CLEAN DEVELOPMENT MECHANISM

CDM-MP72-A09

Draft Large-scale Consolidated Methodology

ACM0017: Production of biofuel ~~biodiesel for use as fuel~~

Version 03.0

Sectoral scope(s): 01 and 05

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 89th meeting, requested the Methodologies Panel (MP) to work on the following areas:

   (a) Explore the broadening of the applicability of the existing methodologies beyond captive fleets;

   (b) Explore the broadening of the applicability of the existing biodiesel methodology to cover biofuels.

2. Purpose

2. The purpose of the draft revision is to*:*

   (a) Broaden the applicability of the methodology beyond captive fleets;

   (b) Broaden the applicability of the methodology to cover biofuels;

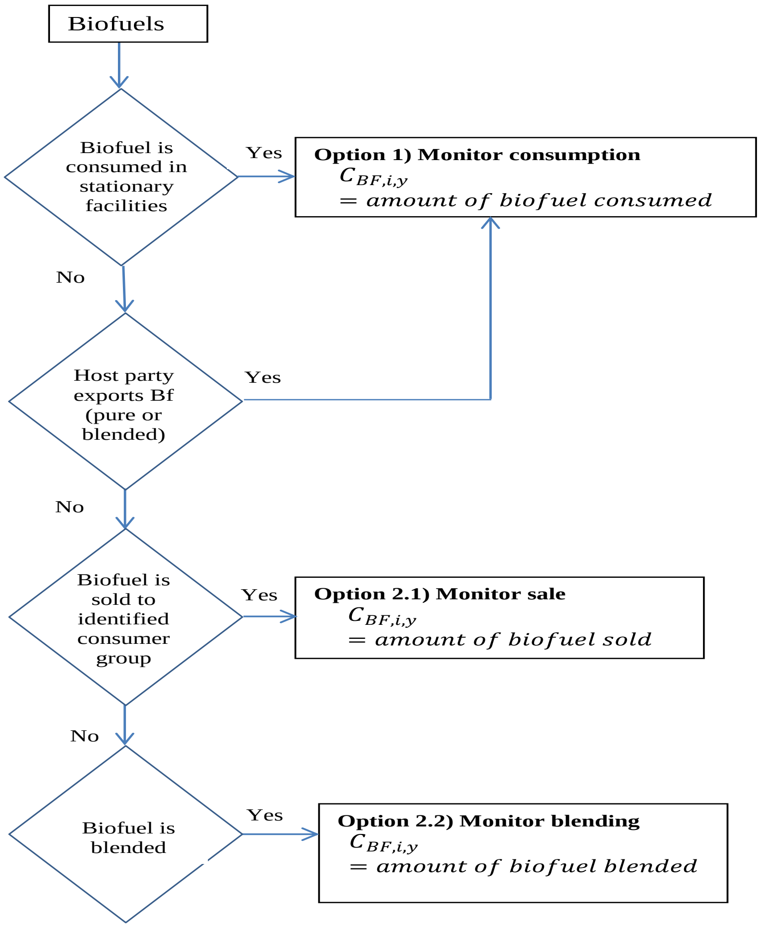
   (c) Include reference to the tool “Project and leakage emissions from biomass”.

3. Key issues and proposed solutions

3. The default values associated with the cultivation of land to produce biomass feedstock are to be updated based on the emission sources and parameters of the methodological tool: Project and Leakage emissions from Biomass.

4. The issue on the avoidance of double counting from biofuel consumers is assessed through the following flowchart. Provisions for biofuel monitoring and double counting avoidance have been included in sections 2.2.d; 5.4; and 6.4 of the draft revised methodology.

Figure 1. Provision for biofuel monitoring



4. Impacts

5. The revision of the methodology, if approved, will broaden its applicability beyond captive fleets and to cover biofuels. Furthermore, the revision will simplify the provisions for calculation of project and leakage emissions by referring to the tool “Project and leakage emissions from biomass”.

5. Subsequent work and timelines

6. No further work is envisaged.

6. Recommendations to the Board

7. The Board may wish to approve the proposed revision of the methodology.

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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)	Construction and operation of a biofuel biodiesel production plant for production of (blended) biofuel biodiesel that is used as fuel in existing stationary installations (e.g. diesel generators) and/or in vehicles. Biodiesel is produced from waste oil/fat and/or vegetable oil that is produced from oilseeds from plants that are cultivated on dedicated plantations established on lands that are degraded or degrading at the start of the project.
Type of GHG emissions mitigation action	Renewable energy: Displacement of more-GHG-intensive fossil fuel for combustion in vehicles and/or stationary installations

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology comprises project activities involving production of biofuel that is used as fuel in existing stationary installations (e.g. diesel generators) and/or in vehicles.

2.2. Applicability

3. The methodology is applicable to project activities that reduce emissions through the production sale and consumption, of blended biodiesel biofuels that is used as fuel, where the biodiesel is produced from:to be used in existing stationary installations and/or in vehicles.

4. The biofuel is produced from one or a combination of the following feedstock:

(a) Waste oil/fat;

(b) Vegetable oil that is produced with oil seeds from plants that are cultivated on dedicated plantations established on lands that are degraded or degrading at the start of the project activity.

(b) Seeds or crops that are cultivated in dedicated plantations;

(c) Biomass residues (e.g. agricultural residues, wood residues, organic wastes).

5. In order to avoid double counting of emission reductions, the methodology ensures that the CERs can only be issued to the producer of the biofuel and not to the consumer. The project proponent shall demonstrate that double counting of emission reductions will not occur e.g. via a contractual agreement with the end-user(s), feedstock producer or other stakeholder involved in the supply chain.

6. The following conditions apply to the methodology:

(a) Feedstock inputs:

(i) For all biofuels: if the ~~biodiesel~~ biofuel in the project plant is only **partly** produced from the sources specified in paragraph 4 above, any volumes of biofuel that are also produced in the project plant but from other feedstock sources, are not included in the quantity of biofuel for which emission reductions are claimed;

(ii) For biodiesel: the alcohol used for esterification is methanol from **fossil origin**. Volumes of biodiesel produced with alcohols other than methanol (for example, ethanol) are not included in the quantity of biodiesel for which emission reductions are claimed.[1]

(b) Dedicated plantations:

(i) ~~The project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed project activity can continue to provide at least the same amount of goods and services as in the absence of the project;~~ If the biofuel is produced from seeds or crops that are cultivated in dedicated plantations, the project activity shall comply with the provisions of the Methodological tool: “Project and leakage emissions from biomass”;

~~(ii) The plantations are established:~~

~~a. On land which was, at the start of the project implementation, classified as degraded or degrading as per the “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities ”; OR~~

~~b. On a land area that is included in the project boundary of one or several registered A/R CDM project activities.~~

~~(iii) The plantations are not established on peatlands;~~

~~(iv) The land area of the dedicated plantations will be planted by direct planting and/or seeding;~~

~~(v) After harvest, regeneration will occur either by direct planting, seeding or natural sprouting.~~

(c) Biofuel ~~biodiesel~~ plant and products:

(i) The ~~petrodiesel~~ fossil-fuels, the ~~biodiesel~~ biofuels and the blended biofuels comply with national regulations (if existent) or with suitable international standards ~~such as ASTM D6751, EN14214, or ANP42~~;

[1] Only methanol from fossil origin is included because the methodology does not provide procedures for estimating emissions associated with the use of other alcohols than methanol from fossil origin. Project proponents are invited to propose procedures to estimate the emissions associated with the production of other alcohols that could be used for esterification, such as ethanol or methanol from renewable sources, as a revision to this methodology.

(ii) The project activity involves construction and operation of a ~~biodiesel~~ biofuel production plant;

(iii) ~~The~~ Any by-product (e.g. glycerol) is not disposed of or left to decay. It should be either incinerated or used as raw material for industrial consumption or sold;

(iv) If biomass or ~~biodiesel~~ biofuel is used at the project plant(s) (processing, production or blending plant) as fuel (e.g. for heat or electricity generation), then at least 95% of the biomass or ~~biodiesel~~ biofuels used in these plants should be either biomass residues from the dedicated plantations established under the project activity or ~~biodiesel~~ biofuel generated in the project plant. The amount of ~~biodiesel~~ biofuel used should not be included in the quantity of ~~biodiesel~~ biofuel for which emission reductions are claimed;

(d) Consumption of ~~biodiesel~~ biofuel:

(i) The (blended) ~~biodiesel~~ biofuel is ~~supplied to~~ used by consumers within the host country ~~who use the (blended) biodiesel for fuel combustion~~ in existing stationary installations (e.g. captive generators) and/or in vehicles;

(ii) In case of vehicles, the target consumer group (e.g. captive fleet of vehicles, gas stations, bulk consumers) and distribution system of the biofuel shall be identified and described in the CDM-PDD ~~the consumer (end-user) of the blended biodiesel is a captive fleet of vehicles~~;

(iii) If the (blended) biofuels are consumed in stationary facilities, the consumer and the producer of the (blended) biofuel are bound by a contract that allows the producer to monitor the consumption of (blended) biofuel and that states that the consumer shall not claim CERs resulting from its consumption;

(iv) If the (blended) biofuels are sold to an identified consumer group within the host party, the buyer and the producer of the (blended) biofuel are bound by a contract that allows the producer to monitor the sale of (blended) biofuel and that states that the consumer shall not claim CERs resulting from its consumption;

(v) ~~Blending is done by the producer, the consumer or a third party who is contractually bound to the producer~~ If the biofuel is blended but neither used in stationary facilities nor sold to an identified consumer group, the blender and the producer of the biofuel are bound by a contract that allows the producer to monitor the blending of biofuel to ensure that blending proportions and amounts are monitored and meet all regulatory requirements, and that states that no CERs resulting from its consumption will be claimed;

(vi) In any case where the host party exports beyond the national boundary (blended) biofuels of the same type(s) as the biofuel(s) produced in the project plant, the consumption of the produced (blended) biofuel shall be monitored in order to ensure that no double counting occurs. The consumer and the producer of the (blended) biofuel shall be bound by a contract that allows the producer to monitor the consumption of (blended) biofuel and that states that the consumer shall not claim CERs resulting from its consumption;

(vii) No modifications in the consumer stationary installations or in the vehicles engines are necessary to consume/combust the (blended) biodiesel. In case of stationary installations, biodiesel biofuels with any blending fraction between 0 and 100% can be used. In case of vehicles, the blending proportion must be appropriate to ensure that the technical performance characteristics of the blended biodiesel biofuels do not differ significantly from those of fossil fuels;

(viii) For biodiesel, the condition in 6.d.vii above is assumed to be met if the blending proportion is up to 20% by volume (B20).[2] If the project participants use a blending proportion of more than 20%, they shall demonstrate in the CDM-PDD that the technical performance characteristics of the blended biodiesel do not differ significantly from those of petrodiesel and comply with all local regulations;

(ix) Only biodiesel biofuel consumed in excess of mandatory regulations is eligible for the purpose of the project activity.[3]

7. In addition, the applicability conditions included in the tools referred to above apply.

2.3. Entry into force

8. The date of entry into force is the date of the publication of the EB 94 meeting report on 5 May 2017.

2.4. Applicability of sectoral scopes

9. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology application of the following sectoral scopes are mandatory.

10. If biofuel is produced from waste oil/fat or biomass residues as a feedstock for:

(a) Stationary applications, then sectoral scope 5 and 1 apply;

(b) Transportation, then sectoral scopes 5 and 7 apply.

11. If biofuel is produced from anything other than waste oil/fat or biomass residues as a feedstock for:

(a) Stationary applications, then sectoral scopes 5, 1 and 15 apply;

(b) Transportation, then sectoral scopes 5, 7 and 15 apply.

[2] 2009 Biodiesel Handling and Use Guidelines, U.S. Department of Energy.

[3] Regulations that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) need not be taken into account.

3. Normative references

12. This consolidated baseline and monitoring methodology is based on the following approved baseline and monitoring methodologies and proposed new methodologies:

(a) AM0047 "Production of biodiesel based on waste oils and/or waste fats from biogenic origin for use as fuel";

(b) NM0180 "BIOLUX Benji Biodiesel Beijing Project", proposed by BIOLUX Benji Energy and Recycling Co. Ltd, whose baseline and monitoring methodology and project design document were prepared by Clemens Plöchl Carbon Consulting;

(c) NM0228 "AGRENCO Biodiesel Project in Alta Araguaia", proposed by Agrenco do Brasil S/A, whose baseline and monitoring methodology and project design document were prepared by Factor Consulting + Management AG and Geoklock Consultoria e Engenharia Ambiental Ltd;

(d) NM0233 "Palm Methyl Ester – Biodiesel Fuel (PME-BDF) production and use for transportation in Thailand" whose baseline and monitoring methodology and project design document were prepared by Japan Transport Cooperation Association, Japan Weather Association and ALMEC Corporation.

13. The methodology also refers to the latest version of the following tools:[4]

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

(b) "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";

(c) ~~"Tool to calculate baseline, project and/or leakage emissions from~~ "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation";

(d) "Project and leakage emissions from biomass";

(e) "Project and leakage emissions from transportation of freight";

(f) ~~Tool to determine project emissions from flaring gases containing methane~~ "Project emissions from flaring";

(g) "Upstream leakage emissions associated with fossil fuel use"

(h) "Apportioning emissions from production processes between main product and co and by-product";

(i) ~~A/R methodological Tool: "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities".~~

14. 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>.

[4] Please refer to: <http://cdm.unfccc.int/goto/MPappmeth>.

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

15. "Existing actual or historical emissions, as applicable".

4. Definitions

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

17. For the purpose of 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 processes;

(c) **Biofuel production plant** - is the plant where 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** - ~~is~~ non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms including ~~as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. Biomass also includes gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material;~~:

(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** ~~- are defined as biomass that is~~ 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~~. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material (however, small fractions of inert inorganic material like soil or sands may be included~~);

(g) **Blended ~~biodiesel~~ biofuel** - blend of fossil fuel and ~~biodiesel~~ 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. In case the dedicated plantation is an A/R CDM project, then the procedures of the approved A/R methodology apply;

(i) **Degraded or degrading lands** - are lands that can be identified as degraded or degrading as per the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities";

(j) **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;

(k) **Mill** - is a plant where seeds or crops are processed into starch/sugar;

(l) **Oil production plant** - is a plant where oil seeds from plants are processed to vegetable oil;

(m) **Oil seeds** - are seeds of plants from which oil can be derived;

(n) **Petrodiesel** - is 100% fossil fuel diesel**;**

(o) **Vegetable oil** - is oil of biogenic origin that is produced from oil seeds from plants;

(p) **Waste oil/fat** - is defined as 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

18. The spatial extent of the project boundary encompasses:

(a) Where applicable, transportation of:

(i) Raw materials (e.g. Oil seeds and/or biomass residues) from the field(s) to the oil production to the project-plant(s);

(ii) Feedstock (e.g. Vvegetable oil and/or waste oil/fats) to the biodiesel biofuel production plant; and

(iii) The biodiesel biofuels to the site where it is blended with petrodiesel fossil fuels;

(b) The biodiesel biofuel production plant at the project site, comprising the esterification processing unit(s) (e.g. esterification, fermentation, hydrolysis) plus other installations on the site (e.g. storage, refining, blending, etc.);

(c) If the feedstock is vegetable oil: the vegetable oil production plant(s) The feedstock processing plant(s) (e.g. oil production plant, mill) on-site or off-site;

(d) If blended biodiesel biofuel is produced: the facility where the biodiesel biofuel is blended with petrodiesel fossil fuel (regardless of the ownership of the blending facility);

(e) Where applicable, vehicles or gas stations and existing stationary combustion installations where the (blended) biodiesel biofuel is consumed;

(f) If the feedstock is ~~vegetable oil~~ sourced from plants produced in dedicated plantations: the geographic boundaries of the dedicated plantations.

~~19. If the feedstock is vegetable oils and/or fats from plants produced in dedicated plantations and the complete land area of the dedicated plantations is included in the project boundary of one or several registered A/R CDM project activities, no further emission sources related to the cultivation of the oil seeds need to be included in the project boundary.[5] Otherwise project emission sources related to the cultivation of the oil seeds shall be considered.~~

Note: Production of ~~petrodiesel~~ fossil fuels leads to emissions, which would occur in the absence of project activity. These emissions are considered in the leakage section, as the production of the ~~petrodiesel~~ fossil fuels is not included in the project boundary. Similarly, emissions associated with the production of methanol used for esterification, or chemicals used for pre-treatment and/or hydrolysis of lignocellulosic biomass are excluded from the project boundary, but are accounted for as leakage.

