CLEAN DEVELOPMENT MECHANISM

CDM-EB92-A10

Large-scale consolidated methodology

ACM0026: Fossil fuel based cogeneration for identified recipient facility(ies)

Version 02.0

Sectoral scope(s): 01

United Nations
Framework Convention on
Climate Change

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1. Introduction

1.1. Background

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical projects	Construction and operation of a fossil fuel cogeneration plant that supplies electricity and heat to a consuming facility(ies)
Type of GHG emissions mitigation action	Technology switch

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology is applicable to project activities that install a project facility to supply i) electricity to recipient facility(ies) and to a power grid, and ii) heat to recipient facility(ies). Project activities can be implemented either by the owner(s) of the recipient facility(ies) or by a third party (e.g. energy service company (ESCO)).

3. In order to facilitate the choice of the methodology for the co-generation activities, a flow chart (Appendix) has been prepared with major checkpoints, such as baseline scenario, fuel type, and heat-to-power ratio.

2.2. Applicability

4. The following applicability conditions apply:

   (a) Heat generated under the project activity is supplied primarily to the recipient facility(ies) and excess can be supplied to a heat network. No emission reductions can be claimed from the excess heat supplied to the heat network;

   (b) Emissions reductions from the electricity supplied to the grid may be claimed if this supply is planned. In this case the CDM-PDD shall contain annual average amount of electricity that is planned to be delivered to the grid;

   (c) In the absence of the project activity, the electricity and/or heat demand of the recipient facility(ies) is fulfilled by separate systems (i.e. electricity and heat in the baseline is not generated using cogeneration facility);

   (d) The heat-to-power ratio of the project cogeneration facility shall be higher than one.

5. In case the project activity is to supply electricity and/or heat to multiple recipient facilities and where applicable to supply electricity to a power grid, the following applies:

   (a) All recipient facilities, existing and Greenfield, shall be clearly identified prior to the implementation of the project activity. Where the project participant plans to claim emission reductions from the electricity supplied to the grid, the grid may be considered as one single recipient facility;

(b) The sources of electricity and heat (technologies) used by the existing recipient facilities should be presented in the CDM-PDD.

6. The methodology is not applicable if the most plausible baseline scenario is the construction and operation of new cogeneration plant for electricity and heat generation but using different technology/fuel.

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

2.3. Entry into force

8. The date of entry into force of the revision is the date of the publication of the EB 92 meeting report on 4 November 2016.

2.4. Applicability of sectoral scopes

9. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology application of sectoral scope 01 is mandatory.

3. Normative references

10. This consolidated baseline and monitoring methodology is based on the following methodologies: “AM0014: Fossil fuel based cogeneration for identified recipient facility(ies)” and “AM0102: Greenfield cogeneration facility supplying electricity and steam to a Greenfield Industrial Consumer and exporting excess electricity to a grid and/or project customer(s)”.

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

(a) “Combined tool to identify the baseline scenario and demonstrate additionality”;

(b) “Tool to determine the remaining lifetime of equipment”;

(c) “Tool to calculate the emission factor for an electricity system”;

(d) “Tool to determine the baseline efficiency of thermal or electric energy generation systems”;

(e) “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”;

(f) “Upstream leakage emissions associated with fossil fuel use”;

(g) “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”;

(h) “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”.

12. For more information regarding the proposed new methodologies and tools, as well as their consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <http://cdm.unfccc.int/methodologies/PAmethodologies/index.html>.

3.1. Selected approach from paragraph 48 of the CDM modalities and procedures

13. "Existing actual or historical emissions as applicable"; or

14. "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment".

