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

TYPE I - RENEWABLE ENERGY PROJECTS

Project participants shall apply the general guidance to the small-scale CDM methodologies, information on additionality (attachment A to appendix B) and general guidance on leakage in biomass project activities (attachment C to appendix B) provided at http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html *mutatis mutandis*.

RENEWABLE ENERGY PROJECTS

I.C. Thermal energy production ~~for the user~~ with or without electricity

Technology/measure

1. This category comprises renewable energy technologies that supply ~~individual households or~~ users[1] ~~or groups of households~~ with thermal energy that displaces fossil fuel use. These units include technologies such as ~~Examples include~~ solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass ~~for water heating, space heating, or drying,~~ and other technologies that provide thermal energy that displaces fossil fuel.

2. Biomass-based co-generating systems that produce heat and electricity are included in this category. For the purpose of this methodology "Cogeneration" shall mean the simultaneous generation of thermal energy and electrical and/or mechanical energy in one process. Cogeneration system may supply one of the following:

(a) Electricity to a grid;

(b) Electricity and/or thermal energy (steam or heat) for on-site consumption or for consumption by other facilities;

(c) Combination of (a) and (b).

3. The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal[2] (see paragraph 5 for the applicable limits for cogeneration project activities).

4. For co-fired[3] systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel shall not exceed 45 MW thermal (see paragraph 5 for the applicable limits for cogeneration project activities).

5. The following capacity limits apply for biomass cogeneration units:

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[1] E.g., residential, industrial or commercial facilities.

[2] Thermal energy generation capacity shall be manufacturer's rated thermal energy output, or if that rating is not available the capacity shall be determined by taking the difference between enthalpy of total output (for example steam or hot air in kcal/kg or kcal/m^3) leaving the project equipment and the total enthalpy of input (for example feed water or air in kcal/kg or kcal/m^3) entering the project equipment. For boilers, condensate return (if any) must be incorporated into enthalpy of the feed.

[3] Co-fired system uses both fossil and renewable fuels.

(a) If the project activity includes emission reductions from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to thermal energy (i.e., for renewable project activities, the maximal limit of 15MW(e) is equivalent to 45 MW thermal output of the equipment or the plant).

(b) If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e. no emission reductions from electricity component), the total installed thermal energy production capacity of the project equipment of the cogeneration unit shall not exceed 45 MW thermal.

(c) If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e. no emission reductions from thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.

6. In case electricity and/or steam/heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) 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. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category.

8. The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should comply with capacity limits in paragraphs 3 to 5 ~~be lower than 45 MW(thermal)~~th and should be physically distinct[4] from the existing units.

9. Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources[5] provided:

(a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or

(b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology AMS-III.K. Alternatively, conservative emission

[4] Physically distinct units are those that are capable of producing thermal/electrical energy without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered “physically distinct”.

[5] Refer to Annex 18, EB 23 for the definition of renewable biomass.

factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g. source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.

Project Boundary

10. The physical, geographical site of the project equipment producing the renewable energy delineates the project boundary. The boundary also extends to the industrial, commercial or residential facility, or facilities, consuming energy generated by the system and the processes or equipment that is affected by the project activity.

Baseline Emissions

11. For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission ~~coefficient~~ factor for the fossil fuel displaced. For calculating the emission factor, reliable local or national data shall be used. IPCC default values shall be used only when country or project specific data are not available or demonstrably difficult to obtain. ~~IPCC default values for emission coefficients factors may be used~~.

12. Project activities producing both heat and electricity including cogeneration shall use one of the following baseline scenarios:

(a) Electricity is imported from the grid and ~~steam/heat~~ thermal energy (steam/heat) is produced using fossil fuel;

(b) Electricity is produced in an on-site captive power plant using fossil (with a possibility of export to the grid) and ~~steam/heat~~ thermal energy (steam/heat) is produced using fossil fuel;

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

(d) Electricity and ~~steam/heat~~ thermal energy (steam/heat) are produced in a cogeneration unit using fossil fuel (with a possibility of export of electricity to the grid/other facilities and/or thermal energy to other facilities);

(e) Electricity is imported from the grid and/or produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid); steam/heat is produced from biomass[6]";

(f) Electricity is produced in an on-site captive power plant using biomass (with a possibility of export to the grid) and/or imported from the grid; steam/heat is produced using fossil fuel;

(g) Electricity and/or thermal energy produced in a co-fired system.

[6] ~~Baseline biomass consumption may include a small amount of complementary fossil fuel.~~

13. Baseline emissions for electricity produced in captive plants shall be calculated as follows: ~~the amount of electricity produced with the renewable energy technology (GWh) multiplied by the CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO2 / TJ) divided by the efficiency of the captive plant~~

$$BE_{captelec,y} = (EG_{captelec,PJ,y} / \eta_{BL,captive\ plant}) * EF_{BL,FF,CO_2} \quad (1)$$

Where:

$BE_{captelec,y}$	The baseline emissions from electricity displaced by the project activity during the year y; ~~in~~ tCO_2
$EG_{captelec,PJ,y}$	The amount of electricity produced by the project activity during the year y; GWh
EF_{BL,FF,CO_2}	The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant obtained from reliable local or national data if available; otherwise, IPCC default emission factors are used; (tCO_2 /GWh)
$\eta_{BL,captive\ plant}$	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

14. Baseline emissions for supply of electricity to and/or displacement electricity from a grid ~~of for electricity that displaces grid import and/or supplies to grid imported from the grid shall be calculated as the amount of electricity displaced or supplied produced bywith the renewable energy technology (GWh) multiplied by the CO_2 emission factor of that grid. The emission factor for grid electricity~~ shall be calculated as per the procedures detailed in AMS-I.D.

