CLEAN DEVELOPMENT MECHANISM

**CDM-EB90-A07**

# Large-scale methodology

# AM0045: Grid connection of isolated electricity systems

Version 03.0

Sectoral scope(s): 01

United Nations
Framework Convention on
Climate Change

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# 1. Introduction

1. The following table describes the key elements of the methodology:

**Table 1. Methodology key elements**

| | |
|---|---|
| **Typical projects** | Expansion of an interconnected grid to supply electricity generated by more-efficient, less-carbon-intensive means to an isolated electric power system |
| **Type of GHG emissions mitigation action** | Displacement of a more-GHG-intensive output: Displacement of electricity that would be provided by more-GHG-intensive means |

# 2. Scope, applicability, and entry into force

## 2.1. Scope

2. This methodology applies to project activities that expand an interconnected grid to supply electricity generated from more efficient and/or less carbon-intensive sources to an isolated electric power system.

## 2.2. Applicability

3. The methodology is applicable to project activities consisting of:

   (a) The expansion of an interconnected electricity grid to isolated systems;

   (b) The displacement of power generation in isolated systems by more efficient, less carbon intensive power generation from the interconnected grid.

4. The methodology is applicable under the following conditions:

   (a) Emission factors estimated take into account the increase of demand of the isolated systems and the remaining lifetime of the equipment;

   (b) Renewable energy based electricity generation in the isolated systems is not displaced and its operation is not significantly affected;

   (c) All fossil fuel fired power plants in the isolated system are 100% displaced.

## 2.3. Entry into force

5. The date of entry into force is the date of the publication of the EB 90 meeting report on the 22 July 2016.

## 2.4. Applicability of sectoral scopes

6. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 01 is mandatory.

# 3. Normative references

7. This baseline methodology is based on the proposed methodology "Baseline methodology for Grid connection of isolated electricity systems" submitted by Grupo Rede, whose baseline and monitoring methodology and project design document were prepared by Ecoinvest Carbon, Brazil.

8. For more information regarding this proposal and its consideration by the Executive Board please refer to case NM0152-rev <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

9. The methodology also refers to the latest approved version of the following methodological tools:

   (a) "Tool for the demonstration and assessment of additionality";

   (b) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation";

   (c) "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

10. The methodology uses the concept of the combined margin emission factor ($EF_{CM}$) from "Tool to calculate emission factor for an electricity system".

## 3.1. Selected approach from paragraph 48 of the CDM modalities and procedures

11. "Actual or historical emissions, as applicable".

# 4. Definitions

12. The definitions contained in the Glossary of CDM terms shall apply.

# 5. Baseline methodology

## 5.1. Project boundary

13. For the project activity, project participants shall account for $CO_2$ emissions from the increase (due to the project activity) of electricity generation in power plants connected to the grid and emissions related to $SF_6$ used in the new equipment of the project activity.

14. For the baseline determination, project participants shall only account $CO_2$ emissions from electricity generation in fossil fuel fired plants in the isolated system, which are displaced by the project activity, taking into account the increase of the demand and the remaining lifetime of the equipment.

15. The spatial extent of the project boundary includes all power plants physically connected to the previously isolated region (isolated grid or isolated individual plant) and all power plants physically connected to the electricity system, which the CDM project is being connected to.

16. For the purpose of determining the build margin (BM) and operating margin (OM) emission factors, as described below, a (regional) **project electricity system** is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly, a **connected electricity system**, e.g. national or international, is defined as a (regional) electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints. In determining the project electricity system, project participants should justify their assumptions.

17. Electricity transfers from connected electricity systems to the project electricity system are defined as electricity imports and electricity transfers to connected electricity systems are defined as electricity exports.

18. For the purpose of determining the Build Margin (BM) emission factor, as described below, the spatial extent is limited to the project electricity system, except where recent or likely future additions to transmission capacity enable significant increases in imported electricity. In such cases, the transmission capacity may be considered as a build margin source, with the emission factor determined as for the OM imports below.

19. For the purpose of determining the Operating Margin (OM) emission factor, use one of the following options to determine the $CO_2$ emission factor(s) for net electricity imports ($COEF_{i,j,imports}$) from a connected electricity system within the same host country(ies):

    (a) 0 $tCO_2$/MWh; or

    (b) The emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known; or

    (c) The average emission rate of the exporting grid, if and only if net imports do not exceed 20% of total generation in the project electricity system; or

    (d) The emission factor of the exporting grid, determined as described in project emissions section below, if net imports exceed 20% of the total generation in the project electricity system.

20. For imports from connected electricity system located in another country, the emission factor is 0 tons $CO_2$ per MWh.

21. Electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the project emission rate.

**Table 2. Emission sources included in or excluded from the project boundary**

| Source | | Gas | Included | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Power generation | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Excluded for simplification. This is conservative |
| | | $N_2O$ | No | Excluded for simplification. This is conservative |
| Project activity | Power generation | $CO_2$ | Yes | Main emission source |

| Source | | Gas | Included | Justification/Explanation |
|---|---|---|---|---|
| | | $CH_4$ | No | Excluded for simplification. This emission source is assumed to be very small |
| | | $N_2O$ | No | Excluded for simplification. This emission source is assumed to be very small |
| | Emissions from the new equipment of the project activity | $SF_6$ | Yes | Emissions related to $SF_6$ used in the new equipment of the project activity |

## 5.2. Procedure for the identification of the baseline scenario

22. The baseline scenario is determined through the following steps:

(a) Identification of realistic and credible alternative scenarios that are consistent with applicable mandatory laws and regulations:

(i) Alternatives may include, inter alia:

a. The proposed project activity undertaken without being registered as a CDM project activity;

b. The proposed project activity, implemented at a later point in time and undertaken without being registered as a CDM project activity;

(ii) The alternative scenarios to the project activity shall be in compliance with all applicable mandatory legal and regulatory requirements - taking into account EB decisions with respect to national and/or sectoral policies and regulations in determining a baseline scenario[1] - even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution;

(b) Identification of barriers and assessment of alternative scenarios that are not prevented by these barriers:

(i) Establish a complete list of barriers that would prevent alternative scenarios to occur in the absence of the CDM, using the guidance provided in Step 3 of the latest version of the "Tool for the demonstration and assessment of additionality";

(ii) Since the proposed project activity undertaken without being registered as a CDM project activity is one of the considered alternatives, any barrier that may prevent the proposed CDM project activity to occur shall be included in the list of identified barriers. Clear specify which alternatives are prevented by at least one of the barriers previously identified and eliminate those alternatives from further consideration. All alternatives shall be compared to the same set of barriers;

[1] Annex 3 of the 22nd EB meeting report: "Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios."

(iii) If there is only one alternative scenario that is not prevented by any of the identified barrier, then this alternative scenario is identified as the baseline scenario;

(iv) Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario, or conduct an investment analysis (Step 2 of the "Tool for the demonstration and assessment of additionality");

(c) Investment analysis:

(i) Conduct an investment analysis, consistent with the guidance in Step 2 of the latest version of the "Tool for the demonstration and assessment of additionality". The most economically attractive alternative is deemed as the most plausible baseline scenario;

(ii) National/Sectoral Policies: In cases where applicable, actively-enforced laws mandating the interconnection of isolated systems, such isolated systems will not be considered as having been displaced by the proposed CDM project activity and, therefore, not included in the project boundary. The project developer will provide to the DOE documentation of the status of any regulatory situation that may potentially affect the project in the selected country, including description of the financing and institutional arrangements in place in the country, if any, to facilitate the expansion of the interconnected grid. Project proponents should identify all the instruments that can potentially remove the barriers that prevent the scenario "the project activity undertaken without being registered as a CDM project" and consider that from the time the identified barriers are overcame with the help of one or a combination of these instruments (financing and/or institutional arrangements), the project scenario undertaken without being registered (if it is the most economically or financially attractive scenario among the remaining scenario) become the baseline scenario.

## 5.3. Additionality

23. Existing policy incentives and public subsidies granted to the project activity shall be explicitly stated and included in the assessment of the additionality. The latest approved "tool for the demonstration and assessment of additionality" shall be applied taking into account the following issues:

(a) In step 2, describe any specific financing and/or subsidizing mechanisms to which such projects are eligible in the host country as introductory background information;

(b) In step 4, describe the latest similar activities undertaken in the sector (including disclosing non-confidential information about the PP's latest similar activities, if any, such as, when they were undertaken, what has changed since then, etc.).

### 5.3.1. Step 1 - As per the latest version of the latest approved "Tool for the demonstration and assessment of the additionality"

### 5.3.2. Step 2 - Investment Analysis

24. Determine whether the proposed project activity, without the revenue from the sale of certified emission reductions (CERs), is economically or financially less attractive than other alternatives. To conduct the investment analysis, use the following sub-steps.

#### 5.3.2.1. Sub-step 2a - Determine appropriate analysis method

25. Determine whether to apply the investment comparison analysis (Option II of the tool) or the benchmark analysis (Option III of the tool).

