Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS

Project participants shall apply the general guidelines to the SSC CDM methodologies, information on additionality (attachment A to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

II.H. Energy efficiency measures through centralization of utility provisions of an industrial facility

Technology/measure

1. This methodology comprises energy efficiency measures implemented through integration of a number of utility provisions (for power, steam/heat/hot air and cooling) of an industrial facility into one single utility. The single utility shall consist of either a Combined Heat and Power (CHP - cogeneration) or a Combined Cooling, Heat and Power (CCHP - tri-generation) installation, replacing one or more:

    (a) Existing utility provisions; and/or

    (b) Facilities that would have otherwise been built.

2. This methodology is applicable under the following conditions:

    (a) The project activity results in total energy saving of no more than 60 GWh (or 180 GWh_{th}) per year;

    (b) The project activity does not displace existing CHP or CCHP systems; and

    (c) In case of CCHP systems, the project activity shall include the shift from vapour compression chillers using chemical refrigerants to chillers which use refrigerants that have no global warming potential (GWP) and no ozone depleting potential (ODP). This conversion must be voluntary and not mandated by laws or regulations;

    (d) If it is identified that the baseline situation is the continued use of the existing system then the existing system must have been in operation for at least three years immediately prior to the start date of the project activity,[1] in order to ensure that adequate baseline performance data are available.

3. Existing chillers, boilers, electricity generating units, etc. may remain in operation after the implementation of the project activity to either: (a) Supply the balance of the demand not met by the CHP or CCHP systems if the CHP or CCHP system has insufficient capacity to supply the total energy demand; and/or (b) Provide backup to the CHP or CCHP facilities. However, emission reductions can only be claimed for the cooling, heat and electricity produced by the new CHP or CCHP system.

4. After the implementation of the project activity the facility may remain connected to a electricity grid (with a possibility of export of electricity to a grid). For a CHP or CCHP unit

[1] The start date of the CDM project activity is defined in EB 41, paragraph 67.

exporting electricity to a grid, emission reductions on account of net electricity delivered to a grid can only accrue from "cogenerated electricity"(electricity that is actually cogenerated) i.e. the electricity generated when the overall fuel input efficiency[2] of CHP or CCHP unit on an annual average basis is greater than or equal to 75%.[3] If it is lower than 75 %, then non-CHP or non-CCHP electricity generation may take place.[4] Cogenerated electricity is determined as follows:

(a) The load pattern (useful heat demand) shall be assessed and evaluated as to whether the unit operates in full cogeneration mode during the monitoring periods. For the period in which the unit operates in full cogeneration mode, the actual/useful heat ($H_{CHP/CCHP}$) and electrical power output from the cogeneration unit shall be measured. From this data the actual "power-to-heat ratio" (α_{actual}) is calculated to determine "cogenereted electricity" ($E_{CHP/CCHP}$) as follows:

$$E_{CHP/CCHP} = H_{CHP/CCHP} * \alpha_{actual}$$

(b) In case of a CCHP system, where it may not be possible to directly measure heat fed to an absorption chiller, equivalent useful heat can be calculated using actual cooling output (from measured parameters e.g. temperature and mass flow rate) from the absorption chiller;

5. Determination of power-to-heat ratio (α):

(a) For CHP or CCHP units under development or in the first year of operation, where measured data cannot be established, the design "power-to-heat ratio" in full CHP or CCHP mode can be used;

(b) If the actual "power-to-heat ratio" of the CHP or CCHP unit is not known, use the default[5] "power-to-heat ratio" as specified below:

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[2] Total energy output (Useful heat + Electricity)/Fuel energy input.

[3] Annex II to EU Cogen Directive 2004/8/EC (Calculation of electricity from cogeneration) on the promotion of cogeneration based on a useful heat demand in the internal energy market, 2008/952/EC "Detailed guidelines for the implementation and application of Annex II to Directive 2004/8/EC " and UNESCAP, 2000. Guidebook on Cogeneration as a Means of Pollution Control and Energy Efficiency in Asia (Reference No.: ST/ESCAP/2026).