15. For steam/heat produced using fossil fuels the baseline emissions are calculated as follows:

~~$BE_y = HG_y * EF_{CO2} / \eta_{th}$~~ **(2)**

~~$BE_{CO_2,y} = HG_y * EF_{CO_2} / \eta_{thermal}$~~

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

Where:

$BE_{thermal,CO_2,y}$ ~~BE_y~~	The baseline emissions from steam/heat displaced by the project activity during the year y; ~~in~~ tCO_2e.
$EG_{thermal,y}$ ~~HG_y~~	The net quantity of steam/heat supplied by the project activity during the year y; ~~in~~ TJ
EF_{FF,CO_2} ~~EF_{CO2}~~	The CO_2 emission factor ~~per unit of energy~~ of the fossil fuel that would have been used in the baseline plant; ~~in (~~tCO_2 / TJ~~)~~, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used

$\eta_{BL,thermal}$ The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

16. For cases 12 ~~7~~ (a), (b) and (c), baseline emissions shall ~~must~~ be calculated as the sum of emissions from the production of electricity and ~~emissions from the production~~ steam/heat considering most recent historical records (average of the data from a minimum of three most recent years excluding abnormal years is required)[7]. ~~For the case 13 7(c) the amount of electricity that would have been produced in the on-site power plant and the electricity that would have been exported or imported from the grid should be determined~~

For project activities that displace on-site captive electricity and/or displace grid electricity import and/or supply electricity to grid, the emission factor for the electricity should reflect the emissions intensity of the captive power plant and the grid of the baseline scenario. If annual electricity produced in the project activity is less than or equal to the sum of on-site captive generation and net grid import [8](average of most recent three years data) in the baseline scenario, the emission factor shall be calculated as the weighted average of on-site captive electricity generation and the net grid electricity import in the baseline[9]. If annual electricity produced in the project activity is greater than the sum of on-site captive generation and net grid import (average of most recent three years data) in the baseline, lower of the two i.e., emission factor of the grid or the emission factor of the baseline captive plant shall be used for the incremental generation (i.e., the difference between the electricity generation in the project activity and the sum of captive generation and net grid import).

For project activities that do not displace captive electricity generated by existing plant but displace grid electricity import and/or supply electricity to grid, the emission factor of the grid shall be calculated as per the procedures detailed in AMS-I.D.

17. For electricity and thermal energy (steam/heat) produced in a cogeneration unit, using fossil fuel (case 12 ~~7~~ (d)), the following formula shall be used:

~~$BE_y = (HG_y + EG_y * 3.6) * EF_{CO2} / \eta_{cogen}$~~

~~$BE_{CO_2,y} = (HG_y + EG_y * 3.6) * EF_{CO_2} / \eta_{cogen}$~~

$$BE_{cogen,CO_2,y} = \left[(EG_{PJ,thermal,y} + EG_{PJ,electrical,y} * 3.6) / \eta_{BL,cogen}\right] * EF_{FF,CO_2} \quad (3)$$

7 Cases where no historical information is available, the most plausible energy supply sources shall be established in accordance with the guidance on Greenfield projects in the general guidance to SSC methodologies.

8 Difference of total electricity imported from the grid and total electricity exported to the grid.

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

Where:

$BE_{cogen,CO_2,y}$ ~~BE_y~~	Baseline emissions from electricity and thermal energy ~~steam/heat~~ displaced by the project activity during the year *y*; tCO_2e
$EG_{PJ,electrical,y}$ ~~EG_y~~	The amount of electricity supplied by the project activity during the year *y*; ~~in~~ GWh ~~[measured]~~
3.6	Conversion factor; TJ/GWh
$EG_{PJ,thermal,y}$ ~~HG_y~~	The net quantity of thermal energy ~~steam/heat~~ supplied by the project activity during the year *y*; ~~in~~ TJ
EF_{FF,CO_2} ~~EF_{CO2}~~	The CO_2 emission factor ~~per unit of energy~~ of the fossil fuel that would have been used in the baseline cogeneration plant; ~~in (~~tCO_2 / TJ~~)~~ obtained from reliable local or national data if available, otherwise IPCC default emission factors are used
$\eta_{BL,cogen}$	The total efficiency (including both thermal and electrical ~~both included~~) of the cogeneration plant using fossil fuel that would have been used in the absence of the project activity. Efficiency should be calculated as the total energy produced (electricity and steam/heat extracted) divided by thermal energy of the fuel used

18. Efficiency of the baseline units shall be determined by adopting one of the following criteria (in a preferential order):

(a) Highest annual measured operational efficiency of a unit with similar specifications, using baseline fuel;

(b) Highest of the annual operational efficiency values provided by two or more manufacturers for units with similar specifications, using the baseline fuel;

(c) ~~Maximum~~ Default efficiency of 100%.

19. For case 12 ~~7~~ (e), baseline emissions from the production of electricity shall be calculated as per paragraph 16. Emission reductions from heat generation are not eligible.