#### 5.3.2.2. Sub-step 2b - Option II of the tool. Apply investment comparison analysis

26. As per the latest approved "Tool for the demonstration and assessment of the additionality".

#### 5.3.2.3. Sub-step 2b - Option III of the tool. Apply benchmark analysis

27. As per the latest approved "Tool for the demonstration and assessment of the additionality".

#### 5.3.2.4. Sub-step 2c - Calculation and comparison of financial indicators

28. As per the latest approved "Tool for the demonstration and assessment of the additionality".

#### 5.3.2.5. Sub-step 2d - Sensitivity Analysis

29. As per the latest approved "Tool for the demonstration and assessment of the additionality".

### 5.3.3. Step 3 – Barrier Analysis

30. If this step is used, determine whether the proposed project activity faces barriers that:

    (a) Prevent the implementation of this type of proposed project activity; and

    (b) Do not prevent the implementation of at least one of the alternatives.

### 5.3.4. Use the following sub-steps

#### 5.3.4.1. Sub-step 3a - Identify barriers that would prevent the implementation of the proposed project activity

31. Identify barriers that would prevent the implementation of the type of proposed project activity from being carried out if the project activity were not registered as a CDM activity. Such barriers may include, among others:

    (a) Investment barriers, other than the economic/financial barriers in Step 2 above, inter alia:

        (i) Debt Funding is not available for this type of innovative projects;

        (ii) No access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in the country where the project activity is to be implemented;

    (b) Technological barriers, inter alia:

        (i) Skilled and/or properly trained labour to operate and maintain the technology is not available and no education/training institution in the country provides the needed skill, leading to equipment disrepair and malfunctioning;

        (ii) Lack of infrastructure for implementation of the technology;

    (c) Barriers due to prevailing practice, inter alia:

        (i) The project activity is the “first of a kind”: No project activity of this type is currently operational in the host country or region;

    (d) The identified barriers are sufficient grounds for additionality only if they would prevent potential project proponents from carrying out the proposed project activity were it not registered as a CDM activity.

32. Provide transparent and documented evidence, and offer conservative interpretations of this documented evidence, as to how it demonstrates the existence and significance of the identified barriers. Anecdotal evidence can be included, but alone is not sufficient proof of barriers. The type of evidence to be provided may include:

    (a) Relevant legislation, regulatory information or industry norms;

    (b) Relevant (sector) studies or surveys (e.g. market surveys, technology studies, etc.) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc.;

    (c) Relevant statistical data from national or international statistics;

    (d) Documentation of relevant market data (e.g. market prices, tariffs, rules);

    (e) Written documentation from the company or institution developing or implementing the CDM project activity or the CDM project developer, such as minutes from board meetings, correspondence, feasibility studies, financial or budgetary information, etc.;

(f) Documents prepared by the project developer, contractors or project partners in the context of the proposed project activity or similar previous project implementations;

(g) Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, and training centers), industry associations and others.

33. Are there planned instruments as financing and/or institutional arrangements that could help the project to overcome the identified barriers during the crediting period? If the answer is yes, describe them, indicate when they will take place and conservatively evaluate if the arrangements are or are not enough to overcome the identified barriers during the crediting period. The financing and/or institutional arrangements application shall be monitored during the project lifetime. The last EB guidance concerning national policies shall be taken into account.

#### 5.3.4.2. Sub-step 3 b - Show that the identified barriers would not prevent the implementation of at least one of the alternatives (not including the proposed project activity)

34. If the identified barriers also affect other alternatives, explain how they are affected less strongly than they affect the proposed CDM project activity. In other words, explain how the identified barriers are not preventing the implementation of at least one of the alternatives. Any alternative that would be prevented by the barriers identified in Sub-step 3a is not a viable alternative, and shall be eliminated from consideration. At least one viable alternative shall be identified.

35. If both Sub-steps 3a – 3b are satisfied, proceed to Step 4 (Common Practice Analysis).

36. If one of the Sub-steps 3a – 3b is not satisfied, the project is not additional.

### 5.3.5. Step 4. Common Practice Analysis

37. As per the latest approved “Tool for the demonstration and assessment of the additionality”.

## 5.4. Baseline emissions[2]

38. The baseline emission factor of the isolated system at the time of the interconnection to the grid ($EF_{bl,ini}$) is calculated as the generation weighted average emissions per unit electricity ($tCO_2$/MWh)of all generating units displaced in the isolated system using data for the most recent three years before the connection to the grid:

$$EF_{bl,ini} = \frac{\sum_{i,j} F_{i,j,bl} \times COEF_{i,j}}{\sum_{j} GEN_{j,bl}} \quad \text{Equation (1)}$$

Where:

| | | |
|---|---|---|
| $EF_{bl,ini}$ | = | Baseline emission factor of the isolated system ($tCO_2e$/MWh) at the time of the interconnection to the grid |
| $F_{i,j,bl}$ | = | Amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* in the most recent three years |
| $COEF_{i,j}$ | = | $CO_2$ coefficient of fuel *i* ($tCO_2$/mass or volume unit of the fuel), taking into account the carbon emission factor of the fuels ($tCO_2$/TJ) used by relevant power sources *j*, net calorific value of the fuel (TJ/mass of volume unit) and the percent oxidation of the fuel *i* |
| $GEN_{j,bl}$ | = | Electricity (MWh) delivered to the isolated system by source *j* in the most recent three years prior to implementation of the proposed CDM project |