[4] Non-CHP electricity means the electrical energy generated by a cogeneration unit in a reporting period at times when one of the following situations occurs: no related heat produced by the cogeneration process or part of the heat produced cannot be considered as useful heat. Non-CHP electricity generation might occur in the following cases:

(a) In processes with insufficient useful heat demand or no generation of useful heat energy or no utilisation of heat;

(b) In processes with heat rejection facilities (for example, in the condensing part of steam cycle power plants and in combined-cycle power plants with extraction-condensing steam turbines).

[5] Annex II to EU Cogen Directives 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market.

Type of unit	Default power-to-heat ratio (α)
Combined cycle gas turbine with heat recovery	0.95
Steam backpressure turbine	0.45
Steam condensing extraction turbine	0.45
Gas turbine with heat recovery	0.55
Internal combustion engine	0.75

6. In case the produced electricity, cooling or steam/heat/hot air are delivered to another facility within the project boundary, a contract between the supplier and consumer of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.

7. For the purpose of this methodology, natural gas is defined as a gas which consists primarily of methane and which is generated from: (i) Natural gas fields (non-associated gas); (ii) Associated gas found in oil fields. It may be blended up to 1% on a volume basis with gas from other sources, such as, *inter alia*, biogas generated in biodigesters, gas from coal mines, gas which is gasified from solid fossil fuels etc.[6]

Boundary

8. The project boundary is the physical, geographical site of the industrial facility where the CHP or CCHP system is being implemented. The boundary also extends to the industrial facility consuming energy generated by the system and the processes or equipment that are affected by the project activity.

Baseline

9. One of the following options for baseline emission calculations shall be used depending on the technology that would have been used to produce the heat/steam/hot air and power and where relevant cooling, in the absence of the project activity:

(a) Electricity is imported from the grid (includes the cooling load of a vapour compression system where relevant) and/or steam/heat is produced using fossil fuel;

(b) Electricity is produced in an on-site captive power plant (includes cooling load of a vapour compression system where relevant) and/or steam/heat/hot air is produced using fossil fuel;

(c) A combination of (a) and (b).

(d) Steam/heat/hot air is produced using fossil fuel and the electricity (delivered to the grid by the project activity) would otherwise have been generated by the operation

[6] This limitation is included because the methodology does not provide procedures to estimate the GHG emissions associated with the production of gas from these other sources. Project activities that use gas that does not comply with this definition must apply for a revision of the methodology.

of grid-connected power plants and by the addition of new generation sources to the grid.

10. The appropriate baseline scenario must be selected from one of the following scenarios:

(a) Replacing/supplementing existing systems: The project consists of the installation of a new system that replaces or supplements the operation of existing systems that supply electricity (grid or on-site generation) and cooling (e.g. chillers) and/or heating systems (e.g. boilers). In such cases the baseline scenario is defined as either:

(i) If the total annual consumption of energy (electricity, cooling and heating) by the consuming facility does not increase by more than 20% from the established baseline values during the crediting period then the baseline scenario is the continuation of the operation of the existing systems where baseline emissions are established from the characteristics of the existing systems using data from the immediately prior three years to the start date of the project activity;

(ii) If during the crediting period, total annual consumption of energy (electricity, cooling and heating) by the consuming facility does increase by more than 20% from the established baseline values then one of two options are applicable:

- If it can be demonstrated, using the related and relevant procedures prescribed in the general guidelines to small scale CDM methodologies, that the most plausible baseline scenario for the supply of additional amounts of energy is the same as the existing systems then such systems can be continued to be used for determining baseline emissions;
- If it cannot be demonstrated that the most plausible baseline scenario for the supply of additional amounts of energy is the same as the existing systems then the Baseline Reference Plant Approach, as defined below shall be used;

(iii) If, irrespective of total annual energy consumption of baseline or project scenarios, it is determined that new and more efficient systems (as compared to the existing systems) would have been installed in the absence of the project activity (for example, due to the baseline equipment reaching the end of its useful life at any point during the crediting period) then the baseline reference plant approach, as defined below, shall be used;

(b) Replacing systems that would have been built: The project consists of the installation of a new system that replaces the operation of electricity and cooling and/or heating systems that would have been built and utilized. In such cases the

Baseline Reference Plant Approach, as defined below, shall be used to define the baseline scenario.