20. For case 12 (f), baseline emissions from the production of steam/heat using fossil fuel shall be calculated as per paragraph 15. Emission reductions from displacing on-site electricity generation are not eligible.

21. For 12 (g), baseline emissions shall be determined based on three years average historical data on the relative share of fossil fuel and biomass in the baseline fuel mix. The relative share is determined based on the energy content of each fuel.

$$BE_{cofire,CO_2,y} = (EG_{cofire,PJ,y} / \eta_{BL,cofire}) * EF_{cofire,CO_2} \quad ((4))$$

Where:

$BE_{thermal,CO_2,y}$ ~~BE_y~~	The baseline emissions from thermal and/or electrical energy displaced by the project activity during the year *y*; ~~in~~ tCO_2e
$EG_{cofire,PJ,y}$ ~~HG_y~~	The net quantity of energy (electricity/thermal) supplied by the project activity during the year *y*; ~~in~~ TJ
EF_{cofire,CO_2} ~~EF_{CO2}~~	CO_2 emission factor of the fossil fuel that would have been used in the baseline co-fired plant established using three years average historical data (tCO2 / TJ)
$\eta_{BL,cofire}$	The efficiency of the co-fired plant that would have been used in the absence of the project activity

22. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy production facility, where the existing and new units share the use of common and limited renewable resources (e.g. biomass residues), the potential for the project activity to reduce the amount of renewable resource available to, and thus thermal energy production by, existing units must be considered in the determination of baseline emissions, project emissions, and/or leakage, as relevant.

For project activities that involve the addition of new energy production units (e.g. turbines) at an existing facility, net increase in thermal energy generation ~~the increase in energy production associated with the project (EG_y in MWh/ year)~~ should be calculated as follows:

~~$TE_{PJ,add,y} = TE_y - TE_{old,y}$ $EG_y = TE_y - WTE_y$~~

$$EG_{thermal,add,y} = EG_{thermal,PJ,y} - EG_{thermal,old,y} \quad (5)$$

~~the amount of electricity supplied by the project activity during the year y~~

Where:

~~$TE_{PJ,add,y}$~~ $EG_{thermal,add,y}$	Net increase in thermal energy generation at existing plant in year *y* that should be considered as energy baseline (EG_{BL}); TJ~~/y~~
$EG_{thermal,PJ,y}$ ~~TE_y~~	Total actual thermal energy produced in year *y* by all units, existing and new project units; TJ~~/y~~
$EG_{thermal,old,y}$ ~~$TE_{old,y}$~~	Estimated thermal energy that would have been produced by existing units (installed before the project activity) in year *y* in the absence of the project activity; TJ~~/y~~
~~TE_y~~	~~the total thermal energy produced in year y by all units, existing and new project units~~
~~WTE_y~~	~~the estimated thermal energy that would have been produced by existing units (installed before the project activity) in year y in the absence of the project activity, where~~

The value $EG_{thermal,old,y}$ is given by

~~$TE_{old,y} = MAX(TE_{actual,y}, TE_{estimated,y})$ E_y = MAX($WTE_{actual,y}$, $WTE_{estimated,y}$)~~

$$EG_{thermal,old,y} = MAX(EG_{thermal,actual,y}, EG_{thermal,estimated,y}) \quad (6)$$

Where:

$EG_{thermal,actual,y}$ ~~$WTE_{actual,y}$~~	The actual, measured thermal energy production of the existing units in year *y*; TJ~~/y~~
$EG_{thermal,estimated,y}$ ~~$WTE_{estimated,y}$~~	The estimated thermal energy that would have been produced by the existing units under the observed availability of the renewable resource for year *y*; TJ~~/y~~

If the existing units shut down, are derated, or otherwise become limited in production, the project activity should not get credit for generating thermal energy from the same renewable resources that would have otherwise been used by the existing units (or their replacements). Therefore, the equation for $EG_{thermal,old,y}$ ~~$TE_{old,y}$ WTE~~ still holds, and the value for $EG_{thermal,estimated,y}$ ~~$TE_{estimated,y}$ $WTE_{estimated,y}$~~ should continue to be estimated assuming the capacity and operating parameters are the same as that at the time of the start of the project activity.

If the existing units are subject to modifications or retrofits that increase production, then $EG_{thermal,old,y}$ ~~$TE_{old,y}$ WTEy~~ can be estimated using the procedures described for $EG_{BL,thermal,retrofit,y}$ ~~$TE_{BL,retrofit}$ EGbaseline~~ below.

23. For project activities that seek to retrofit or modify an existing facility for renewable energy generation the baseline scenario is the following:

In the absence of the CDM project activity, the existing facility would continue to provide thermal energy $EG_{BL,thermal,retrofit,y}$ (~~$TE_{BL,retrofit,y}$ $EG_{baseline}$~~) at historical average levels $EG_{HY,thermal,retrofit,y}$ (~~TE~~~~$EG_{historical}$~~$_{historical}$), until the time at which the thermal energy facility would be likely to be replaced or retrofitted in the absence of the CDM project activity ($DATE_{BaselineRetrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline thermal energy production ~~($EG_{baseline}$)~~ is assumed to equal project thermal energy production ~~(EG_y, in MWh/year),~~ and no emission reductions are assumed to occur.

