

AMS-I.H.

Small-scale Methodology

Biofuel production and use for energy generation in stationary applications

Version 03.0

Sectoral scope(s): 01, 05 and 15



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)	Biofuel is produced from biomass residues, waste oil/fat, seeds or crops that are cultivated in dedicated plantations and used to generate thermal; mechanical or electrical energy including cogeneration
Type of GHG emissions mitigation action	Renewable energy: Displacement of more-GHG-intensive fossil fuel for combustion in stationary installations

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology comprises activities involving the cultivation of seeds or crops and the sourcing of waste oil/fat or biomass residues for production of biofuel to generate thermal/mechanical/electrical energy including cogeneration to displace fossil fuel and/or fossil fuel based technologies.

2.2. Applicability

3. The methodology is applicable to project activities that reduce emissions through the production of (blended) biofuels to be used in stationary applications within the host country.
4. The methodology is applicable under the following conditions:
 - (a) Pure biofuel and blends above 10 per cent with fossil fuel shall be used in equipment¹ that is specially built or modified;
 - (b) Biofuel must comply with national quality regulations;
 - (c) The retailers, final users and the producer of the biofuel or its blend are bound by a contractual agreement allowing emission reductions to be claimed only by the project proponent;
 - (d) In case of esterification, any alcohol used is either methanol from fossil fuel origin or bioalcohol produced with biomass from dedicated plantations. Any biofuel produced using other alcohols shall not be included in the quantity of biofuel for which emission reductions are claimed;
 - (e) Co-firing with solid fuels is not eligible;
 - (f) The export of biofuel produced is not allowed under this methodology.

¹ For internal combustion engines conversion measures include adaptations of fuel supply, combustion and injection mechanisms.

5. The biofuel produced by the project activity may be used as a blend with pure fossil fuel or with fossil fuel that has already been blended with biofuel.² In the latter case, the fraction of biofuel blended in excess of the baseline is eligible for crediting. The biofuel content of the primary blend shall be considered as carbon neutral, however, in the calculation of the project emissions, the fuel used for blending (primary blend) shall be considered as 100 per cent fossil fuel fraction. This conservative approach is used because it may not be feasible to determine the upstream emissions associated with the production of the biofuel used for the primary blending.
6. If the project activity utilizes biomass sourced from dedicated plantations, the applicability conditions prescribed in the methodological tool “Project and leakage emissions from biomass” shall apply.
7. Project eligibility limits (capacity limits) are in accordance with the guidelines in:
 - (a) AMS-I.C. for thermal energy and cogeneration applications;
 - (b) AMS-I.B. for mechanical energy applications;
 - (c) AMS-I.D., AMS-I.F. or AMS-I.A. for electricity applications.

2.3. Entry into force

8. The date of entry into force is the date of the publication of the EB 98 meeting report on 1 March 2018.

2.4. Applicability of sectoral scopes

9. For validation and verification of CDM projects and programme of activities using this methodology, application of the following sectoral scopes is mandatory:
 - (a) If biofuel is produced from waste oil/fat or biomass residues as a feedstock, then sectoral scope 5 and 1 apply;
 - (b) If biofuel is produced from anything other than waste oil/fat or biomass residues as a feedstock, then sectoral scopes 5, 1 and 15 apply.

3. Normative references

10. Project participants shall apply the “General guidelines for SSC CDM methodologies” and “Guidelines on the demonstration of additionality of small-scale project activities” provided at <<https://cdm.unfccc.int/Reference/Guidclarif/index.html>>.
11. This methodology also refers to the latest approved versions of the following approved methodologies and tools:
 - (a) “AMS-I.A.: Electricity generation by the user”;
 - (b) “AMS-I.B.: Mechanical energy for the user with or without electrical energy”;

² It is expected that biofuel is blended with pure fossil fuel, however, where the project proponent has no access to pure fossil fuel (e.g. due to local regulations requiring sale of blended fossil fuel in the region/country) blended fuel may be used.

