CLEAN DEVELOPMENT MECHANISM

CDM-SSCWG47-A02

Draft Small-scale Methodology

AMS-III.B: Switching fossil fuels

Version 18.0

Sectoral scope(s): 01

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) in decision 3/CMP.9 in paragraph 11 of further guidance to clean development mechanism (CDM) has reiterated its encouragement to the Executive Board (hereinafter referred to as the Board), as contained in decision 5/CMP.8, to continue its work on the simplification and streamlining of methodologies, with the aim of reducing transaction costs for all project activities and programmes of activities, especially those in regions underrepresented in the clean development mechanism.

2. The Board, at its seventy-eighth meeting, considered a concept note on further work on methodologies, tools and standards and agreed on the methodological products for further work in 2014 (See EB 78 meeting report, annex 8).

3. Issues related to small-scale methodological products for simplification and streamlining under MAP project 223 for 2014 are targeted to include consistent and comparable methods distinguished by project size across small-scale methodologies for fuel switch (e.g. emission reduction calculations, applicability, definition of existing facility, simplification for microscale projects) taking into account the methods in the approved large-scale methodologies.

4. The Small-Scale Working Group (SSC WG) at its 45th meeting initiated a discussion on the potential elements for revision of small-scale fuel switch methodologies and agreed on elements for revisions of small-scale fuel switch methodologies as per the agreements reflected in the information note contained in annex 1 to SSC WG 45th meeting internal report.

5. The SSC WG at its 46th meeting agreed to recommend the draft revised methodology "AMS-III.B: Switching fossil fuels" for call for public input.

2. Purpose

6. The purpose is to revise "AMS-III.B: Switching fossil fuels" in order to simplify and streamline it as per the objective MAP project 223 for 2014 and to further improve consistency amongst fuel switch methodologies with distinguishing methods by project size across small-scale and large-scale fuel switch methodologies (e.g. emission reduction calculations, applicability, definition of existing facility, simplification for microscale projects).

3. Key issues and proposed solutions

7. AMS-III.B is one of the highly used small scale methodologies in the CDM pipeline with 31 registered projects (1 PoA) and 103 at registration (3 PoAs). Analysis shows that 6.5% of projects in the pipeline that withdrawn their registration, 3.7% of rejected cases and 3.4% of cases with a negative validation are projects applying fuel switch

methodologies. Also the IGES study "Towards CDM reform"[1] states that fuel switching and waste heat projects have the lowest rate of automatic registration. This may imply that that this project type is facing particular difficulties to get their registration. Based on the project assessment experience and taking into account clarifications and public comments received in the past, the proposed revision aims to resolve methodological impediments as mentioned below to further facilitate the development of CDM projects in this area: .

8. **Issue 1:** The export of electricity to a grid is though allowed but associated emissions reduction are not qualified to claim

9. **Proposed solution to issue 1:** The methodology "ACM0011: Consolidated baseline methodology for fuel switching from coal and/or petroleum fuels to natural gas in existing power plants for electricity generation" has robust procedure for quantifying emissions from exporting electricity to the grid which includes three tiered approach. The SSC WG, at its 45th meeting, agreed to allow fuel switch project activities to claim emissions for export of electricity to a grid by using ACM0011 approach, limiting it to existing facilities which have three years operational history. Taking into account that small-scale additionality can be followed, the capacity of facilities supplying electricity to the grid will be limited to 15 MW.

10. **Issue 2:** AMS-III.B is only applicable to processes where energy output can be directly measured.

11. **Proposed solution to issue 2:** To include "ACM0009: Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas" approach under AMS-III.B for deriving baseline emissions based on the combustion of the quantity of fuel that would in the absence of the project activity be used in element processes *i*. Baseline emissions are calculated based on the quantity of fuel that would be combusted in each element processes *i* in the absence of the project activity and respective net calorific values and CO_2 emission factors. The quantity of fuel that would be used in the absence of the project activity in an element process *i* (*FFbaseline,i,y*) is calculated based on the actual monitored quantity of project fuel in this element process (*FFproject,i,y*) and the relation of the energy efficiencies and the net calorific values between the project scenario and the baseline scenario. Currently Option D of ACM0009 allows as a simplification to assume that project and baseline efficiencies are equal if it is demonstrated that project efficiency does not change significantly or is higher than baseline efficiency and can be fixed for the crediting period which leads to monitoring simplification.

12. **Issue 3:** AMS-III.B is applicable to Greenfield facilities, and it only provides guidance on how to determine baseline scenario following the "General Guidelines for SSC CDM methodologies", but the methodology does not provide any procedure on how the baseline emissions are to be calculated .

13. **Proposed solution to Issue 3:** In order to further elaborate procedures for Greenfield facilities under AMS-III.B the Reference Plant approach is recommended. Alternative simplified approach based on ACM0009 approach to calculate baseline emissions is also provided (i.e., based on the actual monitored quantity of project fuel in element

[1] IGES, Towards CDM reform, page6, Retrieved from <http://pub.iges.or.jp/modules/envirolib/upload/2798/attach/towards_cdm_reform.pdf>.

process and the relation of the energy efficiencies and the net calorific values between the project scenario and the baseline scenario) ..