39. In order to calculate the baseline emission factor of the project the lifetime decrease of the existing equipment and the potential demand increase must be taken into account (see Figure 1).

$$S_{yp} = S_{ini} - S_{ini}\frac{yp}{(2 \times LT_{avg})}, if\ yp \leq 2 \times LT_{avg} \quad \text{Equation (2)}$$

[2] The initial baseline emission factor at the beginning of the project activity ($EF_{bl,ini}$) is calculated as the generation weighted average emissions per electricity unit ($tCO_2$/MWh) in the most recent three years before the connection to the grid of all generating units displaced in the isolated system for a demand up to maximum supply capacity at the moment of the interconnection of the isolated system to the grid. During the crediting period, in the case of a demand over the maximum supply capacity at the time of the interconnection to the grid, a trend towards the best available technologies emission factors for the kind of technology used in the system shall be used to calculate the emission factor $EF_{bl,y}$ of the baseline scenario for year y. The remaining lifetime of the equipment shall also be considered for the determination of $EF_{bl,y}$. The equipment that reaches its end-lifetime is replaced in the baseline scenario by the best available technologies in the system at the beginning of the project activity so that there is a trend towards the emission factors of the best available kind of technologies used in the system. It is assumed that for the equipment that has not already reached its end-lifetime, the efficiency of electricity generation and the composition of fossil fuels fired in the most recent three years before the connection of the isolated system to the grid would not change significantly over the crediting period. The emission factor of the best available technology for the kind of technology used in the system is also considered fixed during all the crediting period and equal to its value at the beginning of the project activity.

$$S_{yp} = 0, if\ yp \geq 2 \times LT_{avg}$$ Equation (3)

$$LT_{avg} = \frac{\left(\sum S_{ini} \times LT_{i,ini}\right)}{\sum S_{ini}}$$ Equation (4)

Where:

$S_{yp}$ = Power that would be supplied in the baseline scenario to previously isolated system in project year *yp* (MW) if the equipment in the system were not replaced at the end of their lifetime

$S_{ini}$ = Equipment power supply capacity in the isolated system (in MW) at the time of the interconnection to the grid

$yp$ = Number of years since the isolated system was interconnected to the grid (project year)

$LT_{avg}$ = Average remaining lifetime of the equipment used in the isolated system at the time of the interconnection, weighted with the supply capacity of the equipment at the beginning of the project activity

$LT_{i,ini}$ = Life time of equipment *i* (in years) used in the isolated grid, estimated at the time of isolated system being connected to the grid

$$EF_{bl,yp} = EF_{bl,ini}\ if S_{yp} > 0\ and\ S_{yp} > D_{yp}$$ Equation (5)

$$EF_{bl,yp} = \frac{EF_{bl,ini} \times S_{yp} + EF_{BAT} \times D_{yp} - S_{yp}}{D_{yp}}$$ Equation (6)

$$EF_{bl,yp} = EF_{BAT}, if S_{yp} = 0$$ Equation (7)

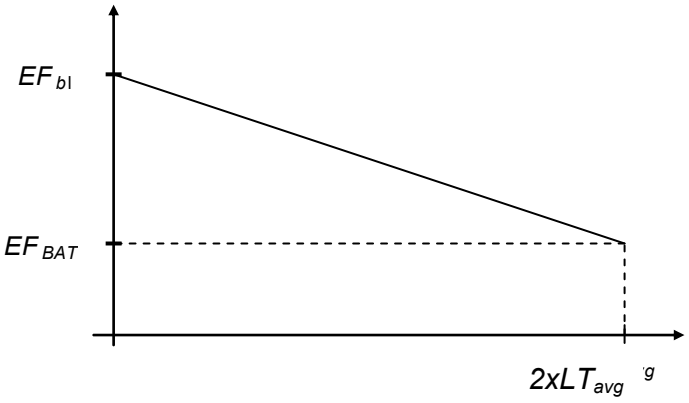
Where:

$EF_{bl,yp}$ = Baseline emission factor (in $tCO_2e/MWh$) of the project (previously isolated system at year *yp*)

$D_{yp}$ = Power electricity demand in MW of the project (previously isolated system at year *yp*)

$EF_{BAT}$ = Baseline emission factor (in $tCO_2e/MWh$) for the best available kind of technology in the isolated system; with the lowest $CO_2$ emission factor at the beginning of the project activity