4. Definitions

15. The definitions contained in the Glossary of CDM terms shall apply.

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

    (a) **Project facility** - a new fossil-fuel-based cogeneration facility established through investment as CDM project activity to generate and supply electricity and/or heat directly to recipient facility(ies);

    (b) **Cogeneration plant** - facility that generates electricity and heat simultaneously by use of fossil fuel;

    (c) **Heat** - heat is useful thermal energy that is generated in a heat generation facility (e.g. a boiler, a cogeneration plant, thermal solar panels, etc.) and transferred to a heat carrier (e.g. liquids, gases, steam, etc.) for utilization in thermal applications and processes. Note that the specific heat, as defined in this document, refers to the net quantity of thermal energy per unit of mass of heat carrier that is generated in the project facility. For example, in case of a boiler it refers to the difference of the specific enthalpy of the steam generated in the boiler and the specific enthalpy of the feed water;

    (d) **Heat network** - the spatial extent of the heat generation facilities that are physically connected through heating pipeline (e.g. pipeline network that supplies heat to several recipient facility(ies)) where project heat can be dispatched in this network without transmission constraints;

    (e) **A power grid** - is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the project facility location or the recipient facility(ies) where electricity is being consumed) and that can be dispatched without significant transmission constraints, as defined under the "tool to calculate the emission factor for an electricity system";

    (f) **Recipient facility(ies)** - the facility(ies), that consumes electricity and/or heat supplied by the CDM project activity.

5. Baseline methodology

5.1. Project boundary

17. The spatial extent of the project boundary encompasses:

    (a) The cogeneration plant;

    (b) Recipient facility(ies);

(c) Captive power plant(s) and/or power grid connected physically to a recipient facility(ies) in the baseline or project scenario;

(d) All heat generation facilities, connected physically to a recipient facility(ies) in the baseline or project scenario;

(e) The power grid, in case the project facility supplies electricity to the power grid.

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

Table 2. Emission sources included in or excluded from the project boundary

Source		Gas	Included	Justification/Explanation
Baseline	Fossil fuel consumption for electricity production	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Fossil fuel consumption for heat production	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Fossil fuel consumption for generation of heat and electricity in the project cogeneration plant	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

5.2. Selection of the baseline scenario and demonstration of additionality

19. The selection of the baseline scenario and the demonstration of additionality shall be conducted using the latest version of the "Combined tool to identify the baseline scenario and demonstrate additionality". The following additional guidance should be used when applying the tool.

20. When applying **"Sub-step 1a"** of the tool, alternative scenarios shall include all realistic and credible alternatives to the project activity for the project proponent that are consistent with current laws and regulations of the host country and that provide heat and electricity supply to the recipient facility(ies) with comparable quality and quantity as the proposed CDM project activity. However, alternatives to the project activity should also include the scenario for the construction and operation of new cogeneration plant for electricity and heat generation but using different technology/fuel.

21. For electricity supplied to the recipient facility(ies) and to the power grid, the realistic and credible alternative(s) may include, inter alia:

(a) The project activity is implemented, but not as a CDM project;

(b) Construction and operation of new captive power plant(s) to meet the electricity demand of facility(ies) supplied by project activity;

(c) Import of electricity from the grid to meet the electricity demand of the facility(ies) supplied by the project activity;

(d) Continuation of the current practice at the site of the recipient facility(ies), i.e. operation of the existing captive power plants and/or import of electricity from the power grid;

(e) The continuation of the current situation in the power grid, that is to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated and supplied to the power grid under the project would be generated in existing and new grid-connected plants.

22. For heat supplied to the recipient facility(ies), the realistic and credible alternative(s) may include, inter alia:

(a) The project activity is implemented, but not as a CDM project;

(b) Construction and operation of boilers to meet the heat demand of the facility(ies) supplied by the project activity;

(c) Continuation of the current practice, i.e. operation of the existing boilers to meet the heat demand of the facility(ies) supplied by the project activity.

23. Where the project boundary includes greenfield and existing recipient facilities, continuation of current practice applies only to existing facilities and the analysis of alternative scenarios available to greenfield recipient facility(ies) should be included, which may include alternatives available to third parties. Where the project boundary includes greenfield recipient facility(ies) only, continuation of current practice is not a plausible alternative.

24. The remaining lifetime of the existing equipment at the recipient facility(ies) shall be taken into account. It shall be determined using the latest version of the "Tool to determine the remaining lifetime of equipment".

25. However, if the remaining lifetime of the existing equipment is shorter than the crediting period(s), and the project participants wish to claim emission reductions after the end of the lifetime of the baseline equipment, baseline scenario alternative(s) shall be adjusted. The possible baseline scenario after the end of the lifetime of the existing equipment should be the economically most attractive combination of technology and fuel on the date when the lifetime ends. It may be necessary to follow the provisions for changes to registered CDM project activity as per CDM project cycle procedure, while determining the most attractive baseline scenario and documenting in the PDD when the lifetime of existing equipment ends.