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

Source		Gas	Included	Justification/Explanation
Baseline	Vehicles and stationary combustion installations consuming ~~petrodiesel~~ fossil fuels	CO_2	Yes	Main source of baseline emissions
		CH_4	No	Excluded for simplification. CH4 and N2O emissions are assumed to be very small. No systematic difference to project activity
		N_2O	No	
Project activity	On-site energy consumption at ~~biodiesel~~ biofuel production plant and the ~~oil~~ feedstock production plant(s)	CO_2	Yes	May be a significant emissions source
		CH_4	No	Excluded for simplification. CH_4 emissions are assumed to be very small
		N_2O	No	Excluded for simplification. N_2O emissions are assumed to be very small
	Combustion of fossil fuel derived methanol in the biodiesel ester	CO_2	Yes	May be a significant emissions source
		CH_4	No	Excluded for simplification. CH_4 emissions are assumed to be very small
		N_2O	No	Excluded for simplification. N_2O emissions are assumed to be very small

[5] The CDM Executive Board, at its 25th meeting, agreed that the emissions associated with an A/R activity should be accounted for in the A/R CDM project activity. In general, all project activities using biomass for energy should account for emissions associated with production of biomass. However, in the case that it can be demonstrated that for a project activity using biomass for energy, which uses biomass originating from a registered A/R project activity (i.e. through contractual agreement for procurement of biomass) it need not account for emissions related to biomass production.

	Source	Gas	Included	Justification/Explanation
	Transportation of feedstock ~~oil seeds, vegetable oils and or oil/fat wastes~~	CO_2	Yes	May be a significant emissions source
		CH_4	No	Excluded for simplification. CH_4 emissions are assumed to be very small
		N_2O	No	Excluded for simplification. N_2O emissions are assumed to be very small
	Transportation of ~~biodiesel~~ biofuel to blending facility	CO_2	Yes	May be a significant emissions source
		CH_4	No	Excluded for simplification. CH_4 emissions are assumed to be very small
		N_2O	No	Excluded for simplification. N_2O emissions are assumed to be very small
	Anaerobic wastewater treatment in feedstock ~~crude vegetable oil~~ production.	CO_2	No	Excluded for simplification. CO_2 emissions are assumed to be very small
		CH_4	Yes	May be a significant emissions source
		N_2O	No	Excluded for simplification. N_2O emissions are assumed to be very small
	Cultivation of biomass ~~land to produce oil seeds (if the feedstock is vegetable oils and / or fats from plants produced~~ in a dedicated plantation~~)~~[6]	CO_2	Yes	May be a significant emissions source
		CH_4	Yes	May be a significant emissions source
		N_2O	Yes	May be a significant emissions source

5.2. Procedure for the selection of the ~~most plausible~~ baseline scenario

20. The baseline scenario shall be separately identified among all realistic and credible alternative(s) for the following elements:

(a) **Production of fuels (P)**: what would have happened at the production level in the absence of the CDM project activity?

(b) **Consumption (C):** which fuel would have been consumed in the absence of the CDM project activity?

(c) **Material (M)**: what would have happened to the material used as input for production of ~~biodiesel~~ biofuel in the absence of the CDM project activity?

[6] This emission source does not need to be included in the project boundary, if the complete land area of the dedicated plantation is included in the project boundary of one or several registered CDM A/R project activities.

21. If the ~~biodiesel~~ biofuel is produced from seeds or crops from plants cultivated in dedicated plantations, the following element should be taken into account:

    (a) **Land used for plantations (L):** what would be the land use in the absence of the CDM project activity?

22. For the **fuel production (P)**, project participants shall identify the most likely baseline scenario among all realistic and credible alternative(s), applying steps of the latest approved version of the "Tool for the demonstration and assessment of additionality". Step 3 should be used to assess which of these alternatives is to be excluded from further consideration (i.e. alternatives where barriers are prohibitive or which are clearly economically unattractive) and Step 2 should be applied for all remaining alternatives. In case project proponent is a company already producing fuels other than ~~biodiesel~~ biofuels then only Step 2 should be applied for all options identified (barrier analysis is not allowed). Include a sensitivity analysis applying Sub-step 2d of the latest version of the "Tool for the demonstration and assessment of additionality". If the sensitivity analysis is conclusive (for a realistic range of assumptions), then the most cost effective scenario is the baseline scenario. In case the sensitivity analysis is not fully conclusive, select the baseline scenario alternative with least emissions among the alternatives that are the most economically attractive according to the investment analysis and the sensitivity analysis.

23. At the production level the realistic and credible alternative(s) may include, inter alia:

    (a) P1: Continuation of current practices with no investment in ~~biodiesel~~ biofuel production capacity;

    (b) P2: The project activity implemented without the CDM; and

    (c) P3: Investment in any other alternative fuel replacing partially or totally the baseline fuel.

24. For the **consumption of fuel (C)**, the baseline should be determined as follows:

5.2.1. Step 1: Identify all realistic and credible alternatives for the fuel used by end consumers

25. Project participants should at least consider the following alternatives with respect to the intended consumer of blended ~~biodiesel~~ biofuel:

    (a) C1: Continuation of fossil fuel consumption or blended ~~biodiesel~~ biofuel consumption (in case of mandatory regulations);[7]

    (b) C2: Consumption of ~~biodiesel~~ biofuel from other producers;

    (c) C3: Consumption of other single alternative fuel such as CNG or LPG, etc.;

    (d) C4: Consumption of a mix of above alternative fuels;

    (e) C5: Consumption of ~~biodiesel~~ biofuel from the proposed project plant.

[7] Regulations that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) need not be taken into account.

5.2.2. Step 2: Eliminate alternatives that are not complying with applicable laws and regulations

26. Eliminate alternatives that are not in compliance with all applicable legal and regulatory requirements. Apply Sub-step 1b of the latest version of the “Tool for the demonstration and assessment of additionality”.

5.2.3. Step 3: Eliminate alternatives that face prohibitive barriers

27. Scenarios that face prohibitive barriers (e.g. technical barrier) should be eliminated by applying Step 3 of the latest version of the “Tool for the demonstration and assessment of additionality”.

5.2.4. Step 4: Compare economic attractiveness of remaining alternatives

28. Compare the economic attractiveness for all the remaining alternatives by applying Step 2 of the latest version of the “Tool for the demonstration and assessment of additionality”. Provide all the assumptions in the CDM-PDD.

29. Include a sensitivity analysis applying Sub-step 2d of the latest version of the “Tool for the demonstration and assessment of additionality”. If the sensitivity analysis is conclusive (for a realistic range of assumptions), then the most cost effective scenario is the baseline scenario. In case the sensitivity analysis is not fully conclusive, select the baseline scenario alternative with least emissions among the alternatives that are the most economically attractive according to the investment analysis and the sensitivity analysis.

30. For the **material (M)** level, the previous Steps 1 through 4 shall be taken.

31. Project participants should at least consider the following alternatives:

    (a) M1: Use of material for production of ~~biodiesel~~ biofuel (by the project proponent or by others);

    (b) M2: Use for material production of substances other than fuel;

    (c) M3: Incineration of material for the purpose of energy recovery;

    (d) M4: Incineration of material without energy recovery;

    (e) M5: Disposal of material in an anaerobic or aerobic manner.

32. For the **land use where the dedicated plantations are established (L)**, the baseline scenario should be determined as follows:

5.2.5. Step 1: Identify all realistic and credible alternatives for the land use

33. Project participants should at least consider the following alternatives with respect to the baseline scenario for the use of the land where the dedicated plantations are established:

    (a) L1: Continuation of current land use, i.e. continued absence of agricultural and forestry activities on degraded or degrading lands;

    (b) L2: Conversion to dedicated seed or crop plantations ~~of the oil plant~~ without CDM;

(c) L3: Conversion to another plantation (annual or perennial).

5.2.6. Steps 2 – 4: Eliminate scenarios which are not in legal compliance or face prohibitive barriers or are not economically attractive, as described above for the fuel consumption scenarios

34. The project participants should demonstrate that the most plausible scenario is continuation of current land use (L1), by assessing the attractiveness of the plausible alternative land uses in terms of benefits to the project participants, consulting with stakeholders for existing and future land use, and identifying barriers for alternative land uses. This can be done by demonstrating that similar lands in the vicinity are not planned to be used for alternative land uses other than L1. Show that apparent financial and/or other barriers, which prevent alternative land uses can be identified.

35. If the biodiesel biofuel is produced from waste oil/fat or biomass residues this methodology is applicable for the baseline scenario which combines P1, C1, and any one of the M scenarios. For material scenarios M1, M2 and M3, possible leakage from the displacement of existing uses of waste oil/fat or biomass residues needs to be assessed, as stated in the leakage section.

36. If the biodiesel biofuel is produced from feedstock cultivated in dedicated plantations, this methodology is applicable for the baseline scenario which combines P1, C1 and L1.

5.3. Additionality

37. The additionality of the project activity shall be demonstrated and assessed using the latest version of the “Tool for the demonstration and assessment of additionality” agreed by the CDM Executive Board, and available on the UNFCCC CDM website.

38. Where Step 2 of the “Tool for the demonstration and assessment of additionality” (Investment Analysis) is used, the investment analysis shall include a sensitivity analysis of the biodiesel biofuel sales price, the feedstock costs and fuel costs.

39. Guidance for the Barriers Analysis when the dedicated plantation (or part of) is covered under an A/R CDM project activity:

(a) If the A/R CDM activity and the activity covering the production, sale and consumption of blended biodiesel biofuel are two independent project activities (which may imply also that project proponents are different) then:

(i) A barrier related to the implementation of the plantation cannot be used for the project activity covering the production, sale and consumption of blended biodiesel biofuel;

(b) If the A/R CDM project activity and the project activity covering the production, sale and consumption of blended biodiesel biofuel are part of an integrated development project (which means that the same project proponents are to be involved in the two CDM activities) then:

(i) A barrier related to the implementation of the plantation can also be used by the production, sale and consumption of blended biodiesel biofuel activity.

40. Investment in the establishment of dedicated plantations must be considered, whether or not the establishment of such plantations is part of an A/R CDM project activity, if there is

no market for the feedstock. By definition, tCERs from A/R CDM activities, whose plantations are part of the biofuel project, implemented under this methodology and CERs accruing from CDM project activities under this methodology must not be included in the investment analysis performed in order to identify the baseline scenario.

5.4. Baseline emissions

41. Baseline emissions from displaced fossil fuel ~~petrodiesel~~ are determined as follows:

$$BE_y = B\cancel{D}F_y \times NCV_{B\cancel{D}F,y} \times EF_{CO2,FF} \qquad \text{Equation (1)}$$

With

$$BF_y = \left[min\left\{ \left(P_{B\cancel{D}F,y} - P_{B\cancel{D}F,on-site,y}\right); \left(\sum_i f_{PJ,i,y} \times C_{B\cancel{D}F,i,y}\right)\right\} - P_{B\cancel{D}F,other,y}\right] \times \left(\frac{\sum_i C_{BF,i,y} \times \left(\frac{f_{PJ,i,y} - f_{reg,y}}{f_{PJ,i,y}}\right)}{\sum_i C_{BF,i,y}} \right) \qquad \text{Equation (2)}$$

Where:

BE_y	=	Baseline emissions during the year *y* (tCO_2)
$BF\cancel{D}_y$	=	Quantity of ~~biodiesel~~ biofuel eligible for crediting in year *y* (t)
$NCV_{B\cancel{D}F,y}$	=	Net calorific value of ~~biodiesel~~ biofuel produced in year *y* (GJ/t)
$EF_{CO2,FF}$	=	Carbon dioxide emissions factor for displaced fossil fuel (tCO_2/GJ)
$P_{B\cancel{D}F,y}$	=	Quantity of ~~biodiesel~~ biofuel produced in the project plant in year *y* (t)
$P_{B\cancel{D}F,on-site,y}$	=	Quantity of ~~biodiesel~~ biofuel consumed at the project plant(s) (biofuel production and/or feedstock processing) in year *y* (t)
$PD_{B\cancel{D}F,other,y}$	=	Quantity of ~~biodiesel~~ biofuel that is either produced with alcohols other than methanol from fossil origin or produced using feedstock or waste oil(s)/fat(s) other than those eligible under this methodology according to the applicability conditions in year *y* (t)
$C_{B\cancel{D}F,i,y}$	=	Quantity of ~~biodiesel~~ biofuel type *i* consumed/sold/blended in year *y* (t)
$f_{PJ,i,y}$	=	Fraction of ~~biodiesel~~ biofuel in the blended ~~biodiesel~~ biofuel type *i* in year *y* (ratio)
$f_{reg,y}$	=	Fraction of ~~biodiesel~~ biofuel in the blended ~~biodiesel~~ biofuel which is required by mandatory regulations of the host country in year *y* (ratio)
i	=	Blended ~~biodiesel~~ biofuel type (e.g. B5, B10, B20, B50 etc.)

42. Project participants shall determine $C_{BF,i,y}$ as follows:

(a) For (blended) biofuels that are consumed in stationary installations, $C_{BF,i,y}$ shall be based on the monitored amount of biofuels consumed;

(b) For (blended) biofuels that are sold to an identified consumer group, $C_{BF,i,y}$, shall be based on the monitored amount of (blended) biofuel sold;

(c) For biofuels that are blended but neither used in stationary facilities nor sold to an identified consumer group, $C_{BF,i,y}$ shall be based on the amount of biofuel blended at the blending facility(ies).

5.5. Project Emissions

43. Project emissions include four components:

(a) If the ~~biodiesel~~ biofuel is produced from feedstock ~~oil seeds~~ that is cultivated in dedicated plantations: project emissions from cultivation of seeds or crops ~~(this source shall not be included if the total area of dedicated plantation is registered as one or several A/R CDM project activities);~~

(b) Project emissions from transportation, where applicable. This includes:

(i) Any transportation of raw feedstock (e.g. ~~oil~~ seeds, biomass residues) from the field(s) to the oil production plant(s)/mill(s);

(ii) Any transportation of feedstock (e.g. vegetable oil, waste oil/fats) to the ~~biodiesel~~ biofuel production plant, and;

(iii) Any transportation of the ~~biodiesel~~ biofuel to the site where it is blended with fossil fuel ~~petrodiesel~~;

(c) Project emissions at the ~~biodiesel~~ biofuel production facility and, if applicable, the feedstock processing plant(s) (e.g. ~~in case of vegetable oils,~~ the oil production plant(s) and/or mill(s));

(d) CO_2 from combustion of fossil carbon contained in methanol that is chemically bound in the biodiesel during the esterification process, and released upon combustion.

44. These emission sources are only partly allocated to the production of ~~biodiesel~~ biofuel, through the allocation factor $AF_{1,y}$ in equation 3). 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 $AF_{2,y}$ in equation 3). The Allocation factors are estimated as per the methodological tool "Apportioning emissions from production processes between main product and co and by-product".

45. Accordingly, project emissions are calculated as follows:

$$PE_y = AF_{1,y} \times \left(PE_{BPF,y} + PE_{MeOH,y} + PE_{TR,y} + AF_{2,y} \times PE_{BC,y}\right) \quad \text{Equation (3)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
$PE_{BPF,y}$	=	Project emissions at the ~~biodiesel~~ biofuel production plant and, if applicable, the oil production plant(s)/mill(s) in year *y* (tCO_2)
$PE_{MeOH,y}$	=	Project emissions from fossil carbon in the biodiesel due to esterification with methanol of fossil origin in year *y* (tCO_2)
$PE_{TR,y}$	=	Project emissions from transportation in year *y* (tCO_2)
$PE_{BC,y}$	=	Project emissions associated with the cultivation of land in dedicated plantations in year *y* (tCO_2)
$AF_{1,y}$	=	Allocation factor for the production of ~~biodiesel~~ biofuel in year *y* (fraction)
$AF_{2,y}$	=	Allocation factor for the land cultivation in year *y* (fraction)

5.5.1. Project emissions at the biofuel production plant and feedstock processing plant(s) (*$PE_{BPF,y}$*)

46. These emissions include fuel and electricity consumption that occurs at the site of the biofuel production plant and, if applicable, emissions associated with the anaerobic treatment of wastewater in ~~oil~~ ~~production~~ the feedstock processing plant(s) (e.g. oil production plant(s)/mill(s)).

