Draft baseline and monitoring methodology AM00XX

"Production of waste cooking oil-based biodiesel for use as fuel"

I. SOURCE AND APPLICABILITY

Source

This methodology is based on the project activity "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.

For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0180: "Production of waste cooking oil-based biodiesel for use as fuel" on http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

This methodology also refers to the latest version of the "Tool for the demonstration and assessment of additionality", ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" [1] and AMS I.D "Grid connected renewable electricity generation."

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable"

Applicability

The methodology is applicable to project activities that reduce emissions through the production, sale and consumption of blends of petrodiesel with biodiesel to be used as fuel, where the biodiesel is based on waste cooking oil. For the purpose of this methodology the following definitions apply:

- petrodiesel is 100% fossil fuel diesel;
- biodiesel is 100% trans-esterified biofuel diesel; and,
- blended biodiesel is defined as any blending fraction of petrodiesel with biodiesel greater than 0 and smaller than 100%.

The methodology ensures that the CERs can only be issued to the producer of the biodiesel and not to the consumer.

The following conditions apply to the methodology:

Feedstock inputs

a) For this specific methodology, *waste cooking oil* is defined as a residue or waste stream from restaurants or related commercial sectors. Any biodiesel volumes produced by other sources must be clearly identified and a new methodology should be proposed to account for them. No CERs can be claimed under this methodology for biodiesel that is not produced from waste cooking oil.

[1] Please refer to: < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

Product outputs

a) The petrodiesel, the biodiesel and their blends comply with national regulations or with suitable international standards.
b) The by-product glycerol is not disposed of or left to decay. It should be either incinerated or used as raw material for industrial consumption.

Consumption of biodiesel

a) The blended biodiesel is supplied to consumers within the host country whose existing stationary installations or vehicles, that actually combust the blend, are included in the project boundary.
b) The consumer (end-user) of blended biodiesel in the transport sector is a captive fleet.
c) The consumer and the producer of the blended biodiesel are bound by a contract that allows the producer to monitor the consumption of blended biodiesel and states that the consumer shall not claim CERs resulting from its consumption.
d) No major modifications in the consumer stationary installations or in the vehicles engines are deemed necessary to consume/combust the blended biodiesel. In case of stationary installations, the blending fraction can have any value between 0 and 100%. In case of vehicles use, the blending proportion must be low enough to ensure that the technical performance characteristics of the blended biodiesel do not differ significantly from those of pure petrodiesel. The default value for the maximum allowable blending proportion is 20% by volume (B20)[2]. Blending is done by the producer, the consumer or a third party who is contractually bound to the producer to ensure that blending proportions and amounts are monitored and meet all regulatory requirements.

Activities for which CERs are claimed

a) Project participants claim CERs only for the CO_2 emissions from petrodiesel displaced by the biodiesel.
b) Project participants **do not** claim CERs for the following: (i) Reductions in life-cycle emissions associated with the production of displaced petrodiesel; (ii) Biodiesel consumed for non-energy purposes; (iii) Utilization of by-products such as glycerol; (iv) Avoidance of methane emissions from waste water treatment due to the reduction of waste oil in waste water.

II. BASELINE METHODOLOGY

Project boundary

The spatial extent of the project boundary encompasses:

- Transportation of waste cooking oil to the project site (e.g. road transport by vehicles);
- Biodiesel production plant at the project site, comprising the esterification unit plus other installations on the site (e.g. storage, refining, blending, etc.);
- Transportation of biodiesel to the facility where the biodiesel is blended with petrodiesel;
- Facility where the biodiesel is blended with petrodiesel; (regardless of the ownership of the blending facility)
- Transportation of the blended biodiesel to the final consumer (end-user);
- Vehicles and existing stationary combustion installations where the blended biodiesel is consumed.

[2] 2004 Biodiesel Handling and Use Guidelines, U.S. Department of Energy.

Relevant emission sources within this boundary include the following (see table below for details):

- Emissions from combustion of petrodiesel and biodiesel, taking into account the fossil carbon contained in methanol used in biodiesel production;
- Emissions from fuel and electricity consumed in the production of biodiesel;
- Emissions from the transport of waste cooking oil to the biodiesel plant;
- Emissions from the transport of biodiesel to the facility where the biodiesel is blended with petrodiesel. These emissions are to be added to the project emissions only if the current distribution of the petrodiesel being displaced does not involve similar transport of fuel to a blend/distribution location.