4. Impacts

14. AMS-III.B is the most widely used amongst the small-scale fuel switch methodologies (89% of the CDM fuel switch project activities in the pipeline apply AMS-III.B).

15. The revision will:

    (a) Expand applicability of the methodology for project activities which are grid connected and export electricity to a grid;

    (b) Result in simplified monitoring requirements and potentially in reduced transaction costs.

16. The impact of the simplified monitoring requirements of AMS-III.B will address 10 out of 38 RfR issues raised during the assessment of registration cases.

17. The revision, if approved, will facilitate the implementation of CDM project activities and component project activities (CPAs) involving switching fossil fuels and may potentially contribute to increased number of fossil fuel switch projects in LDCs and underrepresented countries.

5. Subsequent work and timelines

18. The methodology is recommended by the SSC WG for consideration by the Board at its eighty-third meeting. No further work is envisaged.

6. Recommendations

19. The SSC WG at its 47th meeting agreed to recommend to the Board the revision of AMS-III.B for approval.

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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)	The fossil fuel switching in new or existing industrial, residential, commercial, institutional or electricity generation applications
Type of GHG emissions mitigation action	Switch to a fossil fuel with a lower GHG intensity ~~(~~in Greenfield or retrofit or replacement activities~~)~~

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology comprises fossil fuel switching in industrial, residential, commercial, and institutional or electricity generation applications[2] (e.g., fuel switch from fuel oil to natural gas in an existing captive electricity generation or replacement of a fuel oil boiler by a natural gas boiler).

3. Fuel switch may be in a single element process or may include several element processes[3] within the facility. Multiple fossil fuel switching in an element process however is not covered under this methodology. In other words, only element processes utilizing a single fuel in the baseline as well as in the project scenario are eligible, dual or multiple fuel utilization by an element process is not covered.[4]

Table 2. Summary of the approaches for determining baseline emissions

Summary of the methodological approaches under AMS-III.B	
Existing facilities	Using paragraph 32 or 38 below
Greenfield/capacity expansion facilities	As per the procedure in paragraph 38 below
Project activities with element processes with annual emission reductions equal to or less than 600 t CO2e	As per the procedure in paragraph 43 below
Existing plant that supplies electricity to a grid	As per the procedure in paragraph 34 below

[2] Fuel switch in transportation technologies is not covered ~~eligible~~ under this methodology.

[3] ~~An 'element process' is defined as fuel combustion, energy conversion or energy use in a single equipment. Each element process generates a single output (such as electricity, steam, hot air) by using a single energy source.~~ This methodology covers switch of energy sources in several element processes (i.e. project participants may submit one project design document (PDD) for fuel switch in several element processes within a facility).

[4] For example fuel oil was used in a boiler in the baseline. The project used only natural gas in the boilers (i.e., the project plant does not use more than one fuel in one element process).

2.2. Applicability

4. This methodology is applicable for

(a) Retrofit or replacement of existing installations;[5]

(b) Greenfield facilities or project activities involving capacity additions.

5. Fuel switching may also result in energy efficiency improvements. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this methodology. If fuel switching is part of a project activity focussed primarily on energy efficiency, the project activity falls under a Type-II methodology.

~~6. Greenfield New facilities (Greenfield projects) and project activities involving capacity additions. compared to the baseline scenario are only eligible if they comply with the related and relevant requirements related to demonstration of the baseline scenario prescribed in the latest approved version of the "General guidelines to for SSC CDM methodologies".~~[6]

6. The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the latest approved version of the ~~"General guidelines to SSC CDM methodologies"~~ "Tool to determine the remaining lifetime of equipment". If the remaining lifetime of the affected systems increases due to the project activity, the crediting period shall be limited to the estimated remaining lifetime, (i.e., the time when the affected systems would have been replaced in the absence of the project activity).

7. The following types of fuels as listed under the 2006 IPCC Guidelines for greenhouse gas inventories (volume 2, chapter 1, table 1.1) are eligible under this methodology:

(a) Liquid fuel (crude oil and petroleum products);

(b) Solid fuel (coal and coal products);

(c) Gas (natural gas).

8. This methodology excludes the use of derived gases (from coal and coal products) listed in the table mentioned in paragraph 7 above.

9. This methodology is not applicable to project activities that propose switch from fossil fuel use in the baseline to renewable biomass, biofuel or renewable energy in the project scenario. A relevant Type I methodology shall be used for such project activities that generate renewable energy displacing fossil fuel use. This methodology is also not applicable to project activities involving the use of waste energy (e.g., waste gases from H_2SO_4 facilities etc.); these project activities might be eligible under "AMS-III.Q: Waste energy recovery (gas/heat/pressure) projects".