26. For project activities where the ~~of~~ electricity and/or heat is supplied to the power grid/heat network, boundary of the investment analysis should include revenues from selling electricity and/or heat to the power grid/heat network or/and to the recipient facilities.

27. In undertaking investment analysis, the analysis would be based on combining the baseline alternatives listed in paragraph 18 and 19 above for power and heat. The investment for each baseline alternative includes investments that would be made for meeting the heat and/or power for all recipient facilities, included in the project boundary.

28. The sensitivity analysis should also consider variations of:

    (a) Heat-to-power ratios, as the level of profitability of two sources are different. For example, if the project is additional for the variation of heat-to-power ratio by +/- 10 per cent, then the heat-to-power ratio should be within this range in the crediting period. This shall be done by monitoring a parameter ($\theta_{PJ,y}$);

    (b) Amounts of electricity and heat supplied to each recipient facility and a power grid, where it is applicable. For example, if the project is additional for the variation of heat demand by +/- 10 per cent for one of the recipient facilities, then the heat supply to this recipient facility should be within this range in the crediting period. This shall be monitored.

29. The heat-to-power ratio of the project facility in year *y* ($\theta_{PJ,y}$) should be determined as follows:

$$\theta_{PJ,y} = \frac{HG_{PJ,y}}{3.6 \times EG_{PJ,y}} \quad \text{Equation (1)}$$

Where:

$\theta_{PJ,y}$	=	Heat-to-power ratio of the project facility in year *y*
$HG_{PJ,y}$	=	Amount of heat generated in the project facility and supplied to the recipient facility in year *y* (GJ)
$EG_{PJ,y}$	=	Amount of electricity generated by the project facility in year *y* (MWh)

5.3. Baseline emissions

30. Baseline emissions are calculated as a sum of emissions due to generation of electricity and heat:

$$BE_y = BE_{EG,y} + BE_{HG,y} \quad \text{Equation (2)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2e)
$BE_{EG,y}$	=	Baseline emissions for electricity generation in year *y* (t CO_2)
$BE_{HG,y}$	=	Baseline emissions for heat generation in year *y* (t CO_2)

5.3.1. Determination of baseline emissions for electricity generation ($BE_{EG,y}$)

31. Baseline emissions due to electricity generation ($BE_{EG,y}$) are calculated based on i) the amount of electricity generated and supplied to the recipient facility(ies) and to the grid by the project facility and ii) the baseline emission factors associated with the electricity supplied to the recipient facility(ies) and to the grid.

$$BE_{EG,y} = EG_{PJ,Grid,y} \times EF_{BL,grid,y} + \sum_l EG_{PJ,l,y} \times EF_{BL,f,y} \quad \text{Equation (3)}$$

Where:

$BE_{EG,y}$	=	Baseline emissions for electricity generation in year *y* (t CO_2)
$EG_{PJ,l,y}$	=	Amount of electricity generated and supplied to the recipient facility(ies) *l* by the project facility in year *y* (MWh)
$EF_{BL,f,y}$	=	Baseline emission factor for electricity supplied to the recipient facility(ies) in year *y* (t CO_2/MWh)
$EG_{PJ,Grid,y}$	=	Electricity supplied to the grid by the project facility in year *y* (MWh)
$EF_{BL,grid,y}$	=	Baseline emission factor for electricity supplied to the grid in year *y* (t CO_2/MWh).

5.3.2. Determination of baseline emission factor for electricity supplied to the grid in year *y* ($EF_{BL,grid,y}$)

32. There is a considerable uncertainty relating to which type of ~~other~~ power generation is substituted by the power generati~~on fractione~~d by ~~of~~ the project facility. As a result of the project, the application of an alternative power generation technology(ies) could be avoided, or the construction of a series of other power plants could simply be delayed. Furthermore, if the project were installed sooner than these other projects might have been constructed, its near-term impact could be largely to reduce electricity generation in existing plants. This depends on many factors and assumptions (e.g. whether there is a supply deficit) that are difficult to determine and that change over time. In order to address this uncertainty in a conservative manner, project participants shall use the following emission factors to determine parameters $EF_{BL,grid,y}$:

(a) EF1: The build margin, calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system" ($EF_{grid,BM,y}$);

(b) EF2: The combined margin, calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system", using a 50/50 OM/BM weight ($EF_{grid,CM,y}$) for the first crediting period and 25/75 for the subsequent ones;

33. The baseline emission factor for electricity supplied to the grid in year *y* ($EF_{BL,grid,y}$) shall be determined as the minimum between emission factors EF1 and EF2.