Emissions associated with the production of methanol used for esterification are excluded from the project boundary, but are accounted for as leakage.

Table 1: Summary of gases and sources included in the project boundary, and justification / explanation where gases and sources are not included.

	Source	Gas	Included?	Justification / Explanation
Baseline	Vehicles and stationary combustion sources consuming petrodiesel	CO_2	Yes	Main source of baseline emissions
		CH_4	No	Excluded for simplification. CH_4 and N_2O emissions are assumed to be very small. No systematic difference to project activity
		N_2O	No	
Project Activity	Transportation of waste cooking oil to project site	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.
	On site energy consumption at biodiesel production plant	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 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.
	Vehicles and stationary combustion sources consuming blended biodiesel	CO_2	Yes	Fossil carbon contained in methanol used for esterification. It is a significant source of emissions . Other biodiesel carbon is climate neutral (i.e. from residual waste cooking oil)
		CH_4	No	Excluded for simplification. CH_4 and N_2O emissions are assumed to be very small. No systematic difference to baseline scenario
		N_2O	No	

Procedure for the selection of the most plausible baseline scenario

The baseline scenario should be separately determined for the following elements:

- **Production of fuels (P)**: What would have happened at the production level in the absence of the CDM project activity?
- **Consumption (C):** Which fuel would have been consumed in the absence of the CDM project activity?

For the **fuel production** level, project participants shall identify the most likely baseline scenario among all realistic and credible alternatives(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 then only step 2 should be applied for all options identified (barrier analysis is not allowed). Where more than one credible and plausible alternative scenario remains, project participants shall, as a conservative assumption, adopt the alternative that results in the lowest baseline emissions as the most likely baseline scenario.

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

P1 Continuation of current practices with no investment in biodiesel production capacity;
P2 The project activity implemented without the CDM; and
P3 Investment in any other alternative fuel replacing partially or totally the baseline fuel.

For the **consumption of fuel**, the baseline should be determined as follows:

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

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

C1 Continuation of petroleum diesel consumption;
C2 Consumption of biodiesel from other producers;
C3 Consumption of other single alternative fuel such as CNG or LPG, etc;
C4 Consumption of a mix of above alternative fuels;
C5 Consumption of biodiesel from the proposed project plant.

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

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".

Step 3: Eliminate alternatives that face prohibitive barriers

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".

Step 4: Compare economic attractiveness of remaining alternatives

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.

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.

This methodology is only applicable for the baseline scenario which combines P1 and C1.

Additionality

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 web site.

Additionality is assessed only for the project activity (i.e. the construction and operation of the biodiesel plant). Additionality is established ex-ante for the duration of the crediting period, i.e. the relevant parameters are not subject to monitoring, and only need to be revalidated at the renewal of the crediting period.

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 sales price, the feedstock costs and fuel costs.

Baseline emissions

Baseline emissions from displaced petrodiesel are determined using the following equation:

$$BE_y = BD_y \cdot CF_{PD} \cdot EF_{CO2,PD} \cdot NCV_{PD} \quad (1)$$

Where:

BE_y = Baseline emissions during the year y (tCO_2)

BD_y = Most conservative value among production of biodiesel ($P_{BD,y}$), consumption of biodiesel ($C_{BD,y}$) and consumption of blended biodiesel times blending fraction ($C_{BBD,y}*f_{\%}$). Only blended biodiesel from waste cooking oil shall be considered and that which is consumed by identified in-country consumers to substitute petrodiesel in the year y (tonnes)

CF_{BD} = Conversion factor from biodiesel to petrodiesel (tonnes petrodiesel/tonnes biodiesel)

$EF_{CO2,PD}$ = Carbon dioxide emissions factor for petrodiesel (tCO_2/GJ)

NCV_{PD} = Net calorific value of petrodiesel (GJ/tonne)

In determining emission coefficients, emission factors or net calorific values in this methodology, guidance by the 2000 IPCC Good Practice Guidance[3] should be followed. Project participants may either conduct regular measurements or they may use accurate and reliable local or national data where available. Where such data is not available, IPCC default emission factors[4] (country-specific, if available) may be used if they are deemed to reasonably represent local circumstances. All values should be chosen in a conservative manner and the choices should be justified.

