Draft baseline and monitoring methodology AM00XX

"Renewable energy power generation in isolated grids"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

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

- ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

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

- "Combined tool to identify the baseline scenario and demonstrate additionality";
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion.

For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable".

Definitions

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

Isolated grid.

Note: The Meth Panel is evaluating different options to define the conditions an isolated grid has to comply with to use the methodology. The proposals that could be used independently or in combinations are:

(1) An isolated grid is an electrical network that is independent and is not connected to the national grid;

(2) The electricity dispatched in an isolated grid is not managed by one grid operator;

(3) The installed capacity of the grid is less than 100 MW;

(4) The distance from the closest point of the national or main grid is at least 50 km;

(5) An isolated grid:

- Consists of predominantly diesel generators and some renewable energy generation;
- Has at least 80% of its installed capacity based on diesel generators.

Renewable energy sources. This includes: Hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.

Installed power generation capacity (or installed capacity or nameplate capacity). The installed power generation capacity of a power unit is the capacity, expressed in Watts or one of its multiples, for which the power unit has been designed to operate at nominal conditions. The installed power generation capacity of a power plant is the sum of the installed power generation capacities of its power units.

Capacity addition. An increase in the installed power generation capacity of an existing power plant through: (i) the installation of a new power plant beside the existing power plant/units, or (ii) the installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

Retrofit (or Rehabilitation or Refurbishment). A retrofit is an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

Replacement. Investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The new power plant or unit has the same or a higher power generation capacity than the plant or unit that was replaced.

Reservoir. A water body created in valleys to store water generally made by the construction of a dam.

Existing reservoir. A reservoir is to be considered as an "existing reservoir" if it has been in operation for at least three years before the implementation of the project activity.

Applicability

This methodology applies to power generation using renewable energy sources connected to new or existing isolated grids. The methodology is applicable to the following type of project activities:

(a) Installation of a greenfield renewable energy power plant and/or the establishment of an isolated grid;

(b) Renewable energy capacity additions;

(c) Retrofit of (an) existing renewable energy power plant(s); or

(d) Replacement of (an) existing renewable energy power plant(s).

In case of hydro power plants, one of the following conditions must apply:

- The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or
- The project activity is implemented in an existing reservoir, where the volume of the reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; or
- The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.

The methodology is not applicable to the following:

- In a region where main or national electric grid is available;
- Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.

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

Finally, this methodology is only applicable if the application of the procedure to identify the baseline scenario results in the scenario that the **installation of a fossil fuel power plant** is the most plausible baseline scenario.

Project boundary

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the isolated grid that the CDM project power plant is connected to.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table 1.

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included ?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	Yes	Main emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source
	For solar thermal and geothermal power plants, CO_2 emissions from combustion of fossil fuels for electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source

II. BASELINE METHODOLOGY PROCEDURE

Identification of the baseline scenario and demonstration of additionality

Project proponents shall determine the most plausible baseline scenario and demonstrate additionality through the use of the latest version of the "Combined tool to identify the baseline scenario and demonstrate additionality".

In applying Step 1 of the tool, define realistic and credible alternative scenarios that could provide the same amount of energy as the proposed CDM project activity. These alternatives are to include inter alia:

(a) The proposed project activity undertaken without being registered as a CDM project activity;

(b) Stand alone Solar PV generation with an storage capacity of up to five days;

(c) Other renewable power generation, including geothermal, wind, biomass or hydro power generation;

(d) Power generation using fossil fuels;

(e) Power generation using hybrid systems with an storage capacity of at least one day, e.g. solar PV+diesel.

Finally the proposed project activity is additional if the identified baseline scenario is power generation with fossil fuels and the project activity is not considered as common practice.

Project emissions

For most renewable power generation project activities, $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(1)}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (t CO_2e/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (t CO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (t CO_2e/yr)

The procedure to calculate the project emissions from each of these sources is presented next.

Fossil Fuel Combustion ($PE_{FF,y}$)

For geothermal and solar thermal projects, which also use fossil fuels for electricity generation, CO_2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$).

$PE_{FF,y}$ shall be calculated as per the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)

For geothermal project activities, project participants shall account for fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam.[1] Non-condensable gases in geothermal reservoirs usually consist mainly of CO_2 and H_2S. They also contain a small quantity of hydrocarbons, including predominantly CH_4. In geothermal power projects, non-condensable gases flow with the steam into the power plant. A small proportion of the CO_2 is converted to carbonate/bicarbonate in the cooling water circuit. In addition, parts of the non-condensable gases are re-injected into the geothermal reservoir. However, as a conservative approach, this methodology assumes that all non-condensable gases entering the power plant are discharged to atmosphere via the cooling tower. Fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered as they are negligible.

