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~~ for ~~small-scale~~ SSC CDM methodologies, information on additionality (attachment A to appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

## *II.K. Installation of co-generation or tri-generation systems supplying energy to commercial buildings*

**Technology/measure**

1. This methodology applies to the installation of fossil fuel based co-generation or tri-generation facilities that simultaneously produce electricity and cooling (e.g. chilled water) and/or heating (e.g. steam or hot water) for supplying such energy to commercial, non-industrial, buildings.

2. The methodology is applicable to installation of new cogeneration or tri-generation systems that replace or supplement either: the operation of (a) existing systems that supply electricity (grid or on-site generation) and cooling (e.g. chillers) and/or heating systems (e.g. boilers) or (b) electricity and cooling and/or heating systems that would have been built and utilized.

3. The methodology does not apply to the replacement of existing co-generation or tri-generation systems.

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

5. This methodology only applies to commercial, non-industrial applications. Projects that comprise energy efficiency measures implemented through integration of a number of utility provisions (for example, integrating power, steam/heat and cooling systems) of an industrial facility cannot apply this methodology.

6. 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.[1]

7. Any chilled water/cooling, steam/hot water/heat and electricity produced by the cogeneration or trigeneration system must be used on-site (within the project boundary) to meet all or part of the energy demand. Existing chillers, boilers, electrical heaters, electricity generating units, etc. may remain in operation after the implementation of the project activity to either (a)

[1] 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.

supply the balance of the demand not met by the cogeneration or trigeneration systems if the cogeneration or trigeneration system has insufficient capacity to supply the total energy demand and/or (b) provide backup to the co-generation or tri-generation facilities. However, emission reductions can only be claimed for the cooling, heat and electricity produced by the new co-generation or tri-generation system.

8. The energy savings caused by a single project activity may not exceed the equivalent of 60 GWh per year. A maximum saving of 60 GWh is equivalent to maximum savings of 60 $GWh_e$ of electricity consumption or maximum savings of 180 $GWh_{th}$ of fuel consumption, i.e. for calculation of maximum savings allowable per year, 1 $GWH_e$ equals 3 $GWH_{th}$.

9. This project activity can include installation of cooling equipment which use refrigerants only if such refrigerants have ~~no global warming potential (GWP) and~~ no ozone depleting potential (ODP) and if such installation is not mandated by laws or regulations.

10. In case the produced electricity, cooling and/or heat are delivered to a facility that is not owned or under the control of the project owner, a contract between the project owner and consumer of the energy must be in force, during the crediting period, specifying that only the facility generating the energy can claim CERs from the emissions displaced by the subject project.

**Boundary**

11. The project boundary encompasses the physical site of the facility where the co-generation or tri-generation system is being implemented and the facility or facilities consuming the energy generated by the project activity.

**Baseline**

12. The baseline scenario for baseline emission calculations shall depend on: (a) the source of electricity; and (b) the technology that would have been used to produce heating and/or cooling, in the absence of the project activity. The following baseline options are applicable to this methodology:

(a) Electricity is imported from the grid and/or produced in an onsite captive power plant;

(b) Cooling (e.g. chilled water) is produced in a vapour compression system driven by electricity;

(c) Heating (e.g. hot water or steam) is produced using fossil fuel or electricity.

13. 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 co-generation or tri-generation 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 commercial buildings does not increase by more than 20% from the established baseline[2] values during the crediting period then the baseline scenario is the continuation of the operation of the existing systems and baseline emissions are established from the characteristics of the existing systems using data from the immediately prior three years (to the date of project start up);

(ii) If during the crediting period, total annual consumption of energy (electricity, cooling and heating) by the consuming commercial building 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 for SSC 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 co-generation or tri-generation 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**

14. 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 commercial sector and in the same country or region as the project. The identification of the reference plant should

[2] The DOE shall check the historical energy consumption of consumers and compare to energy consumed during the project activity.

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[3] 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.

**Procedure for estimating the end of the remaining lifetime of existing equipment**

15. 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 to determine the remaining lifetime of equipment”. The project activity shall be considered as one possible baseline scenario at the end of the useful life of existing equipment.

16. The baseline emissions, $BE_y$, are calculated using equation (1):

$$BE_y = BE_{grid,y} + BE_{capt,y} + BE_{BC,y} + BE_{BH,y} \quad (1)$$

Where:

| | |
|---|---|
| $BE_{grid,y}$ | Baseline emissions associated with the grid electricity displaced by the project 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 water) produced in year $y$ ($tCO_2e$/year) |

17. Baseline electricity related emissions are calculated 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 ($BE_{grid,y}$) 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 “Grid connected renewable electricity generation”.