[5] It also includes installation of new energy generating facility to replace existing energy generating facility that is ~~solely~~ e.g. fuelled by solid or liquid petroleum fuel such as coal, diesel or fuel oil.

[6] Refer to the "General guidelines for SSC CDM methodologies" available at <http://cdm.unfccc.int/Reference/Guidclarif/index.html#meth>.

10. The methodology is limited to fuel switching measures which require capital investments. Examples of capital investment include creating infrastructure required to use project fuel or retrofitting existing installations.

11. The facility may involve grid connected element processes. However, under this methodology project activities that export electricity to a regional and/or national grid (hereinafter mentioned as grid)[~~7~~] may:

(a) Not claim emission reductions for the grid component; or

(b) Claim emission reductions for the grid component, provided that they have operational history of three years and the installed capacity of the project element process supplying electricity to the grid is up to or equal to 15 MW. Greenfield and capacity-addition are not covered under this category.

12. This methodology does not cover emission reductions on account of shift from use of grid electricity (e.g. shift from a carbon intensive grid to a low carbon intensive fossil fuel). In such a case, other applicable methodologies such as “AMS-III.AG: Switching from high carbon intensive grid electricity to low carbon intensive fossil fuel” might be explored.

13. This ~~category~~ methodology is applicable to project activities where it is possible to directly measure and record the energy use/output (e.g. heat, steam and electricity) and consumption (e.g. fossil fuel) within the project boundary. In case of project activities that meet the criteria under paragraph 43 below, this methodology is applicable only where it is possible to directly measure and record at least the energy consumption in the element process (e.g. fossil fuel input).

14. Heat, steam or electricity produced under the project activity shall be for on-site captive use and/or export to other facilities and/or a grid included in the project boundary. In case of electricity generation plants, the generated electricity may also be supplied to users via mini/isolated grid(s) system[~~8~~] exclusively supplied by fossil fuel units.

15. In case energy produced by the project activity is delivered to another facility, or facilities, within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displacement.

16. Regulations do not constrain the facility from using the energy sources cited in paragraph 7~~2~~ above, before or after the fuel switch. Regulations do not require the use of low carbon energy source (e.g. natural gas or any other fuel) in the element processes.

17. The project activity does not result in integrated process change. The purpose is to exclude measures that affect other characteristics of the process besides switch of energy sources e.g. operational conditions, type of raw material processed, use of non-energy additives, change in type or quality of products manufactured etc.

[~~7~~] ~~Grid here refers to national/regional grid.~~

[~~8~~] ~~Stand alone or interconnected grid system that is not connected to a national/regional grid.~~

18. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

2.3. Entry into force

19. The date of entry into force is the date of the publication of the EB 83 meeting report on the 17 April 2015.

3. Normative references

20. Project participants shall apply the latest approved version of the “General guidelines for SSC CDM methodologies”, information on additionality (attachment A to appendix B) and abbreviations provided at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>.

21. This methodology refers to the latest version of the following methodological standards, tools and guidelines:[9]

(a) “AMS-I.D: Grid connected renewable electricity generation”;

(b) “AMS-III.Q: Waste energy recovery (gas/heat/pressure) projects”;

(c) “AMS-III.AG: Switching from high carbon intensive grid electricity to low carbon intensive fossil fuel”;

(d) “General guidelines for SSC CDM methodologies”;

(e) “Tool to determine baseline efficiency of thermal and electricity systems”;

(f) “ACM0009: Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas”.

4. Definitions

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

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

(a) **Element process** - an ‘element process’ is defined as fuel combustion, energy conversion or energy use in a single equipment. Each element process generates a single output (such as electricity, steam, hot air) by using a single energy source;

(b) **Existing facilities** - existing facilities are those that have been in operation for at least three years immediately prior to the start date of the project activity.

(c) **Mini/Isolated grid system(s)** - Stand alone or interconnected grid system that is not connected to a national/regional grid

[9] Please refer to: <https://cdm.unfccc.int/Reference/index.html>.

5. Baseline methodology

5.1. Project boundary

~~24.~~ The project boundary comprises the physical, geographical site where the switching of energy source takes place. It includes all installations, processes or equipment affected by the switching. ~~In case energy produced by the project activity is delivered to another facility, the boundary also extends to the industrial, commercial facilities consuming energy generated by the system.[10]~~

25. In case energy produced by the project activity is delivered to another facility, the boundary also extends to the industrial, commercial facilities consuming energy generated by the system.[11]

26. In case electricity is exported to a grid, the project boundary encompasses the project power plant and power plants connected to the grid to which the project power plant is connected.

5.2. Baseline scenario

5.2.1. For existing facilities

27. In case of existing facilities, historical information (detailed records) on the use of fossil fuels and the energy output (e.g. heat, steam or electricity) in the element process from at least three years prior to project implementation shall be used in the baseline calculations, e.g. information on coal use and heat output by a district heating plant, diesel use and steam generated by an industrial plant, liquid fuel oil use and electricity generated by a generating unit (records of fuel used and output can be used in lieu of actual collecting baseline validation data).[12] For existing facilities not supplying electricity to a grid, which have three years of operation history but do not have sufficient operational data, all historic information shall be available for the purpose of determining baseline (a minimum of one year operational data is required).