**Figure 1. Baseline emission factor adjustment for a demand higher than the supply capacity at the time of the interconnection**




40. Baseline emissions ($BE_y$ in $tCO_2$) are the product of the baseline emission factor ($EF_{bl,yp}$ in $tCO_2$/MWh) and electricity supplied to the isolated ~~area~~ system by the grid in the project activity ($EG_y$ in MWh).

$$BE_y = EG_y \times EF_{bl,yp} \quad \text{Equation (8)}$$

Where:

$EG_y$ = ~~Is e~~Electricity supplied to the isolated ~~area~~ system by the grid in the year *yp* (MWh)

## 5.5. Project Emissions

41. The emissions from the project activity are those resulting from electricity generated due to the project activity by the operation of existing grid-connected power plants and by the addition of new generation sources. Additionally, emissions related to $SF_6$ use and potentially higher transmission losses than the grid average are taken into account.

42. For the calculation of the project emissions, the combined margin emission factor of the interconnected grid is to be used as in "Tool to calculate emission factor for an electricity system" with a default value of 0.5 for the weights.

$$EF_p = W_{OM} \times EF_{OM,y} + W_{BM} \times EF_{BM,y} \quad \text{Equation (9)}$$

43. Emissions related to $SF_6$ used in the new equipment of the project activity during the year *y* ($PE_{SF6,y}$), in tonnes of $CO_2e$, are calculated as follows:

$$PE_{SF6,y} = M_{SF6,y} \times GWP_{SF6} \quad \text{Equation (10)}$$

Where:

$M_{SF6,y}$ = Average quantity of $SF_6$ leaks in the equipment during year *y* in tonnes of $SF_6$. The value shall be determined using the equipment manufacturer's information and/or amount of $SF_6$ injected in the equipment during maintenance to maintain their operation standards

| | | |
|---|---|---|
| $GWP_{SF6}$ | = | Global warming potential of sulphur hexafluoriode (23,900 is the value for first commitment period) |

44. With the above, the project emissions are calculated as follows:

$$PE_y = (EG_y \times EF_p) \times (TL + 1) + PE_{SF6,y} \quad \text{Equation (11)}$$

Where:

| | | |
|---|---|---|
| $TL$ | = | Incremental transmission losses (1.0 ≥ TL ≥ 0.0) of the project activity over and above those in the isolated area |

## 5.6. Leakage

45. Possible emissions potentially giving rise to leakage in the context of electrification projects are emissions arising due to transmission lines construction. Leakages[3] related to deforestation in the construction of interconnection lines are calculated as follows:

$$L_1 = A_{def} \times L_C \quad \text{Equation (12)}$$

Where:

| | | |
|---|---|---|
| $L_1$ | = | Leakage emissions to be accounted in the first year of project crediting period |
| $A_{def}$ | = | Area of land deforested in hectares |
| $L_C$ | = | Carbon stock per unit area (above ground, below ground, soil carbon, litter and dead biomass), in tonnes of $CO_2$ per hectare |

46. Leakage from deforestation is a one-time emission. If the estimated leakage from deforestation is below 1% of the project's estimated emission reductions over the first crediting period, then the leakage shall not be accounted. Otherwise the total leakage estimated will be fully deducted from the emissions reductions in the first verification period.

47. Project participants do not need to consider other emission sources as leakage in applying this methodology.

## 5.7. Emission reductions

48. The project activity mainly reduces carbon dioxide through substitution of isolated systems electricity generation with fossil fuel fired power plants by electricity supplied by an interconnected grid. The emission reduction $ER_y$ by the project activity during a given year *y* is the difference between baseline emissions ($BE_y$), project emissions ($PE_y$) and emissions due to leakage ($L_y$), as follows:

$$ER_y = BE_y - PE_y - L_y \quad \text{Equation (13)}$$

[3] Change of carbon stocks as a result of clearing biomass.

## 5.8. Changes required for methodology implementation in 2nd and 3rd crediting periods

49. ~~Consistent with guidance by the Executive Board, p~~Project participants shall assess the continued validity of the baseline and update the baseline by applying the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

~~50. If a project developer chooses to renew the crediting period, the most recent version of this methodology should be used. In order to assess the continued validity of the baseline, project participants should apply the procedure to determine the most plausible baseline scenario, as outlined above. The crediting period may only be renewed if the application of the procedure results in that the baseline scenarios determined in the registered CDM PDD still apply.~~

~~51. Specifically, project proponents should verify whether one of the instruments (financing and/or institutional arrangements) that can potentially remove the barriers that prevent the scenario "the project activity undertaken without being registered as CDM project" has been implemented thus rendering the project non-additional.~~