- (c) “AMS-I.C.: “Thermal energy production with or without electricity”;
- (d) “AMS-I.D.: Grid connected renewable electricity generation”;
- (e) “AMS-I.F.: Renewable electricity generation for captive use and mini-grid”;
- (f) “AMS-III.G.: Landfill methane recovery”;
- (g) “AMS-III.F.: Avoidance of methane emissions through composting”;
- (h) “AMS-III.H.: Methane recovery in wastewater treatment”;
- (i) “Project and leakage emissions from biomass”;
- (j) “Project and leakage emissions from transportation of freight”;
- (k) “Upstream leakage emissions associated with fossil fuel use”;
- (l) “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”;
- (m) “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”.

4. Definitions

- 12. The definitions contained in the Glossary of CDM terms shall apply.
- 13. Furthermore, for this methodology, the following definitions apply:
 - (a) **Biodiesel** is a diesel fuel consisting of long-chain alkyl (methyl, propyl or ethyl) esters which is produced by esterification of vegetable oils and/or waste oil/fat with alcohols from biogenic and/or fossil origin;
 - (b) **Bioethanol** - is an alcohol produced through the fermentation of sugars or starches, followed by a distillation process and, if required, a dehydration process;
 - (c) **Biofuel production plant** - is the plant where the feedstock (e.g. oil, waste oil/fat sugar, starch) is processed to biofuel;
 - (d) **Biogenic** - means that the oils and/or fats originate from either vegetable or animal biomass, but not from mineral (fossil) sources;
 - (e) **Biomass** - non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms including:
 - (i) Biomass residue;
 - (ii) The non-fossilized and biodegradable organic fractions of industrial and municipal wastes; and
 - (iii) The gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material;

- (f) **Biomass residues** -non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms which is a by-product, residue or waste stream from agriculture, forestry and related industries;
- (g) **Blended biofuel** - blend of fossil fuel and biofuels;
- (h) **Dedicated plantations** - are plantations that are newly established as part of the project activity for the purpose of supplying feedstock to the project plant. If the dedicated plantation is an A/R CDM project, then the procedures of the approved A/R methodology apply;
- (i) **Esterification** - denotes the formation of an ester compound from carbonic acid and alcohol. Transesterification denotes the exchange of one alcohol in an ester against another (for example glycerol against methanol). In this methodology, “esterification” is used to denote both esterification and transesterification for simplicity;
- (j) **Mill** - is a plant where seeds or crops are processed into starch/sugar;
- (k) **Oil production plant** - is a plant where oil seeds are processed to vegetable oil;
- (l) **Oil seeds** - are seeds of plants from which oil can be derived;
- (m) **Petrodiesel** - is 100% fossil fuel diesel;
- (n) **Vegetable oil** - is oil of biogenic origin that is produced from oil seeds from plants;
- (o) **Waste oil/fat** is a residue or waste stream of biogenic origin from restaurants, agro and food industry, slaughterhouses or related commercial sectors.

5. Baseline methodology

5.1. Project boundary

14. The spatial extent of the project boundary encompasses:
- (a) Where applicable, transportation of feedstock to the project plant(s) and the biofuels to the site where it is blended with fossil fuels;
 - (b) The biofuel production plant at the project site, comprising the processing unit(s) (e.g. esterification, fermentation, hydrolysis) plus other installations on the site (e.g. storage, refining, blending, etc.);
 - (c) The feedstock processing plant(s) (e.g. oil production plant, mill) on-site or off-site;
 - (d) The sites where the waste water and solid waste are treated;
 - (e) If blended biofuel is produced: the facility where the biofuel is blended with fossil fuel (regardless of the ownership of the blending facility);
 - (f) The site where biofuel is consumed in the project equipment to produce thermal/electrical/mechanical energy and the end users of the produced energy;

- (g) If the feedstock is sourced from plants produced in dedicated plantations: the geographic boundaries of the dedicated plantations.

