CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Sunflower Methyl-Ester Biodiesel Project in Philippines

Date: 31/03/2007
Version: 0.0

A.2. Description of the project activity:

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Outline and Objective of the Project

This project is to contribute to reduction of GHG emissions in the Republic of the Philippines though planting the sunflower as a project biomass feedstock in Central Luzon region, making the sunflower seed oil, producing the bio-diesel fuel (Hereafter, it is called BDF) at the Subic Special Economic and Freeport Zone , blending it into petrodiesel oil in Manila City, selling as B1 (volume ratio 1:99 of BDF and petrodiesel) in Metro Manila, and as a result displacing the fossil fuel by the biomass fuel.

The farmlands to supply the project sunflowers are located in the Central Luzon basin of Central Luzon region. The plantings are done after harvesting rice so that the plantings contribute to sustainable development by improving the income of a poor farm village part.
The farmland area is estimated about as 60,000ha, assuming necessary seeds of 120,000 ton/year and seed yield of 2.0 ton/ha. The plantings and supplies of the sunflower seeds are planed to be done by the contract farmers exclusively for Sun Care Fuel Philippines (hereafter, SCF Philippines) who guarantees the lowest purchase price.
In the project, GHG emissions by use of fertilizers are reduced as much as possible doing follows.
1) Residues of the sunflower are turned to compost, and returned to the field and doesn't been burnt.
2) The required quantity of synthetic fertilizers is calculated by an agricultural specialist based on the local conditions and the necessary amounts are supplied to the contract farmers.

The BDF production facility is planed to construct at the Subic Special Economic and Freeport Zone in Central Luzon region. The facility is operated by SCF Philippine. The BDF production facility consists of the pressing plant of sunflower seeds and BDF production plant facility.
The pressing plant has the capacity of producing 38,000 ton of the oil from 119,000 ton of seeds per year, and the BDF manufacturing facility has the production capacity of 38,000 ton per year which is 126.6 ton per day with 300 working days per year.
The oil cakes after pressing process are used as fodder, and the glycerin that is the by-product of BDF is sold as an industrial material.

The produced BDF is transported and sold to the oil terminals owned by oil companies in City of Manila City is from about 140 from the BDF production facility.
And then the project BDF is blended by petrodiesel and sold to the individual vehicle owners at fuel stations or mass consumers (e.g., bus company, industrial consumer, etc.) as BDF1.
Therefore the project activity displaces the use of petrodiesel by the use of BDF, and as a result, decreases CO_2 emissions from use of petrodiesel.

According to the Philippine Department of Energy (DOE), the current energy demands in year 2005 were 500.5 million barrels of crude oil equivalent. And it is expected that this demand will increase by 3.9% a year on the average, and will reach the energy demand in 2005 up to 605,400,000 barrels of crude equivalent by 2010.
On the other hand, the dependence on the energy supply from foreign countries is relatively high. The current ratio of the imports of petroleum oil is 36.5%. Accordingly, the national energy supply structures are easily influenced by the international crude oil market price fluctuation.
For example, the recent sudden rise of international crude oil price pushes up the energy prices for the entire country, and a securing steady energy source becomes a very important issue in Philippine.

Consistency with the Philippine Government Policy

The target of self-sufficiency rate 60% of energy in 2010 was set in a mid-term energy development plan (2005 - 2014) of "Philippines energy plan" by the DOE, and one of the major measure is a promotion of the renewable energy introduction including the biomass in the Philippines. "Biofuels Act of 2006" to reduce the importation of crude oil and to improve the balance of international trade was signed by President Arroyo on January 12, 2007. In this act, within 3 month from the effectivity of the acts, a minimum 1 % of biofuel shall be blended into all diesel engine fuel, and the board to determine the feasibility to mandate a minimum of 2 % blend of biofuel within two years.
Therefore, this project is along the government policy.

Contribution to farmers

In the Philippines, there are a lot of small-scale farmers who have 2ha of farmland on the average. And 70% of the population lives in the provinces, and 2/3 of them are farmer. Therefore, the increment of rural employment and income contributes to the development of a country greatly. The sunflowers are possible to be planted by small-scale farmers unlike palm and coconuts. And they are planted as a second crop of rice and improve the harvest of rice. Furthermore, the planting sunflowers give the additional income by sales of oil cakes as fodder and even by using for apiculture. Those advantages contribute to the improvement of the life of the poor farmer and the farm village.