## 5.9. Data and parameters not monitored

**Data / Parameter table 1.**

| **Data / Parameter:** | ***COEF*$_{i,j}$** |
|---|---|
| Data unit: | $tCO_2$/mass or volume unit |
| Description: | $CO_2$ emission coefficient of each fuel type *i* consumed by the power plants j of the isolated system in the baseline scenario. This is estimated as product of carbon content of the fossil fuel per unit energy, NCV, and oxidation factor. |
| Source of data: | Latest local statistics or IPCC |
| Measurement procedures (if any): | Not applicable |
| Any comment: | Obtained at the validation. Publicly available official data. Default data and literature statistics are used to check the local data. Plant or country-specific values are preferred to IPCC default values. |

**Data / Parameter table 2.**

| **Data / Parameter:** | ***COEF*$_{i,IMPORTS}$** |
|---|---|
| Data unit: | $tCO_2$/mass or volume unit |
| Description: | $CO_2$ emission coefficient of each fuel type *i* (if imports occur) |
| Source of data: | Latest local statistics or IPCC |
| Measurement procedures (if any): | Not applicable |
| Any comment: | Updated yearly. Publicly available official data. Default data and literature statistics are used to check the local data. Plant or country-specific values are preferred to IPCC default values |

**Data / Parameter table 3.**

| **Data / Parameter:** | $COEF_i$ |
|---|---|
| Data unit: | $tCO_2$/mass or volume unit |
| Description: | $CO_2$ emission coefficient of each fuel type *i* |
| Source of data: | Latest local statistics or IPCC |
| Measurement procedures (if any): | Statistical data |
| Any comment: | Updated yearly. Plant or country-specific values are preferred to IPCC default values. Publicly available official data. Default data and literature statistics are used to check the local data |

**Data / Parameter table 4.**

| **Data / Parameter:** | $GEN_{j,bl}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied to the isolated system in the baseline scenario by power generation source 'j' during the last three years before the beginning of the project activity |
| Source of data: | Historic records based on electricity meters recording |
| Measurement procedures (if any): | At the validation. Directly measured or publicly available official data. Double check by receipt of sales/payment. Default data and literature statistics are used to check the local data |
| Any comment: | Based on the most recent statistics available at the time of CDM-PDD submission. Double check by receipt of sales/payment |

**Data / Parameter table 5.**

| **Data / Parameter:** | $F_{i,j,bl}$ |
|---|---|
| Data unit: | Mass or volume |
| Description: | Amount of fossil fuel consumed by each power plant of the isolated system in the baseline scenario during the last three years before the beginning of the project activity |
| Source of data: | Historic records of the isolated system |
| Measurement procedures (if any): | At the validation. Directly measured or publicly available official data. Default data and literature statistics are used to check the local data |
| Any comment: | Based on the most recent statistics available at the time of CDM-PDD submission. Obtained from producers, dispatch centers, electricity agencies or literature |

**Data / Parameter table 6.**

| **Data / Parameter:** | $LT_{avg,}$ |
|---|---|
| Data unit: | years |
| Description: | $LT_{avg}$ is the average remaining lifetime of the equipment estimated using formulae 4 defined in the baseline emission section above |
| Source of data: | Project activity |

| | |
|---|---|
| Measurement procedures (if any): | Once at the validation |
| Any comment: | An expert assessment is used |

**Data / Parameter table 7.**

| **Data / Parameter:** | $EF_{BAT}$ |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | $EF_{BAT}$ is the baseline emission factor (in $tCO_2e/MWh$) for the most efficient kind of technology displaced in the isolated system |
| Source of data: | Project activity |
| Measurement procedures (if any): | At the validation. Measurements and calculation. Directly measured or publicly available official data |
| Any comment: | - |

**Data / Parameter table 8.**

| **Data / Parameter:** | $EF_{bl,ini}$ |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | $EF_{bl,ini}$ is the baseline emission factor (in $tCO_2e/MWh$) of the isolated electricity system at the time of the interconnection to the grid |
| Source of data: | Project activity |
| Measurement procedures (if any): | At the validation. Calculated |
| Any comment: | - |

**Data / Parameter table 9.**

| **Data / Parameter:** | $A_{def}$ |
|---|---|
| Data unit: | hectares |
| Description: | Area of land deforested in the construction of the interconnection lines |
| Source of data: | Project activity |
| Measurement procedures (if any): | At the validation. Topographical characterization and/or engineering plants and/or maps. Directly measured or publicly available official data |
| Any comment: | - |

**Data / Parameter table 10.**

| **Data / Parameter:** | ***TL*** |
|---|---|
| Data unit: | % |
| Description: | Additional transmission losses. |
| Source of data: | Project activity |
| Measurement procedures (if any): | Yearly. Directly measured or publicly available data |
| Any comment: | - |