5.2. Baseline emissions

15. The energy baseline and the corresponding baseline emissions for biofuel based renewable energy sources and/or technologies shall be chosen as follows:
 - (a) As per the procedures of AMS-I.A. if the project activity is for standalone off-the-grid power systems supplying electricity to households/users included in the boundary;
 - (b) As per the procedures of AMS-I.F. if the project activity displaces electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit;
 - (c) As per the procedures of AMS-I.D. if the project activity supplies electricity to a regional or national grid;
 - (d) As per the procedures of AMS-I.C. if the project activity produces thermal energy and/or cogenerates heat and electricity;
 - (e) As per the procedures of AMS-I.B. if project activity is generating mechanical energy.
16. For project activities that involve retrofit of an existing facility and/or capacity addition at an existing facility, the baseline emissions shall be calculated following the applicable principles described in AMS-I.D.

5.3. Project emissions

17. Project emissions (PE_y) are the emissions related to the cultivation of biomass feedstock and production and distribution of biofuel. The emissions from the combustion of the renewable carbon content in biofuel are carbon neutral and may be disregarded. The following sources of project emissions shall be considered.

5.3.1. Project emissions at the biofuel production plant and feedstock processing plant ($PE_{BP,y}$)

18. These emissions include fuel and electricity consumption that occur at the site of the biofuel production plant and, if applicable, emissions associated with the anaerobic treatment of wastewater in the feedstock processing plant(s).
19. These emissions are estimated as follows:

$$PE_{BP,y} = \sum_j PE_{FC,j,y} + PE_{EC,y} + PE_{WW,y} \quad \text{Equation (1)}$$

Where:

$PE_{BP,y}$ = Project emissions at the biofuel production facility and, if applicable, the feedstock processing plant(s) in year y (tCO₂)

$PE_{FC,j,y}$	=	Project emissions from combustion of fuel type j in the biofuel production plant and the feedstock processing plant(s) in year y (tCO ₂)
$PE_{EC,y}$	=	Project emissions from electricity consumption in the biofuel production plant and the feedstock processing plant(s) in year y (tCO ₂)
$PE_{WW,y}$	=	Project emissions from anaerobic treatment of waste/waste water in year y (tCO ₂)

20. Emissions from fossil fuel consumption ($PE_{FC,j,y}$) should include CO₂ emissions from all fossil fuel consumption that occurs at the site of the biofuel production plant and, if applicable, the feedstock processing plant(s) (e.g. oil production plant(s) and/or mill(s)) that is attributable to the project activity. The project emissions from fossil fuel combustion ($PE_{FC,j,y}$) shall be calculated following the latest version of "Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion". For this purpose, the processes j in the tool correspond to all fossil fuel combustion sources at these plants.
21. Emissions from electricity consumption ($PE_{EC,y}$) includes electricity delivered from the grid to the biofuel production plant and, if applicable, the feedstock processing plant (s) (e.g. oil production plant(s) or mill(s)). Electricity generated on-site should not be included here.³ The project emissions from electricity consumption ($PE_{EC,y}$) shall be calculated following the latest version of the methodological tool: "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".
22. Emissions from solid waste disposal and wastewater treatment ($PE_{WW,y}$) are calculated as per provisions in AMS-III.G. (landfill); AMS-III.F. (composting) and AMS-III.H. (waste water treatment) in the cases where the wastes are disposed/treated under anaerobic conditions.

5.3.2. Project emissions from fossil carbon in the biofuel due to the use of methanol from fossil origin in the esterification process ($PE_{MeOH,y}$)

23. Project emissions from fossil fuel carbon in the biofuel due to the use of methanol from fossil origin in the esterification process are estimated as follows:

$$PE_{MeOH,y} = MC_{MeOH,y} \times EF_{C,MeOH} \times \frac{44}{12} \quad \text{Equation (2)}$$

Where:

$PE_{MeOH,y}$	=	Project emissions from fossil carbon in the biofuel due to esterification with methanol of fossil origin in year y (t CO ₂ e)
$MC_{MeOH,y}$	=	Quantity of methanol consumed in the biofuel plant, including spills and evaporations in year y (tonnes)

³ On-site electricity generation with fossil fuels should be included in $PE_{FC,j,y}$. On-site electricity generation with biomass residues or biofuel is accounted as zero emissions, as the use of biomass residues is not assumed to result in any emissions and emissions associated with the production of biofuel are included in the emission sources accounted under this methodology.