The conversion factor (CF_{PD}) shall be calculated based on the respective net calorific values of biodiesel and petrodiesel, as shown in equation (2):

$$CF_{PD} = \frac{NCV_{BD}}{NCV_{PD}} \quad (2)$$

Where:
CF_{PD} = Conversion factor from biodiesel to petrodiesel (tonnes petrodiesel/tonnes biodiesel)
NCV_{BD} = Net calorific value of biodiesel (GJ/tonne)
NCV_{PD} = Net calorific value of petrodiesel (GJ/tonne)

Project Emissions

Project activity emissions include four components:

- CO_2 from consumption of fuels at the biodiesel production facility;
- CO_2 from consumption of electricity at the biodiesel production facility;
- 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;
- CO_2 from transport of both waste cooking oil to the project site and biodiesel from the project site where the blending takes place.

The petrodiesel fraction in the blend is excluded from the calculations.

$$PE_y = PE_{fuel,y} + PE_{elec,y} + PE_{MeOH,y} + PE_{Tr,y} \quad (3)$$

Where:
PE_y = Project emissions during the year y (tCO_2)
$PE_{fuel,y}$ = Project emissions from combustion of fuels (i.e. for required steam) in biodiesel production in year y (tCO_2)
$PE_{elec,y}$ = Project emissions from electricity consumption in the biodiesel plant in year y (tCO_2)
$PE_{MeOH,y}$ = Project emissions from combustion of fossil fuel derived methanol in the biodiesel ester in year y (tCO_2)
$PE_{Tr,y}$ = Project emissions from transport of both waste cooking oil to the project site and biodiesel to the facility where the blending takes place in year y (tCO_2)

[3] IPCC 2000, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

[4] IPCC 2006, Revised 2006 Guidelines for National Grenhouse Gas Inventories, Reference Manual

Emissions from fossil fuel consumption

Emissions from fuel consumption (i.e. for steam production) are calculated on the basis of measured consumption of heating fuel(s) on either the biodiesel production site or the site of an external supplier of steam as shown in equation (4).

$$PE_{fuel,y} = \sum_i \left(FC_{BDP,i,y} \times NCV_i \times EF_{CO2,i} \right) \quad (4)$$

Where:

$PE_{fuel,y}$ = Project emissions from combustion of fuels (i.e. for required steam) in biodiesel production in year *y* (tCO_2)
$FC_{BDP,i,y}$ = Fuel of type *i* consumed on-site for biodiesel production in year *y* (tonnes)
NCV_i = Net calorific value of fuel type *i* (GJ/tonne)
$EF_{CO2,i}$ = Carbon dioxide emissions factor for fuel *i* (tCO_2/GJ)

Emissions from electricity consumption

Emissions from electricity consumption are calculated on the basis of measured electricity consumption at the biodiesel production site, as shown in equation (5).

$$PE_{elec,y} = EC_y \times EF_{CO2,elec} \quad (5)$$

Where:

$PE_{elec,y}$ = Project emissions from electricity consumption in the biodiesel plant in year *y* (tCO_2)
EC_y = Electricity consumption at project site in year *y* (MWh)
$EF_{CO2,elec}$ = Emissions factor for grid electricity (tCO_2/MWh)

The emission factor ($EF_{CO2,elec}$) shall be calculated in accordance with the latest version of the following approved methodologies:

- ACM0002 shall be used if the consumption exceeds the CDM small scale thresholds as defined by the Executive Board.
- AMS I.D may be used if the consumption does not exceed the CDM small scale thresholds as defined by the Executive Board.

Emissions from fossil carbon content in methanol

Methanol is normally produced from natural gas, hence the carbon is fossil fuel derived. The carbon in the methanol is incorporated into the methyl ester biodiesel fuel, and is oxidized into CO_2 during combustion of the fuel. The emissions from combustion of methanol are based on the measured consumption of methanol in the biodiesel plant and the mass fraction of fossil carbon in the methanol, as shown in equation (6). 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.

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

Where:

$PE_{MeOH,y}$ = Project emissions from combustion of fossil fuel derived methanol in the biodiesel ester in year *y* (tCO_2)
$MC_{MeOH,y}$ = Mass of methanol consumed in the biodiesel plant, including spills and evaporations in year *y* (tonnes)
$EF_{C,MeOH}$ = Carbon emissions factor of methanol, based on molecular weight (tC/tMeOH) (= 12/32)
44/12 = Molecular weight ratio to convert tonnes of carbon into tonnes of CO_2 (tCO_2/tC)

Transport Emissions

For transport emissions (to and from the biodiesel plant) project participants may choose between two different approaches to determine emissions: an approach based on distance and vehicle type (option 1) or on actual monitored vehicle fuel consumption (option 2).

