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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*.

I.D.   *Grid connected renewable electricity generation*

Technology/measure

1.   This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

2.   Hydro power plants with reservoirs that satisfy atleast one of the following conditions are eligible to apply this methodology:

- The project activity is implemented in an existing reservoir, with no change in the volume of reservoir;

- The project activity is implemented in an existing reservoir, where the volume of 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;

- 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.

3.   If the unit added has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel[1], the capacity of the entire unit shall not exceed the limit of 15 MW.

4.   Combined heat and power (co-generation) systems are not eligible under this category.

5.   In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[2] from the existing units.

6.   Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

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

[2] Physically distinct units are those that are capable of generating electricity 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".

Boundary

7.   The physical, geographical site of the renewable generation source delineates the project boundary.

Baseline

8.   In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation the baseline shall be calculated in accordance with paragraphs below. If the recovered methane is used for heat generation it is eligible under category I.C.

9.   For a system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual kWh generated by the renewable unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.D.1.

Table I.D.1

Emission Factors for diesel generator systems (in kg CO_2e/kWh*) for three different levels of load factors**

Cases:	Mini-grid with 24 hour service	i) Mini-grid with temporary service (4-6 hr/day) ii) Productive applications iii) Water pumps	Mini-grid with storage
			100%
Load factors [%]	25%	50%	
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW***	0.8	0.8	0.8

*A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories)

**Values are derived from fuel curves in the online manual of RETScreen lnternational's PV 2000 model, downloadable from http://retscreen.net/

***Default values

10.   For all other systems, the baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in kWh of electricity produced by the renewable generating unit multiplied by an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2} \tag{1}$$

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I.D.   Grid connected renewable electricity generation (cont)

Where:

BE_y Baseline Emissions in year y; t CO_2

$EG_{BL,y}$ Energy baseline in year y; kWh

EF_{CO2} CO_2 Emission Factor in year y; t CO_2e/kWh

11.   The Emission Factor can be calculated in a transparent and conservative manner as follows:

(a)   A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the Emission Factor for an electricity system'.

OR

(b)   The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available)[3] and made publicly available.

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

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[3] Plant Emission Factors used for the calculation of Emission Factors should be obtained in the following priority:
1. *Acquired directly* from the dispatch center or power producers, if available; or
2. *Calculated*, if data on fuel type, fuel Emission Factor, fuel input and power output can be obtained for each plant;
   If confidential data available from the relevant host Party authority are used, the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon Emission Factor and the corresponding list of plants;
3. *Calculated*, as above, but using estimates such as: default IPCC values from the 2006 IPCC Guidelines for National GHG Inventories for net calorific values and carbon Emission Factors for fuels instead of plant-specific values technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date; or
4. *Calculated*, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

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I.D.   Grid connected renewable electricity generation (cont)

For project activities that involve the addition of new generation units (e.g., turbines) at an existing facility, the energy baseline corresponding to the net increase in electricity production associated with the project should be calculated as follows:

$$EG_{add,y} = EG_{PJ,y} - EG_{existing,y} \tag{2}$$

Where:

$EG_{add,y}$ Net increase in electrical energy generation at existing plant in year y; kWh/y

$EG_{PJ,y}$ The total net actual electrical energy produced in year y by all units, existing and new project units; kWh/y

$EG_{existing,y}$ The estimated net electrical energy that would have been produced by existing units (installed before the project activity) in year y in the absence of the project activity, kWh/y

The value $EG_{existing,y}$ is given by

$$EG_{existing,y} = MAX(EG_{actual,y}, EG_{estimated,y}) \tag{3}$$

Where:

$EG_{actual,y}$ The actual, measured net electrical energy production of the existing units in year y; kWh/y

$EG_{estimated,y}$ The estimated net electrical energy that would have been produced by the existing units under the observed availability of the renewable resource (e.g., hydrological conditions) for year y; kWh/y

If the existing units shut down, are derated, or otherwise become limited in production, the project activity should not get credit for generating electricity from the same renewable resources that would have otherwise been used by the existing units (or their replacements). Therefore, the equation for $EG_{existing,y}$ still holds, and the value for $EG_{estimated,y}$ 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 $EG_{existing,y}$ can be estimated using the procedures described for $EG_{BL,retrofit,y}$ below.

13.   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 electricity to the grid $EG_{BL,retrofit,y}$ at historical average levels $EG_{historical,y}$ until the time at which the electrical generation facility would be likely to be replaced or retrofitted in the absence of the

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I.D.   Grid connected renewable electricity generation (cont)

CDM project activity ($DATE_{BaselineRretrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production is assumed to equal project net electricity production ($EG_{PJ,retrofit,y}$), and no emission reductions are assumed to occur.

$$EG_{BL,retrofit,y} = MAX\left(EG_{historical,,y}, EG_{estimated,y}\right) \ until \ DATE_{BaselineRretrofit} \qquad (4)$$

$$EG_{BL,retrofit,y} = EG_{PJ,retrofit,y} \ on/after \ DATE_{BaselineRretrofit} \qquad (5)$$

Where:

$EG_{BL,retrofit,y}$	Net electrical energy production by an existing facility in the absence of the project activity; kWh/y
$EG_{historical,y}$	Average of historical net electrical 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); kWh/y
	A minimum of 5 years (60 months) (excluding abnormal years) of historical generation data is required in the case of hydro facilities. For other facilities, a minimum of 3 years of data is required. In the case that 5 years of historical data (or three years in the case of non hydro project activities) are not available - e.g., due to recent retrofits or exceptional circumstances as described in footnote 4 - a new methodology or methodology revision must be proposed
$EG_{estimated,y}$	Estimated net electrical energy that would have been produced by the existing units under the observed availability of renewable resource in year *y*; kWh/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 baseline emissions ($BE_{retrofit,CO_2,y}$) then correspond to the difference of electricity supplied by the project activity to the grid ($EG_{PJ,retrofit,y}$) and the baseline electricity supplied to the grid in the absence of the project activity $EG_{BL,retrofit,y}$ multiplied by the emission factor of the fossil fuel that would have been used to generate the incremental energy as follows:

$$BE_{retrofit,CO2,y} = \left(EG_{PJ,retrofit,y} - EG_{BL,retrofit,y}\right)* EF_{CO2} \qquad (6)$$

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[4] Data for periods affected by unusual circumstances such as natural disasters, conflicts, and transmission constraints shall be excluded.