Baseline reference plant approach

11. In cases where the baseline scenario consists of the installation of new cooling and/or heating systems and/or the utilization of new electricity sources, a reference plant shall be defined as the baseline scenario. The reference plant shall be based on common practice for similar capacity, new heating and cooling systems and sources of electricity in the same industrial sector and in the same country or region as the project. The identification of the reference plant should exclude plants implemented as CDM project activities. In cases where no such plant exists within the region, the economically most attractive technology and fuel type should be identified among those which provide the same service (i.e. the same or similar power, heat and/or cooling capacity), that are technologically available, and that are in compliance with relevant regulations. The efficiency of the technology should be selected in a conservative manner, i.e. where several technologies could be used and are similarly economically attractive, the most efficient technology should be defined as the baseline scenario. In addition, the least carbon intensive fuel type should be chosen in case of multiple fuels being possible choices.

12. For each identified equipment that is/would be displaced by the project activity an assessment shall be carried out to determine:

(a) Historical relative contribution of the equipment to the total annual output of energy type concerned (power, steam/heat/hot air or cooling) based on the measured relative contribution over the last three years;[7]

(b) In case the project activity displaces captive equipment(s), the baseline determined is only applicable up to the point in time when the concerned equipment needs to be replaced or is no longer fit for service $(DATE_{ServiceEnd})$. Beyond this time, it is assumed that the equipment will be replaced by an equipment analogous to the equipment installed in the project activity and thus from that point onwards the baseline emissions from this source are considered zero;[8]

(c) The remaining/expected service lifetime of the equipment as outlined in paragraph 13 below.

[7] In case more than one captive system is generating a specific energy type (power, steam/heat or cooling) and one or more systems are being replaced in the project activity, the relative contribution of these systems to the total output shall be taken into account in the formulas for baseline and project emissions. For example, if a project activity replaces two boilers, the first boiler delivers 2TJ and the second boiler 8TJ, the ratio of contribution by the individual boilers is 2/10 and 8/10 respectively. The formulas for baseline and project emission calculations shall be adjusted accordingly.

[8] For example, if a project activity displaces boiler “A” with service lifetime up to 2020, and an electrical chiller “B” with service lifetime up to 2015, then the baseline determined for the displacement of the boiler “A” is applicable up to 2020, whereas the determined baseline for displacing the electrical chiller “B” is applicable up to 2015. The baseline emissions for boiler “A” and chiller “B” beyond 2020 and 2015 respectively are considered zero.

13. The point in time at which the baseline systems would have been replaced in the absence of the project activity, and thus triggering the requirement for a new baseline scenario, shall be estimated in a conservative manner using the tool "Tool to determine the remaining lifetime of the equipment". The project activity shall be considered as one possible baseline scenario at the end of the useful life of the existing equipment.

14. The baseline emissions BE_y are calculated as follows:

$$BE_y = BE_{grid,displ,y} + BE_{grid,\exp ort,y} + BE_{capt,y} + BE_{BC,y} + BE_{BH,y} + BE_{LR,y} \quad \textbf{(1)}$$

Where:

$BE_{grid,displ,y}$	Baseline emissions associated with the grid electricity displaced by the project unit in year *y* (tCO_2e/year)
$BE_{grid,\exp ort,y}$	Baseline emissions associated with the electricity exported to a grid by the project unit in year *y* (tCO_2e/year)
$BE_{capt,y}$	Baseline emissions associated with the electricity produced by a captive power plant in year *y* (tCO_2e/year)
$BE_{BC,y}$	Baseline emissions associated with the cooling (e.g. chilled water) produced in year *y* (tCO_2e/year)
$BE_{BH,y}$	Baseline emissions associated with the heat (e.g. steam or hot air) produced in year *y* (tCO_2e/year)
$BE_{LR,y}$	The baseline emissions associated with the physical leakage of refrigerant from chiller in year *y* (tCO_2e/year)

15. In the case of a project activity displacing a captive electricity generation plant and/or grid electricity, the baseline emissions are determined as follows:

(a) If the project activity displaces electricity that was previously obtained from the grid or would have been obtained from the grid, the baseline emissions include the CO_2 emissions of the power plants connected to the grid. The baseline emissions ($BE_{grid,displ,y}$) are calculated based on the amount of grid electricity displaced by the project activity-times the emission factor of the grid calculated, as indicated in Equation (2) in accordance with methodology AMS-I.D.