47. These emissions are estimated as follows:

$$PE_{BPF,y} = \sum_j PE_{FC,j,y} + PE_{EC,y} + PE_{W,y} \qquad \text{Equation (4)}$$

Where:

$PE_{BPF,y}$	=	Project emissions at the ~~biodiesel~~ biofuel production facility and, if applicable, the ~~oil production~~ feedstock processing plant(s) in year *y* (tCO_2)
$PE_{FC,j,y}$	=	Project emissions from combustion of fuel type *j* in the ~~biodiesel~~ biofuel production plant and the ~~oil production~~ feedstock processing plant(s) in year *y* (tCO_2)
$PE_{EC,y}$	=	Project emissions from electricity consumption in the ~~biodiesel~~ biofuel production plant and the ~~oil production~~ feedstock processing plant(s) in year *y* (tCO_2)
$PE_{W,y}$	=	Project emissions from anaerobic treatment of waste water in year *y* (tCO_2)

5.5.1.1. Emissions from fossil fuel consumption (*$PE_{FC,j,y}$*)

48. This emission source should include CO_2 emissions from all fossil fuel consumption that occurs at the site of the ~~biodiesel~~ biofuel production plant and, if applicable, the ~~oil production~~ feedstock processing plant(s) (e.g. oil production plant(s) and/or mill(s)) that is attributable to the project activity. This shall include, inter alia, fossil fuel combustion for heat and/or electricity generation.

49. 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 CO_2 emissions from fossil fuel combustion”. For this purpose, the processes *j* in the tool correspond to all fossil fuel combustion sources at these plants.

5.5.1.2. Emissions from electricity consumption ($PE_{EC,y}$)

50. Emissions from electricity consumption includes electricity delivered from the grid to the biofuel production plant and, if applicable, the ~~oil production~~ feedstock processing plant (s) (e.g. oil production plant(s)/mill(s)). Electricity generated on-site should not be included here.[8]

51. The project emissions from electricity consumption ($PE_{EC,y}$) will be calculated following the latest version of “~~Tool to calculate baseline, project and/or leakage emissions from electricity consumption~~ “Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”. In this particular case, the tool can also be applied if captive renewable power generation technologies are installed to provide electricity; however, only the electricity purchased from the grid should be included in $EC_{PJ,j,y}$ and Scenario A of the tool should be applied respectively.

5.5.1.3. Project emissions from waste water treatment ($PE_{w,y}$)

52. Emissions associated with the anaerobic treatment of wastewater in the ~~oil production~~ feedstock processing plant (s) (e.g. oil production plant(s)/mill(s)) should be estimated where applicable.

53. If the methane from anaerobic treatment of wastewater is vented to the atmosphere, then $PE_{w,y}$ is estimated as follows:

$$PE_{w,y} = Q_{COD,y} \times P_{COD,y} \times B_0 \times MCF_p \times GWP_{CH4} \quad \text{Equation (5)}$$

Where:

$PE_{w,y}$	=	Project emissions from anaerobic treatment of waste water in year *y* (tCO_2e)
$Q_{COD,y}$	=	Amount of wastewater treated anaerobically or released untreated from the feedstock processing plant(s) in year *y* (m^3)
$P_{COD,y}$	=	Chemical Oxygen Demand (COD) of wastewater in year *y* ($tCOD/m^3$)
B_0	=	Maximum methane producing capacity (t CH_4/t COD)
MCF_p	=	Methane conversion factor (fraction)
GWP_{CH4y}	=	Global warming potential of CH_4 (tCO_2e/tCH_4)

54. If the methane from anaerobic treatment of waste water is flared, then the methodological tool “~~Tool to determine project emissions from flaring gases containing methane~~ “Project emissions from flaring” should be used to estimate project emissions from waste water

[8] On-site electricity generation with fossil fuels should be included in $PE_{FC,j,y}$. On-site electricity generation with biomass residues or biodiesel 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 biodiesel are included in the emission sources accounted under this methodology.

treatment. In this case, $PE_{w,y}$ will be calculated ex ante as per equation 5, and then monitored during the crediting period.

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

55. Under the current applicability of the methodology, methanol of fossil origin is used for the esterification of vegetable oil or waste oil/fats. In the esterification process, the carbon from the methanol remains in the esters. Thus, a fraction of the carbon in the biodiesel is of fossil origin and need to be accounted as project emissions. These emissions are estimated as follows:

$$PE_{MeOH,y} = MC_{MeOH,y} \times EF_{C,MeOH} \times \frac{44}{12}$$ Equation (6)

Where:

$PE_{MeOH,y}$	=	Project emissions from fossil carbon in the biodiesel due to esterification with methanol of fossil origin in year *y* (tCO_2)
$MC_{MeOH,y}$	=	Quantity of methanol consumed in the biodiesel plant, including spills and evaporations on-site in year *y* (tMeOH)
$EF_{C,MeOH}$	=	Carbon emissions factor of methanol, based on molecular weight (tC/tMeOH)
$44/12$	=	Molecular weight ratio to convert t of carbon into t of CO_2 (tCO_2/tC)

5.5.3. Project emissions from transportation ($PE_{Tr,y}$)

56. Emissions resulting from transportation are estimated by following the provisions in the methodological tool “Project and leakage emissions from transportation of freight”

57. Project emissions from transportation only have to be accounted if distances of more than 50 km are covered.

58. Project emissions from transportation include the following sources, where applicable:

(a) Any transportation of raw feedstock (e.g. seeds, biomass residues) from the field(s) to the processing plant(s) (e.g. oil production plant(s)/mill(s)) ~~oil seeds to the oil production plant(s);~~

(b) Any transportation of feedstock (e.g. vegetable oil, waste oil/fats) to the ~~biodiesel~~ biofuel production plant, and;

(c) Any transportation of the ~~biodiesel~~ biofuel to the site where it is blended with fossil fuel.

~~**Option 1:** Emissions are calculated on the basis of distance and the average truck load:~~

$$PE_{TR,y} = \sum_{m} \left(\frac{MT_{m,y}}{TL_m} \times AVD_m \times EF_{TR} \right)$$ ~~Equation (7)~~

Where:

$PE_{TR,y}$	=	Project emissions from transportation in year *y* (tCO_2)
$MT_{m,y}$	=	Material m transported in year *y* (t)
TL_m	=	Average truck load for vehicles transporting material m (t)
AVD_m	=	Average distance travelled by vehicles transporting material m (km), including the return trip/s
EF_{TR}	=	Carbon dioxide emissions factor for vehicles transporting material (tCO_2/km)
m	=	Material transported (e.g. oil seeds, vegetable oil and biodiesel)

Option 2: Emissions are calculated based on the actual quantity of fossil fuel consumed for transportation.

$$PE_{TR,y} = \sum_m \sum_i (FC_{m,i,y} \times NCV_i \times EF_{CO2,i}) \quad \text{Equation (8)}$$

Where:

$PE_{TR,y}$	=	Project emissions from transportation in year *y* (tCO_2)
$FC_{m,i,y}$	=	Fuel consumption of type *i* for transporting material m in year *y* (t)
NCV_i	=	Net calorific value of fuel type *i* (GJ/t)
$EF_{CO2,i}$	=	Carbon dioxide emissions factor for fuel type *i* (tCO_2/GJ)
m	=	Material transported (e.g. oil seeds, vegetable oil and biodiesel)

5.5.4. Project emissions associated with the cultivation of lands to produce oil seeds/crops in dedicated plantations ($PE_{BC,y}$)

59. 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" This step calculates emissions associated with the cultivation of lands to produce the oil seeds used in oil production plant(s) and is applicable if the biodiesel is produced from oil seeds cultivated in dedicated plantations.

60. If the oil seeds are sourced from a plantation area that is registered as one or several A/R CDM project activities, these emissions are not accounted as project emissions under this methodology.

61. Project participants should clearly document and justify in the CDM-PDD which emission sources are applicable to the project activity.

62. Project participants may choose among two options to calculate this emission source:

(a) Option A provides a simple approach, using conservative **default values** for the emissions associated with the cultivation of lands, taking into account different geographical regions. This approach can only be used for oil seeds from **palm or jatropha**;

(b) ~~Option B calculates the emissions based on actual data from the cultivation process and is more accurate than Option A but requires the collection of more data by the project participants.~~

63. 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**.

5.5.4.1. ~~Option A:~~ Use of a default emission factor

$$PE_{BC,y} = PE_{SOC,y} + \sum_{s} A_{s,y} \times EF_{s,y}$$ Equation (9)

Where:

$PE_{BC,y}$	=	Project emissions associated with the cultivation of land to produce biomass feedstock ~~oil seed~~ in year *y* (tCO_2)
$PE_{SOC,y}$	=	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 feedtstock ~~oil seed~~ 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 feedstock ~~oil seed~~ type *s* (tCO_2e/ha). See Table 3 below for available values.

Table 3. Conservative default emission factors for the GHG emissions associated with the cultivation of land to produce ~~oil seeds~~ biomass feedstock

Feedstock type s	Fresh palm fruit bunches	Cassava roots	Jatropha nuts	Soybeans	Corn Seed	Sugarcane	Pongamia
$EF_{s,y}$ (t CO_2e/ha)	2.5	1.9	2.6	0.8	2.1	2.3	1.5

~~Crop~~	~~Climate Zone~~[9]	~~$EF_{s,y}$ (tCO_2e/ha)~~
~~Palm Methyl Esther~~	~~Tropical Moist~~	~~1.87~~
~~Palm Methyl Esther~~	~~Tropical Wet~~	~~1.87~~
~~Jatropha Methyl Ester~~	~~Tropical Moist~~	~~1.76~~
~~Jatropha Methyl Ester~~	~~Tropical Dry~~	~~2.52~~

64. An excel sheet 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/PAmethodologies/approved.html>.

[9] See Appendix 2.

5.5.4.2. Option B: Use of project specific data

65. Project emissions associated with the cultivation of land vary between different project types. Table 4 explains which emission sources must be considered. The procedures to estimate these emissions are contained in Appendix 1 and in the tools listed in the table.

66. Project participants should clearly document and justify which emission sources are applicable to the project activity. An excel sheet that can be used to calculate the emission factors for the GHG emissions associated with the cultivation of land to produce oil seeds for different type of crops under different climatic conditions is provided at the following weblink at UNFCCC CDM website <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

Table 4. Cases for which relevant emission sources from the cultivation of biomass should be taken into account

Emission Sources	**# of Equations in Appendix 1**	**Cases in which the emission sources should be considered**
Fossil fuel consumption for agricultural operations	-	Should be estimated if fossil fuels are used for agricultural operations. This source should be calculated following the latest version of "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Electricity consumption for agricultural operations	-	Should be estimated of electricity is used for agricultural operations (e.g. irrigation). This source should be calculated following the latest version of "Tool to calculate baseline, project and/or leakage emissions from electricity consumptionMethodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
N_2O emissions from the application of fertilizers	1, 2, 3	Should be estimated if **synthetic fertilizers** or **organic fertilizers** (e.g. animal manure, compost, sewage sludge, rendering waste) are applied at the plantation
CO_2 emissions from urea application	4	Should be estimated if urea is applied as a nitrogen source at the plantation
CO_2 emissions from application of limestone and dolomite	5	Should be estimated if **limestone** or **dolomite** is applied to the plantation to reduce soil acidity and improve plant growth
CH_4 and N_2O emissions from the field burning of biomass	6	Should be estimated if biomass from the plantation is to be burnt regularly during the crediting period (e.g. after harvest)
N_2O emissions from land management at the plantation	7, 8, 9, 10, 11, 12	Should be estimated when relevant, for example, drainage/management of organic soils is only applicable in the case of organic soils
Emissions from the production of synthetic fertilizer that is used at the plantations	13	Should be estimated if synthetic fertilizers are applied at the plantation
CO_2 emissions resulting from changes in soil carbon stocks	14, 15, 16, 17, 18	Should be estimated if land use change or change in land management practices is introduced with the

Emission Sources	# of Equations in Appendix 1	Cases in which the emission sources should be considered
following land use changes or changes in the land management practices		cultivation of biomass under the project activity. For perennial plants only, if it can be demonstrated that at maturity of the acreage, the total stock in above ground and below ground biomass is higher in the project case than in the baseline these emissions are expected to be negligible and they are accounted for as zero. For this, the project proponents should: (a) Estimate the above and below ground biomass in the baseline; (b) Estimate the above and below ground biomass with the project when the acreage reaches maturity. This should be done using specific data for the project activity

5.6. Leakage

67. This methodology estimates the following sources of leakage:

(a) Emissions associated with the production of the methanol used for esterification or the chemicals used for pre-treatment and/or hydrolysis of lignocellulosic biomass;

(b) If the biodiesel biofuel is produced from waste oil/fat or biomass residues, diversion displacement of existing applications uses of waste oil/fat or biomass residues that may result in increased demand for fossil fuels elsewhere;

(c) Positive leakage associated with the avoided production and transportation of fossil fuel petrodiesel.

68. The leakage emissions are calculated as follows:

$$LE_y = LE_{MeOH,y} + LE_{BR,y} - LE_{FF,y}$$ Equation (10)

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2)
$LE_{MeOH,y}$	=	Leakage emissions associated with production of methanol used in biodiesel production in year *y* (tCO_2)
$LE_{BR,y}$	=	Leakage emissions from displacement of existing uses of waste oil/fat or biomass residues in year *y* (tCO_2)
$LE_{FF,y}$	=	Leakage related to the avoided production of fossil fuel petrodiesel in year *y* (tCO_2)

69. Please note that the overall leakage emissions shall not be less than zero. In cases where, in year *y*, LE_y is less than zero, consider it as zero.

5.6.1. Leakage from methanol/chemicals production

70. Emissions from production of methanol that is ~~are~~ used in the esterification process to produce the biodiesel are estimated as follows:

$$LE_{MeOH,y} = MC_{MeOH,y} \times EF_{MeOH,PC} \qquad \text{Equation (11)}$$

Where:

$LE_{MeOH,y}$	=	Leakage emissions associated with production of methanol used in biodiesel production in year *y* (tCO_2)
$MC_{MeOH,y}$	=	Quantity of methanol consumed in the biodiesel 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 (tCO_2/t MeOH)

71. 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”.

5.6.2. Leakage from the diversion of existing applications of waste oil/fat and/or biomass residues.

72. 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”.

73. These emissions will only be estimated if the biofuel is produced from waste oil/fat and/or biomass residues. For material scenarios M1, M2 and M3, project participants shall demonstrate that the use of these materials by the project activity does not result in increased fossil fuel consumption elsewhere. For this purpose, project participants shall monitor the total supply of waste oil/fat or biomass residues used in the project plant.

~~74. Project participants shall demonstrate that there is a surplus of waste oil/fat in the region of the project activity, which is not currently recovered or used for any purpose. For the purpose of this methodology, “surplus” is defined as the quantity of available waste oil/fat produced in the region being at least 25% larger than the quantity of waste oil/fat that is recovered (e.g. for energy generation or as feedstock), including the project plant.~~

~~75. Project participants shall clearly define the geographical boundary of the region and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the usual distances for waste oil/fat transport. In other words, if waste oil/fat is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In any case, the region should cover a radius around the project activity of at least 20 km. Once defined, the region should not be changed during the crediting period(s).~~

~~76. Where project participants cannot demonstrate that the total quantity of waste oil/fat used by the project activity does not result in increased fossil fuel use elsewhere, a leakage penalty shall be applied. The penalty is calculated as follows: For scenario M2, this applies~~

where the most likely substitute, taking into account common practice of the region, is derived from fossil fuel.