$PE_{GP,y}$ is calculated as follows:

$$PE_{GP,y} = \left(w_{steam,CO2,y} + w_{steam,CH4,y} \cdot GWP_{CH4}\right) \cdot M_{steam,y} \quad \textbf{(2)}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (t CO_2e/yr)
$w_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (t CO_2/t steam)
$w_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (t CH_4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (t CO_2e/tCH_4)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/yr)

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

For hydro power project activities that result in new reservoirs or in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir, estimated as follows:

(a) If the power density of the project activity (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} \cdot TEG_y}{1000} \quad \textbf{(3)}$$

[1] In the case of retrofit or replacement projects at geothermal plants, this methodology does not account for baseline emissions from release of non-condensable gases from produced steam or fossil fuel combustion. Project participants are welcome to propose revisions to this methodology to account for these baseline emissions.

Where:

$PE_{HP,y}$	=	Project emissions from water reservoirs (t CO_2e/yr)
EF_{Res}	=	Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO_2e/MWh)
TEG_y	=	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

<u>(b) If the power density of the project activity (*PD*) is greater than 10 W/m^2:</u>

$$PE_{HP,y} = 0 \quad \textbf{(4)}$$

The power density of the project activity (*PD*) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \textbf{(5)}$$

Where:

PD	=	Power density of the project activity (W/m^2)
Cap_{PJ}	=	Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL}	=	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ}	=	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL}	=	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

Baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing and/or new power plants connected to the isolated grid. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{isolated\_grid} \quad \textbf{(6)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the isolated grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{isolated\_grid}$	=	Emission factor of the isolated grid (t CO_2/MWh)

Calculation of $EF_{isolated\_grid}$

Project participants have to follow the two-step approach below to determine the baseline emission factor:

Step 1: Determine the composition of the grid

In case of existing isolated grids, project proponents should provide information on the installed capacity in the isolated grid. As far as possible, project proponents should use official documentation as evidence for the determination of the composition of the grid.

The following composition scenarios can exist for isolated grids.

- No power generation capacity may exist: This applies to project activities that include the construction of a renewable energy power plant and an isolated grid;
- 100% Diesel: the isolated grid only has generation units that use diesel as fuel;
- Mix of fossil fuel generation capacity, i.e. the grid has generation units that use fossil fuels but no renewable energy sources exist;
- Mix of renewable energy and diesel generators, i.e. the grid contains thermal power plants using only diesel as fuel as well as renewable energy power plants;
- Mix of renewable energy and fossil fuel generation capacity, i.e. the grid contains thermal power plants using different fossil fuels as well as renewable energy power plants.

Step 2: Assignment of emission factors according to the composition of the grid

Project participants shall choose the appropriate emission factor from the table below for the grid based on the composition of the isolated grid.

Composition of the isolated grid	$EF_{isolated\_grid}$ t CO_2e/MWh
No power generation capacity exists (for projects that include the construction of an isolated grid and a renewable energy power plant)	0.8
100% Diesel	0.8
Mix of fossil fuel generation capacity	The emissions factor should correspond to the fossil fuel used with the lowest emission factor Diesel = 0.8 Natural gas = 0.5 Residual fuel oil = 0.9
Mix of renewable energy and diesel generators	0.8

Mix of renewable energy and fossil fuels generation capacity	The emissions factor should correspond to the fossil fuel used with the lowest emission factor Diesel = 0.8 Natural gas = 0.5 Residual fuel oil = 0.9

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for (a) greenfield plants, (b) retrofits and replacements, and (c) capacity additions. These cases are described next:

(a) Greenfield renewable energy power plants

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y} \quad \textbf{(7)}$$

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

(b) Retrofit or replacement of an existing renewable energy power plant

If the project activity is the retrofit or replacement of an existing grid-connected renewable power plant, the baseline scenario is the continuation of the operation of the existing plant. The methodology uses historical electricity generation data to determine the electricity generation by the existing plant in the baseline scenario, assuming that the historical situation observed prior to the implementation of the project activity would continue.