$$BE_{grid,displ,y} = E_{grid,displ,y} * EF_{grid,y} \quad \textbf{(2)}$$

Where:

$E_{grid,displ,y}$	Amount of grid electricity displaced by the project in year *y* (MWh)
$EF_{grid,y}$	Emission factor of the grid, calculated in accordance with methodology AMS-I.D. (tCO_2/MWh)

(b) If the project activity displaces electricity previously obtained from the operation of a captive power plant, the baseline emissions in year y $(BE_{capt,y})$ are calculated based on the amount of captive power plant electricity displaced by the project activity times the emission factor of the captive power plant(s) calculated as follows:

$$BE_{capt,y} = \sum_{i} E_{capt,i,y} * EF_{capt,i} \quad (3)$$

Where:

$E_{capt,i,y}$	Amount of electricity displaced by the project activity in year y from captive power plant i (MWh)
$EF_{capt,i}$	Emission factor of the captive power plant i (tCO_2/MWh)

16. The emission factor of the captive power plant ($EF_{capt,i}$) is calculated based on the specific fuel consumption[9] (quantity of fuel in thermal, mass or volume unit per unit electrical output) of the captive power plant ($SFC_{cap,i}$) determined as follows:

(i) For project activities displacing electricity previously obtained from the operation of existing captive power plants, the specific fuel consumption should be established based on historical performance data from the last three years;

(ii) For project activities displacing electricity from a captive power plant that otherwise would have been built, the specific fuel consumption ($SFC_{cap,i}$) is obtained from at least two manufacturers of equipment of similar specifications and a conservative value shall be used;

(iii) The emission factor for the captive power plant (EF_{capt}) is calculated as the product of the emission factor of fuel j used by the captive power plant i ($COEF_{i,j}$) times $SFC_{cap,i}$; Equations (2), (3), or (4) contained in the tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" shall be used for this purpose.

$$EF_{capt,i} = \sum_{j} COEF_{i,j} * SFC_{cap,i} \quad (4)$$

[9] In case, in the baseline situation more than one type of fossil fuel is used in the captive power plant, the relative contribution to the total output of each fossil fuel shall be considered and the formulas for baseline emissions shall be adjusted accordingly.

Where:

$EF_{capt,i}$	Emission factor of captive power plant *i* (tCO_2/MWh_e)
$SFC_{cap,i}$	Specific fuel consumption rate of the captive power plant (quantity of fuel in thermal, mass or volume unit/MWh)
$COEF_{i,j}$	CO_2 emission coefficient of fuel type *j* (tCO_2/quantity of fuel in thermal, mass or volume unit)

17. In case the project activity displaces electricity from a captive power plant as well as from the grid, then the emission factor for the displacement of electricity should reflect the emissions intensity of the captive power plant and the grid. The emission factor for the electricity displaced ($EF_{electricity}$) shall be calculated as the weighted average of captive electricity generation and the grid electricity.[10] For new facilities, the most conservative (lowest) emission factor of the two power sources should be used.

18. In case the project activity exports electricity to a grid, baseline emissions can be calculated as follows:

$$BE_{grid,export,y} = E_{grid,export,y} * EF_{grid,y} \quad \textbf{(5)}$$

Where:

$E_{grid,export,y}$	Amount of net electricity that is exported to a grid in year *y* (MWh)

19. In the case of a project activity displacing a captive steam generation plant:

(a) The baseline emissions are calculated based on the equivalent amount of fuel that would have been used in the absence of the project activity calculated as follows:

$$BE_{BH,y} = \sum_i EF_i * \frac{S_{p,i,y}}{\eta_{cs}} \quad \textbf{(6)}$$

Where:

EF_i	Emission factor of fossil fuel *i*
η_{cs}	Efficiency of the displaced steam generation system(s) in year *y*
$S_{p,i,y}$	Thermal energy delivered by the project activity (TJ) in year *y* measured on an hourly basis using mass flow rate and enthalpy data

[10] For example if in the baseline 80% of annual electricity requirement was met by grid import and the remaining by captive generation, the weighted average emission factor ($EF_{electricity}$) would be 0.8 EF_{grid} + 0.2 $EF_{captive}$.