~~$EG_{baseline}$ = MAX($EG_{historical}$, $EG_{estimated,y}$) until $DATE_{BaselineRetrofit}$~~

~~$$TE_{BL,retrofit,y} = MAX(TE_{historical,y}, TE_{estimated,y}) \quad until \quad DATE_{BaselineRretrofit}$$~~

$$EG_{BL,thermal,retrofit,y} = MAX(EG_{historical,thermal,y}, EG_{estimated,thermal,y}) \quad until \quad DATE_{BaselineRretrofit} \quad (7)$$

$$EG_{baseline} = EG_y \text{ on/after } DATE_{BaselineRetrofit}$$

Where:

$TE_{BL,retrofit,y}$ $EG_{BL,thermal,retrofit,y}$	Thermal energy production by an existing facility in the absence of the project activity; TJ
$TE_{historical,y}$ $EG_{historical,thermal,y}$	Average of historical thermal energy levels delivered by the existing facility, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e. by 5% or more). A minimum of 3 years (excluding abnormal years) of historical production data is required. In the case that 3 years of historical data are not available - e.g. due to recent retrofits or exceptional circumstances, a new methodology or methodology revision must be proposed; TJ/y
$TE_{estimated,y}$ $EG_{estimated,thermal,y}$	Estimated thermal energy that would have been produced by the existing units under the observed availability of renewable resource in year *y;* TJ/y
$DATE_{BaselineRretrofit}$	Date at which the existing generation facility is likely to be replaced or retrofitted in the absence of the CDM project activity

The bBaseline emissions $BE_{retrofit,CO_2,y}$ emissions ($E_B BE_y$ in tCO_2e) then correspond to the difference of the thermal energy supplied by the project activity ($TE_{PJ,retrofit,}$, TJ/y) and minus the baseline thermal energy supplied in the case of modified or retrofit facilities ($TE_{BL, retrofit,y}$ $EG_{baseline}$) multiplied by the emission factor of the fuel that would have been used to generate the incremental energyas follows:

$$BE_{retrofit,CO2,y} = (EG_{thermal,retrofit,y} - EG_{BL,thermal,retrofit,y}) * EF_{FF,CO2} \quad \textbf{(8)}$$

$$TE_{BL} = (TE_{PJ,retrofit,y} - TE_{BL,retrofit,y})$$

Where:

$BE_{retrofit,CO2,y}$	Baseline emissions from the incremental thermal energy supplied due to retrofit; tCO_2e
$TE_{PJ,retrofit,y}$ $EG_{thermal,retrofit,y}$	Thermal energy supplied by the project activity (after retrofit) in year *y*; TJ/y
$TE_{BL,retrofit,y}$ $EG_{BL,thermal,retrofit,y}$	Thermal energy production by an existing facility in the absence of the project activity (before retrofit) in year *y*; TJ/y
$EF_{FF,CO2}$	The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant to generate the incremental energy; tCO_2 / TJ obtained from reliable local or national data if

available, otherwise IPCC default emission factors are used

~~$EG_{historical,thermal,y}$ $TE_{historical}$ EGhistorical is the average of historical thermal energy levels delivered by the existing facility, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofitted or modified in a manner that significantly affected output (i.e. by 5% or more) expressed in TJ per year. A minimum of 3 years (excluding abnormal years) of historical production data is required. In the case that 3 years of historical data are not available - e.g. due to recent retrofits or exceptional circumstances, a new methodology or methodology revision must be proposed $EG_{estimated,y}$ is the estimated thermal energy that would have been produced by the existing units under the observed availability of renewable resource for year y.~~

The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the General Guidance for SSC methodologies. If the remaining lifetime of the affected systems increases due to the project activity, the crediting period shall be limited to the estimated remaining lifetime, i.e. the time when the affected systems would have been replaced in the absence of the project activity

In order to estimate the point in time when the existing equipment would need to be replaced in the absence of the project activity ($DATE_{BaselineRetrofit}$), project participants may follow the procedures described in the general guidance. ~~may take the following approached into account~~

~~(a) The typical average technical lifetime of the equipment type may be determined and documented, taking into account common practices in the sector and country, e.g. on the basis of e.g. based on industry surveys, statistics, technical literature, etc.~~

~~(b) The common practices of the responsible company regarding replacement schedules may be evaluated and documented, e.g. on the basis of based on historical replacement records for similar equipment.~~

~~(c) The point in time when the existing equipment would need to be replaced in the absence of the project activity should be chosen in a conservative manner, that is, i.e. if a range is identified, the earliest date should be chosen.~~

Project Emissions

24. Project emissions include:

- CO_2 emissions from collection/processing/transportation of biomass residues to the project site;
- CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";

- CO_2 emissions from electricity consumption by the project activity using the latest version of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with project activity within the project boundary;
- For geothermal project activities, project participants shall account for the following emission sources, where applicable: fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam; and, carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant[10].