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I.D.   Grid connected renewable electricity generation (cont)

All project electricity generation above baseline levels $EG_{BL,retrofit,y}$ would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described.

The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the general guidance for SSC methodologies[5]. 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.

Project emissions

14.   For most renewable energy project activities, $PE_y = 0$. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002.

- Emissions related to the operation of geothermal power plants (e.g.non-condensable gases, electricity/fossil fuel consumption)

- Emissions from water reservoirs of hydro power plants

Geothermal power plants

For geothermal project activities, project participants shall account 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[6],[7]. Project emissions are calculated as follows:

$$PE_y = PES_y + PEFF_y \hspace{6cm} (7)$$

Where:

PE_y Project emissions in year y (tCO$_2$/y)

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$_2$/y)

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[5] Refer to: "General guidance to Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories".
<http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid06_v12.pdf>.

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

[7] In the case of retrofit projects at geothermal plants, this methodology does not currently subtract Baseline Emissions from steam components or fossil fuel combustion. Project proponents are welcome to propose new methodologies or methodology revisions to address these baseline emissions.

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I.D.   Grid connected renewable electricity generation (cont)

$PEFF_y$ Project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in year y (tCO$_2$/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 is calculated as:

$$PES_y = \left(w_{Main,CO2} + w_{Main,CH4} * GWP_{CH4} \right) * M_{S,y} \qquad (8)$$

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$_2$/y)

$w_{Main,CO2}$ 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$_2$e/tCH$_4$)

$M_{S,y}$ Quantity of steam produced during the year y (tonnes)

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

$$PEFF_y = PE_{FC,j,y} \qquad (9)$$

Where:

$PEFF_y$ Project emissions from combustion of fossil fuels related to the operation of the geothermal power plant in year y (tCO$_2$/y)

$PE_{FC,j,y}$ CO$_2$ emissions from fossil fuel combustion in process j during the year y (tCO$_2$/y). 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

15.   If the energy generating equipment is transferred from another activity, leakage is to be considered.

Emission reductions

16.   Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad (13)$$

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I.D.   Grid connected renewable electricity generation (cont)

Where:

ER_y Emission reductions in year y (t CO_2e/y)

BE_y Baseline Emissions in year y (t CO_2e/y)

PE_y Project emissions in year y (t CO_2/y)

LE_y Leakage emissions in year y (t CO_2/y)

Monitoring

17.   Monitoring shall consist of metering the net electricity supplied by the project activity to the grid. Measurement results shall be cross-checked with records for sold electricity. Hourly measurement and monthly recording are required.

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

19.   For projects consuming biomass a specific fuel consumption[8] 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.

20.   If fossil fuel is used, the electricity generation metered should be adjusted by deducting the electricity generation from fossil fuels using the specific fuel consumption and the quantity of fossil fuel consumed.

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

22.   The amount of electricity generated using biomass fuels calculated as per paragraph 20 shall be compared with the amount of electricity generated calculated using specific fuel consumption and amount of each type of biomass fuel used. The lower of the two values should be used to calculate emission reductions.

Project activity under a programme of activities

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

23.   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.

24.   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

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[8] Specific fuel consumption is the fuel consumption per unit of electricity generated (e.g., tonnes of bagasse per MWh).

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I.D.   Grid connected renewable electricity generation (cont)

of appendix B[9] of simplified modalities and procedures for small-scale clean development mechanism project activities; decision 4/CMP.1) or following the procedures included in the leakage section of AM0042.

25.   In case the project activity involves the replacement of equipment, and the leakage 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.

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History of the document[*]

Version	Date	Nature of revision(s)
15	EB 50, Annex # 16 October 2009	To include the procedures to calculate project emissions for hydropower with reservoirs as specified in Annex 5 of EB 23.
14	EB 48, Annex 23 17 July 2009	To include more guidance on: the monitoring of electricity generated; calculation of project emissions for geothermal project activities; and editorial changes.
13	EB 36, Annex 26 14 December 2007	To refer directly to the "tool to calculate the emission factor for an electricity system" for reasons of clarity.
12	EB 33, Annex 23 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 31, Annex 21 04 May 2007	To include guidance on monitoring of biomass project activities. All small-scale biomass project activities applying AMS-I.D. (firing only biomass or firing biomass and fossil fuel) are required to monitor the biomass and any fossil fuel used.
10	EB 28, Annex 22 23 December 2006	The proposed revision includes guidance on consideration of capacity limit and on estimation of baseline/project/leakage emissions in the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility.
09	EB 25, Annex 29 28 July 2006	An amendment to the procedure for estimating the combined margin emission factor of AMS-I.D, making it thereby consistent with ACM0002.
08	EB 23, Annex 32 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.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		

* 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.

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[9] Available on <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>.

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I.D.   Grid connected renewable electricity generation (cont)

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).
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		