

AM0119

Large-scale Methodology

SF₆ emission reductions in gas insulated metal enclosed switchgear

Version 01.0

Sectoral scope(s): 11



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 project(s)	To introduce new, or to replace existing gas insulated switchgears (GIS) with those filled with lower content of SF ₆ or SF ₆ -free.
Type of GHG emissions mitigation action	GHG emission avoidance: Avoidance of SF ₆ fugitive emissions in switchgears.

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology applies to project activities that introduce new, or replace existing gas insulated switchgear(s) (GIS) with those filled with lower content of SF₆ or SF₆ free. As a result, recharging with SF₆ to compensate for fugitive leaks of the baseline equipment is reduced or avoided¹.

2.2. Applicability

3. This methodology applies to project activities that:
 - (a) Install new SF₆ free C-GIS (cubicle type gas insulated metal enclosed switchgear) or lower volume SF₆ C-GIS equipment (as opposed to baseline situation) at a site where no equipment for the same function is in operation prior to the implementation of the project activity; or
 - (b) Replace the existing SF₆ C-GIS with SF₆ free C-GIS or lower volume SF₆ C-GIS (as opposed to baseline situation) in the power system; or
 - (c) Add SF₆ free C-GIS or lower volume SF₆ C-GIS to existing installation with baseline equipment for the same function in the power system (expansion of capacity project).
4. The methodology is applicable under the following conditions:
 - (a) The project equipment shall be able to provide the same or better functional results as the baseline equipment (e.g. the same level of service, including the same applicable voltage, etc.);
 - (b) The project proponent shall demonstrate that refilling of SF₆ is required to the baseline equipment for its proper operation during the lifetime of the equipment. Furthermore, the project developer shall demonstrate that the residual SF₆ of both, the baseline and the project equipment at the end of its lifetime, would have the

¹ Project proponents may expand the scope of the methodology to claim emission reductions from the residual SF₆ of the baseline equipment, by proposing additional procedures to address the fate of the residual SF₆ of the baseline equipment.

same fate (e.g., atmosphere venting), inter alia by reviewing the applicable local and/or national regulations and the sectoral common practices with respect to the disposal of the baseline and project equipment;

- (c) The type of baseline GIS shall be high voltage (> 52kV), closed pressure system for gas, but not the sealed pressure system which does not require gas charging during its operation²;
- (d) A contractual agreement has to be in place to ensure that the emission reductions are claimed only by the project proponent.

5. In addition, the applicability conditions included in the tools referred to below apply.

2.3. Entry into force

6. The date of entry into force is the date of the publication of the EB 94 meeting report on 4 May 2017.

2.4. Applicability of sectoral scopes

7. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 11 is mandatory.

3. Normative references

8. This baseline and monitoring methodology is a proposed new methodology prepared by Beijing Keji Environmental Technology Co., Ltd. and Shenyang Huade High Technology Electric CO. LTD.

9. This methodology also refers to the latest approved versions of the following tools:

- (a) Combined tool to identify the baseline scenario and demonstrate additionality;
- (b) Tool to determine the remaining lifetime of equipment.

10. For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board please refer to <<http://cdm.unfccc.int/goto/MPappmeth>>.

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

- 11. “Existing actual or historical emissions, as applicable”; or
- 12. “Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment”.

4. Definitions

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

² According to IEC 62271-1 from the International Electrotechnical Commission.

14. For the purpose of this methodology, the following definitions apply:

- (a) **SF₆ free cubicle type gas insulated metal enclosed switchgear (SF₆ free C-GIS)** - no use of SF₆ as isolation gas. Dry air, nitrogen or other gases with no GWP are used to carry out insulation;
- (b) **Cubicle gas insulated metal enclosed switchgear using lower volume of SF₆ (lower volume SF₆ C-GIS)** - Equipment that contains less SF₆ than the identified baseline equipment, in which SF₆ is to participate in the electric isolation, but in a lower volume.

5. Baseline methodology

5.1. Project boundary

- 15. The spatial extent of the project boundary in which the project activity is implemented encompasses the power grid (or a part of the grid) or facilities (such as enterprise's substation).
- 16. The greenhouse gases included in or excluded from the project boundary are shown in Table 2.