34. The determination of the emission factors EF1 or EF2 shall be done ex post as described in the "Tool to calculate the emission factor for an electricity system".

5.3.3. Determination of the baseline emission factor for electricity supplied to the recipient facility(ies) in year *y* ($EF_{BL,f,y}$)

35. The baseline emission factor for electricity supplied to the recipient facility(ies) in year *y* shall be determined as follows:

$$EF_{BL,f,y} = \frac{\sum_j EG_{BL,f,j,y} \times EF_{BL,f,j,y}}{\sum_j EG_{BL,f,j,y}} \qquad \text{Equation (4)}$$

Where:

$EF_{BL,f,y}$	=	Baseline emission factor for electricity supplied to the recipient facility(ies) in year *y* (t CO_2/MWh)

$EG_{BL,f,j,y}$	=	Maximum amount of electricity that would have been generated in the baseline by technology/source *j* in and supplied to the recipient facility(ies) year *y* (MWh)
$EF_{BL,f,j,y}$	=	Baseline emission factor for electricity generation in the baseline by technology/source *j* in year *y* (t CO_2/MWh)
J	=	Technology/source that would have been used in the baseline to generate electricity

36. Baseline emission factor for electricity generation supplied to the recipient facility(ies) ($EF_{BL,f,j,y}$) depends on the baseline technology as identified in the baseline scenario determination process, and therefore have three different approaches on how it shall be determined:

(a) **Approach 1** - applicable for the amount of electricity that would have been supplied to the recipient facility(ies) in the baseline scenario by the power grid. Baseline emission factor $EF_{BL,f,j,y}$ shall be determined as ~~a~~ the combined margin, calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system", using 50/50 OM/BM weight; This approach applies to ~~a PA~~ project activities where in the baseline scenario the electricity would have been supplied by the power grid to the existing and/or greenfield recipient facilities;

(b) **Approach 2** - applicable for the amount of electricity that would have been supplied to the recipient facility(ies) in the baseline scenario by captive power plant(s). Baseline emission factor for electricity generation shall be determined as follows:

$$EF_{BL,f,j,y} = \frac{EF_{BL,EG}}{\eta_{BL,EG}} \times 3.6 \qquad \text{Equation (5)}$$

Where:

$EF_{BL,f,j,y}$	=	Baseline emission factor for electricity supplied to the recipient facility(ies), generated in the baseline by technology *j* in year *y* (t CO_2/MWh)
$EF_{BL,EG}$	=	CO_2 emission factor of the fuel used in the baseline captive power plant (t CO_2/GJ)
$\eta_{BL,EG}$	=	~~The e~~Energy efficiency of the baseline fossil fuel fired power plant (Fraction)
J	=	Technology that would have been used in the baseline scenario to generate electricity supplied to the recipient facility(ies).

(i) $EF_{BL,EG}$ shall be determined as the CO_2 emission factor of the fuel identified as the baseline fuel in the baseline power plant;

(ii) Where project participants identify operation of existing captive power plant(s) as the most plausible baseline scenario, the energy efficiency of the captive power plant ($\eta_{BL,EG}$) shall be determined according to the latest version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems". The values determined for $\eta_{BL,EG}$ should be documented in the CDM-PDD and shall remain fixed till the end of the lifetime of the existing captive power plant(s);

(iii) Where project participants identify operation of new captive power plant(s) as the most plausible baseline scenario, the baseline fossil fuel is the same as that used by project facility and the energy efficiency of the captive power plant ($\eta_{BL,EG}$) shall correspond to the maximum efficiency at the optimal operating conditions, provided by the manufacturer.