$LE_{WOF,y} = WOF_{L,y} \times NCV_{BD,y} \times EF_{CO2,L}$ (for scenario M1 and M3) Equation (12)

$LE_{WOF,y} = COEF_{WOF,L} \times WOF_{L,y} \times NCV_L \times EF_{CO2,L}$ (for scenario M2 where the substitute for substance is likely to be derived from fossilfuel) Equation (13)

Where:

$LE_{WOF,y}$	=	Leakage emissions from displacement of existing uses of waste oil/fat in year *y* (tCO_2)
$WOF_{L,y}$	=	Waste oil/fat that causes increased fossil fuel consumption elsewhere (t)
$NCV_{BD,y}$	=	Net calorific value of biodiesel produced in year *y* (GJ/t)
NCV_L	=	Net calorific value of the fossil fuel likely to substitute waste oil / fat (GJ/t)
$EF_{CO2,L}$	=	Carbon dioxide emissions factor of most carbon intensive fuel oil in the country (tCO_2/GJ)
$COEF_{WOF,L}$	=	Coefficient of substitution of fossil fuel to waste oil / fat to produce the substance previously produced by waste oil / fat

77. Determination of $WOF_{L,y}$

$$WOF_{L,y} = \begin{cases} \dfrac{(1.25 \times WOF_{D,y}) - WOF_{S,y}}{1.25} & if\ (1.25 \times WOF_{D,y}) > WOF_{S,y} \\ 0 & if\ (1.25 \times WOF_{D,y}) \leq WOF_{S,y} \end{cases}$$ Equation (14)

With

$WOF_{D,y} = WOF_{DS,y} + u_D$ Equation (15)

$WOF_{S,y} = WOF_{SS,y} + u_S$ Equation (16)

Where:

$WOF_{L,y}$	=	Waste oil/fat that causes increased fossil fuel consumption elsewhere (t)
$WOF_{D,y}$	=	Demand for waste oil/fat, including the project activity, in the defined region (t), corrected for uncertainties associated with its determination
$WOF_{S,y}$	=	Supply of waste oil/fat in the defined region (t), corrected for uncertainties associated with its determination
$WOF_{DS,y}$	=	Statistical mean value obtained from surveys or other sources for the demand for waste oil/fat, including the project activity, in the defined region (t)
$WOF_{SS,y}$	=	Statistical mean value obtained from surveys or other sources for the supply of waste oil/fat in the defined region (t)

u_D	=	Uncertainty for waste oil/fat demand (t)
u_S	=	Uncertainty for waste oil/fat supply in the defined region (t)

78. Methods to determine $WOF_{D,y}$, $WOF_{S,y}$ and the associated uncertainties are indicated in the monitoring methodology section below.

79. In the case that overall emission reductions from the project activity are negative in a given year because of the leakage penalty emissions, CERs are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the given year.

5.6.3. Leakage related to the avoided production of fossil fuel

80. The substitution of biofuel for fossil fuel biodiesel for petrodiesel reduces indirect ("upstream") emissions associated with the production of petrodiesel fossil fuel.

81. For the purpose of this methodology, the following upstream emissions stages *i* are considered:

(a) Production of crude oil. These include emissions from venting, flaring and energy uses;

(b) Oil refinery. These include emissions from energy uses, production of chemicals and catalysts, disposal of production wastes (including flaring) and direct emissions;

(c) Long distance transport.[10]

82. Emissions related to infrastructure are not be taken into account either for the production of crude oil (e.g. drilling and maintenance of the oil wells) or for the oil refinery (e.g. construction of the refinery), to keep consistency with the estimation of project emissions from biodiesel biofuel production where these emission sources are also ignored.

83. Emissions from the distribution to filling stations are not taken into account, as it is assumed that these emissions balance with the emissions of transport of the biodiesel biofuel to the blending facility.

$$LE_{FF,y} = BF_y \times \sum_x \sum_i \sum_j NCV_{BF,y} \times EF_{i,j,x,y}$$ Equation (17)

[10] Emissions from international long distance transport (transport of crude oil to the refinery) will not be taken into account since the EB has clarified that CDM project activities cannot claim emission reductions from reducing international bunker fuel consumption. EB 25 report paragraph 58 states that "The Board agreed to confirm that the project activities/parts of project activities resulting in emission reductions from reduced consumption of bunker fuels (e.g. fuel saving on account of shortening of the shipping route on international waters) are not eligible under the CDM." If long distance transport occurs within the host country where the project activity takes place, these emissions will be accounted for as per equation 17

Where:

$LE_{FF,y}$	=	Leakage related to the avoided production of fossil fuel ~~petrodiesel~~ 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 CO2e/TJ)

~~$$LE_{PD,y} = LE_{PROD,y} + LE_{REF,y} + LE_{LDT,y}$$~~ ~~Equation (18)~~

~~Where:~~

~~$LE_{PD,y}$~~	~~=~~	~~Leakage related to the avoided production of petrodiesel in year *y* (tCO_2)~~
~~$LE_{PROD,y}$~~	~~=~~	~~Leakage related to the production of crude oil in year *y* (tCO_2)~~
~~$LE_{LDT,y}$~~	~~=~~	~~Leakage related to the long distance transport in year *y* (tCO_2)~~
~~$LE_{REF,y}$~~	~~=~~	~~Leakage related to refining of crude oil in year *y* (tCO_2)~~

~~Leakage related to the production of crude oil (*$LE_{PROD,y}$*)~~

~~$$LE_{PROD,y} = BD_y \times \frac{NCV_{BD,y}}{NCV_{PD}} \times EF_{PROD}$$~~ ~~Equation (19)~~

~~Where:~~

~~$LE_{PROD,y}$~~	~~=~~	~~Leakage related to the production of crude oil in year *y* (tCO_2)~~
~~BD_y~~	~~=~~	~~Quantity of biodiesel eligible for crediting in year *y* (t)~~
~~$NCV_{BD,y}$~~	~~=~~	~~Net calorific value of biodiesel produced in year *y* (GJ/t)~~
~~NCV_{PD}~~	~~=~~	~~Net calorific value of petrodiesel (GJ/t)~~
~~EF_{PROD}~~	~~=~~	~~Emission factor for production of crude oil (tCO_2e/t)~~

~~Leakage related to oil refining (*$LE_{REF,y}$*)~~

~~$$LE_{REF,y} = BD_y \times \frac{NCV_{BD,y}}{NCV_{PD}} \times EF_{REF}$$~~ ~~Equation (20)~~

~~Where:~~

~~$LE_{REF,y}$~~	~~=~~	~~Leakage related to refining of crude oil in year *y* (tCO_2)~~
~~BD_y~~	~~=~~	~~Quantity of biodiesel eligible for crediting in year *y* (t)~~
~~$LE_{REF,y}$~~	~~=~~	~~Net calorific value of biodiesel produced in year *y* (GJ/t)~~
~~NCV_{PD}~~	~~=~~	~~Net calorific value of petrodiesel (GJ/t)~~

EF_{REF}	=	Emission factor related to oil refining expressed by per ton of petrodiesel (tCO_2e/t)

Leakage related to the long distance transport ($LE_{LDT,y}$)

84. Emissions from international long distance transport (transport of crude oil to the refinery) will not be taken into account since the EB has clarified that CDM project activities can not claim emission reductions from reducing international bunker fuel consumption. EB 25 report paragraph 58 states that "The Board agreed to confirm that the project activities/parts of project activities resulting in emission reductions from reduced consumption of bunker fuels (e.g. fuel saving on account of shortening of the shipping route on international waters) are not eligible under the CDM."

85. If long distance transport occurs within the host country where the project activity takes place, these emissions will be accounted for as per the following equation:

$$LE_{LDT,y} = BD_y \times \frac{NCV_{BD,y}}{NCV_{PD}} \times EF_{LDT}$$ Equation (21)

Where:

$LE_{LDT,y}$	=	Leakage related to the long distance transport in year *y* (tCO_2)
BD_y	=	Quantity of biodiesel eligible for crediting in year *y* (t)
$NCV_{BD,y}$	=	Net calorific value of biodiesel produced in year *y* (GJ/t)
NCV_{PD}	=	Net calorific value of petrodiesel (GJ/t)
EF_{LDT}	=	Emission factor related to long distance transportation expressed by per ton of petrodiesel (tCO_2e/t)

5.7. Emission reductions

86. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ Equation (22)

Where:

ER_y	=	Emission reductions in year *y* (tCO_2)
BE_y	=	Baseline emissions in year *y* (tCO_2)
PE_y	=	Project emissions in year *y* (tCO_2)
LE_y	=	Leakage emissions in year *y* (tCO_2)

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

87. Refer to the "Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" (Annex 1 of the "Procedures for renewal of the crediting period of a registered CDM project activity").[11]

5.9. Data and parameters not monitored

Baseline Emissions

Data / Parameter table 1.

Data / Parameter:	NCV_{FF}
Data unit:	GJ/t
Description:	Net calorific value of fossil fuel petrodiesel displaced
Source of data:	2006 IPCC Guidelines for GHG Inventories
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	$EF_{CO2,FF}$
Data unit:	tCO_2/GJ
Description:	Carbon dioxide emissions factor for fossil fuel petrodiesel displaced
Source of data:	Default value may be derived from 2006 IPCC Guidelines, or from national statistics, if available
Measurement procedures (if any):	-
Any comment:	Local or national data should be preferred. Default values from the IPCC may be used alternatively

Project Emissions

Data / Parameter table 3.

Data / Parameter:	MCF_p
Data unit:	%
Description:	Methane conversion factor
Source of data:	The source of data should be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain

[11] <https://cdm.unfccc.int/Reference/Procedures/reg_proc04.pdf>.

Measurement procedures (if any):	-
Any comment:	Preferably local specific value should be used. In absence of local values, MCF_p default values can be obtained from table 6.3, chapter 6, volume 4 from IPCC 2006 guidelines

Data / Parameter table 4.

Data / Parameter:	B_0
Data unit:	t CH_4/t COD
Description:	Maximum methane producing capacity
Source of data:	IPCC 2006 guidelines specifies the value for B_0 as 0.25 kg CH_4/kg COD. Taking into account the uncertainty of this estimate, project participants should use a value of 0.265 kg CH_4/kg COD as a conservative assumption for B_o
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data:	IPCC
Measurement procedures (if any):	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$EF_{C,MeOH}$
Data unit:	tC/tMeOH
Description:	Carbon emissions factor of methanol, based on molecular weight
Source of data:	-
Measurement procedures (if any):	Use the value of 0.375 (calculated as 12/32)
Any comment:	-

~~**Leakage**~~

Data / Parameter table 7.

Data / Parameter:	EF_{MeOH_PC}
Data unit:	tCO_2/t MeOH
Description:	Pre-combustion (i.e. upstream) emissions factor for methanol production

Source of data:	Apple 1998: <http://edj.net/sinor/SFR4-99art7.html> and 2006 IPCC Guidelines
Measurement procedures (if any):	1.95 tCO_2/t produced methanol
Any comment:	Based on 30 GJ/t energy requirement and average of IPCC emissions factors for natural gas and diesel oil

Data / Parameter table 8.

Data / Parameter:	NCV_L
Data unit:	GJ/t
Description:	Net calorific value of the fossil fuel likely to substitute waste oil / fat or biomass residues.
Source of data:	2006 IPCC Guidelines for GHG Inventories
Measurement procedures (if any):	-
Any comment:	Identification of the fossil fuel shall be made taking into account common practice

Data / Parameter table 9.

Data / Parameter:	$EF_{i,j,x,y}$
Data unit:	tCO_2e/TJ
Description:	Emission factor for upstream emissions stage i associated with consumption of fossil fuel type x from fossil fuel origin j applicable to year y
Source of data:	-
Value to be applied:	$EF_{i,j,x,y}$ shall be determined in accordance with the Methodological tool: “Upstream leakage emissions associated with fossil fuel use”
Any comment:	-

~~**Data / Parameter table 10.**~~

~~**Data / Parameter:**~~	~~$EF_{CO2,L}$~~
~~Data unit:~~	~~tCO_2/GJ~~
~~Description:~~	~~Carbon dioxide emission factor of the most carbon intensive fuel oil in the country~~
~~Source of data:~~	~~Reliable official data (e.g. official statistics and government publication publications)~~
~~Measurement procedures (if any):~~	~~-~~
~~Monitoring frequency:~~	~~Annually~~
~~Any comment:~~	~~Local or national data should be preferred. Default values from the 2006 IPCC Guidelines may be used alternatively and should be chosen in a conservative manner~~

~~Data / Parameter table 11.~~

~~**Data / Parameter:**~~	~~$COEF_{WOF,I}$~~
~~Data unit:~~	~~Dimensionless~~
~~Description:~~	~~Coefficient of substitution of fossil fuel to waste oil / fat to produce the substance previously produced by waste oil / fat~~
~~Source of data:~~	~~Industry data~~
~~Measurement procedures (if any):~~	~~-~~
~~Monitoring frequency:~~	~~Annually~~
~~Any comment:~~	~~Local or national data should be preferred. Identification of the fossil fuel shall be made taking into account common practice~~

~~Data / Parameter table 12.~~

~~**Data / Parameter:**~~	~~EF_{PROD}~~
~~Data unit:~~	~~tCO_2e/t petrodiesel~~
~~Description:~~	~~Emission factor for production of crude oil~~
~~Source of data:~~	~~-~~
~~Value to be applied:~~	~~The emission factor for the production of crude oil (EF_{PROD}) is 0.073 tCO_2e/t petrodiesel[12]. A global value was calculated with the assumption that that upstream emissions with respect to crude oil production in Annex I countries is zero~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 13.~~

~~**Data / Parameter:**~~	~~EF_{REF}~~
~~Data unit:~~	~~tCO_2e/t petrodiesel~~
~~Description:~~	~~Emission factor related to oil refinery~~
~~Source of data:~~	~~-~~
~~Value to be applied:~~	~~The emission factor related to oil refinery (EF_{REF}) shall be one of the following:~~ ~~(a) In the absence of a country-specific data, a global average figure of 0.233t-CO_2e/t-petrodiesel can be used.[13]~~ ~~(b) If refining occurs in the host country, reliable local emission factors from an official information source (e.g. national communications) may be used instead of the default emission factor~~
~~Any comment:~~	~~-~~

[12] This value was calculated using data from World Bank GGFR (amount of flared gas) and BP statistical review (crude oil production) for the year 2005.

[13] This value was calculated using data from IEA for the year 2005 and NCV values from IPCC 2006 Guidelines.

Data / Parameter table 14.

Data / Parameter:	***EF_{LDT}***
Data unit:	tCO_2e/t petrodiesel
Description:	Emission factor related to long distance transportation
Source of data:	-
Value to be applied:	Reliable local emission factors from an official information source (e.g. national communications)
Any comment:	-

Data / Parameter table 15.

Data / Parameter:	***$EF_{CO2,i}$***
Data unit:	tCO_2/TJ
Description:	CO_2 emissions factor for fossil fuel type *i*
Source of data:	The following data sources may be used if the relevant conditions apply:
Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards
Any comment:	-

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% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If (a) is not available

6. Monitoring methodology

6.1. Monitoring procedures

88. Describe and specify in the draft CDM-PDD all monitoring procedures, including the type of measurement instrumentation used, the responsibilities for monitoring and QA/QC procedures that will be applied. Where the methodology provides different options (e.g. use of default values or on-site measurements), specify which option will be used. All meters and instruments should be calibrated regularly as per industry practices.

89. Biofuel ~~Biodiesel~~ production must apply national industry standards on QA/QC or, if there are no national QA/QC standards yet, apply industry standards from mature biofuel ~~biodiesel~~ production markets such as in Brazil, Europe or US.

6.2. Specific CDM related monitoring procedures

90. The quality manual necessary under the above mentioned QA/QC standards shall include a section describing the elements of the CDM related monitoring procedures and how to assure and control their quality. A quality management representative from the project participant shall ensure that the monitoring procedures are established and that they meet the requirements as specified in this methodology.

91. Monitoring the plant inputs and outputs required for calculating leakage, baseline and project emissions shall be based on a complete documented mass balance, adjusted for stock changes, covering:

    (a) Amounts of waste oil/fat or biomass residues purchased and processed, if applicable;

    (b) Amounts of feedstock from dedicated plantations purchased and processed; if applicable;

    (c) Amounts of catalysts purchased, processed and recovered;

    (d) Amounts of methanol purchased and processed;

    (e) Amounts of glycerol or other by-products produced and incinerated and/or sold for utilization;

    (f) Amounts of blended ~~biodiesel~~ biofuel ~~delivered to consumers and~~ consumed, sold or blended.