$$EF_{C,MeOH} = \text{Carbon emission factor of methanol, based on molecular weight (tC/t MeOH) (= 12/32)}$$

$$\frac{44}{12} = \text{Molecular weight ratio to convert tonnes of carbon into tonnes of CO}_2 \text{ (t CO}_2\text{/tC)}$$

5.3.3. Project emissions from transportation ($PE_{TR,y}$)

24. Project emissions resulting from transportation of biomass feedstock to the biofuel production plant/feedstock processing plant and biofuel to the site where it is blended with fossil fuel are estimated using the latest version of the methodological tool “Project and leakage emissions from transportation of freight”, if the transportation distance is more than 200 km, otherwise they can be neglected.

5.3.4. Project emissions associated with the cultivation of land to produce biomass feedstock in dedicated plantations ($PE_{BC,y}$)

25. Project emissions associated with the cultivation of lands in a dedicated plantation are estimated by following the provisions in the methodological tool: “Project and leakage emissions from biomass”. Project participants should clearly document and justify in the CDM-PDD which emission sources are applicable to the project activity.
26. Alternatively, project participants may choose a simplified approach to calculate this emission source using conservative default values for the emissions associated with the cultivation of lands. This approach can only be used for palm, cassava, jatropha, soy, corn, sugarcane or pongamia.

5.3.4.1. Use of a default emission factor

$$PE_{BC,y} = PE_{SOC,y} + \sum_s A_{s,y} \times EF_{s,y} \quad \text{Equation (3)}$$

Where:

- $PE_{BC,y}$ = Project emissions associated with the cultivation of land to produce biomass feedstock in year y (tCO₂)
- $PE_{SOC,y}$ = Emissions resulting from loss of soil organic carbon, in year y (t CO₂e) to be estimated as per the methodological tool: “Project and leakage emissions from biomass”
- $A_{s,y}$ = Area in which feedstock type s is cultivated for use in the project plant in year y (ha)
- $EF_{s,y}$ = Default emission factor for the GHG emissions associated with the cultivation of land to produce biomass feedstock type s (tCO₂e/ha). See Table 2 below for available values

Table 2. Conservative default emission factors for the GHG emissions associated with the cultivation of land to produce biomass feedstock

Feedstock type s	Fresh palm fruit bunches	Cassava roots	Jatropha nuts	Soybeans	Corn Seed	Sugarcane	Pongamia
$EF_{s,y}$ (t CO ₂ e/ha)	2.5	1.9	2.6	0.8	2.1	2.3	1.5

27. A spreadsheet that can be used to calculate the emission factors for the GHG emissions associated with the cultivation of land to produce crops is provided at the following weblink at UNFCCC CDM website:
<http://cdm.unfccc.int/methodologies/DB/9FN4ZZ301OABDDB72U4P89EI4WQ931>.
28. These emission sources are only partly allocated to the production of biofuel, through the allocation factor $AF_{1,y}$ in equation (4). Where applicable, project emissions associated with the cultivation of land are allocated between the different products produced from the plants expressed through the allocation factor $AF_{2,s,y}$ in equation (4):

$$PE_y = \sum_s [FP_{BF,s,y} \times AF_{1,y} \times (PE_{TR,s,y} + PE_{BP,s,y} + PE_{MeOH,y} + AF_{2,s,y} \times PE_{BC,s,y})] \quad \text{Equation (4)}$$

Where:

- PE_y = Project emissions in year y (t CO₂e)
- $FP_{BF,s,y}$ = Amount of biofuel produced with feedstock type s by the project activity in year y (tonnes)
- $AF_{1,y}$ = Allocation factor for the production of biofuel in year y (fraction)
- $AF_{2,s,y}$ = Allocation factor for the land cultivation of feedstock type s in year y (fraction)
- $PE_{TR,s,y}$ = Emissions from transportation of feedstock type s and/or biofuel in year y (t CO₂e)
- $PE_{BP,s,y}$ = Emissions from biofuel production using feedstock type sin year y (t CO₂e)
- $PE_{MeOH,y}$ = Emissions from fossil fuel carbon in methanol used in the trans-esterification process in year y (t CO₂e)
- $PE_{BC,s,y}$ = Emissions from cultivation of land for feedstock type s in year y (t CO₂e)

29. The allocation factors are calculated as per the methodological tool “Apportioning emissions from production processes between main product and co and by-product”.