(b) The efficiency of the captive steam generation plant (η_{cs}) is determined as follows:

(i) If the baseline scenario is an existing steam generator or generators, then the efficiency shall be determined based on existing steam generator performance data from the last three years immediately prior to the start of the project activity. In the case where multiple steam generators exist, average performance data shall be used in a conservative manner with consideration of the historic output and energy consumption of each steam generator;

(ii) If the baseline scenario is a steam generator or generators that would have been built (i.e. not existing steam generators), the efficiency shall be determined as per the tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems";

(c) The baseline emissions associated with the combustion of fossil fuels, shall be calculated following the provisions specified in the tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".

20. Baseline emissions associated with the electricity consumed, which is from captive power plants and/or power from the grid, to produce chilled water within the project boundary are determined as follows:

$$BE_{BC,y} = EF_{ELEC,y} * \sum_i \frac{C_{P,i,y}}{COP_{c,i}} \quad \textbf{(7)}$$

Where:

$BE_{BC,y}$	Baseline emissions for chilled water produced in the project activity in year *y* (tCO_2e/year)
$EF_{ELEC,y}$	Electricity emission factor of the grid, calculated in accordance with methodology AMS-I.D, and/or of the captive plant(s), calculated in accordance with Equation (4) (tCO_2e/MWh)
$COP_{c,i}$	The Coefficient of Performance of the baseline scenario chiller(s) *i* (MWh_{th}/MWh_e). The Coefficient of Performance is defined as 'cooling output divided by electricity input'
$C_{p,i,y}$	Cooling output of baseline scenario chiller(s) *i* in year *y* (MWh_{th}/year)

(a) Baseline scenario chiller Coefficient of Performance (COP) is determined as follow:

(i) If the baseline scenario is an existing chiller or chillers, then the COP shall be based on existing chiller performance data from last three years immediately prior to the start of the project activity. In the case where

multiple chillers exist, average performance data shall be used in a conservative manner with consideration of the historic output and power consumption of each chiller;

(ii) If the baseline scenario is a chiller or chillers that would have been built (i.e. not existing chillers), the COP shall be determined as the highest COP full load performance value provided by two or more manufacturers for chillers commonly sold in the project country for the indicated commercial application;

Manufacturers often do not directly specify the COP values but quote the chillers performance in tonnage of refrigerant (TR) per kW of electrical input. 1 TR is equivalent to the amount of heat absorbed by the melting of 1 ton of ice within 24 hours and is equivalent to 3.513 kW.

(b) The cooling output of each baseline scenario chiller *i* is calculated using measured values of the total chilled water mass flow-rate and of the differential temperature of incoming and outgoing chilled water; as recorded on an hourly basis per the equation below;

$$C_{p,i,y} = \frac{\sum_{h=1}^{8,760} m_{C,i,h} * C_{\rho w,C} * \Delta T_{C,i,h}}{3600} \quad \textbf{(8)}$$

Where:

$C_{p,i,y}$	Cooling output of the baseline chiller(s) *i* in year *y* (MWh_{th}/year)
$m_{C,i,h}$	The chilled water mass flow-rate for chiller(s) *i* produced by the project in hour *h* of year *y* (tonnes/hour)
$C_{\rho w,C}$	The specific heat capacity of water (MJ/tonnes °C) (4.2 MJ/t °C)
$\Delta T_{C,i,h}$	Differential temperature of inlet and outlet chilled water for chiller(s) *i* in hour *h* of year *y* of incoming and outgoing water from the project (°C)

(c) Emissions associated with the physical leakage of refrigerants if the electrical chillers would have continued to be in service. This is only applicable if:

1. The displaced refrigerant is a greenhouse gas listed in Annex A of the Kyoto Protocol; and
2. The displaced chiller is an existing unit, and not an equipment that would otherwise been built.

The leakage rate shall be chosen in a conservative way.