25. Project emissions in the case of geothermal project activities are calculated as follows:

$$PE_{Geo,y} = PES_y + PEFF_y \quad \textbf{(9)}$$

Where:

PE_y	Project emissions in year *y* (tCO_2/yr)
PES_y	Project emissions of carbon dioxide and methane due to the release of non-condensable gases from the steam produced in the geothermal power plant in year *y* (tCO_2/yr)
$PEFF_y$	Project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in year *y* (tCO_2/yr)

Project emissions of carbon dioxide and methane due to the release of non-condensable gases from the steam produced in the geothermal power plant is calculated as:

$$PES_y = \left(w_{Main,CO2} + w_{Main,CH4} \cdot GWP_{CH4}\right) \cdot M_{S,y} \quad \textbf{(10)}$$

Where:

PES_y	Project emissions due to release of carbon dioxide and methane from the produced steam in the geothermal power plant in year *y* (tCO_2/yr)
$w_{Main,CO2}$	Average mass fraction of carbon dioxide in the produced steam (non-dimensional)
$w_{Main,CH4}$	Average mass fraction of methane in the produced steam (non-dimensional)
GWP_{CH4}	Global warming potential of methane valid for the relevant commitment period (tCO_2e/tCH_4)
$M_{S,y}$	Quantity of steam produced during the year *y* (tonnes)

[10] Fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered, as they are negligible.

Project emissions from combustion of fossil fuels related to the operation of the geothermal power plant is calculated as:

$$PEFF_y = PE_{FC,j,y} \quad (11)$$

Where:

$PEFF_y$	Project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in year y (tCO_2/yr)
$PE_{FC,j,y}$	CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr). This parameter shall be calculated as per the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" where j stands for the processes required for the operation of the geothermal power plant

Leakage

26. If the energy generating equipment is transferred from another activity, ~~or if the existing equipment is transferred to another activity, leakage is to be considered.~~ leakage is to be considered.

27. In case collection/processing/transportation of biomass residues is outside the project boundary, CO_2 emissions from collection/processing/transportation of biomass residues to the project site.

Emission reductions

28. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (12)$$

Where:

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

Monitoring

29. Monitoring shall consist of one of the following:

(a) Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient,

~~OR~~

(b) Metering the thermal and/or electrical energy produced[11].

(i) In the case of heat energy (e.g. hot air, hot water), direct measurement of flow and temperature is required.

(ii) In the case of steam energy, direct measurement of flow, temperature, pressure is required to determine enthalpy of the steam.

(c) If the emissions reduction per system is less than 5 tonnes of CO_2e a year:

(i) Recording annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute), if necessary using survey methods;

(ii) Estimating the annual hours of operation of an average system, if necessary using survey methods. Annual hours of operation can be estimated from total output (e.g. tonnes of grain dried) and output per hour if an accurate value of output per hour is available.

(d) For household or commercial applications where it can be demonstrated that the metering of thermal energy output is not plausible, as in the case of biomass stoves, gasifiers, driers, water heaters etc, the project output energy shall be estimated based on consumption of the biomass (in terms of energy quantity) times the efficiency of the project equipment. The formula below shall be used

$$BE_y = [HG_{PJ,y} / \eta_{BL}] * EF_{FF,CO2}$$

$$= \{[B_{biomass,PJ,y} * NCV_{biomass} * \eta_{PJ}] / \eta_{BL}\} * EF_{FF,CO2} \qquad \textbf{(13)}$$

Where:

BE_y	the baseline emissions from thermal energy displaced by the project activity using renewable biomass during the year *y* in tCO_2
$HG_{PJ,y}$	the net quantity of thermal energy supplied by the project activity using renewable biomass during the year *y* in TJ
η_{BL}	efficiency of the baseline equipment being replaced (determined as per paragraph 18)
η_{PJ}	efficiency of the project equipment measured using representative sampling methods or based on referenced literature values
$EF_{FF,CO2}$	the CO_2 emission factor of the fossil fuel that would have been used in the baseline in tCO2 / TJ
$B_{biomass,PJ,y}$	the net quantity of the biomass consumed in year *y* in tons

[11] In case project activity is exporting heat/electricity to other facilities, metering shall be carried out at the recipient end.

$NCV_{biomass}$ the net calorific value of the biomass in TJ/tons

OR

30. For projects where only biomass or biomass and fossil fuel are used the amount of biomass and fossil fuel input shall be monitored.

~~For projects consuming biomass a specific fuel consumption[12] of each type of fuel (biomass or fossil) to be used should be specified *ex ante*. The consumption of each type of fuel shall be monitored.~~

31. If more than one type of biomass fuel is consumed, each shall be monitored separately.

32. In the case of project activity consuming biomass and fossil fuel to produce thermal and or electrical energy, specific energy consumption[13] of each type of fuel (biomass or fossil) to be used shall be specified ex ante. The consumption of each type of fuel shall be monitored.

Specific energy consumption can be derived as follows:

$$SEC_{j,PJ,y,measured} = \frac{\sum_j (FC_{j,PJ,y} \times NCV_{j,y})}{EG_{PJ,y}} \quad \textbf{(14)}$$

Where:

$SEC_{j,PJ,y,measured}$	Specific energy consumption of fuel type j of the project activity in year y *in TJ/MWh*
$EG_{PJ,y}$	Energy generation in MWh in *y*.
$FC_{j,PJ,y}$	Quantity of fuel type j combusted in the project activity during the year *y* in volume or mass unit
$NCV_{j,y}$	Average net calorific value of fuel type j combusted during the year in TJ per unit volume or mass unit

~~33. If fossil fuel is used, the thermal energy or the electricity generation metered should be adjusted to deduct by deducting the thermal energy or electricity generation from fossil fuels using the specific energy consumption and the quantity of fossil fuel consumed.~~

34. For the specific case of co-fired plants, the baseline emissions for the amount of thermal energy or electricity produced corresponding to biomass fuels use shall be calculated as follows:

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[12] ~~Specific fuel consumption is the fuel consumption per unit of thermal energy or electricity generated (e.g. tonnes of bagasse per MWh).~~

[13] Specific energy consumption is the fuel consumption (in energy basis) per unit of thermal energy or electricity generated (e.g. TJ of bagasse energy per MWh output).

$$BE_{cofire,y} = \frac{\sum_k (FC_{biomass,k,y} \times NCV_{biomass,k,y})}{SEC_{PJ,j,y,measured} \times \eta_{BL}} \cdot EF_{BL} \qquad (15)$$

Where:

$BE_{cofire,y}$	Baseline emissions during the year *y* in t CO_2
$FC_{biomassj,y}$	Quantity of biomass *type k* combusted during the year *y* in volume or mass unit
$NCV_{biomassj,y}$	Average net calorific value of *biomass type k* combusted during the year *y* in TJ per unit volume or mass unit
EF_{BL}	CO_2 emission factor of the fossil fuel that would have been used in the baseline co-fired plant established using three years average historical data (tCO2 / TJ).
η_{BL}	Energy efficiency of the equipment that would have been used in the baseline

35. For the co-fired systems, baseline emissions calculated as per paragraph 21 shall be compared with the baseline emissions calculated as per paragraph 34.The lower of the two values shall be used to calculate emission reductions.

36. For the determination of the emission factor ($EF_{BL,i}$) and of the net calorific value (NCV_j) for the fossil fuel used in the baseline scenario, guidance by the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories shall be followed where appropriate. Project participants may either conduct measurements or they may use accurate and reliable local or national data where available. In the case of coal, the data shall be based on test results for periodic samples of the coal purchased if such tests are part of the normal practice for coal purchases. Where such data is not available, IPCC default emission factors (country-specific, if available) may be used if they are deemed to reasonably represent local circumstances. All values shall be chosen in a conservative manner (i.e. lower values should be chosen within a plausible range) and the choice shall be justified and documented in the SSC-CDM-PDD. Where measurements are undertaken, project participants shall document the measurement results and the calculated average values of the emission factor or net calorific value for the baseline fuel ex-ante in the SSC-CDM-PDD

Project activity under a programme of activities

The following conditions apply for use of this methodology in a project activity under a program~~me~~ of activities:

(a) In the specific case of biomass project activities the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042. ~~as in annex 1 of this document~~.

(b) In the specific case of biomass project activities the determination of leakage shall be done following the general guidance for leakage in small-scale biomass project activities (attachment C of appendix B[14] of simplified modalities and procedures for small-scale clean development mechanism project activities; decision 4/CMP.1) or following the ~~prescriptions~~ procedures included in the leakage section of AM0042. ~~as in annex 1 of this document.~~

(c) In case the project activity involves the replacement of equipment, and the leakage ~~effect of~~from the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.

[14] Available on http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html.

Annex 1

(APPLICABILITY CONDITIONS AND GUIDANCE ON LEAKAGE BELOW CONCERNS PROJECT ACTIVITY UNDER A PROGRAMME OF ACTIVITIES)

Applicability

1. The methodology is applicable under the following conditions:

- The project activity involves the installation of a new plant that is mainly fired with renewable biomass from a dedicated plantation (fossil fuels or other types of biomass may be co-fired);
- Prior to the implementation of the project activity, no steam/heat was generated at the project site (i.e. the project plant does not substitute or amend any existing generation at the project site);
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available;
- Biomass used by the project facility is not stored for more than one year;
- The dedicated plantation must be newly established as part of the project activity for the purpose of supplying biomass exclusively to the project.
- The biomass from the plantation is not chemically processed (e.g. esterification to produce biodiesel, production of alcohols from biomass, etc) prior to combustion in the project plant but it may be processed mechanically or be dried;
- The site preparation does not cause longer-term net emissions from soil carbon. Carbon stocks in soil organic matter, litter and deadwood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity;
- The land area of the dedicated plantation will be planted by direct planting and/or seeding;
- After harvest, regeneration will occur either by direct planting or natural sprouting;
- Grazing will not occur within the plantation;
- No irrigation is undertaken for the biomass plantations;
- The land area where the dedicated plantation will be established is, prior to project implementation, severely degraded and in absence of the project activity would have not been used for any other agricultural or forestry activity. The land degradation can be demonstrated using one or more of the following indicators:

  (a) Vegetation degradation, e.g.

  - Crown cover of pre-existing trees has decreased in the recent past for reasons other than sustainable harvesting activities;

  (b) Soil degradation, e.g.

~~– Soil erosion has increased in the recent past;~~

~~– Soil organic matter content has decreased in the recent past.~~

~~(c) Anthropogenic influences, e.g.~~

~~– There is a recent history of loss of soil and vegetation due to anthropogenic actions; and~~

~~– Demonstration that there exist anthropogenic actions/activities that prevent possible occurrence of natural regeneration.~~

~~Furthermore, this methodology is only applicable if the most plausible baseline scenarios are:~~

- ~~For power generation, electricity generated by the project would have been generated by existing and/or new power plants in the grid; and~~
- ~~For the use of biomass residues, If biomass residues are co-fired in the project plant case B1, B2, B3, B4 and/or B5. If case B5 is the most plausible scenario, the methodology is only applicable if:~~