The power generation of renewable energy projects can vary significantly from year to year, due to natural variations in the availability of the renewable source (e.g. varying rainfall, wind speed or solar radiation). The use of few historical years to establish the baseline electricity generation can therefore involve a significant uncertainty. The methodology addresses this uncertainty by adjusting the historical electricity generation by its standard deviation. This ensures that the baseline electricity generation is established in a conservative manner and that the calculated emission reductions are attributable to the project activity. Without this adjustment, the calculated emission reductions would mainly depend on the natural variability observed during the historical period, rather than the effects of the project activity.[2]

[2] As an alternative approach for hydropower plants, the baseline electricity generation could be established as a function of the water availability. In this case, the baseline electricity generation would be established ex-post based on the water availability monitored during the crediting period. Project participants are encouraged to consider such approaches and submit the related request for a revision to this methodology.

$EG_{PJ,y}$ is calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} - (EG_{historical} + \sigma_{historical}) \text{; until } DATE_{BaselineRetrofit} \quad \textbf{(8)}$$

and

$$EG_{PJ,y} = 0 \text{; on/after } DATE_{BaselineRetrofit} \quad \textbf{(9)}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)
$EG_{historical}$	=	Annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity (MWh/yr)
$\sigma_{historical}$	=	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity (MWh/yr)
$DATE_{BaselineRetrofit}$	=	Point in time when the existing equipment would need to be replaced in the absence of the project activity (date)

$EG_{historical}$ is the annual average of historical net electricity generation, delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity. To determine $EG_{historical}$, project participants may choose between two historical periods. This allows some flexibility: the use of the longer time period may result in a lower standard deviation and the use of the shorter period may allow a better reflection of the (technical) circumstances observed during the more recent years.

Project participants may choose among the following two time spans of historical data to determine $EG_{historical}$:

(a) The five last calendar years prior to the implementation of the project activity; or

(b) The time period from the calendar year following $DATE_{hist}$, up to the last calendar year prior to the implementation of the project, as long as this time span includes at least five calendar years, where $DATE_{hist}$ is latest point in time between:

  (i) The commercial commissioning of the plant/unit;

  (ii) If applicable: the last capacity addition to the plant/unit; or

  (iii) If applicable: the last retrofit of the plant/unit.

<u>(c) Capacity addition to an existing renewable energy power plant</u>

In the case of hydro or geothermal power plants, the addition of a new power plant or unit may significantly affect the electricity generated by the existing plant(s) or unit(s). For example, a new hydro turbine installed at an existing dam may affect the power generation by the existing turbines. Therefore, the same approach as for retrofits and replacements is used for hydro power plants and geothermal power plants.

In the case of wind, solar, wave or tidal power plants, it is assumed that the addition of new capacity does not significantly affect the electricity generated by existing plant(s) or unit(s).[3] In this case, the electricity fed into the grid by the added power plant(s) or unit(s) could be directly metered and used to determine $EG_{PJ,y}$.

If the project activity is a capacity addition, project participants may use one of the following two options to determine $EG_{PJ,y}$:

Option 1: Use the approach applied to retrofits and replacements above. $EG_{facility,y}$ corresponds to the total electricity generation of the existing plant(s) or unit(s) and the added plant(s) or unit(s). A separate metering of electricity fed into the grid by the added plant(s) or unit(s) is not necessary under this option. This option may be applied to all renewable power projects.

Option 2: For wind, solar, wave or tidal power plant(s) or unit(s), the following approach can be used provided that the electricity fed into the grid by the added power plant(s) or unit(s) addition is separately metered:

$$EG_{PJ,y} = EG_{PJ\_Add,y} \quad \textbf{(10)}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{PJ\_Add,y}$	=	Quantity of net electricity generation supplied to the grid in year *y* by the project plant/unit that has been added under the project activity (MWh/yr)

Project participants should document in the CDM-PDD which option is applied.

Calculation of $DATE_{BaselineRetrofit}$

In order to estimate the point in time when the existing equipment would need to be replaced/retrofitted in the absence of the project activity ($DATE_{BaselineRetrofit}$), project participants may take the following approaches into account:

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

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

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

[3] In this case of wind power capacity additions, some shadow effects can occur but are not accounted under this methodology.

Connection between isolated grid and a national/regional grid

If the isolated grid is connected to a national or regional grid in future, the baseline emission factor from the time of connection has to be determined by applying the latest version of ACM0002.

Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \tag{11}$$

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_2e/yr)

Data and parameters not monitored

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

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane valid for the relevant commitment period
Source of data:	IPCC
Value to be applied:	For the first commitment period: 21 t CO_2e/tCH_4
Any comment:	-

Data / Parameter:	EF_{Res}
Data unit:	$kgCO_2e/MWh$
Description:	Default emission factor for emissions from reservoirs of hydro power plants in year y
Source of data:	Decision by EB23
Value to be applied:	90 $kgCO_2e/MWh$
Any comment:	-

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data:	Project site
Measurement procedures (if any):	Determine the installed capacity based on recognized standards
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data:	Project site
Measurement procedures (if any):	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	-

Data / Parameter:	$EG_{historical}$
Data unit:	MWh/yr
Description:	Annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data:	Project activity site
Measurement procedures (if any):	Electricity meters
Any comment:	-

Data / Parameter:	$\sigma_{historical}$
Data unit:	MWh/yr
Description:	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data:	Calculated from data used to establish $EG_{historical}$
Measurement procedures (if any):	Parameter to be calculated as the standard deviation of the annual generation data used to calculate $EG_{historical}$ for retrofit or replacement project activities
Any comment:	-

Data / Parameter:	$DATE_{hist}$
Data unit:	date
Description:	Point in time from which the time span of historical data for retrofit or replacement project activities may start
Source of data:	Project activity site
Measurement procedures (if any):	$DATE_{hist}$ is the latest point in time between: (i) The commercial commissioning of the plant/unit; (ii) If applicable: the last capacity addition to the plant/unit; or (iii) If applicable: the last retrofit of the plant
Any comment:	-

Data / Parameter:	$DATE_{BaselineRetrofit}$
Data unit:	date
Description:	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data:	Project activity site
Measurement procedures (if any):	As per provisions in the methodology above
Any comment:	-

Data / Parameter:	$EF_{isolated\_grid}$
Data unit:	tCO_2/MWh
Description:	Emission factor from the isolated grid
Source of data:	<table><tr><td></td><td>Emission factor (t CO_2e/MWh)</td></tr><tr><td>Diesel</td><td>0.8</td></tr><tr><td>Natural gas</td><td>0.5</td></tr><tr><td>Residual fuel oil</td><td>0.9</td></tr></table>
Measurement procedures (if any):	As per provisions in the methodology above
Any comment:	-

III. MONITORING METHODOLOGY

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

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated differently in the comments in the tables below.

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

Data and parameters monitored

Project emissions

Emission of non-condensable gases from the operation of geothermal power plants

Data / Parameter:	$w_{steam,CO2,y}$
Data unit:	tCO_2/t steam
Description:	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data:	Project activity site
Measurement procedures (if any):	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H_2S) and carbon dioxide (CO_2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane
Monitoring frequency:	At least every 3 months and more frequently, if necessary
QA/QC procedures:	-
Any comment:	Applicable to geothermal power projects

Data / Parameter:	$w_{steam,CH4,y}$
Data unit:	tCH_4/t steam
Description:	Average mass fraction of methane in the produced steam in year *y*
Source of data:	Project activity site
Measurement procedures (if any):	As per the procedures outlined for $w_{steam,CO2,y}$
Monitoring frequency:	As per the procedures outlined for $w_{steam,CO2,y}$
QA/QC procedures:	-
Any comment:	Applicable to geothermal power projects

Data / Parameter:	$M_{steam,y}$
Data unit:	t steam/yr
Description:	Quantity of steam produced in year *y*
Source of data:	Project activity site
Measurement procedures (if any):	The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports
Monitoring frequency:	Daily
QA/QC procedures:	-
Any comment:	Applicable to geothermal power projects

Emissions from water reservoirs

Data / Parameter:	TEG_y
Data unit:	MWh/yr
Description:	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*
Source of data:	Project activity site
Measurement procedures (if any):	Electricity meters
Monitoring frequency:	Continuous measurement and at least monthly recording
QA/QC procedures:	-
Any comment:	Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Project site
Measurement procedures (if any):	Determine the installed capacity based on recognized standards
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data:	Project site
Measurement procedures (if any):	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Baseline emissions

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data:	Project activity site
Measurement procedures (if any):	Electricity meters
Monitoring frequency:	Continuous measurement and at least monthly recording
QA/QC procedures:	Cross check measurement results with records for sold electricity
Any comment:	-

Data / Parameter:	$EG_{PJ\_Add,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied to the grid in year y by the project plant/unit that has been added under the project activity
Source of data:	Project activity site
Measurement procedures (if any):	-
Monitoring frequency:	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	-
Any comment:	Applicable to wind, solar, wave or tidal power plant(s) or unit(s), provided that option 2 in the baseline methodology is applied

IV. REFERENCES AND ANY OTHER INFORMATION

Not applicable.

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History of the document

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