Emissions from transport of biodiesel to the blending station are to be added to the project emissions only if the current distribution of the petrodiesel being displaced does not involve similar transport of fuel to a blend/distribution location.

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

$$PE_{tr,y} = \left(\frac{WCO_{tr,y}}{TL_{WCO}} \times AVD_{WCO} \times EF_{km,tr} \right) + \left(\frac{P_{BD,y}}{TL_{BD}} \times AVD_{BD} \times EF_{km,tr} \right) \quad (7)$$

Where:
$PE_{tr,y}$ = Project emissions from transport of both waste cooking oil to the project site and biodiesel to the facility where the blending takes place in year *y* (tCO_2)
$WCO_{tr,y}$ = Waste cooking oil used as biodiesel feedstock in year *y* (tonnes)
TL_{WCO} = Average truck load for vehicles transporting waste cooking oil (tonnes)
AVD_{WCO} = Average distance travelled by vehicles transporting waste cooking oil (km)
$EF_{km,tr}$ = Carbon dioxide emissions factor for vehicles transporting waste cooking oil or biodiesel (tCO_2/km)
$P_{BD,y}$ = Quantity of biodiesel from waste cooking oil that is used by host country consumers to substitute petrodiesel in the year *y* (tonnes)
TL_{BD} = Average truck load for vehicles transporting biodiesel (tonnes)
AVD_{BD} = Average distance travelled by vehicles transporting biodiesel to the blending plant (km)

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

$$PE_{tr,y} = \sum_i \left(FC_{WCO,i,y} \times NCV_i \times EF_{CO2,i} \right) + \sum_i \left(FC_{BD,i,y} \times NCV_i \times EF_{CO2,i} \right) \quad (8)$$

Where
$PE_{Tr,y}$ = Project emissions from transport of waste cooking oil to the project site and biodiesel to the facility where the blending takes place in year *y* (tCO_2)
$FC_{WCO,i,y}$ = Fuel consumption of type *i* for transporting waste cooking oil in year *y* (tonnes)
NCV_i = Net calorific value of fuel type *i* (GJ/tonne)
$EF_{CO2,i}$ = Carbon dioxide emissions factor for fuel type *i* (tCO_2/GJ)

$FC_{BD,i,y}$ = Fuel consumption of type *i* for transport biodiesel to blending plant in year *y* (tonnes)

Leakage

This methodology distinguishes two categories of leakage:

- Emissions associated with the production of the methanol used for esterification;
- Displacement of existing uses of waste cooking oil that may result in increased demand for fossil fuels elsewhere.

$$LE_y = LE_{MeOH,y} + LE_{WCO,y} \quad (9)$$

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)

$LE_{WCO,y}$ = Leakage emissions from displacement of existing utilization of waste cooking oil in year *y* (tCO_2)

Leakage from methanol production

Emissions from production of methanol that are used in the trans-esterification process to produce the biodiesel.

$$LE_{MeOH,y} = MC_{MeOH,y} \cdot EF_{MeOH,PC} \quad (10)$$

Where:

$LE_{MeOH,y}$ = Leakage emissions associated with production of methanol used in biodiesel production in year *y* (tCO_2)

$MC_{MeOH,y}$ = Mass of methanol consumed in the biodiesel plant, including spills and evaporation on site, in year *y* (tonnes)

$EF_{MeOH,PC}$ = Pre-combustion (i.e. upstream) emissions factor for methanol production (tCO_2/t MeOH).

Parameters	Value	References or Sources	Vintage	Spatial level	Monitored?	Comments
$LE_{MeOH,y}$	Calculated	-	-	-	No	-
$MC_{MeOH,y}$	Obtained through monitoring	Biodiesel plant data	latest	Project specific	Yes	-
$EF_{MeOH,PC}$	Default : 1.95	Apple 1998: http://edj.net/sinor/SFR4-99art7.html and 2006 IPCC Guidelines		International	Yes	

Leakage from the displacement of existing uses of waste cooking oil

Project participants shall demonstrate that the use of the waste cooking oil 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 cooking oil used in the project plant.

