# 13. Energy / Distribution System Efficiency Improvement

## 1. Typical Project Outline

- Enhancement of efficiency of existing distribution systems.
- Establishment of new high efficient distribution systems.

## 2. Applicability

(1) Replacement, repairing and improvement of existing low efficient transformers in a distribution system.

(2) Distribution system efficiency improvement through such as introduction of high efficient transformers along with expansion of a distribution system.

## 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 (e.g. transmission system with low efficiency) and project scenario (transmission system with high efficiency)[1].

Details of sources of each data in the following formulae are provided in "4. Data and Parameters for the Estimation".

$$ER_y = BE_y - PE_y$$

$ER_y$ : Emission reduction through the project in year y (t-$CO_2$e/y)

$BE_y$ : GHG emission from the baseline scenario in year y (t-$CO_2$e/y)

$PE_y$ : GHG emission from the project scenario in year y (t-$CO_2$e/y)

(1) Calculation of Baseline Emission

Baseline GHG emission is calculated based on the amount of electricity to the transmission system in the project, transmission loss of the baseline transmission system and $CO_2$ emission factor the electricity generation system.

$$BE_y = DE_{PJ,y} \times DLR_{BL,y} \times EF_{elec}$$

$DE_{PJ,y}$ : Amount of electricity to the distribution system in the project in year y (MWh/y)

$DLR_{BL,y}$ : Distribution loss rate of the baseline distribution system in year y (%)

$EF_{elec}$ : $CO_2$ emission factor of the electricity (t-$CO_2$/MWh)

(2) Calculation of Project Emission

Project GHG emission is calculated based on the electricity loss of the project transmission system and $CO_2$ emission factor of the electricity generation system.

$$PE_y = DL_{PJ,y} \times EF_{elec}$$

$DL_{PJ,y}$ : Electricity loss of the project distribution system in year y (MWh/y)

$EF_{elec}$ : $CO_2$ emission factor of the electricity (t-$CO_2$/MWh)

## 4. Data and Parameters for the Estimation

[1] The target year shall be a representative year under average operation or an annual average of multiple years.

| Data | Description | Data Sources | |
|---|---|---|---|
| | | For baseline emission calculation | For project emission calculation |
| $DLR_{BL,y}$ | Distribution loss rate of the baseline distribution system in year y (%) | A value of historical performance | N/A |
| $DE_{PJ,y}$ | Amount of electricity to the distribution system in the project in year y (MWh/y) | A planned value | A planned value |
| $DL_{PJ,y}$ | Electricity loss of the project distribution system in year y (MWh/y) | N/A | A planned value |
| $EF_{elec}$ | In the case of grid connection: $CO_2$ emission factor of the grid electricity (t-$CO_2$/MWh) | A default value (Table 3, "Energy Efficiency", Appendix) If there is no default value applied or if there is another appropriate value, that value may be used. | |
| | In the case of captive power generation or mini-grid: $CO_2$ emission factor of the diesel power generation (t-$CO_2$/MWh) | A default value (Table 4, Appendix) If there is no default value applied or if there is another appropriate value, that value may be used. | |

**5. Others**

(1) Project Boundary

The physical boundary for measuring GHG emissions includes power transmission system where project activity is implemented.

(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

There are CDM methodologies such as AM0067 (Methodology for installation of energy efficient transformers in a power distribution grid, Version 02) and AMS-II.A. (Supply side energy efficiency improvements – transmission and distribution, Version 10) can be references for development of the methodology.

The logic of emission reduction calculation in the methodology is almost the same as that of the AMS-II.A. However, this methodology tries to apply distribution loss rate of the baseline transmission system and amount of electricity into the project transmission system in order to reflect any change of electricity in the system by expansion of the distribution system. Moreover, there is no limitation for the emission reduction in the methodology like the CDM methodologies did.

(4) Revision history

| Version | Year/Month | Revisions |
|---|---|---|
| 2.0 | March 2014 | • Added default values for combined margins and operating margins of CO2 emission factors of electricity |
| 3.0 | September | • Prioritized the use of default values |

| | | |
|---|---|---|
| | 2019 | |
| 4.0 | March 2023 | • In the description of the calculation method and necessary data of baseline emissions, the words "before project implementation" was revised to use "the baseline scenario". The baseline scenario is the scenario that would have occurred in the absence of the project, such as continuation of the pre-project conditions.<br>• Deleted the column "Ex-post" in "4. Data and Parameters Estimated and Need Monitoring": current version of Climate-FIT aims to quantify GHG emission reductions in the "planning phase"). |
| 5.0 | March 2024 | • No revision. |