92. This mass balance shall be based on a combination of purchase/sales records and records of measurements, in accordance with the measuring instruments available at the plant and stationary consumers or fuelling stations of the captive fleet owner in case of use in transport sector. The mass balance serves as a QA/QC instrument to crosscheck results of monitoring parameters as defined in the following section.

93. The following procedure shall be used to verify the actual amount of ~~biodiesel~~ biofuel from waste oil/fat or biomass residues that is consumed by the end user for displacement of

fossil fuel petrodiesel and its correspondence with the produced amount of biodiesel biofuel from waste oil/fat or biomass residues:

(a) If the biodiesel biofuel is produced from waste oil/fat or biomass residues the produced amount of biofuel from these sources is recorded by a periodically calibrated metering system;

(b) If the biodiesel biofuel is produced from feedstock oil seeds cultivated in dedicated plantations, the produced amount of biodiesel biofuel from feedstock from dedicated plantations is recorded by a periodically calibrated metering system;

(c) The amount of biodiesel biofuel produced from waste oil/fat, biomass residues, or from feedstock from dedicated plantations transported to the storage of the blender is recorded by a calibrated metering system at the point of filling the (road) tankers and at the point of delivery at the blender site;

(d) During the process of creating the biodiesel biofuel blend at the blending station, the blending operation shall be monitored to assure adequate mixing of the products in the specified proportions. This includes measuring and recording the volumes and blend levels as verified through bills of lading, meter printouts or other auditable records of both the biofuel and fossil fuel, which comprise the blended biodiesel biofuel;

(e) Contractually the biofuel producer has to monitor consumption by the consumer as follows:

(i) The receiving amount of blended biofuel in the gas station or final distributor has to be recorded by a calibrated metering system and the storage fill level is recorded by a calibrated filling level indicator;

(ii) For stationary installations, the amount of the blended biofuel filled into the installation or vehicle where combustion takes place must be recorded by a calibrated metering system;

(iii) If blending is done by a third party contractual arrangement shall be made, that the receiving amount of biofuel at the blending facility has to be recorded by a calibrated metering system and the storage fill level is recorded by a calibrated filling level indicator that the same monitoring procedure as described above can be applied.

94. If the biodiesel biofuel is produced from feedstock oil seeds cultivated in dedicated plantations, the following specific guidance should be taken into account:

(a) If feedstock is pre-processed off-site, the energy consumption of the corresponding facilities shall be included in the monitoring; This applies, for example, for crude vegetable oil production plant (oil mills) located in between the plantations and the biodiesel plant;

(b) Monitoring compliance with the applicability conditions.

6.3. Data Archiving

95. All data need to be archived electronically until two years after end of the crediting period.

6.4. Data and parameters monitored

~~Applicability conditions~~

Data / Parameter table 16.

Data / Parameter:	$f_{PJ,i,y}$
Data unit:	ratio
Description:	Fraction of biofuel ~~biodiesel~~ in the blended biofuel ~~biodiesel~~ from the project activity, with blending ratio *i*, in year *y*
Source of data:	Records from blending operations
Measurement procedures (if any):	Recording volumes or flows with calibrated meters
Monitoring frequency:	Every produced blend must be monitored
QA/QC procedures:	During the process of creating the blended biofuel ~~biodiesel~~ at the blending station, the blending operation shall be monitored to assure adequate mixing of the products in the correct proportions. ~~For automotive purposes the blending ratio must not exceed 20%.~~ This includes measuring and recording the volumes and blend levels as verified through bills of lading, meter printouts or other auditable records of both the biofuel and fossil fuel ~~biodiesel and diesel fuel~~, which comprise the blend
Any comment:	

Data / Parameter table 17.

Data / Parameter:	$f_{reg,y}$
Data unit:	ratio
Description:	Fraction of biofuel ~~biodiesel~~ in the blended biofuel ~~biodiesel~~ which is required by mandatory regulations of the host country in year *y*
Source of data:	Regulations in the Host Country
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 18.

Data / Parameter:	Various parameters; Compliance of biofuel ~~produced~~ with national regulations
Data unit:	Various data units
Description:	Compliance of produced biofuel ~~biodiesel~~ with national regulation, biofuel ~~biodiesel~~ properties
Source of data:	Various measurements based on national or international standards
Measurement procedures (if any):	Various methods of measurement and uncertainty analysis
Monitoring frequency:	According to national regulation, at least annually

QA/QC procedures:	According to national or international standards
Any comment:	-

Data / Parameter table 19.

Data / Parameter:	$MP_{Glyc,y}$
Data unit:	t
Description:	Amount of by-product (e.g. glycerol) produced during plant operation
Source of data:	Project participants
Measurement procedures (if any):	Volumetric flow meter including a volume integrator or load cell to measure the weight of produced by-product
Monitoring frequency:	All quantity of produced by-product ~~glycerol~~ must be monitored
QA/QC procedures:	Volumetric flow meter and integrator calibrated periodically Load cell calibrated periodically. Measured amounts to be crosschecked against mass balance of the biofuel ~~biodiesel~~ production unit
Any comment:	This monitored parameter is used to meet the applicability condition “The by-product (e.g. glycerol) is not disposed of or left to decay. It should be either incinerated or used as raw material for industrial consumption or sold”. $MP_{Glyc,y}$ should be equal to $MU_{Glyc,y}$

Data / Parameter table 20.

Data / Parameter:	$MU_{Glyc,y}$
Data unit:	t
Description:	Amount of by-product (e.g. glycerol) incinerated or sold or used
Source of data:	Project participants, based on sales data and internal records in case of use inside the plant or incinerated
Measurement procedures (if any):	-
Monitoring frequency:	All produced by-product must be tracked via sales data or internal records or its mode of disposal checked by DOE (incl. visual inspection of facilities and record of incineration or disposal if any)
QA/QC procedures:	DOE to check the produced by-product was marketed
Any comment:	This monitored parameter is used to meet the applicability condition “The by-product (e.g. glycerol) is not disposed of or left to decay. It should be either incinerated or used as raw material for industrial consumption or sold”

Data / Parameter table 21.

Data / Parameter:	$P_{BDF,y}$
Data unit:	t
Description:	Quantity of biofuel ~~biodiesel~~ produced in the project plant in year *y*
Source of data:	On-site measurements by the project participants
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning

Monitoring frequency:	All produced biofuel biodiesel must be metered
QA/QC procedures:	Cross check production and consumption data with sales records
Any comment:	-

Data / Parameter table 22.

Data / Parameter:	$P_{BDF,on-site,y}$
Data unit:	t
Description:	Quantity of biofuel biodiesel consumed at the project biofuel biodiesel production plant and/or the oil production plant(s) in year *y*
Source of data:	On-site measurements by the project participants
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning
Monitoring frequency:	All consumed biofuel must be metered
QA/QC procedures:	Cross check production and consumption data with sales records
Any comment:	-

Data / Parameter table 23.

Data / Parameter:	$PD_{BDF,other,y}$
Data unit:	t
Description:	Quantity of biofuel biodiesel that is either produced with alcohols other than methanol from fossil origin or produced using feedstock other than those eligible under this methodology according to the applicability conditions in year *y*
Source of data:	On-site measurements by the project participants
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning
Monitoring frequency:	All consumed biofuel must be metered
QA/QC procedures:	Cross check production and consumption data with sales records
Any comment:	-

Data / Parameter table 24.

Data / Parameter:	$C_{BDF,i,y}$
Data unit:	t
Description:	Quantity of biofuel biodiesel with blending ratio *i*, consumed/sold to identified consumer/blended in year *y*
Source of data:	Metering system at fuelling stations
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning
Monitoring frequency:	Continuous recording of filling consumers´ stationary combustion installations or vehicles
QA/QC procedures:	Cross check production and consumption data with sales records

Any comment:	Project participants shall determine $C_{BF,i,y}$ as follows: - For (blended) biofuels that are consumed in stationary installations, $C_{BF,i,y}$ shall be based on the monitored amount of biofuels consumed; - For (blended) biofuels that are sold to an identified consumer group $C_{BF,i,y}$, shall be based on the monitored amount of (blended) biofuel sold; - For biofuels that are blended but neither used in stationary facilities nor sold to an identified consumer group, $C_{BF,i,y}$, shall be based on the amount of biofuel blended at the blending facility(ies).

Data / Parameter table 25.

Data / Parameter:	$NCV_{BDF,y}$
Data unit:	GJ/t
Description:	Net calorific value of biofuel ~~biodiesel~~ produced in year *y*
Source of data:	Laboratory analysis
Measurement procedures (if any):	Measured according to relevant national or international standards regulating determination of NCV by calibrated equipment
Monitoring frequency:	Annually
QA/QC procedures:	Check consistency of measurements and local / national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements
Any comment:	Analysis has to be carried out by accredited laboratory. A sample is representative if uncertainty of the NCV does not exceed ±5% at 95% confidence level

~~**Project emissions**~~

Data / Parameter table 26.

Data / Parameter:	$MC_{MeOH,y}$
Data unit:	tMeOH
Description:	Quantity of methanol consumed in the biofuel ~~biodiesel~~ plant, including spills and evaporations on-site in year *y*
Source of data:	Mass meters
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning. The methanol consumption should be net of any water content. Methanol spilled and evaporated on the project site should be considered as consumption for estimating the emissions
Monitoring frequency:	Continuously
QA/QC procedures:	Crosscheck against methanol purchase receipts and calculated stochiometric requirements

Any comment:	Adjust for stock changes when comparing purchase data with consumption data; also used for leakage calculations. Use most conservative values. Any spills on-site and evaporation are accounted as consumption. Please note that data should also report the source of methanol - from fossil fuel or non-fossil fuel sources. As per the applicability only biofuel biodiesel produced using fossil fuel based methanol can be credited

Data / Parameter table 27.

Data / Parameter:	$MT_{m,y}$
Data unit:	t
Description:	Material m transported in year *y*
Source of data:	Plant record, Records of truck operators
Measurement procedures (if any):	Mass or volumetric (including quantity integrator) meters (e.g. load cell)
Monitoring frequency:	Every Material transported (e.g. oil seeds, vegetable oil and biodiesel) must be monitored
QA/QC procedures:	Crosscheck data provided by trucks delivering the material with measured feedstock inputs at plant. Use most conservative values
Any comment:	-

Data / Parameter table 28.

Data / Parameter:	AVD_m
Data unit:	Km
Description:	Average distance travelled by vehicles transporting material m, including the return trip(s)
Source of data:	Records of truck operator
Measurement procedures (if any):	Vehicle odometer
Monitoring frequency:	Annually
QA/QC procedures:	Check consistency of distance records provided by the truck operators by comparing recorded distances with other information from other sources (e.g. maps)
Any comment:	If material m is supplied from different sites, this parameter should correspond to the mean value of km travelled by trucks that supply the biodiesel plant

Data / Parameter table 29.

Data / Parameter:	TL_m
Data unit:	t
Description:	Average truck load for vehicles transporting material *m*
Source of data:	Records of truck operator; plant records, vehicle manufacturer information
Measurement procedures (if any):	-

Monitoring frequency:	Annually
QA/QC procedures:	Cross check against vehicle manufacturer's capacity rating
Any comment:	-

Data / Parameter table 30.

Data / Parameter:	***EF_{TR}***
Data unit:	tCO_2 /km
Description:	Carbon dioxide emission factor for vehicles transporting material m and biodiesel
Source of data:	Measurements or local / national data should be preferred. Default values from the IPCC may be used alternatively
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	Check consistency of measurements and local / national data with default values from IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements
Any comment:	Local or national data should be preferred. Default values from the IPCC may be used alternatively and should be chosen in a conservative manner

Data / Parameter table 31.

Data / Parameter:	***$FC_{m,i,y}$***
Data unit:	t
Description:	Fuel consumption of type *i* for transporting material m in year *y*
Source of data:	Truck operator records
Measurement procedures (if any):	-
Monitoring frequency:	All consumed fuel must be metered.
QA/QC procedures:	Crosscheck fuel purchase data with average consumption for the type of vehicle provided by the manufacturer
Any comment:	Fuel purchase data must be adjusted for stock changes. Subscript *i* denotes different fuel types

Data / Parameter table 32.

Data / Parameter:	***$Q_{COD,y}$***
Data unit:	m^3
Description:	Amount of wastewater treated anaerobically or released untreated from the feedstock crude vegetable oil production plant in year *y*
Source of data:	Measured value by flow meter
Measurement procedures (if any):	-
Monitoring frequency:	Monthly aggregated annually

QA/QC procedures:	The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy
Any comment:	If the wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored

Data / Parameter table 33.

Data / Parameter:	$P_{COD,y}$
Data unit:	$tCOD/m^3$
Description:	Chemical Oxygen Demand (COD) of wastewater in year *y*
Source of data:	Measured value by purity meter
Measurement procedures (if any):	-
Monitoring frequency:	Monthly and averaged annually
QA/QC procedures:	The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy
Any comment:	If the wastewater is treated aerobically, emissions are assumed to be zero, and hence this parameter does not need to be monitored

Data / Parameter table 34.

Data / Parameter:	$AF_{1,y}$
Data unit:	Fraction
Description:	Allocation factor for the production of biofuel ~~biodiesel~~ in year *y*
Source of data:	
Measurement procedures (if any):	Estimated as per the Methodological tool: “Apportioning emissions from production processes between main product and co-and by-product” ~~“Guidance on apportioning of emissions to co-products and by-products~~
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 35.

Data / Parameter:	$AF_{2,y}$
Data unit:	Fraction
Description:	Allocation factor for the biomass cultivation in dedicated plantations in year *y*
Source of data:	-
Measurement procedures (if any):	Estimated as per the Methodological tool: “Apportioning emissions from production processes between main product and co-and by-product” ~~“Guidance on apportioning of emissions to co-products and by-products~~
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 36.

Data / Parameter:	$A_{s,y}$
Data unit:	Ha
Description:	Area in which biomass ~~oil seed~~ 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:	-

~~**Leakage**~~

~~**Data / Parameter table 37.**~~

~~**Data / Parameter:**~~	~~$WOF_{DS,y}$~~
~~Data unit:~~	~~t~~
~~Description:~~	~~Statistical mean value obtained from surveys or other sources for the demand for waste oil/fat, including the project activity, in the defined region~~
~~Source of data:~~	~~Demand by the project activity is known. Other demand can be determined by:~~ ~~reliable official data from authorities; scientific publications; market data from waste collection companies and companies utilizing waste oil/fat ; third party statistically representative surveys that shall include a list of potential uses of waste oil/fats, interviews with collection companies or companies using waste oil/fats, etc.~~
~~Measurement procedures (if any):~~	~~-~~
~~Monitoring frequency:~~	~~Annually~~
~~QA/QC procedures:~~	~~The calculated demand for waste oil/fat shall be based on at least 2 of the above mentioned data sources and associated uncertainties. The most conservative result considering the most conservative uncertainty limit should be adopted~~
~~Any comment:~~	~~Formal and informal market demand for waste oil/fat, including the project activity, in the defined region~~

~~**Data / Parameter table 38.**~~

~~**Data / Parameter:**~~	~~$WOF_{SS,y}$~~
~~Data unit:~~	~~t~~
~~Description:~~	~~Statistical mean value obtained from surveys or other sources for the supply of waste oil/fat in the defined region~~

Source of data:	Reliable official data from authorities; scientific publications; market data from waste collection companies; third party statistically representative survey that shall include oil consumption data, information about fat absorption data of cooked food, etc.; compare with data from other countries
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	The calculated supply for waste oil/fat shall be based on at least 2 of the above mentioned data sources and associated uncertainties. The most conservative result considering the most conservative uncertainty limit should be adopted
Any comment:	Supply for waste oil/fat in the defined region

Data / Parameter table 39.

Data / Parameter:	u_D
Data unit:	t
Description:	Uncertainty for waste oil/fat demand
Source of data:	Demand by the project activity is known. Other demand can be determined by: reliable official data from authorities; scientific publications; market data from waste collection companies and companies utilizing waste oil/fat ; third party statistically representative surveys that shall include a list of potential uses of waste oil/fats, interviews with collection companies or companies using waste oil/fats, etc.
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	The calculated demand for waste oil/fat shall be based on at least 2 of the above mentioned data sources and associated uncertainties. The most conservative result considering the most conservative uncertainty limit should be adopted.
Any comment:	Surveys must be realized with a 95% confidence interval. This confidence interval corresponds to the guidelines issued by the EB in its 22nd meeting Annex 2 (EB 22 report, Annex 2, D, page 3): “Methodologies employing sampling to derive parameters in estimating emissions reductions shall quantify these parameter uncertainties at the 95% confidence level”

Data / Parameter table 40.