28. For existing facilities not supplying electricity to a grid, that have no historical data/information on baseline parameters such as efficiency, energy consumption and output (e.g. the available data is not reliable due to various factors such as the use of imprecise or non-calibrated measuring equipment), the baseline parameters can be determined using a performance test/measurement campaign to be carried out prior to the implementation of the project activity. The project proponent may follow the relevant provisions from the latest version "Tool to determine baseline efficiency of thermal and

~~[10] In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of generating units where it can be demonstrated that the users were or would have been supplied with electricity solely from higher carbon intensive source in the baseline via mini/isolated grid(s).~~

[11] In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of generating units where it can be demonstrated that the users were or would have been supplied with electricity solely from higher carbon intensive source in the baseline via mini/isolated grid(s).

[12] In the case of coal, the emission coefficient shall be based on test results for periodic samples of the coal purchased if such tests are part of the normal practice for coal purchases.

electricity systems". In the case of project activities that export energy to other facilities within the project boundary, historical data from the recipient plants is also required.

29. In case of project activities where the estimated annual emission reductions of each of the element processes are equal to or less than 600 t CO_2e per year per element process an alternative approach may be used to calculate baseline emissions as per paragraph 43~~31~~ using equation (9 ~~3)~~ instead of applying equation (1).

5.2.2. For Greenfield facilities

30. In case of Greenfield facilities or project activities involving capacity additions either the relevant requirements related to determination of baseline scenario provided in the "General guidelines for SSC CDM methodologies" for Type-II and Type-III Greenfield/capacity expansion project activities or 'Reference plant approach' as described in paragraph 31 below should be applied to define the baseline scenario.

5.2.2.1. Reference plant approach

31. For Greenfield project activities, in cases where the baseline scenario consists of the installation of new systems and/or the utilization of new energy sources, a reference plant may be defined as the baseline scenario. The reference plant shall be based on common practice for similar industrial, residential, commercial, and institutional energy generation systems and sources in the same sector and in the same country or region as the project. The identification of the Reference Plant should exclude plants implemented as CDM project activities. In cases where no such plant exists within the region, the economically most attractive technology and fuel type should be identified among those which provide the same service, that are technologically available, and that are in compliance with relevant regulations. The efficiency of the technology should be selected in a conservative manner, i.e. where several technologies could be used and are similarly economically attractive, the most efficient technology should be defined as the baseline scenario. In addition, the least carbon intensive fuel type should be chosen in case of multiple fuels being possible choices.

5.3. Baseline emissions

32. Baseline emissions for project activities implemented in existing facilities that generate heat, steam or electricity for on-site captive use and/or export to other captive facilities including supply to captive users via mini/isolated grid(s) system shall be determined as follows:

$$BE_y = EF_{BSL} \times Q_{PJ,y} \qquad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2e)
EF_{BSL}	=	Emission factor for the baseline scenario (t CO_2/MWh)
$Q_{PJ,y}$	=	Net energy output in the project activity in year *y* (MWh)

33. The net energy output in the project activity ($Q_{PJ,y}$) is limited to the installed capacity in the baseline scenario, unless it has been demonstrated in accordance with paragraph ~~6~~

4 b) that the ~~new installation~~ ~~(~~Greenfield project~~)~~ or the added capacity has the same baseline scenario.

34. For project activities described under paragraph 11(b) above where the project plant provides electricity to a grid, the following cases are differentiated for the purpose of determining baseline emissions:[13]

(a) **Case A:** The quantity of electricity generated in the project activity power plant ($Q_{PJ,y}$) exceeds the maximum annual quantity of electricity that the plant could have produced prior to the implementation of the project activity (Q_{MAX}). Baseline emissions are calculated as:

$$BE_y = Q_{AVR} \times EF_{BSL} + (Q_{MAX} - Q_{AVR}) \times min\left(EF_{BSL}; EF_{grid,y}\right) + \left(Q_{PJ,y} - Q_{MAX}\right) \times EF_{grid,y}$$ Equation (2)

Where:

Q_{AVR} = Average annual quantity of electricity supplied by the project activity power plant to the electricity grid during the three most recent historical years prior to the implementation of the project activity (MWh/yr)

Q_{MAX} = Maximum annual quantity of electricity that could have been supplied to the electricity grid by the project activity power plant prior to the implementation of the project activity (MWh/yr)

$EF_{grid,y}$ = Emission factor of the electricity grid to which the project activity power plant is connected (tCO_2/MWh) to be established as per the procedure of AMS-I.D

(b) **Case B:** The quantity of electricity generated in the project activity power plant ($Q_{PJ,y}$) exceeds the historic average annual generation level (Q_{AVR}), but is lower than the maximum annual quantity of electricity that the plant could have produced prior to the implementation of the project activity (Q_{MAX}). Baseline emissions are calculated as:

$$BE_y = Q_{AVR} \times EF_{BSL} + \left(Q_{PJ,y} - Q_{AVR}\right) \times min\left(EF_{BSL}; EF_{grid,y}\right)$$ Equation (3)

(c) **Case C:** The quantity of electricity generated in the project activity power plant ($Q_{PJ,y}$) is lower or the same than the historic average annual generation level (QAVR). Baseline emissions are calculated as per equation (1) above.

