant in dry basis
Source of data:	The source of data shall be project specific
Measurement procedures (if any):	Measurements shall be carried out by gas chromatographs, according to relevant international standards
Monitoring frequency:	All data shall be recorded continuously and archived in a digital system. The frequency of registration and archiving shall be parameterized in the electronic system in the level of 1 mean value per minute
QA/QC procedures:	The method of chromatography must follow a recognized standard such as that of ASTM, ISO, CEN, or API. Equipment will be maintained and calibrated regularly according to manufacturer's requirements
Any comment:	No default data shall be used for the *ex post* calculations, given the potential wide variability among different iron and steel facilities

Data / Parameter:	NCV_j
Data unit:	GJ/~~Mass or volume unit~~ tonne
Description:	Net calorific value (energy content) per ~~Mass or volume unit~~ tonne unit of the supplementary fuel *j* used
Source of data:	The source of data should be the following, in order of preference: project specific data, country specific data and default values from IPCC 2006 guidelines. The IPCC default values should be used only when country or project specific data are not available or difficult to obtain
Measurement procedures (if any):	Follow the national and international standard for measurement of NCV if project specific data is used.
Monitoring frequency:	Yearly
QA/QC procedures:	No QA/QC necessary for this data item
Any comment:	IPCC guidelines/Good practice guidance for default values where local data is not available

Data / Parameter:	NCV_i or $NCV_{i,y}$
Data unit:	GJ/~~Mass or volume unit~~ tonne
Description:	Net calorific value (energy content) per ~~Mass or volume unit~~ tonne of the auxiliary fuel *i* used; or: Net calorific value of fossil fuel type *i* in year *y*
Source of data:	The source of data should be the following, in order of preference: project specific data, country specific data and default values from IPCC 2006 guidelines. The IPCC default values should be used only when country or project specific data are not available or difficult to obtain
Measurement procedures (if any):	Follow the national and international standard for measurement of NCV if project specific data is used
Monitoring frequency:	Yearly

QA/QC procedures:	No QA/QC necessary for this data item
Any comment:	IPCC guidelines/Good practice guidance for default values where local data is not available

Data / Parameter:	$FST_{j,y}$ or $FC_{i,y}$
Data unit:	Tonnes ~~or m3~~
Description:	Amount of supplementary fuel *j* consumed in Heat Recovery Steam Generator (HRSG) to operate Steam turbine by the project power plant in year *y* or: Quantity of fossil fuel type *i* combusted in the project activity power plant in year *y*
Source of data:	Fuel meter reading at project boundary, purchase invoice
Measurement procedures (if any):	Fuel flow meter
Monitoring frequency:	All fuel consumed has to be monitored
QA/QC procedures:	All measurements shall use calibrated measurement equipment. Metering will be subject to regular (in accordance with stipulation of the meter supplier or relevant sectoral or national standards) maintenance and testing to ensure accuracy. The readings shall be double checked against purchase invoices
Any comment:	The total fuel consumption shall be monitored at the project boundary and purchase invoices for cross-verification

Data / Parameter:	$FGT_{i,y}$
Data unit:	Tonnes ~~or m3~~
Description:	Amount of auxiliary fuel *i* (~~Mass or volume unit~~ tonne) consumed to operate the gas turbine by the project in year *y*
Source of data:	Fuel meter reading at project boundary, purchase invoice
Measurement procedures (if any):	Fuel flow meter
Monitoring frequency:	All fuel consumed has to be monitored
QA/QC procedures:	All measurements shall use calibrated measurement equipment. Metering will be subject to regular (in accordance with stipulation of the meter supplier or relevant sectoral or national standards) maintenance and testing to ensure accuracy. The readings shall be double checked against purchase invoices
Any comment:	The total fuel consumption shall be monitored at the project boundary and purchase invoices for cross-verification

Data / Parameter:	$WG_{PJ,y}$
Data unit:	Tonnes ~~or m3~~
Description:	Quantity of waste gas consumed by the project power plant in year *y*
Source of data:	Project activity site

Measurement procedures (if any):	Meter readings
Monitoring frequency:	Continuously metered
QA/QC procedures:	All measurements shall use calibrated measurement equipment. Metering will be subject to regular (in accordance with stipulation of the meter supplier or relevant sectoral or national standards) maintenance and testing to ensure accuracy.
Any comment:	--

Data / Parameter:	$EG_{\mathrm{Pr},y}$
Data unit:	MWh
Description:	Net electricity generated by project power plant in year y
Source of data:	Project activity site
Measurement procedures (if any):	Meter readings
Monitoring frequency:	Continuously metered
QA/QC procedures:	All measurements shall use calibrated measurement equipment. Metering will be subject to regular (in accordance with stipulation of the meter supplier or relevant sectoral or national standards) maintenance and testing to ensure accuracy. The readings shall be double checked against selling records (if sold to grid). Calibration shall be done according to national/sectoral or international standards. If there are no standards available, calibration shall be done at least once every year
Any comment:	--

IV. REFERENCES AND ANY OTHER INFORMATION

Not applicable.

- - - - -

History of the document

Version	**Date**	**Nature of revision(s)**
01.0.0	EB 63, Annex # 29 September 2011	To be considered at EB 63.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		