Data / Parameter:	u_S
Data unit:	t
Description:	Uncertainty for waste oil/fat supply in the defined region

~~Source of data:~~	~~Supply of waste oil/fat in the region defined by the project can be determined by: reliable official data from authorities; scientific publications; market data from waste collection companies and companies utilizing waste oil/fat ; third party statistically representative surveys that shall include a list of potential uses of waste oil/fats, interviews with collection companies or companies using waste oil/fats, etc.~~
~~Measurement procedures (if any):~~	~~-~~
~~Monitoring frequency:~~	~~Annually~~
~~QA/QC procedures:~~	~~The calculated supply for waste oil/fat shall be based on at least 2 of the above mentioned data sources and associated uncertainties. The most conservative result considering the most conservative uncertainty limit should be adopted.~~
~~Any comment:~~	~~Surveys must be realized with a 95% confidence interval. This confidence interval corresponds to the guidelines issued by the EB in its 22nd meeting Annex 2 (EB 22 report, Annex 2, D, page 3): "Methodologies employing sampling to derive parameters in estimating emissions reductions shall quantify these parameter uncertainties at the 95% confidence level"~~

Appendix 1. Project emissions associated with the cultivation of lands to produce oil seeds

1. Definitions

96. **Project area** - the total land area where biomass is cultivated under the CDM project activity.

2. N_2O emissions from the application of fertilizers

$$PE_{N2O-N,Fer,y} = F_{N,y} \times EF_{N2O-N,dir} \times GWP_{N2O} \times \frac{44}{28}$$ Equation (1)

Where:

$PE_{N2O-N,Fer,y}$	=	Direct N_2O-N emissions from land management at the plantation in year *y* (tCO_2e)
$F_{N,y}$	=	Amount of synthetic fertilizer nitrogen and organic fertilizer nitrogen from animal manure, sewage, compost or other organic amendments applied at the plantation in year *y* (t N). Where $F_{N,y} = F_{ON,y} + F_{SN,y}$
$EF_{N2O-N,dir}$	=	Emission factor for direct nitrous oxide emissions from Nitrogen inputs (Default Value 0.01 t N_2O-N/t N)
GWP_{N2O}		Global Warming Potential of N_2O (tCO_2e/tN_2O)

97. The amount of organic fertilizer N applied at the plantation ($F_{ON,y}$) is calculated based on the quantity of organic fertilizer applied and the N content in the organic fertilizer, as follows:

$$F_{ON,y} = \sum_{p} M_{OF,p,y} \times w_{N,p,y}$$ Equation (2)

Where:

$F_{ON,y}$	=	Amount of organic fertilizer nitrogen from animal manure, sewage, compost or other organic amendments applied at the plantation in year *y* (t N)
$M_{OF,p,y}$	=	Amount of organic fertilizer *p* applied at the plantation in year *y* (t organic fertilizer)
$w_{N,p,y}$	=	Weight fraction of nitrogen in organic fertilizer type *p* (t N / t organic fertilizer)
p	=	Organic fertilizer types (animal manure, sewage, compost or other organic amendments) applied at the plantation in year *y*

98. The amount of synthetic fertilizer N applied at the plantation ($F_{SN,y}$) is calculated based on the quantity of synthetic fertilizer applied and the N content in the synthetic fertilizer, as follows:

$$F_{SN,y} = \sum_{q} M_{SF,q,y} \times w_{N,q,y}$$ Equation (3)

Where:

$F_{SN,y}$	=	Amount of synthetic fertilizer nitrogen applied at the plantation in year *y* (t N)
$M_{SF,q,y}$	=	Amount of synthetic fertilizer *q* applied at the plantation in year *y* where *q* are the synthetic fertilizer types applied at the plantation in year *y* (t fertilizer/yr)
$w_{N,q,y}$	=	Weight fraction of nitrogen in synthetic fertilizer type *q* (t N /t synthetic fertilizer)
q	=	Synthetic fertilizer types applied at the plantation in year *y*

2.1. Data and parameters not monitored

Data / Parameter table 1.

Data / Parameter:	$EF_{N2O-N,dir}$
Data unit:	tN_2O-N/tN input
Description:	Emissions factor for direct N_2O emissions from N inputs
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.1
Value to be applied:	0.01
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	GWP_{N2O}
Data unit:	tCO_2e/tN_2O
Description:	Global Warming Potential of N_2O
Source of data:	IPCC 1996
Value to be applied:	310 for the first commitment period
Any comment:	-

2.2. Data and parameters monitored

Data / Parameter table 3.

Data / Parameter:	$M_{OF,p,y}$
Data unit:	t organic fertilizer

~~Description:~~	~~Amount of organic fertilizer *p* applied at the plantation in year *y* where *p* are the organic fertilizer types (animal manure, sewage, compost or other organic amendments) applied at the plantation in year *y*~~
~~Source of data:~~	~~On-site records and measurements~~
~~Measurement procedures (if any):~~	~~Measure the quantities of any animal manure, sewage, compost or other organic amendments applied as fertilizers to the plantation~~
~~Monitoring frequency:~~	~~Continuously~~
~~QA/QC procedures:~~	~~-~~
~~Any comment:~~	~~-~~

~~**Data / Parameter table 4.**~~

~~**Data / Parameter:**~~	~~$w_{N,p,y}$~~
~~Data unit:~~	~~tN/t organic fertilizer~~
~~Description:~~	~~Weight fraction of nitrogen in organic fertilizer type *p* where *p* are the organic fertilizer types (animal manure, sewage, compost or other organic amendments) applied at the plantation in year *y*~~
~~Source of data:~~	~~Sample measurements by project participants~~
~~Measurement procedures (if any):~~	~~Where applicable, measure the quantities and nitrogen content of any animal manure, sewage, compost or other organic amendments applied as fertilizers to the dedicated plantation~~
~~Monitoring frequency:~~	~~Regularly~~
~~QA/QC procedures:~~	~~-~~
~~Any comment:~~	~~-~~

~~**Data / Parameter table 5.**~~

~~**Data / Parameter:**~~	~~$M_{SF,q,y}$~~
~~Data unit:~~	~~t synthetic fertilizer~~
~~Description:~~	~~Amount of synthetic fertilizer *q* applied at the plantation in year *y* where *q* are the synthetic fertilizer types applied at the plantation in year *y*~~
~~Source of data:~~	~~On-site records by project participants~~
~~Measurement procedures (if any):~~	~~-~~
~~Monitoring frequency:~~	~~Continuously~~
~~QA/QC procedures:~~	~~Cross-check records of applied quantities with purchase receipts~~
~~Any comment:~~	~~-~~

~~**Data / Parameter table 6.**~~

~~**Data / Parameter:**~~	~~$w_{N,q,y}$~~
~~Data unit:~~	~~tN/t synthetic fertilizer~~
~~Description:~~	~~Weight fraction of nitrogen in synthetic fertilizer type *q* where *q* are the synthetic fertilizer types applied at the plantation in year *y*~~
~~Source of data:~~	~~Specifications by the fertilizer manufacturer~~

Measurement procedures (if any):	-
Monitoring frequency:	Continuously
QA/QC procedures:	-
Any comment:	-

3. CO_2 emissions from urea application

99. Adding urea to soils leads to a loss of CO_2 that was fixed in the industrial production process. Urea ($CO(NH_2)_2$) is converted into ammonium, hydroxyl ion and bicarbonate in the presence of water and urease enzymes in the soil. The bicarbonate evolves into CO_2 and water. CO_2 emissions from urea application are calculated as follows:

$$PE_{urea,y} = M_{urea,y} \times EF_{CO2,urea} \times \frac{44}{12}$$ Equation (4)

Where:

$PE_{urea,y}$	=	Project emissions from urea application at the plantation in year *y* (tCO_2)
$M_{urea,y}$	=	Quantity of urea applied at the plantation in year *y* (t urea)
$EF_{CO2,urea}$	=	CO_2 emission factor for urea application (Default Value 0.2 tCO_2/t urea)

3.1. Data and parameters not monitored

Data / Parameter table 7.

Data / Parameter:	***$EF_{CO2,urea}$***
Data unit:	t CO_2/t urea
Description:	CO_2 emission factor for urea application
Source of data:	2006 IPCC Guidelines for National GHG Inventories, Vol. 5, Ch. 11, Page 11.32
Value to be applied:	0.2
Any comment:	-

3.2. Data and parameters monitored

Data / Parameter table 8.

Data / Parameter:	***$M_{urea,y}$***
Data unit:	t urea
Description:	Quantity of urea applied at the plantation in year *y*
Source of data:	Records by project participants
Measurement procedures (if any):	-
Monitoring frequency:	Continuously

QA/QC procedures:	Cross-check records of applied quantities with purchase receipts
Any comment:	-

4. CO_2 emissions from application of limestone and dolomite

100. Adding carbonates to soils in the form of lime (e.g. calcic limestone ($CaCO_3$) or dolomite ($CaMg(CO_3)_2$) leads to CO_2 emissions as the limes dissolve and release bicarbonate, which evolves into CO_2 and water. The Tier 1 approach from the 2006 IPCC Guidelines for National GHG Inventories is used to estimate these emissions. CO_2 emissions from liming at the plantation are estimated as follows:

$$PE_{lime,y} = \left(M_{limestone,y} \times EF_{limestone} + M_{dolomite,y} \times EF_{dolomite}\right) \times \frac{44}{12} \qquad \text{Equation (5)}$$

Where:

$PE_{lime,y}$	=	Project emissions from application of limestone and dolomite at the plantation in year *y* (tCO_2)
$M_{limestone,y}$	=	Quantity of calcic limestone ($CaCO_3$) applied at the plantation in year *y* ($tCaCO_3$)
$M_{dolomite,y}$	=	Quantity of dolomite ($CaMg(CO_3)_2$) applied at the plantation in year *y* ($t\ Ca\ Mg(CO_3)_2$)
$EF_{limestone}$	=	Carbon emission factor for calcic limestone ($CaCO_3$) application (Default Value 0.12 $tC/tCaCO_3$)
$EF_{dolomite}$	=	Carbon emission factor for dolomite ($CaMg(CO_3)_2$) application (Default Value 0.13 $tC/tCaMg(CO_3)_2$)

4.1. Data and parameters not monitored

Data / Parameter table 9.

Data / Parameter:	$EF_{limestone}$
Data unit:	$tC/tCaCO_3$
Description:	Carbon emission factor for calcic limestone ($CaCO_3$) application
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11 Section 11.3.1
Measurement procedures (if any):	0.12
Any comment:	-

Data / Parameter table 10.

Data / Parameter:	$EF_{dolomite}$
Data unit:	$tC/tCaMg(CO_3)_2$
Description:	Carbon emission factor for dolomite ($CaMg(CO_3)_2$) application
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11 Section 11.3.1
Measurement procedures (if any):	0.13
Any comment:	-

4.2. Data and parameters monitored

Data / Parameter table 11.

Data / Parameter:	$M_{Limestone,y}$
Data unit:	$tCaCO3$
Description:	Quantity of calcic limestone ($CaCO3$) applied at the plantation in year *y*
Source of data:	Records by project participants
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	Cross-check records of applied quantities with purchase receipts
Any comment:	-

Data / Parameter table 12.

Data / Parameter:	$M_{Dolomite,y}$
Data unit:	$tCaMg(CO_3)_2$
Description:	Quantity of dolomite ($CaMg(CO_3)_2$) applied at the plantation in year *y*
Source of data:	Records by project participants
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	Cross-check records of applied quantities with purchase receipts
Any comment:	--

5. Identification and stratification of the project area

101. Project participants should identify and transparently document the project area (i.e. the land area where biomass is cultivated under the CDM project activity) in the CDM-PDD, delineating the project area with GPS data.

102. Project participants should identify and describe in the CDM-PDD the key features of the project area, including, inter alia, the following elements:

(a) The applicable climate region according to the default IPCC classification, applying the guidance in Annex 3A.5 of Chapter 3, Volume 4, of the 2006 IPCC Guidelines;

(b) The relevant soil type according to World Reference Base for Soil Resources (WRB) or USDA soil classifications, following the decision trees in Annex 3A.5 of Chapter 3, Volume 4, of the 2006 IPCC Guidelines;

(c) The vegetation type before the implementation of the project activity;

(d) Whether and how any land clearance is undertaken (e.g. harvesting, burning, etc.);

(e) The land-use type (forest or cropland) under the project activity;

(f) The land management practices that are applied under the project activity.

103. If one or several of the above-mentioned features differ within the project area, project participants should stratify the land area in different strata *s* according to the features above. The land area of each stratum ($A_{PJ,s}$) should be clearly delineated in the CDM-PDD, using GPS data, and the features of each stratum should be transparently documented. Project participants may use geographical information systems (GIS) for that purpose.

6. CH_4 and N_2O emissions from the field burning of biomass

104. Biomass from the plantation may be burnt regularly during the crediting period (e.g. after harvest). In these cases, CH_4 and N_2O emissions should be calculated for each time that field burning is occurring, as follows:

$$PE_{FB,y} = \sum_{s_{FB}} A_{PJ,s_{FB}} \times M_{B,s_{FB}} \times C_{f,s_{FB}} \times \left(EF_{N2O,FB} \times GWP_{N2O} + EF_{CH4,FB} \times GWP_{CH4}\right)$$ Equation (6)

Where:

$PE_{FB,y}$	=	Project emissions from field burning of biomass at the plantation site in year *y* (tCO_2e)
$A_{PJ,s_{FB}}$	=	Size of the land area of stratum s_{FB} (ha)
$M_{B,s_{FB}}$	=	Average mass of biomass available for burning on stratum s_{FB} (t dry matter/ha)
$C_{f,s_{FB}}$	=	Combustion factor, accounting for the proportion of biomass that is actually burnt on stratum s_{FB} (dimensionless)
$EF_{N2O,FB}$	=	N_2O emission factor for field burning of biomass (tN_2O/t dry matter). IPCC default values will be used, see guidance below
GWP_{N2O}	=	Global Warming Potential of N_2O (tCO_2e/tN_2O)
$EF_{CH4,FB}$	=	CH_4 emission factor for field burning of biomass (tCH_4/t dry matter). IPCC default values will be used, see guidance below
GWP_{CH4}	=	Global warming Potential of CH_4 (tCO_2e/tCH_4)
s_{FB}	=	Strata of the project area where biomass is burnt in year *y*[1]

6.1. Data and parameters not monitored

Data / Parameter table 13.

Data / Parameter:	***EF$_{N2O,FB}$***
Data unit:	tN_2O/t dry matter
Description:	N_2O emission factor for field burning of biomass
Source of data:	Select the most suitable value to the type of biomass from the 2006 IPCC Guidelines, Vol. 4, Ch. 2, Table 2.5

[1] If biomass on a stratum is burnt two or more times in the year, emissions from this stratum should be accounted each time burning is occurring.

Value to be applied:	-
Any comment:	-

Data / Parameter table 14.

Data / Parameter:	***$EF_{CH4,FB}$***
Data unit:	tCH_4/t dry matter
Description:	CH_4 emission factor for field burning of biomass
Source of data:	Select the most suitable value to the type of biomass from the 2006 IPCC Guidelines, Vol. 4, Ch. 2, Table 2.5
Value to be applied:	-
Any comment:	-

Data / Parameter table 15.

Data / Parameter:	***GWP_{CH4}***
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data:	IPCC
Value to be applied:	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions
Any comment:	-

6.2. Data and parameters monitored

Data / Parameter table 16.

Data / Parameter:	$M_{B,s_{FB}}$
Data unit:	t dry matter /ha
Description:	Average mass of biomass available for burning on stratum s_{FB} where s_{FB} are the strata of the project area where biomass is burnt in year *y*
Source of data:	Sample measurements by project participants
Measurement procedures (if any):	-
Monitoring frequency:	Each time field burning takes place
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 17.