5.4. Leakage

30. Leakage emissions are calculated as follows:

$$LE_y = LE_{BR} + LE_{MeOH,y} - LE_{FF,y} \quad \text{Equation (5)}$$

Where:

LE_y	=	Leakage emissions in year y (t CO ₂)
LE_{BR}	=	Leakage emissions due to displacement of existing uses of waste oil/fat or biomass residues in year y (t CO ₂)
$LE_{MeOH,y}$	=	Leakage emissions associated with production of methanol/chemicals used in biofuel production in year y (t CO ₂)
$LE_{FF,y}$	=	Negative leakage due to reducing indirect emissions associated with the production of fossil fuel (t CO ₂)

5.4.1. Leakage emissions due to displacement of existing uses of waste oil/fat or biomass residues

31. Leakage emissions from the diversion of existing applications of waste oil/fat and/or biomass residues are estimated in accordance with the methodological tool: "Project and leakage emissions from biomass".

5.4.2. Leakage emissions associated with production of methanol/chemicals used in biofuel production

32. Leakage effects due to the upstream emissions for the methanol production may be disregarded if the leakage due to the avoided production of fossil fuel (including production of crude oil and refining of crude oil) is also disregarded. Otherwise, the leakage emissions due to the production of methanol used in the esterification process shall be calculated as follows:

$$LE_{MeOH,y} = MC_{MeOH,y} \times EF_{MeOH,PC} \quad \text{Equation (6)}$$

Where:

$LE_{MeOH,y}$	=	Leakage emissions associated with production of methanol used in biofuel production in year y (t CO ₂)
$MC_{MeOH,y}$	=	Quantity of methanol consumed in the biofuel plant, including spills and evaporation on-site in year y (t MeOH)
$EF_{MeOH,PC}$	=	Pre-combustion (i.e. upstream) emissions factor for methanol production (t CO ₂ /t MeOH). A default value of 1.95 tCO ₂ /t produced methanol may be used, based on 30 GJ/t energy requirement and average of IPCC emissions factors for natural gas and diesel oil

33. Leakage emissions from production of chemicals that are used for pre-treatment and/or hydrolysis of lignocellulosic biomass to produce cellulosic ethanol may be disregarded, if the leakage due to the avoided production of fossil fuel (including production of crude oil and refining of crude oil) is also disregarded. Otherwise, emissions from production of

chemicals that are used for pre-treatment and/or hydrolysis of lignocellulosic biomass to produce cellulosic ethanol are estimated in accordance with the methodological tool: “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”.

5.4.3. Leakage related to the avoided production of fossil fuel

34. The substitution of fossil fuel by biofuels reduces indirect (“upstream”) emissions associated with the production of fossil fuel ($LE_{FF,y}$) and is treated as negative leakage⁴ and can be calculated based on the default emission factors included in methodological tool “Upstream leakage emissions associated with fossil fuel use”, as follows:

$$LE_{FF,y} = BF_y \times \sum_x \sum_i \sum_j NCV_{BF,y} \times EF_{i,j,x,y} \quad \text{Equation (7)}$$

Where:

$LE_{FF,y}$	=	Leakage related to the avoided production of fossil fuel in year y (tCO ₂)
BF_y	=	Quantity of biofuel eligible for crediting in year y (t)
$NCV_{BF,y}$	=	Net calorific value of biofuel produced in year y (GJ/t)
$EF_{i,j,x,y}$	=	Emission factor for upstream emissions stage i associated with consumption of fossil fuel type x from fossil fuel origin j applicable to year y (t CO ₂ e/TJ)

35. For the purpose of this methodology, the following upstream emissions are considered:
- (a) Production of crude oil. These include emissions from venting, flaring and energy uses;
 - (b) Oil refining. These include emissions from energy uses, production of chemicals and catalysts, disposal of production wastes (including flaring) and direct emissions;
 - (c) Long distance transport.