  ~~(a) The plant where the biomass residues would be used as feedstock in the absence of the project activity can be clearly identified throughout the crediting periods; and~~

  ~~(b) The fuels used as substitutes for the biomass residues at the plant, referred in (a) above, can be monitored by project participants.~~

~~Leakage~~

~~2. An important potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass ***residues*** from other uses to the project plant as a result of the project activity.~~

~~If biomass residues are co-fired in the project plant, project participants shall demonstrate that the use of the biomass residues does not result in increased use of fossil fuels or other GHG emissions elsewhere. For this purpose, project participants shall assess as part of the monitoring the supply situation for each type of biomass residue *k* used in the project plant. Table 6 below outlines the options that may be used to demonstrate that the biomass residues used in the plant did not increase fossil fuel consumption or other GHG emissions elsewhere.~~

~~Which approach should be used depends on the most plausible baseline scenario for the use of the biomass residues. Where scenarios B1, B2 or B3 apply, use approaches L_1, L_2 and/or L_3. Where scenario B4 applies, use approaches L_2 or L_3. Where scenario B5 applies, use approach L_4.~~

~~**Table 6. Approaches to rule out leakage**~~

~~L_1~~	~~Demonstrate that at the sites where the project activity is supplied from with biomass residues, the biomass residues have not been collected or utilized (e.g. as fuel, fertilizer or feedstock) but have been dumped and left to decay, land-filled or burnt without energy generation (e.g. field burning) prior to the implementation of the project activity. Demonstrate that this practice would continue in the absence of the CDM project activity, e.g. by showing that in the monitored period no market has emerged for the biomass residues considered or by showing that it would still not be feasible to utilize the biomass residues for any purposes (e.g. due to the remote location where the biomass residue is generated).~~
~~L_2~~	~~Demonstrate that there is an abundant surplus of the in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of available biomass residues of type *k* in the region is at least 25% larger than the quantity of biomass residues of type *k* that are utilized (e.g. for energy generation or as feedstock), including the project plant.~~
~~L_3~~	~~Demonstrate that suppliers of the type of biomass residue in the region of the project activity are not able to sell all of their biomass residues. For this purpose, project participants shall demonstrate that the ultimate supplier of the biomass residue (who supplies the project) and a representative sample of suppliers of the same type of biomass residue in the region had a surplus of biomass residues (e.g. at the end of the period during which biomass residues are sold), which they could not sell and which are not utilized.~~
~~L_4~~	~~Identify the consumer that would use the biomass residue in the absence of the project activity (e.g. the former consumer). Demonstrate that this consumer has substituted the biomass residue diverted to the project with other types of biomass residues (and not with fossil fuels or other types of biomass than biomass residues[15]) by showing that the former user only fires biomass residues for which leakage can be ruled out using approaches L_2 or L_3. Provide credible evidence and document the types and amounts of biomass residues used by the former user as replacement for the biomass residue fired in the project activity and apply approaches L_2 or L_3 to these types of biomass residues. Demonstrate that the substitution of the biomass residues used in the project activity with other types of biomass residues does not require a significant additional energy input except for the transportation of the biomass residues.~~

~~Where project participants wish to use approaches L_2, L_3 or L_4 to assess leakage effects, they shall clearly define the geographical boundary of the region and document it in the draft CDM-PDD. In defining the geographical boundary of the region, project participants should take the usual distances for biomass transports into account, i.e. if biomass residues are transported up to 50 km, the region may cover a radius of 50 km around the project activity. In any case, the region should cover a radius around the project activity of at least 20 km but not more than 200 km. Once defined, the region should not be changed during the crediting period(s).~~

~~15~~ The generation of other types of biomass than biomass residues may be involved with significant GHG emissions, for example, from cultivation or harvesting.

~~Project participants shall apply a leakage penalty to the quantity of biomass residues, for which project participants cannot demonstrate with one of the approaches above that the use of the biomass residue does not result in leakage. The leakage penalty aims at adjusting emission reductions for leakage effects in a conservative manner, assuming that this quantity of biomass residues is substituted by the most carbon intensive fuel in the country.~~

~~If for a certain biomass residue type *k* used in the project leakage effects cannot be ruled out with one of the approaches above, leakage effects for the year *y* shall be calculated as follows:~~

$$LE_y = EF_{CO2,LE} \cdot \sum_n BF_{LE,n,y} \cdot NCV_n \qquad (1)$$

~~Where:~~

~~LE_y~~	=	~~Leakage emissions during the year *y* (tCO_2/yr)~~
~~$EF_{CO2,LE}$~~	=	~~CO_2 emission factor of the most carbon intensive fuel used in the country (tCO_2/GJ)~~
~~$BF_{LE,n,y}$~~	=	~~Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage can not be ruled out using one of the approaches L_1, L_2, L_3 or L_4 (tons of dry matter or liter)~~
~~NCV_n~~	=	~~Net calorific value of the biomass residue type *n* (GJ/ton of dry matter or GJ/liter)~~
~~n~~	=	~~Biomass residue type *n* for which leakage can not be ruled out using one of the approaches L_1, L_2, L_3 or L_4~~

~~In case of approaches L_1, $BF_{LE,n,y}$ corresponds to the quantity of biomass residue type *n* that is obtained from the relevant source or sources.~~