Data / Parameter:	$C_{f,s_{FB}}$
Data unit:	-
Description:	Combustion factor, accounting for the proportion of biomass that is actually burnt on stratum s_{FB} where s_{FB} are the strata of the project area where biomass is burnt in year *y*

Source of data:	Sample measurements by project participants or assume a default value of 1
Measurement procedures (if any):	Measure the remaining biomass after field burning (if any)
Monitoring frequency:	Each time field burning takes place
QA/QC procedures:	-
Any comment:	-

7. Direct N_2O emissions from land management at the plantation ($PE_{N2O\text{-}N,dir,y}$)

105. N_2O emissions from land management at the plantation can occur from the following activities:

(a) Nitrogen in crop residues (above-ground and below-ground);

(b) Nitrogen mineralization associated with loss of soil organic matter resulting from change of land use or a change of management practices of mineral soils (applicable in case of mineral soils);

(c) Drainage/management of organic soils (applicable in case of organic soils).

106. Some emission sources may not be relevant for certain project types. Project participants should document and justify in the CDM-PDD which of these activities may occur in the context of the proposed project activity.

107. Direct soil N_2O emissions are calculated as follows:

$$PE_{N2O-N,dir,y} = \left\{ \left(\sum_{s_{CR}} F_{CR,s_{CR},y} \right) \times EF_{N2O-N,dir} + \sum_{s_{MS}} \left[F_{SOM,s_{MS},y} \times EF_{N2O-N,dir} \right] + \sum_{s_{OS}} \left[A_{PJ,s_{OS},y} \times EF_{N2O,N,OS} \right] \right\} \times GWP_{N2O} \times \frac{44}{28}$$

Equation (7)

Where:

$PE_{N2O-N,dir,y}$	=	Direct N_2O-N emissions from land management at the plantation in year *y* (tCO_2e)
$EF_{N2O-N,dir}$	=	Emission factor for direct nitrous oxide emissions from N inputs (Default Value 0.01 t N_2O-N/t N)
$F_{CR,s_{CR},y}$	=	Amount of Nitrogen in crop residues (above ground and below ground), including N-fixing crops, returned to the soil on stratum s_{CR} in year *y* (t N)
$F_{SOM,s_{MS},y}$	=	Amount of Nitrogen in the mineral soil that is mineralized on stratum s_{MS} in year *y* in association with loss of soil carbon from soil organic matter as a result of a land use change or a change in the land management practice (t N)

~~$A_{PJ,s_{OS},y}$~~	=	~~Size of the land area of stratum s_{OS} in year y (ha)~~
~~$EF_{N2O,N,OS}$~~	=	~~Emission factor for direct nitrous oxide emissions from drained/managed organic soils (t N_2O-N/ha). Default values are provided below~~
~~s_{CR}~~	=	~~Strata of the project area where crops residues, including N-fixing crops, are returned to the soil~~
~~s_{MS}~~	=	~~Strata of the project area with mineral soils~~
~~s_{OS}~~	=	~~Strata of the project area with organic soils~~

~~108. The amount of Nitrogen in crops residues returned to the soil ($F_{CR,s_{CR},y}$) is calculated for each stratum s_{CR} as follows:~~

$$F_{CR,s_{CR},y} = \sum_{c} M_{c,s_{CR},y} \times \left[R_{AG,c} \times w_{N,AG,c} \times \left(1 - Frac_{REMOVE,c,y}\right) \times \left(1 - f_{burnt,s_{CR},c,y} \times \left(1 - C_{f,c}\right)\right) + R_{BG,c} \times w_{N,BG,c}\right]$$ ~~Equation (8)~~

~~Where:~~

~~$F_{CR,s_{CR},y}$~~	=	~~Amount of Nitrogen in crop residues (above ground and below ground), including N-fixing crops, returned to the soil on stratum s_{CR} in year y (t N)~~
~~$M_{c,s_{CR},y}$~~	=	~~Quantity of crop type c that is harvested on stratum s_{CR} in year y (t dry matter)~~
~~$f_{burnt,s_{CR},c,y}$~~	=	~~Fraction of the area of stratum s_{CR}, cultivated with crop type c, that is burnt in year y~~
~~$C_{f,c}$~~	=	~~Combustion factor, accounting for the proportion of the crop residues from crop type c that are actually combusted when undertaking field burning~~
~~$R_{AG,c}$~~	=	~~Ratio of above-ground residue of crop type c to harvested yield for crop type c~~
~~$w_{N,AG,c}$~~	=	~~N content in the above-ground residues of crop type c (t N/t dry matter)~~
~~$Frac_{REMOVE,c,y}$~~	=	~~Fraction of above-ground biomass residues of crop type c that are removed from the plantation in year y~~
~~$R_{BG,c}$~~	=	~~Ratio of below-ground residue of crop type c to harvested yield for crop type c~~
~~$w_{N,BG,c}$~~	=	~~N content in the below-ground residues of crop type c (t N/t dry matter)~~
~~c~~	=	~~Crop types harvested on stratum s_{CR} in year y~~
~~s_{CR}~~	=	~~Strata of the project area where crops residues, including N-fixing crops, are returned to the soil~~

~~109. When soil Carbon is lost through oxidation as a result of a land use change or a change in land management practices, this loss will be accompanied by a simultaneous mineralization of Nitrogen. This Nitrogen is regarded as an additional source of Nitrogen~~

available for conversion to N_2O. This quantity of N ($F_{SOM,sMS,y}$) is estimated for each stratum s_{MS} as follows:

$$F_{SOM,s_{MS},y} = \frac{SOC_{historic,s_{MS}} - SOC_{PJ,s_{MS}}}{T} \times \frac{1}{R} \times A_{PJ,s_{MS},y}$$ Equation (9)

Where:

$F_{SOM,s_{MS},y}$	=	Amount of Nitrogen in the mineral soil that is mineralized on stratum s_{MS} in year y in association with loss of soil carbon from soil organic matter as a result of a land use change or a change in the land management practice (t N)
$SOC_{historic,s_{MS}}$	=	Soil organic carbon stock with the land use and land management practices on stratum s_{MS} before the implementation of the project activity (tC/ha)
$SOC_{PJ,s_{MS}}$	=	Soil organic carbon stock with the land use and land management practices on stratum s_{MS} under the project activity (tC/ha)
T	=	Time dependence of the stock change factors (years)
R	=	Carbon:Nitrogen ratio of the soil organic matter
$A_{PJ,s_{MS},y}$	=	Size of the land area of stratum s_{MS} in year y (ha)

7.1. Indirect N_2O emissions

110. Indirect N_2O emissions comprise N_2O emissions due to atmospheric decomposition of Nitrogen volatilized from the plantation and N_2O emissions from leaching/run-off:

$$PE_{N2O-N,ind,y} = \left(PE_{N2O-N,ind,ATD,y} + PE_{N2O-N,ind,L,y}\right) \times \frac{44}{28} \times GWP_{N2O}$$ Equation (10)

Where:

$PE_{N2O-N,ind,y}$	=	Indirect N_2O-N emissions from land management at the plantation in year y (tCO_2e)
$PE_{N2O-N,ind,ATD,y}$	=	Indirect N_2O-N emissions due to atmospheric deposition of nitrogen volatilized from the soil of the plantation in year y (tN_2O-N)
$PE_{N2O-N,ind,L,y}$	=	Indirect N_2O-N emissions due to leaching/run-off as a result of nitrogen application at the plantation in year y (tN_2O-N)

111. Indirect N_2O emissions due to atmospheric deposition of nitrogen volatilized from the soil of the plantation are calculated as follows:

$$PE_{N2O-N,ind,ATD,y} = \left(F_{SN,y} \times Frac_{GASF} + F_{ON,y} \times Frac_{GASM}\right) \times EF_{N2O-N,ATD}$$ Equation (11)

Where:

$PE_{N2O-N,ind,ATD,y}$	=	Indirect N_2O-N emissions due to atmospheric deposition of nitrogen volatilized from the soil of the plantation in year *y* (tN_2O-N)
$F_{SN,y}$	=	Amount of synthetic fertilizer nitrogen applied at the plantation in year *y* (t N)
$Frac_{GASF}$	=	Fraction of synthetic fertilizer N that volatilizes as NH_3 and NO_x (t N volatilized / t N applied)
$F_{ON,y}$	=	Amount of organic fertilizer nitrogen from animal manure, sewage, compost or other organic amendments applied at the plantation in year *y* (t N)
$Frac_{GASM}$	=	Fraction of organic N fertilizer that volatilizes as NH_3 and NO_x (t N volatilized / t N applied)
$EF_{N2O-N,ATD}$	=	Emission factor for =atmospheric deposition of N on soils and water surfaces (t N_2O-N / t N volatilized)

112. Indirect N_2O emissions due to leaching and runoff only need to be estimated if leaching and runoff occurs. They are calculated as follows:

$$PE_{N2O-N,ind,L,y} = \left(F_{SN,y} + F_{ON,y} + \sum_{s_{CR}} F_{CR,s_{CR},y} + \sum_{s_{MS}} F_{SOM,s_{MS},y} \right) \times Frac_{LEACH} \times EF_{N2O-N,L}$$

Equation (12)

Where:

$PE_{N2O-N,ind,L,y}$	=	Indirect N_2O-N emissions due to leaching/run-off as a result of nitrogen application at the plantation in year *y* (tN_2O-N)
$F_{SN,y}$	=	Amount of synthetic fertilizer nitrogen applied at the plantation in year *y* (t N)
$F_{ON,y}$	=	Amount of organic fertilizer nitrogen from animal manure, sewage, compost or other organic amendments applied at the plantation in year *y* (t N)
$F_{CR,s_{CR},y}$	=	Amount of N in crop residues (above ground and below ground), including N-fixing crops, returned to the soil on stratum s_{CR} in year *y* (t N)
$F_{SOM,s_{MS},y}$	=	Amount of N in the mineral soil that is mineralized on stratum s_{MS} in year *y* in association with loss of soil carbon from soil organic matter as a result of a land use change or a change in the land management practice (t N)
$Frac_{LEACH}$	=	Fraction of all N added to/mineralized in the soil of the plantation that is lost through leaching and runoff (t N leached and runoff / t N applied)
$EF_{N2O-N,L}$	=	Emission factor for N_2O emissions from N leaching and runoff (t N_2O-N / t N leached and runoff)
s_{CR}	=	Strata of the project area where crops residues, including N-fixing crops, are returned to the soil
s_{MS}	=	Strata of the project area with mineral soils

7.2. Data and parameters not monitored

Data / Parameter table 18.

Data / Parameter:	***$EF_{N2O,N,OS}$***
Data unit:	t N_2O-N/ha
Description:	Emission factor for direct nitrous oxide emissions from drained/managed organic soils
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.1, as provided below
Value to be applied:	see table below
Any comment:	-

Applicable climate and soil type	**Emission factor (tN_2O-N/(ha year))**
Temperate organic crop and grassland soils	8
Tropical organic crop and grassland soil	16
Temperate and boreal organic nutrient rich forest soils	0.6
Temperate and boreal organic nutrient poor forest soils	0.1
Tropical organic forest soils	8

Data / Parameter table 19.

Data / Parameter:	***R***
Data unit:	-
Description:	C:N ratio of the soil organic matter
Source of data:	If reliable and well documented country-specific or regional data are available, such data should be used. If such data is not available, project participants should assume, consistent with the 2006 IPCC Guidelines, a default value of 15 for situations involving land-use change from forest land or grassland to cropland and a default value of 10 for situations involving management changes on cropland
Value to be applied:	-
Any comment:	-

Data / Parameter table 20.

Data / Parameter:	***$Frac_{GASM}$***
Data unit:	t N volatilized / t N applied
Description:	Fraction of organic N fertilizer that volatilizes as NH_3 and NO_X
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3
Value to be applied:	0.2
Any comment:	-

Data / Parameter table 21.

Data / Parameter:	***$Frac_{GASF}$***
Data unit:	t N volatilized / t N applied
Description:	Fraction of synthetic fertilizer N that volatilizes as NH_3 and NO_X
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3
Value to be applied:	0.1
Any comment:	-

Data / Parameter table 22.

Data / Parameter:	$Frac_{LEACH}$
Data unit:	t N leached and runoff / t N applied
Description:	Fraction of all N added to/mineralized in the soil of the plantation that is lost through leaching and runoff
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3
Value to be applied:	0.3
Any comment:	-

7.3. Data and parameters monitored

Data / Parameter table 23.

Data / Parameter:	$M_{c,s_{CR},y}$
Data unit:	t dry matter
Description:	Quantity of crop type *c* that is harvested on stratum s_{CR} in year *y* where (a) *c* are the crop types harvested on stratum s_{CR} in year *y*, and (b) s_{CR} are the strata of the project area where crops residues, including N-fixing crops, are returned to the soil where *c* are the crop types harvested on stratum s_{CR} in year *y*
Source of data:	Records by project proponents
Measurement procedures (if any):	-
Monitoring frequency:	Continuously
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 24.

Data / Parameter:	$f_{burnt,s_{CR},c,y}$
Data unit:	-
Description:	Fraction of the area of stratum s_{CR}, cultivated with crop type *c*, that is burnt in year *y* where: (a) *c* are the *crop* types harvested on stratum s_{CR} in year *y*; and (b) s_{CR} are the strata of the project area where crops residues, including N-fixing crops, are returned to the soil

Source of data:	Records by project proponents
Measurement procedures (if any):	-
Monitoring frequency:	Each time field burning is taking place
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 25.

Data / Parameter:	$R_{AG,c}$
Data unit:	-
Description:	Ratio of above-ground residue of crop type *c* to harvested yield for crop type *c*
Source of data:	Records by project proponents
Measurement procedures (if any):	-
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / Parameter table 26.

Data / Parameter:	$Frac_{REMOVE,c,y}$
Data unit:	-
Description:	Fraction of above-ground biomass residues of crop type *c* that are removed from the plantation in year *y* where: *c* are the crop types harvested on stratum s_{CR} in year *y*, and s_{CR} are the strata of the project area where crops residues, including N-fixing crops, are returned to the soil where *c* are the crop types harvested on stratum s_{CR} in year *y*
Source of data:	Records by project proponents
Measurement procedures (if any):	-
Monitoring frequency:	Continuously
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 27.

Data / Parameter:	$A_{PJ,s_{OS},y}$
Data unit:	ha
Description:	Size of the land area of stratum s_{OS} in year *y*
Source of data:	Project participants
Measurement procedures (if any):	-
Monitoring frequency:	Annually

QA/QC procedures:	-
Any comment:	-

Data / Parameter table 28.

Data / Parameter:	$A_{PJ,s_{MS},y}$
Data unit:	ha
Description:	Size of the land area of stratum s_{MS} in year *y*
Source of data:	Project participants
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

8. Emissions from the production of synthetic fertilizer that is used at the plantations ($PE_{FP,y}$)

113. The GHG emissions from the production of synthetic fertilizer are estimated for each synthetic fertilizer type *f* by multiplying an emission factor with the monitored quantity of fertilizer applied at the plantations during year *y*, as follows:

$$PE_{FP,y} = \sum_{f} \left(EF_{CO2e,FP,f} \times M_{SF,q,y}\right) \quad \text{Equation (13)}$$

Where:

$PE_{FP,y}$	=	Project emissions related to the production of synthetic fertilizer that is used at the dedicated plantations in year *y* (tCO_2e)
$EF_{CO2e,FP,f}$	=	Emission factor for GHG emissions associated with the production of fertilizer type f (tCO_2e/t fertilizer). Default value is provided below
$M_{SF,q,y}$	=	Amount of synthetic fertilizer *q* applied at the plantation in year *y* where *q* are the synthetic fertilizer types applied at the plantation in year *y* (t fertilizer/yr)

8.1. Data and parameters not monitored

Data / Parameter table 29.

Data / Parameter:	$EF_{CO2e,FP,f}$
Data unit:	tCO_2e/t fertilizer
Description:	Emissions factor for GHG emissions associated with the production of fertilizer type *f*
Source of data:	Use default values as provided in the Tables below.