[13] If electricity generation in the project activity power plant is increased beyond historical levels after the implementation of the project activity, it is difficult to clearly attribute whether such an increase would have occurred anyhow. If it would have occurred anyhow the use of coal or petroleum fuel in the project activity power plant is displaced, otherwise the project activity displaces grid electricity. To deal with this uncertainty, in this methodology the lower emission factor between the project activity power plant fired with the baseline fuel and the grid emission factor is used, as a conservative approach.

35. The maximum annual amount of electricity that could have been supplied to the captive consumer/the electricity grid by the project plant prior to the implementation of the project activity is calculated as:

$$Q_{MAX} = CAP_{max} \times T_{max}$$ Equation (4)

Where:

CAP_{max}	=	Maximum power generation capacity of the project plant prior to the implementation of the project activity (MW)
T_{max}	=	Maximum amount of time in which the project activity power plant could have operated at full load prior to the implementation of the project activity (hours). A default value of 8600 hours can be used

36. The average annual amount of electricity supplied to the captive consumer/electricity grid by the project plant prior to the implementation of the project activity is calculated as follows:

$$Q_{AVR} = \sum_{x=1}^{3} Q_{BSL,x} \div 3$$ Equation (5)

Where:

Q_{BSLx}	=	Quantity of electricity supplied by the project activity power plant to the electricity grid or captive consumer(s) in year *x* (MWh/yr)
x	=	Three most recent historical years prior to the implementation of the project activity

37. For existing facilities, the emission factor in the baseline scenario (EF_{BSL}) is the coefficient for the fossil fuel used in the baseline expressed as emissions per unit of energy output.

Equation (6)

$$EF_{BSL} = \sum_{i} (FC_{BL,i,j,y} \times NCV_j \times EF_{CO2,j}) \div Q_{BSL,j}$$

Where:

EF_{BSL}	=	Emission factor for the baseline scenario (t CO_2/MWh)
$FC_{i,j,BL,y}$	=	Amount of fuel *j* consumed by the element process *i* during the year *y* operating at the baseline scenario (mass or volume unit)
NCV_j	=	Net calorific value of the fuel type *j* (kJ/ mass or volume unit)
$EF_{CO2,j}$	=	CO_2 emission factor of the fuel type *j* (t CO_2/kJ)
$Q_{BSL,j}$	=	Net energy generated in the element process *j* in the baseline scenario during the corresponding period of time for which the total fuel consumption was taken (MWh)

38. For existing and Greenfield/capacity expansion project activities the baseline emissions are the CO_2 emissions from the combustion of the baseline fossil fuel that would in the absence of project activity be used ($FC_{BL,i,j,y}$) in element processes as per the below:

$$BE_y = \sum_i FC_{BL,i,j,y} \times NCV_j \times EF_{CO2,j}$$ Equation (7)

39. $FC_{BL,i,j,y}$ is calculated based on the actual monitored quantity of project fossil fuel in the element process ($FC_{PJ,y}$) and the relation of the energy efficiencies and the net calorific values between the project scenario and the baseline scenario.

$$FC_{BL,i,j,y} = FC_{PJ,i,j,y} \times \frac{NCV_{FF,PJ,i,j,y} \times \varepsilon_{project,i,y}}{NCV_j \times \varepsilon_{baseline,i}}$$ Equation (8)

Where:

$NCV_{FF,PJ,i,j,y}$ = Net calorific value of the fossil fuel j used in the element process *i* in the project activity in year *y* (TJ/mass or volume unit)

$FC_{PJ,i,j,y}$ = Amount of fuel *j* consumed in the element process *i* in project activity during year *y* (mass or volume unit)

$\varepsilon_{project,i,y}$ = Energy efficiency of the element process *i* if fired with project fuel

$\varepsilon_{baseline,i}$ = Energy efficiency of the element process *i* if fired with baseline fuel

40. The energy efficiencies have to be determined for each element process for the project activity ($\varepsilon_{project,i}$) and the baseline scenario ($\varepsilon_{baseline,i}$). The efficiencies should be determined by undertaking measurements at the element process firing the relevant fuels. Efficiencies for the project activity ($\varepsilon_{project,i}$) should be measured monthly throughout the crediting period and annual averages should be used for emission calculations, except for cases where Option D under paragraph 41 below is applied.