[3] Fuel type is relevant only for the power plant. The baseline chiller(s) are assumed to use electricity.

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

Where:

| | |
|---|---|
| $BE_{grid,y}$ | Baseline emissions for the grid electricity displaced by the project in year *y* ($tCO_2e$/year) |
| $E_{grid,y}$ | Amount of grid electricity displaced by project in year *y* (MWh) |
| $EF_{grid,y}$ | Emission factor of the grid (calculated in accordance with methodology AMS-I.D ($tCO_2e$/MWh) |

(b) If the project activity displaces electricity that was previously obtained from captive power plant(s), the baseline emissions $(BE_{capt,y})$ include the $CO_2$ emissions 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 indicated in equation (3).

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

Where:

| | |
|---|---|
| $BE_{capt,y}$ | Baseline emissions for the amount of electricity displaced by the captive power plants in year *y* ($tCO_2e$/year) |
| $E_{capt,y,i}$ | Amount of electricity displaced by project in year *y* ($MWh_e$) from captive power plant *i* |
| $EF_{capt,i}$ | Emission factor of the captive power plant *i* ($tCO_2/MWh_e$) |

18. The emission factor of each captive power plant ( $EF_{capt,i}$ ) is calculated based on the specific fuel consumption rate[4] (quantity of fuel in thermal, mass or volume unit per unit electrical output) of the captive power plant ( $SFC_{cp,i}$ ) determined as follows:

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

(b) For project activities displacing electricity from a captive power plant that otherwise would have been built, the specific fuel consumption rate is obtained

[4] In case in the baseline situation where 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.

from at least two manufacturers of systems of similar specifications and a conservative value shall be used;

(c) The emission factor of each captive power plant is calculated as the product of the emission factor of fuel *j* used by captive power plant *i* ($COEF_{i,j}$) times $SFC_{cp,i}$; equations (2), (3), or (4) contained in the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" shall be used for this purpose. See equation (4).

$$EF_{capt,i} = \sum_j COEF_{i,j} * SFC_{cp,i} \quad \textbf{(4)}$$

Where:

| | |
|---|---|
| $EF_{capt,i}$ | Emission factor of captive power plant *i* ($tCO_2/MWh_e$) |
| $SFC_{cp,i}$ | 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 *i* ($tCO_2$/quantity of fuel in thermal, mass or volume unit) |

19. In case the project activity displaces electricity from a captive power plant as well as from the grid, then the weighted average emission factor for the displaced electricity is calculated using values based on the relative historical, prior three year ratios of electricity from captive plants and the grid.[5] For new facilities, the most conservative (lowest) emission factor of the two power sources should be used.

20. Baseline emissions associated with the electricity consumed, whether it is from captive power plants and/or power from the grid, to produce chilled water within the project boundary are determined per equation (5).

$$BE_{BC,y} = EF_{ELEC,y} * \sum_i \frac{C_{P,i,y}}{COP_{c,i}} \quad \textbf{(5)}$$

[5] 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 $EF_{captive}$.

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 (COP) of the baseline scenario chiller(s) *i* ($MWh_{th}/MWh_e$). The COP 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 preceding 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 ~~Coefficient of Performance~~ 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;

(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 equation (6).

$$C_{p,i,y} = \frac{\sum_{h=1}^{8,760} m_{C,i,h} * C_{\rho w,C} * \Delta T_{C,i,h}}{3600} \quad \textbf{(6)}$$

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 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 project (°C) |

21. For project activities with water heating systems, that use electricity, the baseline emissions are determined using the electricity emission factor and hourly measurements of the total water mass flow-rate and differential temperature of incoming and outgoing water, per equation (7). This equation is based on the assumption that the efficiency of electric water heating systems is 100%.

$$BE_{BH,y} = EF_{ELEC,y} * \sum_{h=1}^{8,760} \frac{m_h * C_{\rho w} * \Delta T_h}{3600} \quad \textbf{(7)}$$

Where:

| | |
|---|---|
| $BE_{BH,y}$ | Baseline emissions for hot water produced in the project activity in year *y* |
| $EF_{ELEC,y}$ | Electricity emission factor of the grid (calculated in accordance with methodology AMS-I.D and/or captive plant(s) (calculated in accordance with equation (4)) ($tCO_2e$/MWh) |
| $m_h$ | The water mass flow-rate from heater(s) during hour *h* in year *y* (tonnes/year) |
| $C_{\rho w}$ | The specific heat capacity of water (MJ/tonnes°C) (4.2 MJ/t°C) |
| $\Delta T_h$ | Differential temperature of inlet and outlet hot water for heater(s) during hour *h* (°C) |

22. For project activities replacing baseline scenario steam generating systems (e.g. boiler), that use fossil fuel the baseline emissions are based on the equivalent amount of fuel that would have been used in the absence of the project activity as indicated in equation (8):

$$BE_{BH,y} = \sum_i EF_i * \frac{S_{p,y}}{\eta_{cs}} \quad \textbf{(8)}$$

Where:

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

(a) The efficiency of the steam generation systems ($\eta_{cs}$) is determined as follow:

(i) If the baseline scenario is an existing steam generator or generators, then the efficiency shall be based on existing steam generator performance data from last three years, immediately preceding 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 power 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 per the "Tool to determine the baseline efficiency of thermal or electric energy generation systems";

(b) The baseline emissions associated with the combustion of fossil fuels shall be determined as indicated in the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion".