5.5. Emission reductions

36. Emission reductions are calculated as follows:

$$ER_y = BE_y - \text{MAX}(PE_y + LE_y, 0) \quad \text{Equation (8)}$$

Where:

ER_y	=	Emission reductions in year y (t CO ₂ e)
BE_y	=	Baseline emissions in year y (t CO ₂ e)

⁴ Emission reduction from reducing international bunker fuel consumption is not eligible under CDM as per EB 25 report, paragraph 58.

PE_y = Project emissions in year y (t CO₂)

LE_y = Leakage emissions in year y (t CO₂)

6. Monitoring methodology

37. Relevant parameters shall be monitored as indicated in the tables below. The applicable requirements specified in the “General guidelines for SSC methodologies” (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred by the project participants.

Data / Parameter table 1.

Data / Parameter:	$P_{BF,y}$
Data unit:	tonnes
Description:	Production of biofuel in the project plant in year y
Source of data:	
Measurement procedures (if any):	Measurements are undertaken using calibrated meters. Measurement results shall be cross checked with records of consumption or sales (e.g. invoices/receipts)
Monitoring frequency:	Continuously or in batches
QA/QC procedures:	-
Any comment:	Measurement results shall be cross checked with records for consumption or sales (e.g. invoices/receipts)

Data / Parameter table 2.

Data / Parameter:	$FP_{BF,s,y}$
Data unit:	tonnes
Description:	Amount of biofuel produced with feedstock type s by the project activity in year y (tonnes)
Source of data:	
Measurement procedures (if any):	Measurements are undertaken using calibrated meters. Measurement results shall be cross checked with records of consumption or sales (e.g. invoices/receipts)
Monitoring frequency:	Continuously or in batches
QA/QC procedures:	-
Any comment:	Measurement results shall be cross checked with records for consumption or sales (e.g. invoices/receipts)

Data / Parameter table 3.

Data / Parameter:	CBF_y
Data unit:	tonnes
Description:	Quantity of biofuel consumed at the project plant(s) in year y
Source of data:	

Measurement procedures (if any):	Measurements are undertaken using calibrated meters at the consumption site.
Monitoring frequency:	Continuously or in batches
QA/QC procedures:	-
Any comment:	Measurement results shall be cross checked with sales records (e.g. invoices/receipts)

Data / Parameter table 4.

Data / Parameter:	$NCV_{BF,y}$
Data unit:	GJ/tonnes
Description:	Net calorific value of biofuel produced in year y
Source of data:	
Measurement procedures (if any):	Measured according to relevant national/ international standards. Analysis has to be carried out by an accredited laboratory
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	$MC_{MeOH,y}$
Data unit:	tonnes
Description:	Mass of MEOH/chemicals consumed in the biofuel plant, including spills and evaporation, in year y
Source of data:	
Measurement procedures (if any):	Measured continuously by calibrated equipment at the project site. Cross-checked with purchase data and adjusted for stock changes when deemed necessary
Monitoring frequency:	Continuously or in batches
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$A_{s,y}$
Data unit:	Ha
Description:	Area in which biomass feedstock type s is cultivated for use in the project plant in year y
Source of data:	Project participants
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

38. Monitoring parameters shall be included as prescribed by the applicable Type I methodology chosen in section 5.2 and the applicable tools. Project emissions are monitored as per section 5.3.
39. If paragraph 4(a) is applicable, then the equipment modification or the installation of the new equipment shall be monitored.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	1 March 2018	EB 98, Annex 6 Revision to broaden the applicability of biofuel and reference to TOOL12, TOOL15 and TOOL16.
02.0	28 November 2014	EB 81, Annex 16 This revision removes the applicability conditions related to land eligibility and project emission calculations related to the cultivation of biomass, removes the restriction for application of methodology in PoAs in methodologies and includes reference to the approved tools.
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