41. Baseline efficiency ($\varepsilon_{baseline,i}$) is calculated as:

(a) **Option A:** Use a default conservative value equal to 1;

(b) **Option B:** Use a default conservative value obtained from the manufacture's databook, taking the highest possible efficiency under optimal operational conditions;

(c) **Option C (for existing plants only):** Measure efficiency monthly during 6 months before project implementation and the six months average should be used for emission calculations. All measurements should be conducted at a representative load factor (or operation mode), following national or international standards. Where a representative load factor (or operation mode) cannot be determined, measurements should be conducted for different load factors (or operation modes) and be weighted by the time these load factors (or operation modes) are typically operated. The same load factor(s) (or operation mode(s)) and weight factors should be used in the determination of $\varepsilon_{project,i}$ and $\varepsilon_{baseline,i}$;

(d) **Option D**: Where project participants can reasonably demonstrate that the efficiency of the element process does not change due to the fuel switch or that any changes are negligible (i.e., less than 1%) or that $\varepsilon_{project,i}$ can be expected to be higher than $\varepsilon_{baseline,i}$, project participants can assume $\varepsilon_{baseline,i}$ = $\varepsilon_{project,i}$ as a simplification, provided that $\varepsilon_{baseline,i}$, and $\varepsilon_{project,i}$ can be established ex ante. The same can be applied in cases where $\varepsilon_{project,i}$ are to be established ex post using one year of monitored data and fixed for the crediting period;

(e) **Option E:** Use default baseline efficiency as per Option F, Table 1 of the Tool to determine the baseline efficiency of thermal or electric energy generation systems.

42. The values determined for $\varepsilon_{baseline,i}$ should be documented in the PDD and shall remain fixed throughout the crediting period.

43. In case of project activities where the estimated annual emission reductions of each of the element processes are equal to or less than 600 t CO_2e per year per project element process, the amount of fossil fuel consumed in the project activity in year *y* (FC_y) can be used as a proxy for determining baseline emissions using the following equation:

$$BE_y = FC_{PJ,y} \times NCV_{FF,PJ,y} \times EF_{FF,CO_{2},BL} \tag{9}$$

Where:

$FC_{PJ,y}$	=	Amount of fuel consumed in the project activity during year *y* (mass or volume unit)
$NCV_{FF,PJ,y}$	=	Net calorific value of the fossil fuel used in the project activity (kJ/mass or volume unit)
$EF_{FF,CO_{2},BL}$	=	CO_2 emission factor of the fossil fuel used in the baseline activity (t CO_2/TJ)

44. For the emission factor ($EF_{CO_{2},j}$) and the net calorific value (NCV_j) of the fuels used, guidance by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories shall be followed where appropriate. Project participants may either conduct measurements or they may use accurate and reliable local or national data where available. In the case of coal, the data shall be based on test results for periodic samples of the coal purchased if such tests are part of the normal practice for coal purchases. Where such data is not available, IPCC default emission factors (country-specific, if available) may be used if they are deemed to reasonably represent local circumstances. All values shall be chosen in a conservative manner (i.e. lower values for the baseline and higher values for the project should be chosen within a plausible range) and the choice shall be justified and documented in the PDD. Where measurements are undertaken, project participants shall document the measurement results and the calculated average values of the emission factor or net calorific value, either for the ex ante investment analysis and efficiency determination, or for the ex post determination of the baseline and project emissions.

5.4. Project emissions

45. Project emissions from on-site consumption of fossil fuel should be calculated as follows:

$$PE_y = \sum_i FC_{PJ,i,j,y} \times NCV_{FF,PJ,i,j,y} \times EF_{FF,CO_2,PJ}$$ Equation (10)

Where:

PE_y	=	Project emissions in year *y* (t CO_2e)
$NCV_{FF,PJ,i,j,y}$	=	Net calorific value of the fossil fuel j used in the element process *i* in project activity in year *y* (TJ/mass or volume unit)
$EF_{FF,CO_2,PJ}$	=	CO_2 emission factor of project fuel combusted in the project activity (t CO_2/TJ)

5.5. Leakage

46. No leakage calculation is required.

5.6. Emission reductions

47. The emission reduction achieved by the project activity will be calculated as the difference between the baseline emissions and the project emissions.

$$ER_y = BE_y - PE_y$$ Equation (11)

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Where:

ER_y	=	Emission reductions in the year *y* (t CO_2e)

6. Monitoring methodology

48. ~~Monitoring shall include~~ Relevant parameters shall be monitored and recorded during the crediting period as indicated in the section below. The applicable requirements specified in the “General guidelines for SSC CDM methodologies” are also an integral part of the monitoring guidelines specified below and therefore shall be followed by the project participants.

Data / Parameter table 1.