(c) **Approach 3** - applicable for the amount of electricity that would have been supplied to the recipient facility(ies) in the baseline scenario by the combination of the power grid and captive power plant (combination of Approach 1 and Approach 2). Where the historical data for the recent three years is available, the weighted average emission factor can be used based upon the above two methods and historical shares of grid connected power versus captive power. Otherwise, baseline emission factor for electricity generation shall be determined as the minimum between emission factors for Approach 1 and Approach 2.

5.3.4. Determination of baseline emissions for heat generation ($BE_{HG,y}$)

37. Baseline emissions for heat generation $BE_{HG,y}$ are calculated by multiplying the heat generated by the project facility and delivered to the recipient facility(ies) with a baseline CO_2 emission factor for heat generation:

$$BE_{HG,y} = \sum_{m} HG_{PJ,m,y} \times EF_{BL,HG,y} \quad \text{Equation (6)}$$

Where:

$BE_{HG,y}$	=	Baseline emissions for heat generation in year *y* (t CO_2e)
$HG_{PJ,m,y}$	=	Amount of heat supplied to the recipient facility *m* that was generated in the project facility in year *y* (GJ)
$EF_{BL,HG,y}$	=	Baseline emission factor for heat generation in *year y* (t CO_2/GJ)

38. ~~The baseline scenario can be determined as a combination of several components for heat production. In other words, h~~Heat generated by the project facility could have been produced by different facilities and would have therefore different emission factors. To account for this, the baseline emission factor for heat generation ($EF_{BL,HG,y}$) shall be calculated as follows:

$$EF_{BL,HG,y} = \frac{\sum_k HG_{BL,HG,k} \times EF_{BL,HG,k,y}}{\sum_k HG_{BL,HG,k,y}} \quad \text{Equation (7)}$$

Where:

$EF_{BL,HG,y}$	=	Baseline emission factor for heat generation in year *y* (t CO_2/GJ)
$HG_{BL,HG,k}$	=	Maximum amount of heat that would have been generated in a baseline by technology *k* in year *y* (GJ)
$EF_{BL,HG,k,y}$	=	Baseline emission factor for heat generation in a baseline by technology *k* in year *y* (t CO_2/GJ)
K	=	Technology that would have been used in a baseline to generate heat

39. Baseline emission factor for heat generation ($EF_{BL,HG,k,y}$) depends on baseline technology and therefore have three different approaches on how it shall be determined:

(a) **Approach 1** - applicable if heat in the baseline scenario would have been supplied to the recipient facility from the existing heat network. Baseline emission factor for heat generation shall be determined as follows:

$$EF_{BL,HG,k,y} = \frac{\sum_m \left(HG_{m,y} \times EF_{BL,HG,m}\right)}{\sum_m HG_{m,y}} \quad \text{Equation (8)}$$

Where:

$EF_{BL,HG,k,y}$	=	Baseline emission factor for heat generation in the baseline by technology *k* in year *y* (t CO_2/GJ)
$HG_{m,y}$	=	Heat supplied by the heat generation facility *m* within the heat network in year *y* (GJ)
$EF_{BL,HG,m}$	=	Baseline emission factor for heat generation of the operating heat generation facility *m* (t CO_2/GJ)
m	=	All operating heat generation facilities within the heat network

The baseline emission factor for heat generation of the operating heat generation facility *m* should be determined using approach 2 below.

(b) **Approach 2** - applicable if heat in the baseline scenario would have been supplied to the recipient facility by heat generation facility(ies). Baseline emission factor for heat generation shall be determined as follows:

$$EF_{BL,HG,k,y} = \frac{EF_{BL,HG}}{\eta_{BL,HG}} \quad \text{Equation (9)}$$

Where:

$EF_{BL,HG,k,y}$	=	Baseline emission factor for heat generation in a baseline by technology *k* in year y(t CO_2/GJ)
$EF_{BL,HG}$	=	CO_2 emission factor of the fuel used in the baseline heat generation facility (t CO_2/GJ)
$\eta_{BL,HG}$	=	The energy efficiency of the baseline heat generation facility(Fraction)

(i) $EF_{BL,HG}$ shall be determined as the CO_2 emission factor of the fuel identified as the baseline fuel in the baseline heat generation facility;