~~In case of approaches L_2 or L_3, $BF_{LE,n,y}$ corresponds to the quantity of biomass residue type *k* used in the project plant as a result of the project activity during the year *y* ($BF_{LE,n,y} = BF_{PJ,k,y}$, where *n=k*).~~

~~In case of approach L_4, $\left(BF_{LE,n,y} \cdot NCV_n\right)$ corresponds to the lower value of~~

~~(a) The quantity of fuel types *m*, expressed in energy quantities, that are used by the former user of the biomass residue type *k* and for which leakage can not be ruled out because the fuels used are either (i) fuels types other than biomass residues (e.g. fossil fuels or biomass types other than biomass residues) or (ii) are biomass residues but leakage can not be ruled out for those types of biomass residues with approaches L_2 or L_3; as follows:~~

$$BF_{LE,n,y} \cdot NCV_n = \sum_m FC_{former\ user,m,y} \cdot NCV_m \qquad (2)$$

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

I.C. Thermal energy production ~~for the user~~ with or without electricity (cont)

~~Where:~~

~~$BF_{LE,n,y}$~~	=	~~Quantity of biomass residue type *n* used for heat generation as a result of the project activity during the year *y* and for which leakage can not be ruled out using approach L_4 (tons of dry matter or liter)~~
~~NCV_n~~	=	~~Net calorific value of the biomass residue type *n* (GJ/ton of dry matter or GJ/liter)~~
~~n~~	=	~~Biomass residue type *n* for which leakage can not be ruled out using approach L_4~~
~~$FC_{former\ user,m,y}$~~	=	~~Quantity of fuel type *m* used by the former user of the biomass residue type *n* during the year *y* (mass or volume unit)~~
~~NVC_m~~	=	~~Net calorific value of fuel type *m* (GJ/ton of dry matter or GJ/liter)~~
~~m~~	=	~~Fuel type *m*, being either (i) a fuel type other than a biomass residue (e.g. fossil fuel or biomass other than biomass residues) or (ii) a biomass residues for which leakage can not be ruled out with approaches L_2 or L_3~~

~~(b) The quantity of biomass residue type *k*, expressed in energy quantities, used in the project plant during the year *y* ($BF_{LE,n,y} = BF_{PJ,k,y}$, where $n=k$).~~

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History of the document*

Version	Date	Nature of revision(s)
14	EB 46, Annex # 25 March 2009	To Include additional baseline scenarios; expanded applicability of the methodology for renewable fuel based heat and/or power generation project activities (including cogeneration) that supply: (a) electricity to a grid and/or displace grid electricity; (b) electricity and/or thermal energy for on-site consumption or for consumption by other facilities and combination of (a) and (b); guidance on use of charcoal from renewable biomass sources; procedures for project emission calculations when applying to geothermal projects; more guidance on metering of thermal energy output
13	EB 38, Annex 9 14 March 2008	To expand its applicability to include additional baseline scenarios (e.g. steam/heat produced from renewable biomass and electricity imported from the grid and/or generated in a captive plant in the baseline, while in the project case heat and electricity are produced by a renewable biomass based co-generation unit).
12	EB 33, Annex 22 27 July 2007	To allow for their application under a programme of activities (PoA), where the limit of the entire PoA exceeds the limit for small-scale CDM project activities.
11	EB 32, Annex 27 22 June 2007	To clarify the monitoring of biomass in project activities that apply these methodologies which is consistent with monitoring of biomass in the approved methodology AMS-I.D.
10	EB 31, Annex 20 04 May 2007	To provide options for baseline calculations when cogeneration from fossil fuels is the baseline activity thereby broadening the applicability of AMS-I.C.

09	EB 28, Annex 23 23 December 2006	To align the guidance on capacity addition and retrofit activities to be consistent with the revisions of AMS I.D.
08	EB 23, Annex 31 24 February 2006	To (i) include provisions for retrofit and renewable energy capacity additions as eligible activities; (ii) provide clarification for baseline calculations under category I.D; and (iii) provide clarification on the applicability of Category I.A as against Category I.D.

* This document, together with the 'General Guidance' and all other approved SSC methodologies, was part of a single document entitled: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities until version 07.

Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities contained both the General Guidance and Approved Methodologies until version 07. After version 07 the document was divided into separate documents: 'General Guidance' and separate approved small-scale methodologies (AMS).		
Version	**Date**	**Nature of revision**
07	EB 22, Para. 59 25 November 2005	References to "non-renewable biomass" in Appendix B deleted.
06	EB 21, Annex 22 20 September 2005	Guidance on consideration of non-renewable biomass in Type I methodologies, thermal equivalence of Type II GWhe limits included.
05	EB 18, Annex 6 25 February 2005	Guidance on 'capacity addition' and 'cofiring' in Type I methodologies and monitoring of methane in AMS-III.D included.
04	EB 16, Annex 2 22 October 2004	AMS-II.F was adopted, leakage due to equipment transfer was included in all Type I and Type II methodologies.
03	EB 14, Annex 2 30 June 2004	New methodology AMS-III.E was adopted.
02	EB 12, Annex 2 28 November 2003	Definition of build margin included in AMS-I.D, minor revisions to AMS-I.A, AMS-III.D, AMS-II.E.
01	EB 7, Annex 6 21 January 2003	Initial adoption. The Board at its seventh meeting noted the adoption by the Conference of the Parties (COP), by its decision 21/CP.8, of simplified modalities and procedures for small-scale CDM project activities (SSC M&P).