Data / Parameter:	$FC_{PJ,i,j,y}$ $FC_{PJ,y}$
Data unit:	m³ or kg
Description:	Quantity of fossil fuel j combusted in the element process *i* during the year *y (unit of volume or mass)*
Source of data:	On-site measurements
Measurement procedures (if any):	Use volume/mass meters
Monitoring frequency:	Continuously

QA/QC procedures:	The consistency of metered fuel consumption quantities should be crosschecked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	$\varepsilon_{project,i,y}$
Data unit:	Energy fraction (J/J)
Description:	Energy efficiency (output/input) of the element process *i* if fired with project fuel
Source of data:	-
Measurement procedures (if any):	The efficiencies should be determined by undertaking measurements at the element process firing the relevant fuels. All measurements should be conducted at a representative load factor (or operation mode), based on national or international standards. Where a representative load factor (or operation mode) cannot be determined, measurements should be conducted for different load factors (or operation modes) and be weighted by the time these load factors (or operation modes) are typically operated. For project activities with estimated annual emission reductions of each of the element processes equal to or less than 3000 t CO_2e per year the efficiencies may be determined using sampling in accordance with the standard “Sampling and surveys for CDM project activities and programme of activities”. Estimates at upper limit of the uncertainty at 95 per cent confidence interval should be used
Monitoring frequency:	Monthly or fixed for the crediting period if Option D of the methodology is applied
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	**Installed capacity**
Data unit:	MW
Description:	Installed capacity of the project power plant
Source of data:	Project site
Measurement procedures (if any):	The installed capacity of the power plant before and after the fuel switch activity needs to be tested using internationally approved standard methods available with the help of reputed players or manufacturers in the market. The test report for the same is needed to be submitted to DOE during the validation to check the same. Changes in capacity must remain within 5 per cent of the capacity before the implementation of the project activity, as per the applicability conditions. Manufacturer’s specifications also can be used
Monitoring frequency:	Once at validation only in the case of paragraph 11(b)

QA/QC procedures:	-
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	$Q_{PJ,electrical,y}$
Data unit:	MWh
Description:	Net energy output in the project activity in year *y* (MWh)
Source of data:	On-site measurements
Measurement procedures (if any):	Use energy meters
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	Cross check measurement results with invoices for purchased electricity if relevant
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	$Q_{PJ,thermal,y}$
Data unit:	TJ
Description:	Net quantity of thermal energy supplied by the project activity during the year *y*
Source of data	Plant records
Measurement procedures (if any):	Heat generation is determined as the difference of the enthalpy of the steam or hot fluid and/or gases generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid and/or gases blow-down and if applicable any condensate returns. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. In case of equipment that produces hot water/oil this is expressed as the difference in the enthalpy between the hot water/oil supplied to and returned by the plant. In case of equipment that produces hot gases or combustion gases, this is expressed as the difference in the enthalpy between the hot gas produced and all streams supplied to the plant. The enthalpy of all relevant streams shall be determined based on the monitored mass flow, temperature, pressure, density and specific heat of the gas. In case the project activity is exporting heat to other facilities, the metering shall be carried out at the recipient's end
Monitoring frequency:	Continuous monitoring, aggregated annually
QA/QC procedure	Measurement results shall be cross checked with records for sold/purchased thermal energy (e.g. invoices/receipts)
Any comment:	Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient

Data / Parameter table 6.

Data / Parameter:	$EF_{grid,y}$
Data unit:	t CO_2/MWh
Description:	Emission factor of the electricity grid to which the project plant is connected
Source of data:	As per the procedure in AMS-I.D
Measurement procedures (if any):	As per the procedure in AMS-I.D
Monitoring frequency:	As per the procedure in AMS-I.D
QA/QC procedures:	As per the procedure in AMS-I.D
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	$NCV_{y,j,i}$
Data unit:	GJ/m³
Description:	Average net calorific value of the fossil fuel j combusted in element process *i* during the year *y*

<table>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (a) is not available
These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>(d) IPCC default values at the upper or lower limit - whatever is more conservative [14] - of the uncertainty at a 95 per cent confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table>
</td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a) and (b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For (a) and (b): the NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
For (c): review appropriateness of the values annually.
For (d): any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures:</td><td>Verify if the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards</td></tr>
<tr><td>Any comment:</td><td>Note that for the NCV the same basis (pressure and temperature) should be used as for the fuel consumption</td></tr>
</table>

[14] The more conservative value is the value that results in the lower overall emission reductions of the project activity. This may imply using the higher or the lower value, depending on the specific configuration of the project activity.

Data / Parameter table 8.

Data / Parameter:	EF_{CO2} $EF_{CO2,y,j,i}$
Data unit:	t CO_2/GJ
Description:	CO_2 emission factor of the fossil fuel j combusted in element process *i* in the year *y*
Source of data:	The following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** (a) Values provided by the fuel supplier in invoices — This is the preferred source (b) Measurements by the project participants — If (a) is not available (c) Regional or national default values — If (a) is not available. These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances) (d) IPCC default values at the upper limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If (a) is not available

Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards.
	