Project participants shall demonstrate that there is a surplus of waste cooking oil 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 cooking oil in the region being at least 25% larger than the quantity of waste cooking oil that is recovered or used by all end uses in the region (e.g. for energy generation or as feedstock), including the project plant.

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 cooking oil transport. In other words, if waste cooking oil 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 but not more than 200 km. Once defined, the region should not be changed during the crediting period(s).

Where project participants can not demonstrate that the total quantity of waste cooking oil 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:

$$LE_{WCO,y} = WCO_{L,y} \cdot NCV_{BD} \cdot EF_{CO2,L} \quad (11)$$

Where:

$LE_{WCO,y}$ = Leakage emissions from displacement of existing utilization of waste cooking oil in year y (tCO_2)
$WCO_{L,y}$ = Waste cooking oil that causes increased fossil fuel consumption elsewhere (tonnes)
NCV_{BD} = Net calorific value of biodiesel (GJ/tonne)
$EF_{CO2,L}$ = Carbon dioxide emissions factor of most carbon intensive fuel oil in the country (tCO_2/GJ)

Determination of $WCO_{L,y}$

$$WCO_{L,y} = \begin{cases} \dfrac{\left(1.25 \times WCO_{D,y}\right) - WCO_{S,y}}{1.25} & if \left(1.25 \times WCO_{D,y}\right) > WCO_{S,y} \\ 0 & if \left(1.25 \times WCO_{D,y}\right) \leq WCO_{S,y} \end{cases} \quad (12)$$

With

$$WCO_{D,y} = WCO_{DS,y} + u_D$$

$$WCO_{S,y} = WCO_{SS,y} - u_S$$

Where:

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

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

In the case that overall emission reductions from the project activity are negative in a given year because of the leakage penalty, 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.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (13)$$

Where:

ER_y = Emission reductions during the year y (tCO_2/yr)
BE_y = Baseline emissions during the year y (tCO_2/yr)
PE_y = Project emissions during the year y (tCO_2/yr)
LE_y = Leakage emissions during the year y (tCO_2/yr)

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

No changes required. Compliance with the applicability conditions, baseline scenario (i.e. baseline fuels) and additionality all need be fully revalidated upon renewal of the crediting period.

Data and parameters not monitored

Baseline Emissions

ID Number:	1
Parameter:	NCV_{PD}
Data unit:	GJ/tonne
Description:	Net calorific value of petrodiesel
Source of data:	2006 IPCC Guidelines for GHG Inventories.
Measurement procedures (if any):	
Any comment:	

ID Number:	2
Parameter:	$EF_{CO2,PD}$
Data unit:	tCO_2/GJ
Description:	Carbon dioxide emissions factor for petrodiesel
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

ID Number:	3
Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/GJ
Description:	Carbon dioxide emissions factor for fuel type *i*
Source of data:	Measurements or local / national data are preferred. Default values from the 2006 IPCC Guidelines may be used alternatively.
Measurement procedures (if any):	
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.

ID Number:	4
Data / Parameter:	$NCV_{,i}$
Data unit:	GJ/tonne of fuel
Description:	Net calorific value of fuel type *i*
Source of data:	Measurements or local / national data are preferred. Default values from the 2006 IPCC Guidelines may be used alternatively.
Measurement procedures (if any):	
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.

Leakage

ID Number:	5
Parameter:	$EF_{MeOH\ PC}$
Data unit:	tCO_2/t methanol
Description:	Specific emission per tonne of produced methanol
Source of data:	Apple 1998: http://edj.net/sinor/SFR4-99art7.html and 2006 IPCC Guidelines.
Measurement procedures (if any):	1.95 tCO_2/tonne produced methanol
Any comment:	Based on 30 GJ/tonne energy requirement and average of IPCC emissions factors for natural gas and diesel oil.

ID Number:	6
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.

III. MONITORING METHODOLOGY

Monitoring procedures

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 biodiesel production markets such as in Brazil, Europe or US.

Specific CDM related monitoring procedures

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.

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:

- Amounts of waste cooking oil purchased and processed;
- Amounts of catalysts purchased, processed and recovered;
- Amounts of methanol purchased and processed;
- Amounts of glycerol produced and incinerated and/or sold for utilization;
- Amounts of blended biodiesel delivered to consumers and consumed.