Contribution to the technology transfer

The technology to produce BDF is not common yet in the Philippines. The project implementer, SCF Philippines employs local workers and transfer the technologies of plant operation and quality control, etc.

Contribution to Sustainable Development of Philippines

As mentioned above, the production of BDF from sunflower seeds, as a renewable energy, contributes to the sustainable development of Philippines through

(1) Strengthening energy security by reducing the expenditure for importing oil while increasing the dependence on the local energy sources,

(2) Reducing air pollution as well as climate change mitigation (Since BDF does not contain sulfur and does not emit solid particles),

(3) giving no contribution on national food supply system since the project sunflowers are planted as second crop of rice or on idle farm fields

Advantages of BDF other than the above

Followings are advantages of the project BDF other than the above:

1. Since viscosity of BDF is high, there is an advantage of lubricating engine parts.

2. The per unit energy value of vegetable energy is said to have four times as that of energy value used during its production process. Thus when seen from long-term viewpoint, production cycle can be said as infinite.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host party)	Private and /or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Japan	Sun Care Fuels Co. (SCF)	No
Philippines (host)	SCF Philippines (to be established)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>

The Republic of the Philippines

A.4.1.2. Region/State/Province etc.:

>>

Sunflower fields Central Luzon

Production facility	Subic Special Economic and Freeport Zone
Blending facilities	Manila

A.4.1.3. City/Town/Community etc:

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Sunflower fields	Not applicable
Production plant	Subic Bay Freeport Zone
Blending facilities	Pandacan, Manila

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The farmlands to supply the project sunflowers are located in the Central Luzon basin of Central Luzon region (excluding Aurora Province) in Luzon island.
Luzon island is located in the northern part of Philippines, and it is a biggest island of the Philippines (the 17th in the world), and the areas account for 35% of the gross area in about 104,688 km^2. And it is also a populous island in fourth in the world.

Central Luzon region is composed of 7 provinces, and regional center is San Fernando city of Pampanga Province. The area is 21,470.30 km^2 and the population, 8 million peoples and the population densities are 382 persons per km^2.
It is called “Rice Bowl” of the Philippines because the Central Luzon basin is a low ground, and the greatest rice-growing area in the Philippines.
The climate of the entire Philippines belongs to the tropical monsoon, and as for Central Luzon region, July to October is a rainy season and November to May is dry season. Rice is grown in the rainy season and the sunflower is grown in the dry season.

The oil terminals are located in City of Manila where is a capital and a centre of the politics and the economy in the Philippines.

Figure PDD-1: Map of Central Luzon

A.4.2. Category(ies) of project activity:

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Type III Other Project Activities,
— III.C. Emission Reductions by Low-Greenhouse Gas Emitting Vehicles

in the categorization of small scale CDM projects.

Note: This categorization does not mean that the project is categorized as small scale CDM. The PDD has been prepared for full scale CDM.

The project is a sort of fuel-switching project from fossil fuel to biomass-based fuel in the transportation sector.

A.4.3. Technology to be employed by the project activity:

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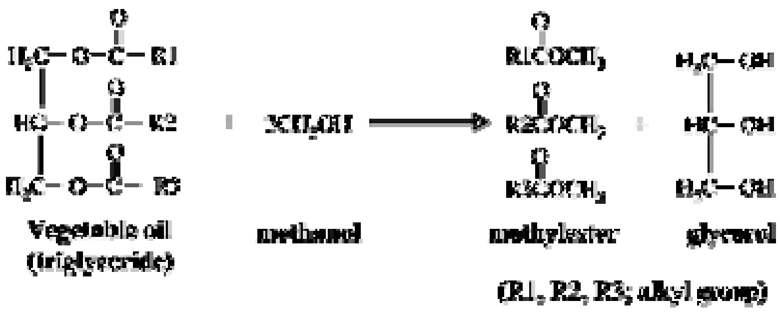
The core technology of this project is to produce BDF by using sunflower seeds.

The chemical reaction on esterification:



will occur at the BDF plant following the process flows below. All "C"s in methanol will be transferred to glycerol (which is not combusted) stoichiometrically.