**Data / Parameter table 11.**

| **Data / Parameter:** | $S_{ini}$ |
|---|---|
| Data unit: | MW |
| Description: | Equipment power supply capacity in the isolated system (in MW) at the time of the interconnection to the grid |
| Source of data: | Nameplate of the equipment |
| Measurement procedures (if any): | At the validation |
| Any comment: | - |

**Data / Parameter table 12.**

| **Data / Parameter:** | $LT_{i,ini}$ |
|---|---|
| Data unit: | years |
| Description: | Lifetime of equipment *i* at the time it is replaced by the grid. |
| Source of data: | Project site |
| Measurement procedures (if any): | - |
| Any comment: | - |

**Data / Parameter table 13.**

| **Data / Parameter:** | $L_c$ |
|---|---|
| Data unit: | $tCO_2$/hectare |
| Description: | Carbon stock per area (above ground, below ground, soil carbon, litter and dead biomass). |
| Source of data: | - |
| Measurement procedures (if any): | - |
| Any comment: | - |

# 6. Monitoring methodology

## ~~6.1. Monitoring procedures~~

49. Where the methodology provides different options (e.g. use of default values or on-site measurements), specify which option will be used.

50. Project proponents have to provide in the CDM-PDD information concerning the system in place to ensure the quality of the data. It should include the actions to be undertaken to constitute and to maintain the needed measurement equipment to satisfy the requirements concerning the quality of the data:

    (a) The inventory, the identification and the description of the measurement equipment used;

    (b) The description of the QA/QC procedures for monitoring;

(c) The organization implemented and the responsibilities;

(d) The calibration and verification of the measurement equipment;

(e) The connecting of the standard equipment to equipment of reference;

(f) The recording.

51. The methodology requires monitoring of the following:

(a) Electricity ~~generation from the proposed project activity~~ supplied by the grid to the isolated system ($EG_y$), by applying the requirements for the parameter $EG_{PJ,grid,y}$ from the latest version of the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" ~~tool~~;

(b) Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with "Tool to calculate emission factor for an electricity system";

(c) Data needed to recalculate the build margin emission factor, if needed, consistent with "Tool to calculate emission factor for an electricity system";

(d) Financing and/or institutional arrangements that could help the project to overcome identified barriers during the crediting period.

~~**Data / Parameter table 14.**~~

| ~~**Data / Parameter:**~~ | ~~$EG_y$~~ |
|---|---|
| ~~Data unit:~~ | ~~MWh~~ |
| ~~Description:~~ | ~~Electricity supplied by the grid to the isolated system included in the project activity~~ |
| ~~Source of data:~~ | ~~Project activity~~ |
| ~~Measurement procedures (if any):~~ | ~~On-site electricity meter~~ |
| ~~Monitoring frequency:~~ | ~~Hourly measurement and monthly recording~~ |
| ~~QA/QC procedures:~~ | ~~Directly measured or publicly available official data. Double check by receipt of sales/payment. Default data and literature statistics are used to check the local data~~ |
| ~~Any comment:~~ | ~~Double check by receipt of sales/payment~~ |

**Data / Parameter table 15.**

| **Data / Parameter:** | $EF_{OM,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | $CO_2$ operating margin emission factor of the grid |
| Source of data: | Project activity |
| Measurement procedures (if any): | Calculated |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | |

| | |
|---|---|
| Any comment: | Calculated as indicated in the relevant OM method in "Tool to calculate emission factor for an electricity system" |

**Data / Parameter table 16.**

| **Data / Parameter:** | $EF_{BM,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | $CO_2$ build margin emission factor of the grid |
| Source of data: | Project activity |
| Measurement procedures (if any): | Calculated |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | |
| Any comment: | Calculated as indicated in the relevant BM method in "Tool to calculate emission factor for an electricity system" |

**Data / Parameter table 17.**

| **Data / Parameter:** | $EF_p$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | $CO_2$ emission factor of the grid |
| Source of data: | Project activity |
| Measurement procedures (if any): | Calculated |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | |
| Any comment: | Calculated as indicated in "Tool to calculate emission factor for an electricity systems" |

**Data / Parameter table 18.**

| **Data / Parameter:** | $F_{i,j,y}$ |
|---|---|
| Data unit: | Mass of volume |
| Description: | Amount of fossil fuel *i* consumed by each power plant j during year y. |
| Source of data: | Latest local statistics |
| Measurement procedures (if any): | Statistical data |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Directly measured or publicly available official data. Default data and literature statistics are used to check the local data |
| Any comment: | Obtained from producers, dispatch centers, electricity agencies or literature |