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 in case of vehicles. The mass balance serves as a QA/QC instrument to crosscheck results of monitoring parameters as defined in the following section.

The following procedure shall be used to verify the actual amount of biodiesel from waste cooking oil that is consumed by the end user for displacement of petrodiesel and its correspondence with the produced amount of biodiesel from waste cooking oil:

- The produced amount of biodiesel from waste cooking oil is recorded by a periodically calibrated metering system;

- The amount of biodiesel produced from waste cooking oil 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;

- During the process of creating the biodiesel 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 biodiesel and diesel fuel, which comprise the blended biodiesel;

- Contractually the biodiesel producer has to monitor consumption by the consumer as follows:
  - The receiving amount of blended biodiesel 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;
  - The amount of the blended biodiesel filled into the installation or vehicle where combustion takes place must be recorded by a calibrated metering system;
  - If blending is done by a third party contractual arrangement shall be made, that the same monitoring procedure as described above can be applied.

Data Archiving

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

Data and parameters monitored

Applicability Conditions

Data / Parameter:	$f_{\%}$
Data unit:	%
Description:	Fraction of biodiesel in the blended biodiesel
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 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 biodiesel and diesel fuel, which comprise the blend.
Any comment:	See "BQ-9000 Quality Assurance Program Requirements for the Biodiesel industry" for further information.

Data / Parameter:	**Various parameters; Compliance of biodiesel produced with national regulations**
Data unit:	Various data units
Description:	Compliance of produced biodiesel with national regulation, biofuel 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.

Data / Parameter:	$\mathbf{MP_{Glyc,y}}$
Data unit:	Tonnes (t)
Description:	Amount of byproduct glycerol produced during plant operation
Source of data:	Measured (volumetric or weighed) values.
Measurement procedures (if any):	Volumetric flow meter including a volume integrator or load cell to measure the weight of produced glycerol.
Monitoring frequency:	All quantity of produced 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 biodiesel production unit.

Data / Parameter:	$\mathbf{MU_{Glyc,y}}$
Data unit:	Tonnes (t)
Description:	Amount of byproduct glycerol sold or used.
Source of data:	Sales data and internal records in case of use inside the plant.
Measurement procedures (if any):	---
Monitoring frequency:	All produced glycerol 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 glycerol was marketed.

Baseline Emissions

Data / Parameter:	BD_y
Data unit:	Tonnes
Description:	Most conservative value among production of biodiesel ($P_{BD,y}$), consumption of biodiesel ($C_{BD,y}$) and consumption of blended biodiesel times blending fraction ($C_{BBD,y}$*$f_{\%}$). The biodiesel from waste cooking oil alone and that consumed by identified in-country consumers to substitute petrodiesel in the year *y* (tonnes) shall be considered for claiming CERs.
Source of data:	Metering system at production site
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	All produced biodiesel must be metered.
QA/QC procedures:	Cross check production and consumption data with sales records.
Any comment:	Measured for reference purposes to ensure consumption of biodiesel does not exceed production of biodiesel.

Data / Parameter:	$P_{BD,y}$
Data unit:	Tonnes
Description:	Quantity of produced biodiesel from waste cooking oil that is used by host country consumers to substitute for petrodiesel.
Source of data:	Metering system at production site.
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	All produced biodiesel must be metered.
QA/QC procedures:	Cross check production and consumption data with sales records.
Any comment:	Measured for reference purposes to ensure consumption of biodiesel does not exceed production of biodiesel.

Data / Parameter:	$C_{BD,y}$
Data unit:	Tonnes
Description:	Quantity of biodiesel from waste cooking oil consumed by host country consumers to substitute for petrodiesel.
Source of data:	Metering system at consumer site.
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:	Consumption of biodiesel will be determined as the consumption of blended biodiesel times the blending fraction of the respective blend.