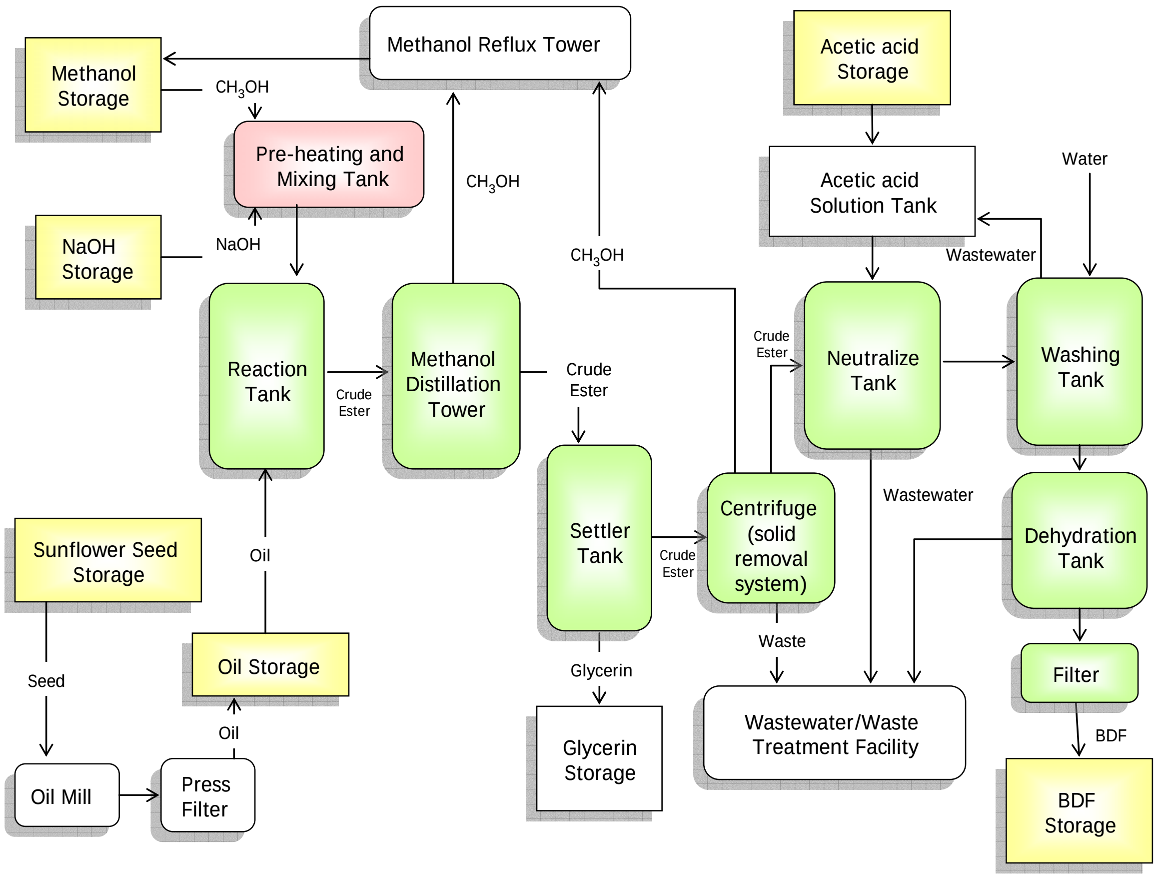


Figure PDD-2: Process Flow of BDF Production

Raw materials are sunflower seeds and methanol (CH_3OH). In addition, sodium hydroxide (NaOH; as catalyst), 0.5% acetic acid solution (CH_3COOH; for primary washing), and water (H_2O; for secondary washing) are needed. Sunflower oil and methanol react to ester due to the existence of methanol.

Finally, the outputs of the process are BDF (ester) as products, and residue after oil press, glycerin after esterification reaction as by-products. Oil press residues are sold as fodder and glycerin is sold as a chemical material.

BDF produced at the plant, will be blended with petro-diesel to be used as a mixed fuel like B1. Such mixture reduces air pollutants such as particulate matter (PM), polycyclic aromatic hydrocarbons (PAH), carbon monoxide (CO), sulfur oxides (SO_X), *etc.* in comparison to petro-diesel.

The various specifications of the project BDF (pure) are shown in Table below together with EN14214 for comparison:

Parameter	**Sunflower BDF**	EU EN 14214	USA ASTM 6751
Density @ 15 ^{0}C (g/cm ^{3})	0.885	0.86 - 0.90	-
D. Viscosity @ 40 ^{0}C (mm ^{2}/s)	4.17	3.5 - 5.0	1.9 - 6.0
90% Distillation (^{0}C)	342.0	-	<360
Flashpoint (^{0}C)	180	>120	>130
Pour Point (^{0}C)	-25 ~ -32	-	-
Sulfur (% mass)	<0.0001	<0.001	<0.05
CCR 100% (% mass)	-	-	<0.05
10% Distillation Carbon Residue(% mass)	0.01	<0.30	-
Sulfated Ash (% mass)	0.00	<0.02	<0.02
Water (mg/kg)	213	<500	<500
Cu-Corros, 3h/50 ^{0}C	1	<3	<3
Cetane No.	51.7	>51	>47
Acid Value (mg KOH/g)	0.21	<0.50	<0.80
Methanol (% mass)	<0.01	<0.20	-
Ester Content (% mass)	>98.0	>96.5	-
Monoglyceride (% mass)	0.39	<0.80	-
Diglyceride (% mass)	<0.05	<0.20	-
Triglyceride (% mass)	<0.05	<0.20	-
Free Glycerol (% mass)	<0.005	<0.02	<0.02
Total Glycerol (% mass)	<0.10	<0.25	<0.24
Iodine Number	112-118	<120	-
Phosphorus Content (mg/kg)	<10	<10	<10

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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The estimated amount of emission reductions is shown below:

Years	Annual Estimation of Emission Reductions (tonnes of CO_2e)
2008	2,894
2009	14,197
2010	65,347
2011	69,075
2012	69,075
2013	69,075
2014	69,075
Total estimated CO_2 reductions (tonnes of CO_2e)	358,738
Total number of crediting years	7 years
Annual Average over the Crediting Period of Estimated Reductions (tonnes of CO_2e)	51,248

A.4.5. Public funding of the project activity:

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No public fund is utilized for this project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Generalized baseline methodology for transportation Bio-Fuel production project with Life-Cycle-Assessment (AM00xx)

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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Here we check each applicability condition specified in the methodology (in boxes) as follows:

(II) Applicability Conditions:

The applicability conditions are listed below:

Condition (a)
A single biomass feedstock accounts for more than 90% of the total biomass feedstock used for the project activity to generate Bio-Fuel. No biomass feedstock from market is to be used. The CERs to be claimed from the use of unidentified biomass feedstock (*e.g.*, biomass-based waste oil)—less than 10% of the total—are to be discounted by 10% of unidentified biomass feedstock if its origin is not clearly identified. Those volumes shall be identified by the project participants. The project participants shall demonstrate that the biomass feedstock supply does not prevent some part of GHG emission reductions or carbon sequestration activities which would be realized otherwise.

This project intends to use sunflower seeds and purchase only from the contract farmers, and not procured from the general market as mentioned in A.2.
The monitoring procedure to be able to identify the volumes of unidentified biomass feedstock will establish.

As for the other activities, there is no chance to prevent GHG reductions by the other activities because sunflowers for the project are planted only in existing rice fields after harvesting of rice's.

Condition (b)
The project is the optimal solution in its scale in the project participants' decision making, taking account of several barriers[1] including economical perspectives, as far as a Bio-Fuel production plant (by using the same biomass) is invested;[2]

The plant size chosen is the best solution considering financial availability and availability of sunflower seeds. Detail explanation will be demonstrated to Validator later.

Condition (c)
In case some mandatory or virtually mandatory regulation (which is not categorized as Type E–[3] policy) on the blended-ratio and/or on the fraction of total sales of the Bio-Fuel or its compatibles are introduced in the host country, the project activity cannot claim CERs if the Bio-Fuel is used just to meet the regulation. On the other hand, if the regulation is not effective (*i.e.*, compliance rate is low) or if it is over-achieved, the production of Bio-Fuel by the project activity can generate CERs (*i.e.*, is recognized as the replacement of the target fossil fuel).

Petro-diesel can be used in Philippines without any restriction.

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[1] Economically, the scale-merit is observed. However, the amount of economically obtainable biomass and/or financial limitation prescribes the upper limit of the scale of Bio-Fuel production.

[2] As demonstrated in the "additionality assessment" later, the project would not be invested in case of no CER (as the baseline). This condition is set to exclude the case where another scale of Bio-Fuel production would be chosen as the baseline.

[3] According to CDM EB 16 Rep Anx3, "Type E-" policies or regulations that have been implemented since the adoption of the CDM M&P (11 November 2001) may not be taken into account in developing a baseline scenario.

Act 9367 came into effect in Philippines in January, 2007, and a minimum 1 % of BDF shall be blended into all diesel engine fuel. However, the project is applicable to the methodology since the project activity will start from year 2008, i.e., before November, 2001 and is considered as “Type E “.

