14. Rural Electrification

1. Typical Project Outline

・ Introduction of renewable energy (hydro, solar etc.) to off-grid areas where households, public and commercial facilities are getting lights from kerosene and diesel generators.

2. Applicability

(1) Targeting off-grid areas.

(2) Provide renewable energy by off-grid stand-alone technologies or mini grids.

3. Methodology of Emission Reduction Calculation

The emission reduction from the project activity is determined as the differences between the GHG emission of baseline scenario (users (households, public facilities) consume kerosene for lighting and electricity from fossil fuels sources) and project scenario (users consume electricity from renewable sources).

$$ER_y = BE_y - PE_y$$

ER_y : Emission reduction through the projet in a year y (t-CO_2e/y)

BE_y : GHG emission from the baseline scenario in a year y (t-CO_2e/y)

PE_y : GHG emission from the project scenario in a year y (t-CO_2e/y)

(1) Calculation of Baseline Emission

In the absence of the project, users consume electricity from stand-alone diesel generators or mini grids or consume kerosene for lighting. A methodology that simplifies the methodology of the small-scale CDM methodology AMS-I.L is used for the baseline GHG emission calculation. That is, energy baseline (for example: 55 kWh/year for households that consume kerosene or electricity from diesel generators by using 2 bulbs, 250 kWh/year for households that consume electricity from diesel generators by using CFLs and other electric appliances such as radios, fans) is multiplied by corresponding CO_2 emission factors.

$$BE_y = BE_{55,y} + BE_{250,y} + BE_{250,plus,y}$$

$BE_{55,y}$: Aggregate baseline emissions for users that consumed equal to or less than 55 kWh of renewable electricity from project renewable electricity systems in year y (t-CO_2e/y)

$BE_{250,y}$: Aggregate baseline emissions for users that consumed more than 55 kWh but equal to or less than 250 kWh of renewable electricity from project renewable electricity systems in year y (t-CO_2e/y)

$BE_{250,plus,y}$: Aggregate baseline emissions for users that consumed greater than 250 kWh of renewable electricity from project renewable electricity systems in year y (t-CO_2e/y)

$$BE_{55,y} = \sum_i 0.055 \times EF_{CO2,55}$$

$BE_{55,y}$: Aggregate baseline emissions for users that consumed equal to or less than 55 kWh of renewable electricity from project renewable electricity systems in year y (t-CO_2e/y)

$EF_{CO2,55}$: Emission factor of users that consumed equal to or less than 55 kWh of renewable electricity from project

renewable electricity systems in year y (6.8 t-CO_2e /MWh)

i : Number of users that consumed electricity equal to or less than 55 kWh/year

$$BE_{250,y} = \sum_j \left((0.250 - 0.055) \times EF_{CO2,250} \right) + C \right)$$

$BE_{250,y}$: Aggregate baseline emissions for users that consumed more than 55 kWh but equal to or less than 250 kWh of renewable electricity from project renewable electricity systems in year y (t-CO_2e/y)

$EF_{CO2,250}$: Emission factor of users that consumed more than 55 kWh but equal to or less than 250 kWh of renewable electricity from project renewable electricity systems in year y (1.3 t-CO_2/MWh)

C : Constant value (0.374 t-CO_2/MWh)

j : Number of households that consumed electricity more than 55 kWh but equal to or less than 250 kWh

$$BE_{250,plus,y} = \sum_k ((EG_{k,y} - 0.250) \times EF_{CO2,250,plus}) + D)$$

$BE_{250,plus,y}$: Aggregate baseline emissions for users that consumed greater than 250 kWh of renewable electricity from project renewable electricity systems in year y (t-CO_2e/y)

$EG_{k,y}$: Electricity delivered by project renewable electricity generation system to users k in year y, where the electricity delivered to the facility is greater than 250 kWh (MWh/y)

$EF_{CO2,250,plus}$: Emission factor of users k that consumed electricity greater than 250 kWh (1 t-CO_2e /MWh)

D : Constant value (0.6275 t-CO_2/MWh)

k : Number of users k that consumed electricity greater than 250 kWh.

(2) Calculation of Project Emission

Project emissions are considered to be zero (i.e. *PEy* =0).

4. Data and Parameters Estimated and Need Monitoring

Data	Description	Data Sources			
		For baseline emission calculation		For project emission calculation	
		Ex-ante	Ex-post	Ex-ante	Ex-post
i	Number of users that consumed electricity equal to or less than 55 kWh/year	A monitored value (Number of households that would have used kerosene for lighting or consume electricity by using bulbs (CFLs or LEDs) in the absence of the project activity)		N/A	
j	Number of households that consumed electricity more than 55 kWh but equal to or less than 250 kWh	A monitored value (Number of households that would have used other electronic appliances (radios, TVs and fans) besides to lighting in the absence of the project activity)		N/A	
k	Number of users k that consumed electricity greater than 250 kWh.	A monitored value (Users other than households such as schools, hospitals and other facilities)		N/A	

$EG_{k,y}$	Electricity delivered by project renewable electricity generation system to users k in year y, where the electricity delivered to the facility is greater than 250 kWh (kWh/year)	A planned value (Electricity provided to users other than households)	A monitored value (Electricity provided to users other than households that is measured through meters installed)	N/A

5. Others

(1) Project Boundary

The physical boundary for measuring GHG emissions includes renewable energy power plants and their users.

(2) Leakage

There are probably indirect emissions that potentially lead to leakage due to activities such as product manufacturing or transport of materials. However, the kind of emission is temporary and negligible compare to the project scale. Therefore, it can be ignored.

(3) Comparison with existing CDM methodologies

CDM methodology AMS-I.L. (Electrification of rural communities using renewable energy, Version 01) is referenced for development of the methodology.

The logic of emission reduction calculation in the methodology is almost the same as that of the AMS-I.L. However, this methodology simplified the methodology by using the concept of suppressed demand that 55 kWh/year is used with no exception as an electricity consumption of a household who consumed kerosene for lighting or electricity from diesel generators by using two bulbs and 250 kWh/year for a household who consume electricity from diesel generators by using CFLs and other electric appliances like radios and fans.

Moreover, there is no limitation for the emission reduction in the methodology like the small-scale CDM methodologies did.