(ii) Where project participants identify operation of existing heat generation facility as the most plausible baseline scenario, the efficiency ($\eta_{BL,HG}$) shall be determined according to the latest version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems". The values determined for $\eta_{BL,HG}$ should be documented in the CDM-PDD and shall remain fixed till the end of the lifetime of the existing heat generation facility;

(iii) Where project participants identify operation of new heat generation facility(ies) as the most plausible baseline scenario, the baseline fossil fuel is the same as that used by project facility and the efficiency ($\eta_{BL,HG}$) shall correspond to the maximum efficiency at the optimal operating conditions, ~~as supported~~ provided by the manufacturer;

(iv) As a conservative alternative, the efficiency of 100 per cent can be used for cases where project participants identify operation of existing or new heat generation facility as the most plausible baseline scenario;

(c) **Approach 3** - applicable if heat in the baseline scenario would have been supplied to the recipient facility by the combination of the heat network and by existing or new heat generation facility (combination of Option 1 and Option 2). Where the historical data for the recent three years is available, the weighted average emission factor can be used. Otherwise, baseline emission factor for heat generation shall be determined as a minimum between emission factors for Approach 1 and Approach 2.

5.4. Project emissions

40. Project emissions (PE_y) shall be calculated as the CO_2 emissions from fossil fuel(s) combustion associated with the production of heat and electricity in the cogeneration plant, using the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". The parameter PE_y corresponds to $PE_{FC,j,y}$ in the tool, where *j* is the type of the fossil fuel used in the cogeneration plant.

5.5. Leakage

41. Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This leakage includes mainly: (i) fugitive CH_4 emissions; (ii) CO_2 emissions from the process of CO_2 removal from the raw natural gas stream in order to upgrade the natural gas to the required market conditions; and (iii) CO_2 emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered:

(a) Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project facility and fossil fuels used in the absence of the project activity;

(b) CO_2 emissions from the process of CO_2 removal from the raw natural gas stream in order to upgrade the natural gas to the required market conditions;

(c) In the case that liquefied natural gas (LNG) is used in the cogeneration plant, CO_2 emissions due to fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

42. Leakage shall be determined using provisions of the latest version of the methodological tool "Upstream leakage emissions associated with fossil fuel use".

5.6. Emission reductions

43. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ Equation (10)

Where:

ER_y = Emission reductions in year *y* (t CO_2e)

BE_y = Baseline emissions in year *y* (t CO_2e)

PE_y = Project emissions in year *y* (t CO_2e)

LE_y = Leakage in year *y* (t CO_2e)

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

44. Refer to the latest approved version of the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

5.8. Project activity under a programme of activities (PoA)

45. Requirements set out in the latest approved version of the standard for "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" shall be followed.

5.9. Data and parameters not monitored

Data / Parameter table 1.

Data / Parameter:	$EF_{BL,EG}$, $EF_{BL,HG}$, $EF_{BL,HG,m}$
Data unit:	t CO_2/GJ
Description:	CO_2 emission factor of the fuel used in the baseline power plant. CO_2 emission factor of fuel used in the baseline heat generation facility. CO_2 emission factor of fuel used in the operating heat generation facility *m*

<table>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:

<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices or contract</td><td>This is the preferred source</td></tr>
<tr><td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (b) is not available

These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>(d) IPCC default values at the lower limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (c) is not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a) and (b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Any comment:</td><td>For (a): if the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, options (b), (c) or (d) should be used</td></tr>
</table>

Data / Parameter table 2.

Data / Parameter:	$EG_{BL,f,j}$
Data unit:	MWh
Description:	Maximum amount of electricity that would have been generated in the baseline by technology/source *j* in and supplied to the recipient facility(ies)
Source of data:	Historical records
Measurement procedures (if any):	Appropriate meter for the existing recipient facility(ies)
Any comment:	This parameter is used to calculate emissions due to historical use of electricity

Data / Parameter table 3.

Data / Parameter:	$HG_{m,y}$
Data unit:	GJ
Description:	Heat supplied by the heat generation facility *m* within the heat network in year *y*
Source of data:	Historical records
Measurement procedures (if any):	~~Appropriate thermal energy meter for the existing recipient facility(ies)~~
Any comment:	This parameter is used to calculate emissions due to historical use of heat

Data / Parameter table 4.