Condition (d)
The target fossil fuel to be replaced by the Bio-Fuel, has excess supply capacity in the host country, therefore the project does not create new/hidden demand of the fossil fuel, *i.e.*, the Bio-Fuel is to replace target fossil fuel fully under the competitive environment.

In Philippines, petro-diesel supply system has excess capacity as no supply limitations are conducted. Therefore, the demand of diesel fuel is not constrained, nor expected to be constrained in the foreseeable future.

Condition (e)
The Bio-Fuel which is produced by the project and for which CERs are claimed is consumed for vehicles, ships or in-house uses[4], or used for some other specific purposes[4] as an alternative to a fossil based fuel in non-Annex I countries, and is not exported to/used in Annex I countries[5]. Namely, CER cannot be claimed for the exported amount of the Bio-Fuel, which shall be monitored.

All project BDF is supplied to general consumers through the oil terminals owned by the oil companies. Therefore, the export of BDF to other countries is not done while that is monitored.
he project participants have no intension to export BDF to outside of host country. This will be proven by demonstrating the letters singed by distributors at the validation stage. At verification stage, verifier can confirm a conformity to this condition by sale records.

Condition (f)
The project Bio-Fuel is consumed as a blended project Bio-Fuel with the certain blend ratio.
The blend ratio shall be the one, whichever the lower figure, the ratio that does not require a modification of consumer’s engines in host country or the ratio given as the national policy, shall be applied as the project blend ratio.
However, the Bio-Fuel is treated not suitable for drinking or other non-energy purposes by, *e.g.*, blending the fossil fuel.

Philippine government obligates to use BDF1 (BDF 1% and petrodiesel 99%) by Act 9367 in 2007, and is intending use of BDF2 within two years.

[4] Since the efficiency (service per fuel, e.g. mileage per litre) ratio of the BDF to diesel oil is basically the same *regardless usage*, the Bio-Fuel will substitutes a same volume of diesel oil in same efficiency. Even if they have small difference, the portion of fuel usage other than transportation is relatively small and consequently such difference can be neglected for calculation on the volume of the target fuel substituted. Therefore the methodology does not limit the usage.

[5] The portion of the project Bio-Fuel exported to Annex I countries cannot generate CERs. These portions are to be identified basically by sale records of the project participants, and as a supportive data by receipt from whom the project Bio-Fuel sold, e.g., blenders, retailers and/or exporters except individual consumers.

Naturally, this project also follows the Act, i.e., 1% (2% in future) which is less percentage of BDF20 that might need remodel of the engine. And it is not suitable for drinking or other non-energy purposes by mixing the oil 99%.

Therefore, the methodology is applicable to the project.

B.3. Description of the sources and gases included in the project boundary

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As specified in the methodology, the principal GHG reductions through the project are realized by many vehicles[6] utilizing the project BDF. This case is similar to the grid-connected renewable energy project-type. Therefore, the project boundary is chosen as

- the plantation site,
- transportation to the project site (BDF production facility),
- the project site,
- transportation to fuel-supply facility,
- fuel-supply facility, and
- all vehicles which utilizes the BDF produced by the project

referring to the case of ACM0002, which includes all the power plants (where emission reductions are realized) connected to the grid to be in the boundary.

As mentioned in A.2., some project emissions and leakages in Section II "5. Project emissions" and "6. Leakage" of the methodology are not applicable. Those are listed below with the reasons.

Project emissions

Item	Reason for no consideration
3	No crop residue burning will be carried out. Crop Residues will be used as fodder.
4-2	Biomass residue will not be used as feedstock for this project.
6	C-components of methanol are transfer to glycerin.[7]

Leakages

Item	Reason for no consideration
LE3	No wastewater treatment with anaerobic condition.

[6] The relevant vehicles are unspecified (*i.e.*, not monitored) each by each in the methodology, however, well-defined as those can be identified strictly. ACM0002 does not estimate each power plant's emission reductions, while this case can monitor them in theory. However, because only aggregated value is needed to calculate emission reductions, monitoring methodology does not require monitoring of each vehicle.

[7] The methanol as a non-bio feedstock for the production of BDF (trans-esterification process) is not necessary to count its use as project emission. Although C-components of methanol are transferred to the project BDF, the same number of C-components also transferred to glycerin. Therefore, non-organic carbons remain in the project BDF, production of glycerin using non-biomass feedstock is reduced at same time. The demand of glycerin can be regarded as independent of the existence of project activity (*i.e.*, common for the baseline and project scenarios).

LE5 No Deforestation is expected.