**Project activity emissions**

23. Project emissions are equal to: (a) the emissions associated with consumption of fossil fuel and electricity within the project boundary by the co-generation or tri-generation system, auxiliary equipment, and systems (such as boilers, chiller and hot water heaters, captive electricity generation plants) used to generate any backup or supplemental electricity, heating or cooling; and (b) the emissions associated with any refrigerants used in new project cooling equipment (e.g. electrical compression chillers which are an integral part of a co-generation/ tri-generation system or in the case of a new facility where electrical compression chillers are used as a backup).

24. Project emissions ($PE_y$) are estimated as follows:

$$\mathrm{PE}_y = PE_{ref,y} + PE_{energy,y} \tag{9}$$

Where

| | |
|---|---|
| $PE_{ref,y}$ | Project emissions from physical leakage of refrigerant, with a GWP greater than zero, from new cooling equipment in year *y*, determined in accordance with paragraph 25 below ($tCO_2e$/yr) |
| $PE_{energy,y}$ | Project emissions due to consumption of fossil fuel and/or electricity ($tCO_2$/yr). Equal to: |

- Fuel consumption of project including any fuel used to run auxiliary equipment. Emissions are calculate using the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion";
- Electricity consumption of project including any electricity used to run auxiliary equipment is calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

25. Emissions from physical leakage of refrigerant from new cooling equipment are determined as follows:[6]

For first project year of the first crediting period:

$$PE_{ref,1} = \left(Q_{ref,PJ,start}\right) * GWP_{ref,PJ} \qquad \textbf{(10)}$$

For projects years beyond the first year:

$$PE_{ref,y} = \left(Q_{ref,PJ,y}\right) * GWP_{ref,PJ} \qquad \textbf{(11)}$$

Where:

| | |
|---|---|
| $PE_{ref,y}$ | Project emissions from physical leakage of refrigerant from new cooling equipment in year *y* ($tCO_2e/yr$) |
| $Q_{ref,PJ,start}$ | Quantity of refrigerant charge in new cooling equipment at its start of operation (only accounted for in the first year of the first crediting period) (tonnes) |
| $Q_{ref,PJ,y}$ | Quantity of refrigerant used in year *y* to replace refrigerant that has leaked in year *y* (tonnes/year) |
| $GWP_{ref,PJ}$ | Global warming potential of the refrigerant that is used in new cooling equipment ($tCO_2e$/t refrigerant) |

$Q_{ref,PJ,y}$ can be determined using one of the following options:

**Option A**: Using the higher of the two quantities below:

(a) The monitored quantity of refrigerant used for top up to compensate for the leaked quantity during the year *y*; or

(b) The typical refrigerant leakage rate for the type of cooling equipment as determined from the Emission Factors (expressed in terms percentage of the initial charge/year) provided in the IPCC 2006 Guidelines, Chapter 7, Table 7.9 “Estimates for charge, lifetime and emissions factors for refrigeration and air conditioning systems”.

**Option B**: Use a default value of 35% of the initial refrigerant charge, i.e. $Q_{ref,PJ,y} = 0.35 \times Q_{ref,PJ,start}$

[6] Baseline emissions related to refrigerant use are assumed to equal zero.

**Leakage**

26. Leakage ($LE_y$) is to be considered if the displaced energy generating equipment is transferred from another activity or the existing equipment is transferred to another activity.

27. If the displaced refrigerant is a greenhouse gas as defined in annex A of the Kyoto Protocol or in paragraph 1 of the Convention and is not destroyed, leakage emission from its storage or usage in another equipment must be considered[7] and deducted from the emission reductions.

**Emission reductions**

28. Emission reductions ($ER_y$) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

**Monitoring**

29. Monitoring shall cover both the co-generation/tri-generation systems and the energy consuming buildings:

(a) Documenting of the technical specification of the equipment and systems displaced or equipment/systems that would otherwise have been built.

30. The metering of all the relevant parameters shall be as per the guidance indicated in the Table 1 below

31. The applicable requirements (e.g. calibration) for monitoring plan specified in the "General Guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participant.