**Data / Parameter table 19.**

| **Data / Parameter:** | $GEN_{i/j/k,y}$ |
|---|---|
| Data unit: | MWh |

| | |
|---|---|
| Description: | Electricity generation of each power plant |
| Source of data: | Latest local statistics |
| Measurement procedures (if any): | Statistical data |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Directly measured or publicly available official data. Double check by receipt of sales/payment. Default data and literature statistics are used to check the local data |
| Any comment: | Obtained from producers, dispatch centers, electricity agencies or literature (information of renewable energy based electricity generation, which shall not be displaced in the isolated system, if any, must be included to verify if its operation is not significantly affected) |

**Data / Parameter table 20.**

| **Data / Parameter:** | **Plant Name** |
|---|---|
| Data unit: | Text |
| Description: | Name of each plant included in the project boundary |
| Source of data: | Latest local statistics |
| Measurement procedures (if any): | Statistical information |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Publicly available official data |
| Any comment: | Identification of plants (j, k or n) obtained from producers, dispatch centers, electricity agencies or literature |

**Data / Parameter table 21.**

| **Data / Parameter:** | **Merit Order** |
|---|---|
| Data unit: | Text |
| Description: | Merit order of dispatch of each plant included in the project boundary |
| Source of data: | Latest local statistics |
| Measurement procedures (if any): | Statistical information |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Publicly available official data |
| Any comment: | Merit order obtained from producers, dispatch centers, electricity agencies or literature |

**Data / Parameter table 22.**

| **Data / Parameter:** | $GEN_{i/j/k,y\ IMPORTS}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity imports quantity to the project electricity system |
| Source of data: | Latest local statistics |

| | |
|---|---|
| Measurement procedures (if any): | Statistical data |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Directly measured or publicly available official data. Default data and literature statistics are used to check the local data. |
| Any comment: | Obtained from producers, dispatch centers, electricity agencies or literature |

**Data / Parameter table 23.**

| **Data / Parameter:** | $M_{SF6,\,y}$ |
|---|---|
| Data unit: | tonnes of $SF_6$ |
| Description: | $SF_6$ leaks in the new equipment of the project activity during year *y* in mass unit. |
| Source of data: | Project activity |
| Measurement procedures (if any): | Extra amount of $SF_6$ injected in the equipment to maintain their operation standards each year |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Directly measured or publicly available data. |
| Any comment: | Equipment manufacturer's information can also be used to cross-check |

**Data / Parameter table 24.**

| **Data / Parameter:** | **Public policies** |
|---|---|
| Data unit: | |
| Description: | Verification and evaluation of financial and institutional arrangements that could help the implementation of the project |
| Source of data: | Project activity |
| Measurement procedures (if any): | |
| Monitoring frequency: | At every verification |
| QA/QC procedures: | |
| Any comment: | Based on publicly available official data and/ or literature |

**Data / Parameter table 25.**

| **Data / Parameter:** | $D_{yp}$ |
|---|---|
| Data unit: | MW |
| Description: | Power demand of the project activity scenario |
| Source of data: | Project activity |
| Measurement procedures (if any): | |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Directly measured or publicly available official data. |

| | |
|---|---|
| Any comment: | Based on the most recent statistics available at the time of CDM-PDD submission. Obtained from producers, dispatch centers, electricity agencies or literature |

**Data / Parameter table 26.**

| **Data / Parameter:** | $S_{yp}$ |
|---|---|
| Data unit: | MW |
| Description: | Power supply of the displaced power plants in isolated area in the baseline scenario |
| Source of data: | Project activity |
| Measurement procedures (if any): | Calculated using equation 2 and equation 3 |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | Calculated f |
| Any comment: | Based on the average remaining lifetime of the equipment |

**Data / Parameter table 27.**

| **Data / Parameter:** | ***yp*** |
|---|---|
| Data unit: | Years |
| Description: | Number of years since the isolated area is connected to the grid. The project may include different isolated areas being connected to the grid at different years within the crediting period |
| Source of data: | Project site |
| Measurement procedures (if any): | Record the date when each isolated system included in the project boundary is connected to the grid. Then, yp is determined counting the number of years from the date of connection to the year *y* in the crediting period |
| Monitoring frequency: | |
| QA/QC procedures: | |
| Any comment: | |

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## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 03.0 | 22 July 2016 | EB 90, Annex 7<br>Revision to include the requirements of TOOL05 and TOOL08. |
| 02.0 | 19 October 2007 | EB 35, Para 24<br>Revision to incorporate the use of the “Tool to calculate emission factor for an electricity system”. |
| 01.0 | 15 December 2006 | EB 28, Annex 2 |

| *Version* | *Date* | *Description* |
|---|---|---|
| | | Initial adoption. |

Decision Class: Regulatory
Document Type: Standard
Business Function: Methodology
Keywords: electricity generation, electric power transmission, power plants