Data / Parameter:	$C_{BBD,y}$
Data unit:	Tonnes
Description:	Quantity of blended biodiesel from waste cooking oil consumed by host country consumers to substitute for petrodiesel.
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:	

Data / Parameter:	NCV_{BD}
Data unit:	GJ/tonne
Description:	Net calorific value of biodiesel.
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:	FC_{BDP,i_y}
Data unit:	Tonnes
Description:	Fuel consumption of fuel type i for biodiesel production.
Source of data:	Mass meters.
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning.
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:	EC_y
Data unit:	MWh
Description:	Electricity consumption at project site.
Source of data:	Electricity meter.
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning.
Monitoring frequency:	Continuously.
QA/QC procedures:	No specific QA/QC procedures, small impact on total emission reductions.
Any comment:	----

Data / Parameter:	$EF_{CO2,Elec}$
Data unit:	tCO_2/MWh
Description:	Emission factor for grid electricity.
Source of data:	Grid supplier data, reliable official publications.
Measurement procedures (if any):	As per ACM0002 or AMS I.D, whichever is appropriate
Monitoring frequency:	Once or annually, depending on option chosen.
QA/QC procedures:	No specific QA/QC procedures, small impact on total emission reductions.
Any comment:	

Data / Parameter:	$MC_{MeOH,y}$
Data unit:	Tonnes
Description:	Mass of methanol consumed in the biodiesel plant.
Source of data:	Mass meters.
Measurement procedures (if any):	Use calibrated measurement equipment that is maintained regularly and checked for proper functioning.
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.

Data / Parameter:	$WCO_{tr,y}$

Data unit:	Tonnes
Description:	Waste cooking oil used as biodiesel feedstock.
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 waste cooking oil must be monitored.
QA/QC procedures:	Crosscheck data provided by trucks delivering waste cooking oil with measured feedstock inputs at plant. Use most conservative values.
Any comment:	

Data / Parameter:	AVD_{WCO}
Data unit:	Km
Description:	Average distance travelled by vehicles transporting waste cooking oil.
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 waste cooking oil 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:	AVD_{BD}
Data unit:	Km
Description:	Average distance travelled by vehicles transporting biodiesel to the blending plant.
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 truckers by comparing recorded distances with other information from other sources (e.g. maps).
Any comment:	If biodiesel is transported to different blending sites, this parameter should correspond to the mean value of km travelled by trucks that transport the biodiesel.

Data / Parameter:	TL_{WCO}
Data unit:	Tonnes
Description:	Average truck load for vehicles transporting waste cooking oil.
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:	TL_{BD}
Data unit:	Tonnes
Description:	Average truck load for vehicles transporting biodiesel.
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:	$EF_{km,tr}$
Data unit:	tCO_2 /km
Description:	Carbon dioxide emission factor for vehicles transporting waste cooking oil 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:	$FC_{WCO,i,y}$
Data unit:	Tonnes
Description:	Fuel consumption of fuel type i for transportation waste cooking oil.
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:	$FC_{BD,i,y}$
Data unit:	Tonnes
Description:	Fuel consumption of fuel type i for transportation of biodiesel to blending plant.
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.

Leakage

Data / Parameter:	$WCO_{DS,y}$
Data unit:	Tonnes
Description:	Formal and informal market demand for waste cooking oil, including the project activity, in the defined region. Statistical mean value obtained from surveys or other sources for the demand for waste cooking oil, including the project activity, in the defined region (tonnes).
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 cooking oil; third party statistically representative surveys that shall include a list of potential uses of waste cooking oils, interviews with collection companies or companies using waste cooking oils, etc.
Measurement procedures (if any):	--
Monitoring frequency:	Annually
QA/QC procedures:	The calculated demand for waste cooking oil 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:	

Data / Parameter:	$WCO_{SS,y}$
Data unit:	Tonnes
Description:	Supply for waste cooking oil in the defined region. Statistical mean value obtained from surveys or other sources for the supply of waste cooking oil in the defined region (tonnes).
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 cooking oil 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:	

Data / Parameter:	u_D
Data unit:	Tonnes
Description:	Uncertainty for waste cooking oil 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 cooking oil; third party statistically representative surveys that shall include a list of potential uses of waste cooking oils, interviews with collection companies or companies using waste cooking oils, etc.
Measurement procedures (if any):	--
Monitoring frequency:	Annually
QA/QC procedures:	The calculated demand for waste cooking oil 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:	u_S
Data unit:	Tonnes
Description:	Uncertainty for waste cooking oil demand.
Source of data:	Supply of waste cooking oil 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 cooking oil; third party statistically representative surveys that shall include a list of potential uses of waste cooking oils, interviews with collection companies or companies using waste cooking oils, etc.
Measurement procedures (if any):	--
Monitoring frequency:	Annually.
QA/QC procedures:	The calculated supply for waste cooking oil 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".