[7] 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: Parameters for monitoring during the crediting period**

| No. | Parameter | Description | Unit | Monitoring/recording frequency | Measurement methods and procedures |
|---|---|---|---|---|---|
| 1 | $E_{grid,y}$ | Amount of grid electricity displaced by project in year *y* | MWh | 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 General guidelines to SSC 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 by project in year *y* | MWh | 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 General guidelines to SSC methodologies. ~~. If applicable, measurement results shall be cross checked with records for sold/purchased electricity (e.g. invoices/receipts) |

| No. | Parameter | Description | Unit | Monitoring/recording frequency | Measurement methods and procedures |
|---|---|---|---|---|---|
| 3 | $EF_{grid,y}$ | $CO_2$ emission factor for the grid electricity displaced in year *y* | t $CO_2$e/kWh | Annually | Grid emission factor shall be as per provisions of AMS-I.D |
| 4 | $C_{P,I,y}$ | Cooling output of the baseline chiller *i* displaced as a result of the installation of project activity in year *y* | $MWh_{th}$/year | Continuous monitoring, hourly measurement and at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies~~ |
| 5 | $m_{C,I,h}$ | The chilled water mass flow-rate for chiller(s) *i* produced by project in hour *h* of year *y* | tonnes/hour | Continuous, integrated hourly, at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies.~~ . |
| 6 | $\Delta T_{C,I,h}$ | Differential temperature for chiller(s) *i* in hour *h* of year *y* of incoming and outgoing water from project | °C | Continuous, integrated hourly, at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies~~ ” |
| 7 | $m_{H,I,h}$ | The water mass flow-rate from heater unit(s) *i* in year *y* | tonnes/hour | Continuous, integrated hourly, at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies.~~ ” |

| No. | Parameter | Description | Unit | Monitoring/recording frequency | Measurement methods and procedures |
|---|---|---|---|---|---|
| 8 | $\Delta T_{H,I,h}$ | Differential temperature of incoming and outgoing water from heater unit *i* | °C | Continuous, integrated hourly, at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies. ~~" |
| 9 | $S_{p,y}$ | Thermal energy delivered by the project activity in year *y* | TJ/y | Continuous, integrated hourly, at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies. ~~"<br>Thermal energy production is determined as the difference of the enthalpy of the steam or hot water 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.<br>In case of equipment that produces hot water/oil this is expressed as difference in the enthalpy between the hot water/oil supplied to and returned by the plant.<br>In case the project activity is exporting |

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for selected small-scale CDM project activity categories

*II.K. Installation of co-generation or tri-generation systems supplying energy to commercial buildings (cont)*

| No. | Parameter | Description | Unit | Monitoring/recording frequency | Measurement methods and procedures |
|---|---|---|---|---|---|
| | | | | | heat to other facilities, the metering shall be carried out at the recipient's end |
| 10 | | Temperature | °C | Continuous monitoring, hourly measurement and at least monthly recording | Measured using calibrated meters<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies.~~ |
| 11 | | Pressure | $kg/cm^2$ | Continuous monitoring, hourly measurement and at least monthly recording | Measured using calibrated meters.<br>~~Calibration shall be as per the related and relevant paragraph of General guidelines to SSC methodologies.~~ |
| 12 | | Quantity of fossil fuel type *j* combusted in year *y* | Mass or volume unit | As per the tool "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" | As per the tool "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" |
| 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 "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 "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" |
| 14 | $Q_{ref,PJ,start}$ | Quantity of refrigerant charge in new cooling equipment at its start of operation | Tonnes | Only accounted for in the first year of the first crediting period | As per manufacturer's specifications of the cooling equipment |

| No. | Parameter | Description | Unit | Monitoring/recording frequency | Measurement methods and procedures |
|---|---|---|---|---|---|
| 15 | $Q_{ref,PJ,y}$ | Quantity of refrigerant used in year *y* to replace refrigerant that has leaked in year *y* (tonnes/year) | Tonnes/year | Annually | Based on inventory of refrigerant cylinders consumed in year *y,* e.g. the total annual amount of refrigerant ordered as indicated in purchase orders cross checked against invoices |

**Project activity under a programme of activities**

32. 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(s) |
|---|---|---|
| 02.0 | EB 67, Annex #<br>11 May 2012 | To include installation of new cooling equipment that uses refrigerants with no ODP but with GWP. Physical leakage associated with refrigerants use, are accounted as project emissions in a conservative manner. |
| 01 | EB 54, Annex 4<br>28 May 2010 | Initial adoption. |
| **Decision Class**: Regulatory<br>**Document Type**: Standard<br>**Business Function**: Methodology | | |