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

Source		Gas	Included	Justification/Explanation
Baseline	SF ₆ leaks from baseline GIS	SF ₆	Yes	Main emission source
		CO ₂	No	Device does not contain this gas
		CH ₄	No	Device does not contain this gas
		N ₂ O	No	Device does not contain this gas
Project activity	SF ₆ leaks from project GIS	SF ₆	Yes	Main emission source
		CO ₂	No	Device does not contain this gas
		CH ₄	No	Device does not contain this gas
		N ₂ O	No	Device does not contain this gas

5.2. Identification of the baseline scenario and additionally demonstration

- 17. For the purpose of identification of the baseline scenario and additionality demonstration, the "Combined tool to identify the baseline scenario and demonstrate additionality" shall be followed.

5.3. Baseline emissions

- 18. Baseline emissions are the avoided or reduced amount of SF₆, that would have been recharged to the baseline equipment. The baseline emissions are calculated according to the equation below.

$$BE_y = R_{baseline,y} \times GWP_{SF_6} / 1000$$

Equation (1)

Where:

BE_y = Baseline emissions in year y (tCO₂)

$R_{baseline,y}$ = The amount of SF₆ recharged to baseline equipment in year y (kg SF₆)

GWP_{SF6} = Global warming potential of SF₆ (tCO₂/t SF₆)

19. In case of replacement of existing equipment (i.e., the type of project activities specified in paragraph 3(b)), $R_{baseline,y}$ is determined by taking the minimum annual amount of SF₆ recharged to the baseline equipment in the most recent 3 years before the implementation of the project activity. In case 3-year historic data are not available, the procedure provided in paragraph 20 shall be followed.
20. Project participants shall estimate the remaining lifetime of the baseline equipment by applying the “Tool to determine the remaining lifetime of equipment”. These items of equipment and their remaining lifetime shall be recorded in the CDM-PDD. From the point in time beyond the remaining lifetime of the baseline equipment, baseline emissions shall be considered as zero.
21. In case of the types of project activities specified in paragraph 3(a) or 3(c), $R_{baseline,y}$ is determined by following the equation below:

$$R_{baseline,y} = OEC_{baseline} \times LR \quad \text{Equation (2)}$$

Where:

$OEC_{baseline}$ = SF₆ content of baseline equipment in the name plate (kg SF₆)

LR = Annual SF₆ loss rate (%)

22. LR is determined by taking the value of the annual leakage rate provided by the equipment manufacturer, if available. Otherwise, the acceptable annual leakage rate³ as required in latest version of the IEC 62271-203 shall be applied. If both data sources are available, the minimum between the two shall be chosen.

5.4. Project emissions

23. For the purpose of this methodology, project emissions exist only when lower volume SF₆ C-GIS type of equipment is used in the project activity. It involves the SF₆ recharge to compensate for fugitive leaks during the operation of the equipment. Project emissions are calculated according to the following equation:

$$PE_y = R_{project,y} \times GWP_{SF6}/1000 \quad \text{Equation (3)}$$

Where:

PE_y = Project emissions in year y (tCO₂)

³ In the IEC 62271-203 (2011), it is specified that “The leakage rate from any single compartment of GIS to atmosphere and between compartments shall not exceed 0.5% per year for the service lifetime of the equipment”.

$R_{project,y}$ = The amount of SF₆ charged on project equipment in year y (kg SF₆)

GWP_{SF6} = Global warming potential of SF₆ (tCO₂/t SF₆)

24. $R_{project,y}$ shall be monitored ex post during the project activity. For the purpose of ex ante estimation, it shall be determined according to one of the following options:

- (a) The value derived by conducting a measurement campaign of the project equipment, or value reported in other similar applications of the project equipment before the implementation of the project activity, if available;
- (b) The value provided by the equipment manufacturer, if available;
- (c) Determined by following the equation (2) above, but applying the SF₆ content in the nameplate of the project equipment.

