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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.F. Renewable electricity generation for captive use and mini-grid

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 user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e., in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:

(a) A national or a regional grid (grid hereafter);

(b) Fossil fuel fired captive power plant;[1]

(c) A carbon intensive mini-grid.

2. For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e., the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.

3. Project activities or project activity components supplying electricity to a grid shall apply AMS-I.D. Project activities for standalone off-the-grid power systems supplying electricity to households/users included in the boundary are eligible under AMS-I.A.

4. Hydro power plants with reservoirs that satisfy at least 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.

5. For biomass power plants, no other biomass other than renewable biomass [2] are to be used in the project plant.

[1] Where the users of the captive electricity are also connected to the grid in the project site.

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

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

6. This methodology is applicable for project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition,[3] (c) involve a retrofit[4] of (an) existing plant(s); or (d) involve a replacement[5] of (an) existing plant(s).

7. In the case of project activities that involve the capacity 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[6] from the existing units.

8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.

9. 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[7], the capacity of the entire unit shall not exceed the limit of 15 MW.

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

11. In case electricity 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 electricity will have to be entered into specifying that only the facility generating the electricity can claim emission reductions from the electricity displaced.

Boundary

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

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[3] A capacity addition is 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.

[4] 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.

[5] 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.

[6] 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".

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

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

Baseline

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

Table I.F.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
Load factors [%]	25%	50%	100%
<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 derived from figures reported in RETScreen lnternational's PV 2000 model retrieved from:
http://retscreen.net/

***Default values

14. Baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y} \quad \textbf{(1)}$$

Where:

BE_y	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year y (MWh)

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

$EF_{CO2,y}$	Emission factor (tCO_2/MWh) -Emission factor of a grid shall be calculated as per the procedures provided in AMS-I.D. -For a mini-grid system other than described in paragraph 13 above, the baseline emission factor shall be determined as per the weighted average emissions for the current generation mix following the procedure provided in AMS-I.D -Emission factor for captive electricity generation shall be calculated as per the procedures described in the latest version of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

15. For project activities that displace grid electricity and fossil fuel fired on-site captive electricity, the baseline emission factor should reflect the emissions intensity of the grid and the captive power plant in the baseline scenario i.e., the weighted average emission factor for the displaced electricity is calculated using values based on the historical, prior three year ratios of electricity from captive plants and the grid[8]. For new facilities, the most conservative (lowest) of the emission factor for the two power sources should be used.

16. For 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 for captive use the baseline shall be calculated in accordance with paragraphs below. If the recovered methane is used for heat generation or cogeneration, it is eligible under category I.C and if generated electricity is supplied to a grid then use AMS-I.D.

17. For project activities that involve retrofit of an existing facility and/or capacity addition at an existing facility, the baseline emissions shall be calculated following the applicable procedures prescribed in AMS-I.D with the exception that emission factor ($EF_{CO2,y}$) is calculated as described in this methodology.

Project emissions

18. For most renewable energy project activities, $PE_y = 0$. However, for the following categories of project activities, project emissions including relevant definitions 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.

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

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

Leakage

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

Emission reductions

20. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (\mathbf{13})$$

Where:

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

Monitoring

21. Relevant parameters shall be monitored as indicated in the table below

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

Table I.F.2: Parameters for monitoring during the crediting period.

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
1	$EF_{CO2,y}$	CO_2 emission factor for the grid/ minigrid/captive electricity in year *y*	t CO_2/MWh		As prescribed in paragraph 13-15 of this methodology
2		CO_2 emission factor of fossil fuel type i	t CO_2/MJ	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
3		Net calorific value of fossil fuel type i	MJ per unit volume or mass unit	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
4		Quantity of fossil fuel consumed in year *y*	Mass or volume unit/y	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
5	$EG_{BL,y}$	Quantity of net electricity displaced in year *y*	MWh/y	Continuous monitoring, hourly measurement and at least monthly recording	Measurements are undertaken using energy meters. Calibration should be undertaken as prescribed in the relevant paragraph of General Guidelines to SSC Methodologies: In the case of electricity sold to a third party, measurement results shall be cross-checked with records of sold/purchased electricity (e.g., invoices/receipts The net electricity displaced is the gross energy generation by the project activity power plant minus the auxiliary/station electricity consumption
6		Quantity of biomass consumed in year *y*	Ton/y	Continuously or estimate using annual mass/ energy balance	Use mass or volume based measurements. Adjust for the moisture content in order to determine the quantity of dry biomass. And/Or perform an annual energy/mass balance that is based on purchased quantities and stock For projects consuming biomass and fossil fuel to produce electricity, a specific energy consumption[9] of each type of fuel (biomass or fossil) to be used should be specified ex ante. The consumption of each type of fuel (biomass or fossil)shall be monitored If fossil fuel is used, the electricity generation metered should be adjusted by deducting the electricity generation from fossil fuels using the specific energy consumption and the quantity of fossil fuel consumed The amount of electricity generated using biomass fuels calculated then

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

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
					shall be compared with the amount of electricity generated calculated using specific energy consumption and amount of each type of biomass fuel used. The lower of the two values should be used to calculate emission reductions
7		Moisture content of the biomass residues	% water	The moisture content of biomass of homogeneous quality shall be monitored at least on a monthly basis The weighted average should be calculated for each monitoring period and used in the calculations	On-site measurements In case of dry biomass, monitoring of this parameter is not necessary
8		Net calorific value of biomass residue type k	GJ/mass or volume unit	Annually	Measurement in laboratories according to relevant national/international standards. Measure the NCV based on dry biomass. Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g., values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
9	Parameters relevant to hydro and geothermal plants not included in this table shall be monitored following the most recent version of ACM0002				

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I.F. Renewable electricity generation for captive use and mini-grid (cont)

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:

22. 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.

23. 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[10] 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.

24. 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)
01	EB 54, Annex 5 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		

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