(d) The emissions associated with the leakage of refrigerant from the baseline chiller in year y ($BE_{LR,y}$) are calculated as a function of the historical specific leakage rate of the displaced chiller (SLR_C) times the global warming potential of the refrigerant concerned (GWP_j) using the following relationship:

$$BE_{LR,y} = SLR_C * GWP_j \quad (9)$$

Where:

$BE_{LR,y}$	The baseline emissions associated with the leakage of refrigerant from chiller in year y (tCO_2e/year)
SLR_C	The historical specific leakage rate of the displaced chiller (tonnes/year)
GWP_j	Global Warming Potential for refrigerant j in the baseline chiller

(e) The historical specific leakage rate of the displaced chiller (SLR_C) shall be based on historical charging records from at least the last three years. This value shall be compared to the default values provided in the 2006 IPCC guidelines for national GHG inventories, volume 3, chapter 7, table 7.9. The lower of the two values i.e. IPCC default values and the leakage rates as determined from historical charging records shall be used.

Project activity emissions

21. Project emissions are equal to the emissions associated with consumption of fossil fuel and electricity within the project boundary by CHP or CCHP system, auxiliary equipment, and systems (such as boilers, chillers, and captive electricity generation plants) used to generate any backup or supplemental electricity, heating or cooling.

Project emissions are determined as follows:

(a) The project fuel consumption including any fuel used to run auxiliary equipment. Emissions are calculate using the tool “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”;

(b) The project electricity consumption including any electricity used to run auxiliary equipment are calculated using the tool “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.

22. In case existing chillers using CFC refrigerant remain in operation as indicated in paragraph 3, project emissions due to fugitive refrigerant leakages on account of operation of existing chillers need to be taken into account to the extent of difference between the cooling load met during the baseline period and the combined cooling load met by the project system and the existing chiller during the crediting period.

23. In the case of a new facility where electrical compression chillers are deployed as a backup chiller system then project emissions (fugitive refrigerant leakage) due to its operation shall be taken into account.

Leakage

24. Leakage is to be considered if the displaced energy generating equipment is transferred from another activity or the existing equipment is transferred to another activity.

25. In case of introduction of a CCHP system, if the displaced refrigerant is a greenhouse gas as defined in Annex A of the Kyoto Protocol or in Article 1, paragraph 5 of the Convention and is not destroyed, leakage emission from its storage or usage in other equipment must be considered[11] and deducted from the emission reductions. As the measures covered in this methodology are limited to shift from chemical refrigerant to a refrigerant with no global warming potential and no ozone depleting potential, leakage due to the production of the refrigerant is not included.

Emission reductions

26. The emission reductions achieved by the project activity shall be calculated as the difference between the baseline emissions and the sum of the project emissions and leakage.

Monitoring

27. Monitoring shall consists of:

(a) Documenting the technical specification of the captive equipment displaced or equipment which would otherwise have been built;

(b) Metering of all the relevant parameters should be as per the Table 1.

[11] The global warming potentials used to calculate the carbon dioxide equivalence of anthropogenic emissions by sources of greenhouse gases not listed in Annex A of the Kyoto Protocol, shall be those accepted by the Intergovernmental Panel on Climate Change in its third assessment report.

Table 1: The following parameters shall be monitored and recorded during the crediting period

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
1	$E_{grid,displ,,y}$	Amount of grid electricity displaced in year *y*	MWh/y	Continuous monitoring, hourly measurement and at least monthly recording	Measurements are undertaken using energy meters and calibration shall be as per the related and relevant paragraph of the “General guidelines to SSC CDM methodologies”. If applicable, measurement results shall be cross checked with records for sold/purchased electricity (e.g. invoices/receipts)
2	$E_{capt,y}$	Amount of captive electricity displaced in year *y*	MWh/y	Continuous monitoring, hourly measurement and at least monthly recording	Measurements are undertaken using energy meters and calibration shall be as per the related and relevant paragraph of the “General guidelines to SSC CDM methodologies”. If applicable, measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices/receipts)
3	$EF_{grid,\,,y}$	CO_2 emission factor for the grid electricity in year *y*	tCO_2e/ kWh	Annually	Grid emission factor shall be determined following the provisions in AMS-I.D