5.5. Leakage

25. There is no consideration of leakage in this methodology.

5.6. Emission reductions

26. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{Equation (4)}$$

Where:

ER_y = Emission reductions in year y (tCO₂e)

BE_y = Baseline emissions in year y (t CO₂e)

PE_y = Project emissions in year y (t CO₂)

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

27. Project proponents shall use the latest version of the tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” when considering the necessary changes in the 2nd and 3rd crediting period.

5.8. Data and parameters not monitored

28. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / Parameter table 1.

Data / Parameter:	GWP_{SF6}
Data unit:	tCO ₂ e/tSF ₆
Description:	Global warming potential of SF ₆
Source of data:	IPCC 4 th Assessment Report

Value to be applied:	22,800 for the second commitment period of the Kyoto Protocol
Any comment:	Shall be updated according to any future COP/MOP decisions

Data / Parameter table 2.

Data / Parameter:	<i>DATE_{BaselineDisp}</i>
Data unit:	Date
Description:	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data:	Project activity site
Measurement procedures (if any):	As per provisions in the Tool to determine the remaining lifetime of equipment
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	<i>OEC_{baseline}</i>
Data unit:	kg SF ₆
Description:	SF ₆ content of baseline equipment
Source of data:	Sourced from equipment nameplate or specifications
Measurement procedures (if any):	-
Any comment:	Only in case of Greenfield

Data / Parameter table 4.

Data / Parameter:	<i>LR</i>
Data unit:	%
Description:	Annual SF ₆ loss rate of the equipment
Source of data:	<ul style="list-style-type: none"> - the equipment manufacturer, if available. Otherwise, - the acceptable annual leakage rate as required in latest version of the IEC 62271-203 Refer to guidance in paragraph 19-21
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	<i>R_{baseline,y}</i>
Data unit:	kg SF ₆
Description:	The amount of SF ₆ recharged to baseline equipment
Source of data:	Refer to guidance in paragraph 19-21

Measurement procedures (if any):	-
Any comment:	-

Data / Parameter table 6.

Data / parameter:	ID_{baseline}
Data unit:	/
Description:	Identification Number of baseline equipment for replacement project activity
Source of data:	Project Proponent
Measurement procedures (if any):	Sourced from equipment nameplate or specifications
Monitoring frequency:	At the replacement of baseline equipment
QA/QC procedures:	Archive the data
Any comment:	-

Data / Parameter table 7.

Data / parameter:	Cap_{baseline}
Data unit:	kV
Description:	Capacity of baseline equipment for replacement project activity
Source of data:	Project Proponent
Measurement procedures (if any):	Sourced from equipment nameplate or specifications
Monitoring frequency:	At the replacement of baseline equipment
QA/QC procedures:	Archive the data
Any comment:	-

6. Monitoring methodology

29. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100 per cent of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.
30. In addition, the monitoring provisions in the tools referred to in this methodology apply.

6.1. Data and parameters monitored

Data / Parameter table 8.

Data / Parameter:	R_{project,y}
Data unit:	kg SF ₆
Description:	The amount of SF ₆ recharged to project equipment
Source of data:	Project activity site

Measurement procedures (if any):	Sourced from SF ₆ charging devices; if the service is provided by a 3 rd party, the data shall be cross checked with the invoice and report from the service provider.
Monitoring frequency:	
QA/QC procedures:	Archive the data
Any comment:	-

Data / Parameter table 9.

Data / parameter:	ID_{project}
Data unit:	/
Description:	Identification Number of project equipment
Source of data:	Project Proponent
Measurement procedures (if any):	Sourced from equipment nameplate or specifications
Monitoring frequency:	Annual
QA/QC procedures:	Archive the data
Any comment:	-

Data / Parameter table 10.

Data / parameter:	Cap_{project}
Data unit:	kV
Description:	Capacity of project equipment
Source of data:	Project Proponent
Measurement procedures (if any):	Sourced from equipment nameplate or specifications
Monitoring frequency:	At the installation of project equipment
QA/QC procedures:	Archive the data
Any comment:	-

Data / Parameter table 11

Data / parameter:	DATE_{instal}
Data unit:	/
Description:	Installation date of project equipment
Source of data:	Project proponent
Measurement procedures (if any):	/
Monitoring frequency:	At the installation of project equipment
QA/QC procedures:	Archive the data
Any comment:	-

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Document information

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