Data / Parameter:	$HG_{BL,HG,k}$
Data unit:	GJ
Description:	Maximum amount of heat that would have been generated in a baseline by technology *k*
Source of data:	Historical records
Measurement procedures (if any):	
Any comment:	This parameter is used to calculate emissions due to historical use of heat

6. Monitoring methodology

46. Describe and specify in the CDM-PDD all monitoring procedures, including the type of measurement instrumentation used, the responsibilities for monitoring and Quality Assurance/Quality Control (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.

47. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. One hundred per cent of the data should be monitored if not indicated differently in the comments in the tables below.

48. In addition, the monitoring provisions in the tools referred to in this methodology apply. Accordingly, $EG_{PJ,grid,y}$ *and* $EG_{PJ,l,y}$ should be determined as per the Tool for "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". When applying the tool, the requirements for $EG_{PJ,facility,l,y}$ should apply to parameter $EG_{PJ,l,y}$.

6.1. Data and parameters monitored

~~**Data / Parameter table 5.**~~

~~**Data / Parameter:**~~	~~$EG_{PJ,l,y}$~~
~~Data unit:~~	~~MWh~~

~~Description:~~	~~Amount of electricity generated and supplied to the recipient facility(ies) / by the project facility in year *y*~~
~~Source of data:~~	~~Measured by project participants using electricity meters~~
~~Measurement procedures (if any):~~	~~On-site measurements~~
~~Monitoring frequency:~~	~~Continuously~~
~~QA/QC procedures:~~	~~-~~
~~Any comment:~~	~~The project participants shall check whether $EG_{PJ,l,y}$ is within the range as considered in the sensitivity analysis under "Selection of the baseline scenario and demonstration of additionality" above. Changes to the value of $EG_{PJ,l,y}$ beyond the range covered in the sensitivity analysis during the crediting period represent a change to the project design document and the relevant procedures shall apply.~~

~~**Data / Parameter table 6.**~~

~~**Data / Parameter:**~~	~~$EG_{PJ,grid,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Amount of electricity generated and supplied to the grid by the project facility in year *y*~~
~~Source of data:~~	~~Measured by project participants using electricity meters~~
~~Measurement procedures (if any):~~	~~On-site measurements~~
~~Monitoring frequency:~~	~~Continuously~~
~~QA/QC procedures:~~	~~-~~
~~Any comment:~~	~~The project participants shall check whether $EG_{PJ,l,y}$ is within the range as considered in the sensitivity analysis under "Selection of the baseline scenario and demonstration of additionality" above. Changes to the value of $EG_{PJ,l,y}$ beyond the range covered in the sensitivity analysis during the crediting period represent a change to the project design document and the relevant procedures shall apply.~~

Data / Parameter table 7.