	For (a): if the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, Options (b), (c) or (d) should be used

Monitoring frequency:	Annual
QA/QC procedures:	-
Any comment:	-

Nested table within "Source of data":

Data source	**Conditions for using the data source**
(a) Values provided by the fuel supplier in invoices	This is the preferred source
(b) Measurements by the project participants	If (a) is not available
(c) Regional or national default values	If (a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)
(d) IPCC default values at the upper limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If (a) is not available

49. Parameters not monitored:

Data / Parameter table 9.

Data / Parameter:	$NCV_{BL,j}$
Data unit:	(TJ/mass or volume unit)
Description:	Net calorific value of fuel type j

Source of data:	National values or the latest version IPCC

Data / Parameter table 10.

Data / Parameter:	**$EF_{CO2,BL,j}$**
Data unit:	gCO2/MJ
Description:	CO_2 emission factor of fuel type j
Source of data:	National values or the latest version IPCC

7. Project activity under a programme of activities

50. The following conditions apply for use of this methodology in a project activity under a programme of activities:

(a) Leakage emissions resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary shall be considered, as per the guidance provided in the leakage section of "ACM0009: Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas". In case leakage emissions in the baseline situation are higher than leakage emissions in the project situation, leakage emissions will be set to zero.

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Document information*

Version	*Date*	*Description*
18.0	27 March 2015	SSC WG 47 Annex 2 Revision to: (a) Include Reference Plant Approach for determining baseline; (b) Expand the applicability of the methodology (c) Provide an emission reduction quantification approach for project activities that switch fossil fuels in existing facilities supplying electricity to a grid; (d) Provide an alternative approach for baseline emission calculations based on the estimation of baseline fuel consumption derived from the project fuel consumption and relation of the energy efficiencies and the net calorific values between the project and baseline scenarios.
17.0	21 February 2014	EB 77, Annex 10 Revision to clarify leakage issues associated with switching of fossil fuels.

* This document, together with the 'General Guidance' and all other approved SSC methodologies, was part of a single document entitled: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities until version 07.

Version	*Date*	*Description*
15	18 February 2011	EB 59, Annex 8 To clarify issues related to the installation of new energy generating facility (low carbon intensive) to replace an existing energy generating facility (carbon intensive) connected to an isolated grid(s) system.
14	28 May 2009	EB 47, Annex 23 Broaden the applicability, for example, to cases involving multiple elemental processes using different fuels in the baseline shifting to single fuel use in the project; reference to combined tool for the selection of baseline scenario.
13	02 August 2008	EB 41, Annex 18 The applicability condition is expanded to new facilities and guidance on treatment of capacity expansions is included.
12	19 October 2007	EB 35, Annex 33 A paragraph is added under technology/measures to provide clarity that the methodology is not applicable to project activities that generate renewable energy displacing fossil fuel use.
11	27 July 2007	EB 33, Annex 30 Revision of the approved small-scale methodology AMS-III.B to allow for its application under a programme of activities (PoA).
10	15 December 2006	EB 28, Meeting Report, Para. 54 Removed the interim applicability condition i.e. 25 ktCO_2e/yr limit from all Type III categories.
09	21 July 2006	EB 25, Annex 31 Introduce the limit of 15 kilo tonnes of CO2 equivalent as annual project activity direct emissions.
08	12 May 2006	EB 24, Meeting Report, Para, 64 Introduced the interim applicability condition i.e. 25ktCO_2e/yr limit for all Type III categories

Decision Class: Regulatory
Document Type: Standard
Business Function: Methodology
Keywords: greenfield, fossil fuel, fuel switching, retrofit, simplified methodologies, type (iii) projects

History of the document: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities

Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities contained both the General Guidance and Approved Methodologies until version 07. After version 07 the document was divided into separate documents: 'General Guidance' and separate approved small-scale methodologies (AMS).

Version	*Date*	*Description*
07	25 November 2005	EB 22, Para. 59 References to "non-renewable biomass" in Appendix B deleted.
06	20 September 2005	EB 21, Annex 22 Guidance on consideration of non-renewable biomass in Type *i* methodologies, thermal equivalence of Type II GWhe limits included.
05	25 February 2005	EB 18, Annex 6 Guidance on 'capacity addition' and 'cofiring' in Type *i* methodologies and monitoring of methane in AMS-III.D included.
04	22 October 2004	EB 16, Annex 2 AMS-II.F was adopted, leakage due to equipment transfer was included in all Type *i* and Type II methodologies.
03	30 June 2004	EB 14, Annex 2 New methodology AMS-III.E was adopted.
02	28 November 2003	EB 12, Annex 2 Definition of build margin included in AMS-I.D, minor revisions to AMS-I.A, AMS-III.D, AMS-II.E.
01	21 January 2003	EB 7, Annex 6 Initial adoption. The Board at its seventh meeting noted the adoption by the Conference of the Parties (COP), by its decision 21/CP.8, of simplified modalities and procedures for small-scale CDM project activities (SSC M&P).

Decision Class: Regulatory
Document Type: Standard
Business Function: Methodology