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
4	SLR_C	The historical specific leakage rate of the chiller displaced as a result of the installation of CHP or CCHP plant *i*	tonnes/year	Annually	Values taken from chiller maintenance record or purchase records of refrigerant. The value shall be cross-checked with the default values provided in the 2006 IPCC guidelines for national GHG inventories, vol.3, chapter 7, table 7.9
5	m	The chilled water mass flow-rate for chiller *i* produced by the project in hour *h* of year *y*	tonnes/hour	Continuous, integrated hourly, at least monthly recording	Measured using calibrated meters. Calibration shall be as per the related and relevant paragraph of the "General guidelines to SSC CDM methodologies"
6	ΔT	Differential temperature for chiller *i* in hour *h* of year *y* of incoming and outgoing water from the project	°C	Continuous, integrated hourly, at least monthly recording	Measured using calibrated meters. Calibration shall be as per the related and relevant paragraph of the "General guidelines to SSC CDM methodologies"

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
7	$S_{p,y}$	Thermal energy delivered by the project activity in year *y*	TJ/y	Continuous, integrated hourly, at least monthly recording	Measured using calibrated meters. Calibration shall be as per the related and relevant paragraph of the "General guidelines to SSC CDM methodologies". Thermal energy production is determined as the difference in enthalpy of the steam/heat generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid and any condensate returns. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. In case of equipment that produces hot air this is expressed as the difference in the enthalpy between the hot air supplied and the total enthalpy of feed input (e.g. air) entering the project equipment. In case the project activity is exporting heat to other facilities, the metering shall be carried out at the recipient's end

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

II.H. Energy efficiency measures through centralization of utility provisions of an industrial facility (cont)

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
8	*T*	Temperature	°C	Continuous monitoring, hourly measurement and at least monthly recording	Measured using calibrated meters. Calibration shall be as per the related and relevant paragraph of the "General guidelines to SSC CDM methodologies". In the cases (e.g. hot air output) where it is justified that the continuous measurement of flow and temperature cannot be done, its enthalpy can be determined through sampling with a 90% confidence level and a 10% precision following a procedure provided in the "General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities"

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

II.H. Energy efficiency measures through centralization of utility provisions of an industrial facility (cont)

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
9	*P*	Pressure	kg/cm^2	Continuous monitoring, hourly measurement and at least monthly recording	Measured using calibrated meters. Calibration shall be as per the related and relevant paragraph of the "General guidelines to SSC CDM methodologies". In the cases (e.g. hot air output) where it is justified that the continuous measurement of flow and temperature cannot be done, its enthalpy can be determined through sampling with a 90% confidence level and a 10% precision following a procedure provided in the "General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities"
10		Quantity of fossil fuel type *j* combusted in year *y*	Mass or volume unit	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
11		Quantity of grid electricity consumed in year *y*	MWh/y	As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"	As per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
12	$EG_{grid,export,y}$	Quantity of net electricity supplied to a grid year *y*	MWh/y	Continuous monitoring, hourly measurement and at least monthly recording	Measurements are undertaken using energy meters. Calibration should be undertaken as prescribed in the relevant paragraph of the "General Guidelines to SSC CDM methodologies". If applicable, measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices/receipts)
13		Quantity of fossil fuel/electricity consumed by the equipment (e.g. chiller, heater, boiler) which remain operational during the project activity during the year *y*	MWh	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" and the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" and the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"
14		Cooling output of the existing chillers which remain operational during the project activity during year *y*	MWh_{th}/year	Continuous monitoring, hourly measurement and at least monthly recording	Measured using calibrated meters. Calibration shall be as per the related and relevant paragraph of the "General guidelines to SSC CDM methodologies

Project activity under a Programme of Activities

28. Leakage emissions resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary shall be considered, as per the guidance provided in the leakage section of ACM0009 "Consolidated baseline and

monitoring methodology for fuel switching from coal or petroleum fuel to natural gas". In case leakage emissions in the baseline situation are higher than leakage emissions in the project situation, leakage emissions will be set to zero.

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History of the document

Version	Date	Nature of revision
03	EB 60, Annex 23 15 April 2011	To cover a project activity that exports electricity to a grid and those that allow continuous operation of pre-project equipment in the project.
02	EB 54, Annex 12 28 May 2010	To include Greenfield project activities and provide options for sample based monitoring of thermal energy output.
01	EB 38, Annex 8 14 March 2008	Initial adoption.
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