Joint Crediting Mechanism Approved Methodology KE_AM001

"Electrification of communities using Micro hydropower generation"

A. Title of the methodology

Electrification of communities using Micro hydropower generation, version 1.0

B. Terms and definitions

Terms	Definitions
Micro hydropower generation unit	Micro hydropower generation unit is a hydropower generation unit with generation capacity of 30 kW or less.
Run-of-river power generation	Run-of-river power generation is a method of power generation that uses water running in a river or a waterway directly into power generation unit without storing water in a reservoir.
Open channel	The waterway with a free surface open to the atmosphere.
Grid-accessible area	The area which is defined as a village where at least one electricity consumer is connected to national electricity grid, but there are other electricity consumers who are not connected to national electricity grid on the day of validation.
Grid-inaccessible area	The area which is defined as a village which is not classified as "grid-accessible area" defined above on the day of validation.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Displacement of electricity using diesel fuel and/or lighting using kerosene by installation and operation of the micro hydropower generation unit.
Calculation of reference emissions	Reference emissions are calculated on the basis of the consumption of electricity generated by micro hydropower generation unit multiplied by either; 1) Emission factor of national electricity grid (for grid-accessible area case) or

	2) Emission factor of diesel or kerosene (for grid-inaccessible area case).
Calculation of project emissions	The project does not assume any project emissions.
Monitoring parameters	The quantity of total electricity consumption by the consumers as a whole and/or each consumer.

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The project installs a run-of-river micro hydropower generation unit which is not connected to national electricity grid.
Criterion 2	The micro hydropower generation unit is installed in open channel with difference of elevation of 5m or less between the upstream and downstream.
Criterion 3	Project monitors the quantity of total electricity consumption by the consumers as a whole.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Consumption of electricity from national electricity grid	CO_2
Consumption of electricity from diesel generation unit	CO_2
Consumption of lighting from kerosene lamps	CO_2
Project emissions	
Emission sources	GHG types
Generation of electricity from micro hydropower unit(s)	N/A

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

There are two types of reference scenarios depending on the accessibility to national electricity grid.

When the project is executed in an area which is defined as a village where at least one

electricity consumer is connected to national electricity grid, but there are other electricity consumers who are not connected to national electricity grid on the day of validation (defined as "Grid-accessible area"), the reference scenario assumes emissions due to electricity supplied by the national electricity grid.

When the project is executed in an area which is defined as a village which is *not* classified as "Grid-accessible area" on the day of validation (defined as "grid-inaccessible area"), the reference scenario assumes the emissions due to electricity supplied by diesel generation unit or kerosene lamps.

In the case of grid-inaccessible area, if electricity consumption of individual consumer is monitored (hereafter "individual monitoring"), the *calculation method 2* can be applied as necessary. If individual monitoring is not in place, the *calculation method 1* is applied for any grid-inaccessible area cases.

In the case of grid-accessible area, the grid emission factor of 0.5893 tCO_2/ MWh, which is the lowest value suggested by Republic of Kenya (2014) for the standardised baseline of CDM project activities in the second and third crediting periods, is chosen to fulfill the requirement of net emission reduction.

Similarly, for grid-inaccessible area case, the reference emissions are calculated in view of ensuring their conservativeness with the emission factor of 1.0 tCO_2/ MWh for diesel generation unit which is less than the lowest value indicated in Table I.F.1 in CDM SSC methodology AMS-I.F for the equivalent load factor to the micro hydropower generation unit of 30kW.

F.2. Calculation of reference emissions

1. Grid-accessible area case:

$$RE_y = EC_{total,y} \times EF_{CO2,Grid}$$

RE_y	Reference CO_2 emissions in year *y*. [tCO_2/yr]
$EC_{total,y}$	Total electricity consumption by the consumers in year *y* of the project. [MWh]
$EF_{CO2,Grid}$	CO_2 emission factor of the national electricity grid. [0.5893 tCO_2/ MWh]

2. Grid-inaccessible area case :

2.1 Calculation method 1:

$$RE_y = EC_{total,y} \times EF_{CO2}$$

RE_y	Reference CO_2 emissions in year *y*. [tCO_2/yr]
$EC_{total,y}$	Total electricity consumption by the consumers in year *y* of the project. [MWh]
EF_{CO2}	CO_2 emission factor of the diesel generation unit. [1.0 tCO_2/ MWh]

2.2 Calculation method 2:

$$RE_y = RE_{55,y} + RE_{ot,y}$$

$$RE_{55,y} = \sum_{i=1}^{My} EC_{i,y} \times EF_{CO2,FUEL}$$

$$RE_{ot,y} = (EC_{total,y} - \sum_{i=1}^{My} EC_{i,y}) \times EF_{CO2,ELEC}$$

RE_y	Reference CO_2 emissions in year *y*. [tCO_2/yr]
$RE_{55,y}$	Reference CO_2 emissions by consumers with individual monitoring that consumed equal to or less than 55 kWh of electricity in year *y*. [tCO_2/yr]
$RE_{ot,y}$	$RE_{ot,y} = RE_y - RE_{55,y}$ Reference CO_2 emissions for electricity consumption by the consumers with individual monitoring that consumed more than 55kWh, excluding their first 55kWh consumed (accounted as displacement of kerosene lamps), and electricity consumption of consumers without individual monitoring.
$EC_{i,y}$	Electricity consumption by each consumer *i* with individual monitoring that consumed equal to or less than 55 kWh in year *y* of the project. [MWh]
$EC_{total,y}$	Total electricity consumption by the consumers in year *y* of the project. [MWh]
$EF_{CO2,FUEL}$	CO_2 emission factor of the lighting from kerosene lamps. [6.8 tCO_2/ MWh]
$EF_{CO2,ELEC}$	CO_2 emission factor of the diesel generation unit. [1.0 tCO_2/ MWh]
M	Number of household(s) of individual monitoring in the project activity.

G. Calculation of project emissions

There are no project emissions.

$$PE_y = 0$$

H. Calculation of emissions reductions

$$ER_y = RE_y$$

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
$EF_{CO2,Grid}$	CO_2 emission factor of national electricity grid (0.5893 tCO_2/ MWh)	The National Environment Management Authority (NEMA) "GRID EMISSION FACTOR REPUBLIC OF KENYA" (2014)
EF_{CO2}	CO_2 emission factor of the diesel generation unit. (1.0 tCO_2/ MWh) CO_2 emission factor of the most efficient diesel generation unit with capacity of 35 to 135kW, which is more conservative than the CO_2 emission factor of the most efficient diesel generation unit with capacity up to 30kW.	Table I.F.1 in CDM SSC methodology AMS-I.F "Renewable electricity generation for captive use and mini-grid" Ver.2
$EF_{CO2,FUEL}$	CO_2 emission factor of the lighting from kerosene lamps. (6.8 tCO_2/ MWh)	CDM-SSC WG [Rationale for default factors used in the proposed methodology SSC-I.L "Electrification of rural communities using renewable energy"]
$EF_{CO2,ELEC}$	CO_2 emission factor of the diesel generation unit. (1.0 tCO_2/ MWh)	Table I.F.1 in CDM SSC methodology AMS-I.F "Renewable electricity generation for captive use and mini-grid" Ver.2

History of the document

Version	Date	Contents revised
01.0	3 February 2016	JC2, Annex 7 Initial approval.