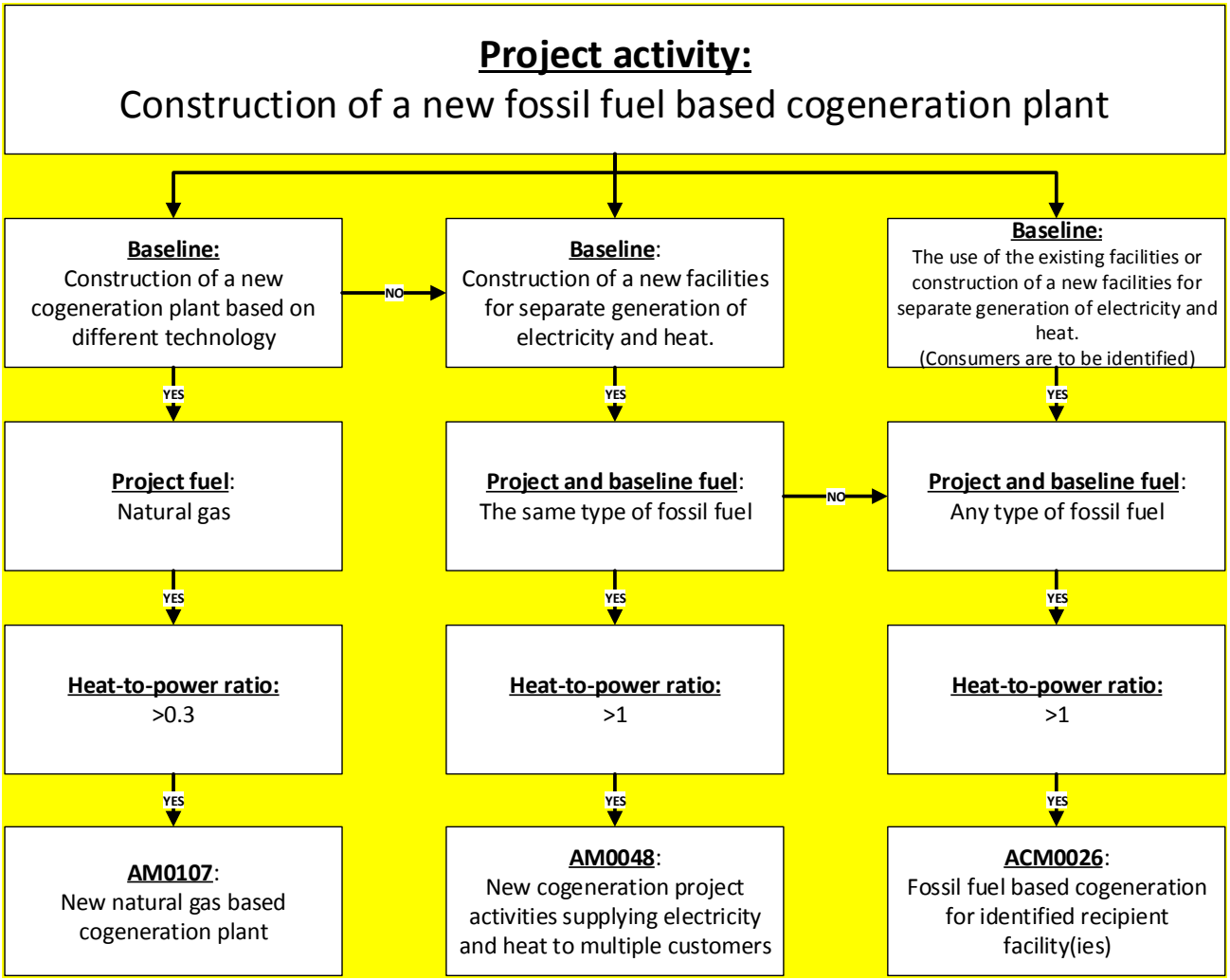
Data / Parameter:	$HG_{PJ,m,y}$
Data unit:	GJ
Description:	Amount of heat supplied to the recipient facility *m* in year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	This parameter should be determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. 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
Monitoring frequency:	Calculated based on continuously monitored data and aggregated as appropriate, to calculate emissions reductions

QA/QC procedures:	-
Any comment:	The project participants shall check whether $HG_{PJ,m,y}$ is within the range as considered in the sensitivity analysis under "Selection of the baseline scenario and demonstration of additionality" above. Changes to the value of $HG_{PJ,m,y}$ beyond the range covered in the sensitivity analysis during the crediting period represent a change to the project design document and the relevant procedures shall apply

Data / Parameter table 8.

Data / Parameter:	$\theta_{PJ,y}$
Data unit:	Fraction
Description:	Heat-to-power ratio of the cogeneration plant in year *y*
Source of data:	Calculated based on parameters $HG_{PJ,y}$ and $EG_{PJ,y}$ as per equation 1
Measurement procedures (if any):	-
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	The project participants shall check whether $\theta_{PJ,y}$ is within the range as considered in the sensitivity analysis under "Selection of the baseline scenario and demonstration of additionality" above. Changes to the value of $\theta_{PJ,y}$ beyond the range covered in the sensitivity analysis during the crediting period represent a change to the project design document and the relevant CDM project cycle procedures shall apply

Appendix. The flowchart to navigate through fossil fuel cogeneration methodologies



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Document information

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02.0	4 November 2016	EB92, Annex 10. Revision to include the requirements in TOOL05 and to incorporate a flowchart to help project participants navigate through fossil fuel cogeneration methodologies.
01.0	27 November 2015	EB 87, Annex 5

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