~~Value to be applied:~~	**N Fertilizer Type** / **Emission factor (tCO_2/tN)**: Urea 1.7; Ammonium nitrate 7.1; Ammonium sulfate 2.0; Calcium nitrate 11.7; Ammonium Phosphate 2.7; Liquid urea/ammonium nitrate 4.9
	P Fertilizer Type / **Emission factor ($tCO2/tP_2O_5$)**: Phosphate rock 2.0; Ammonium phosphate 0.3; Tripple super phosphate 0.5; Single super phosphate 0.2
	K Fertilizer Type / **Emission factor (tCO_2/tK_2O)**: Potassium chloride 0.4; Potassium sulphate 0.3
~~Any comment:~~	~~Source: Calculated based on Wood and Cowie (2004) and Swaminathan (2004)~~

~~N Fertilizer Type~~	~~Emission factor (tCO_2/tN)~~
~~Urea~~	~~1.7~~
~~Ammonium nitrate~~	~~7.1~~
~~Ammonium sulfate~~	~~2.0~~
~~Calcium nitrate~~	~~11.7~~
~~Ammonium Phosphate~~	~~2.7~~
~~Liquid urea/ammonium nitrate~~	~~4.9~~

~~P Fertilizer Type~~	~~Emission factor ($tCO2/tP_2O_5$)~~
~~Phosphate rock~~	~~2.0~~
~~Ammonium phosphate~~	~~0.3~~
~~Tripple super phosphate~~	~~0.5~~
~~Single super phosphate~~	~~0.2~~

~~K Fertilizer Type~~	~~Emission factor (tCO_2/tK_2O)~~
~~Potassium chloride~~	~~0.4~~
~~Potassium sulphate~~	~~0.3~~

~~9. CO_2 emissions resulting from changes in soil carbon stocks following land use changes or changes in the land management practices ($PE_{CO2,soil,y}$)~~

~~114. CO_2 emissions from decreases of carbon stocks in soil carbon pools as a result of land use changes or changes in management practices should be estimated, using the IPCC Tier 1/2 approaches in the 2006 Guidelines for National GHG Inventories. In cases where carbon stocks in soil carbon pools increase as a result of the project activity, these increases should not be accounted as emission reductions and $PE_{CO2,soil,y}$ should be assumed as zero.~~

~~115. The approach to estimate carbon stock changes in soil organic carbon pools is different for organic and mineral soils. Changes in inorganic soil carbon are neglected. Project emissions may include emissions from mineral and organic soils within the project area:~~

$$PE_{CO2,soil,y} = PE_{CO2,MS,y} + PE_{CO2,OS,y} \quad \text{Equation (14)}$$

~~Where:~~

$PE_{CO2,soil,y}$	=	~~Project emissions of CO_2 in year *y* resulting from changes in soil carbon stocks following a land use change or a change in the land management practices (tCO_2)~~

$PE_{CO2,MS,y}$	=	Project emissions of CO_2 in year *y* resulting from changes in soil carbon stocks of mineral soils following a land use change or a change in the land management practices (tCO_2)
$PE_{CO2,OS,y}$	=	Project emissions of CO_2 in year *y* resulting from changes in soil carbon stocks of organic soils following a land use change or a change in the land management practices (tCO_2)

9.1. CO_2 emissions from mineral soils

116. For mineral soils, the IPCC Tier 1 method is used to estimate soil carbon emissions. Consistent with the IPCC Tier 1 approach, it is assumed that soil carbon stocks were in an equilibrium before the implementation of the project activity (or would have reached an equilibrium in the absence of the project activity) and change in a linear fashion during a transition period to a new equilibrium as result of the change in the land use or land management practice.

117. Annual CO_2 emissions from soil carbon stock changes are calculated based on the difference between the soil organic carbon stock before and after implementation of the project activity and the duration of the transition period (i.e. the time dependence of the stock change factors *T*), as follows:

$$PE_{CO2,MS,y} = \sum_{s_{MS}} \frac{SOC_{historic,s_{MS}} - SOC_{PJ,s_{MS}}}{T} \times A_{PJ,s_{MS},y} \times \frac{44}{12} \quad \text{Equation (15)}$$

Where:

$PE_{CO2,MS,y}$	=	Project emissions of CO_2 in year *y* resulting from changes in soil carbon stocks of mineral soils following a land use change or a change in the land management practices (tCO_2)
$SOC_{historic,s_{MS}}$	=	Soil organic carbon stock with the land use and land management practices on stratum s_{MS} before the implementation of the project activity (tC/ha)
$SOC_{PJ,s_{MS}}$	=	Soil organic carbon stock with the land use and land management practices on stratum s_{MS} under the project activity (tC/ha)
$A_{PJ,s_{MS},y}$	=	Size of the land area of stratum s_{MS} in year *y* (ha)
T	=	Time dependence of the stock change factors (years). In case of a renewable crediting period: 20 years. In case of a single crediting period: 10 years
s_{MS}	=	Strata of the project area with mineral soils

118. The soil organic carbon stock is calculated based on reference soil organic carbon stock value of stratum s_{MS} ($SOC_{REF,s_{MS}}$) for the relevant soil type and climate region and stock change factors (F_{LU}, F_{MG} and F_I) that reflect that land-use type, the land management practices and any carbon input in the soil, as follows:

$$SOC_{historic,s_{MS}} = SOC_{REF,s_{MS}} \times F_{LU,historic,s_{MS}} \times F_{MG,historic,s_{MS}} \times F_{I,historic,s_{MS}} \quad \text{Equation (16)}$$

And

$$SOC_{PJ,s_{MS}} = SOC_{REF,s_{MS}} \times F_{LU,PJ,s_{MS}} \times F_{MG,PJ,s_{MS}} \times F_{I,PJ,s_{MS}} \quad \text{Equation (17)}$$

Where:

$SOC_{historic,s_{MS}}$	=	Soil organic carbon stock with the land use and land management practices on stratum s_{MS} before the implementation of the project activity (tC/ha)
$SOC_{PJ,s_{MS}}$	=	Soil organic carbon stock with the land use and land management practices on stratum s_{MS} under the project activity (tC/ha)
$SOC_{REF,s_{MS}}$	=	Reference soil organic carbon stock value for stratum s_{MS} (tC/ha). IPCC default values will be used, see guidance below
$F_{LU,historic,s_{MS}}$	=	Stock change factor for the historic land-use system on stratum s_{MS}
$F_{LU,PJ,s_{MS}}$	=	Stock change factor for the land-use system on stratum s_{MS} under the project activity
$F_{MG,historic,s_{MS}}$	=	Stock change factor for the historic land management regime on stratum s_{MS}
$F_{MG,PJ,s_{MS}}$	=	Stock change factor for the land management regime on stratum s_{MS} under the project activity
$F_{I,historic,s_{MS}}$	=	Stock change factor for input of organic matter on stratum s_{MS} for the historical situation
$F_{I,PJ,s_{MS}}$	=	Stock change factor for input of organic matter on stratum s_{MS} under the project activity
s_{MS}	=	Strata of the project activity with mineral soils

9.2. CO_2 emissions from organic soils

119. For organic soils, the land area is multiplied with an annual emission factor that estimates the losses of carbon following drainage. Annual project emissions are calculated as follows:

$$PE_{CO2,OS,y} = \sum_{s_{OS}} A_{PJ,s_{OS},y} \times EF_{organic,s_{OS}} \times \frac{44}{12} \quad \text{Equation (18)}$$

Where:

$PE_{CO2,OS,y}$	=	Project emissions of CO_2 in year y resulting from changes in soil carbon stocks of organic soils following a land use change or a change in the land management practices (tCO_2)
$A_{PJ,s_{OS},y}$	=	Size of the land area of stratum s_{OS} in year y (ha)
$EF_{organic,s_{OS}}$	=	Emission factor for carbon soil losses for organic soils on stratum s_{OS} (t C/ha). IPCC default values will be used, see guidance below
s_{OS}	=	Strata of the project area with organic soils

~~9.3. Data and parameters not monitored~~

~~Data / Parameter table 30.~~

~~**Data / Parameter:**~~	~~T~~
~~Data unit:~~	~~years~~
~~Description:~~	~~Time dependence of the stock change factors~~
~~Source of data:~~	~~-~~
~~Value to be applied:~~	~~In case of a renewable crediting period: 20 years (commonly used value)~~ ~~In case of a single crediting period: 10 years~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 31.~~

~~**Data / Parameter:**~~	~~$SOC_{REF,s_{MS}}$~~
~~Data unit:~~	~~tC/ha~~
~~Description:~~	~~Reference soil organic carbon stock value for stratum s_{MS} where s_{MS} are the strata of the project area with mineral soils~~
~~Source of data:~~	~~Select the applicable value for the soil type identified from the 2006 IPCC Guidelines, Vol. 4, Ch. 2, Table 2.3~~
~~Value to be applied:~~	~~-~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 32.~~

~~**Data / Parameter:**~~	~~$F_{LU,historic,sMS}$, $F_{MG,historic,sMS}$, $F_{I,historic,sMS}$~~
~~Data unit:~~	~~dimensionless~~
~~Description:~~	~~Stock change factor on stratum s_{MS} for the historic land-use system ($F_{LU,historic,sMS}$), for the historic management regime ($F_{MG,historic,sMS}$) and for input of organic matter for the historical situation ($F_{I,historic,sMS}$)~~
~~Source of data:~~	~~If available, reliable, well documented and reasonably representative for the project area, regional or national stock change factors should be used. If such data is not available, the following default values from the 2006 IPCC Guidelines should be used:~~ ~~Forest land: Use 1.0 for all factors~~ ~~Cropland: Vol. 4, Ch. 5, Table 5.5~~ ~~Grassland: Vol.4, Ch. 6, Table 6.2~~
~~Value to be applied:~~	~~-~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 33.~~

~~**Data / Parameter:**~~	~~$F_{LU,PJ,sMS}$, $F_{MG,PJ,sMS}$, $F_{I,PJ,sMS}$~~
~~Data unit:~~	~~dimensionless~~

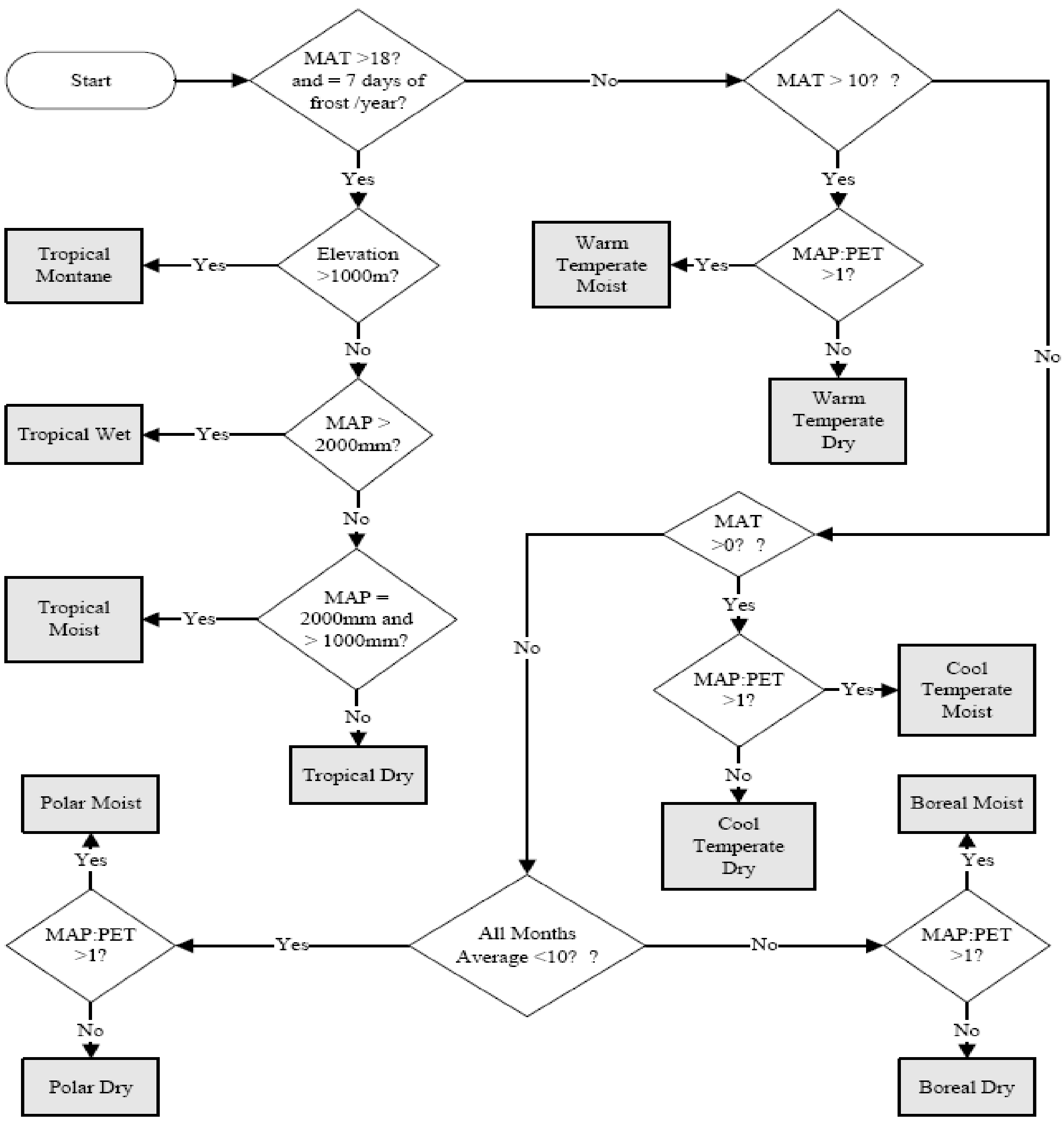
Description:	Stock change factor for the land-use system on stratum sMS under the project activity, Stock change factor for the historic land management regime on stratum sMS and Stock change factor for input of organic matter on stratum sMS for the historical situation
Source of data:	If available, reliable, well documented and reasonably representative for the project area, regional or national stock change factors should be used. If such data is not available, the following default values from the 2006 IPCC Guidelines should be used: Forest land: Use 1.0 for all factors Cropland: Vol. 4, Ch. 5, Table 5.5 Grassland: Vol.4, Ch. 6, Table 6.2
Value to be applied:	-
Any comment:	-

Data / Parameter table 34.

Data / Parameter:	$EF_{organic,sOS}$
Data unit:	t C /hectare
Description:	Emission factor for carbon soil losses for organic soils on stratum s_{OS}
Source of data:	2006 IPCC Guidelines, Vol. 4, Ch. 5, Table 5.6
Value to be applied:	Select the suitable default value as follows: The plantation is cropland: Vol. 4, Ch. 5, Table 5.6 The plantation is forest land: Vol. 4, Ch. 4, Table 4.6
Any comment:	-

Appendix 2. Climate Zone

Figure 3A.5.2 **Classification scheme for default climate regions. The classification is based on elevation, mean annual temperature (MAT), mean annual precipitation (MAP), mean annual precipitation to potential evapotransporation ratio (MAP:PET), and frost occurrence.**



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Document information

Version	*Date*	*Description*
03.0	3 April 2017	MP 72, Annex 09 To be considered by the Board at EB94. The draft version of this revised methodology (CDM- MP71-A06) was available for public input from 27 October to 11 November 2016. It received one input. Revision to broaden the applicability of the existing methodology and to cover bio-ethanol, bio-methanol and biogas.
02.1	29 September 2011	EB 63, Annex 17 Amendment to: • Simplify the determination of BDy (Quantity of biodiesel eligible for crediting in year *y*); and • Improve the methodology by including missing parameters in the monitoring table, removing not required parameters from the monitoring table, correcting errors in the equations in the nomenclature of parameters and other editorial improvements.
02.0	17 September 2010	EB 56, Annex 8 Revision to clarify: • That the methodology is not applicable for the dedicated plantations established on peatlands; • That the possibility to account for the CO_2 emissions resulting from changes in soil carbon stocks as zero applies only to perennial plants.
01.1	23 March 2010	Editorial revision to: • Correct Table 2, as emission factors for jatropha corresponded to Tropical **Dry** climates and not Tropical **Wet** climates; • Remove inconsistencies between the methodology and the excel sheet used to calculate the emission factors for the GHG emissions associated with the cultivation of land.
01.0	16 October 2009	EB 50, Annex 3 Initial adoption. This methodology is a consolidation of the approved methodology AM0047, incorporating cases NM0228, NM0233 and incorporating elements based on the request for revision AM_REV_0071.

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