The numbers, such as PE1, LE1 are correspond to the numbers in the column "Monitored?" of the table NMB-1 below as well as paragraph B.6 to facilitate identification.

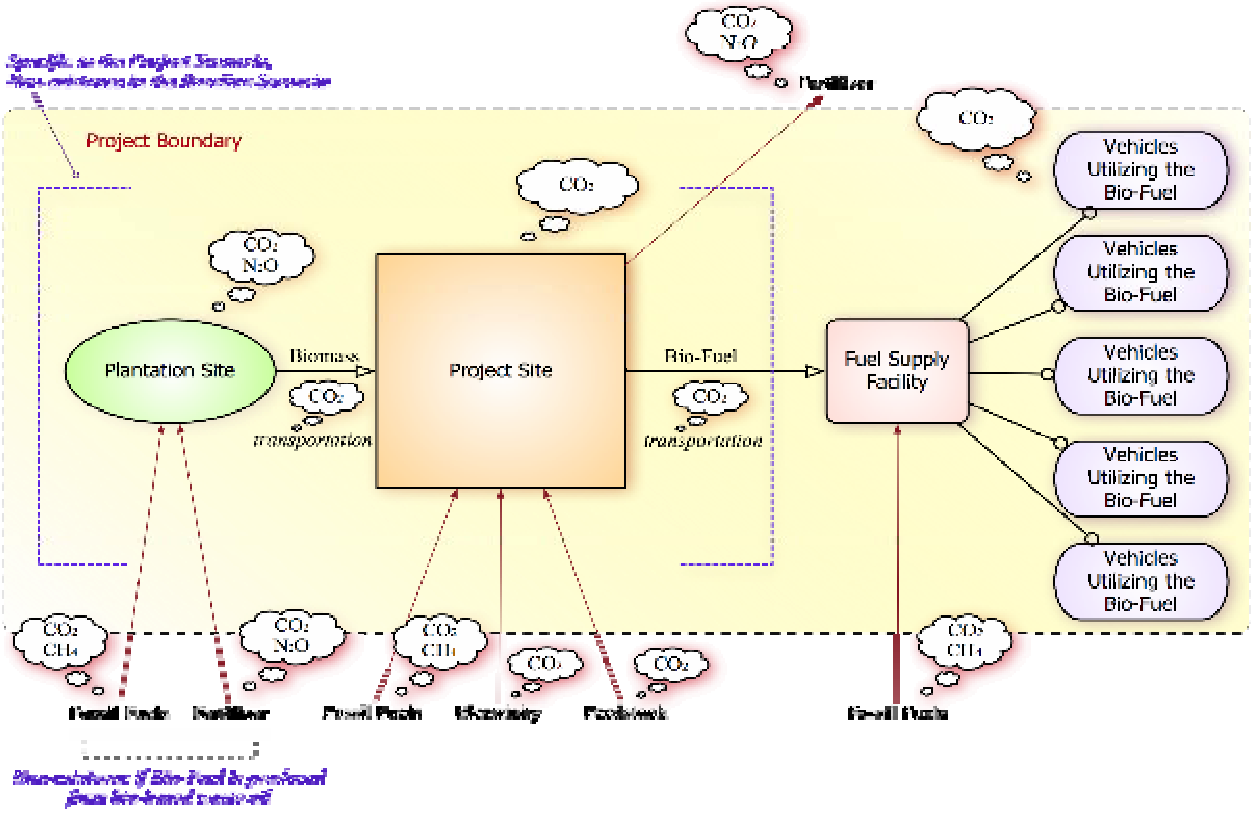

Figure PDD-3: Project Boundary and Associated GHG Emissions

Table NMB-1: Emissions Sources Included in or Excluded from the Project Boundary

	Source	Gas	Project Boundary?	Monitored?	Justification / Explanation
Baseline	Each vehicle utilizing the Bio-Fuel in the PJS	CO_2	Inside	Yes (BE)	CO_2 from fossil fuel use replaced by biomass part of the Bio-Fuel *[substitution effect]*
		CH_4		No	Small amounts of CH_4 and N_2O are emitted from fossil fuel combustion, while the difference between PJS is negligible.
		N_2O			
	Exploitation,	CO_2	Outside	Yes	LCA effects are considered. CO_2 part is

	refinement, transportation of fossil fuels replaced by the Bio-Fuel [oil field/port/ refinery/gas station]	CH_4		(BE)	larger than CH_4 part in it.[8]
		N_2O		No	N_2O is minor portion in comparison to CO_2 and CH_4 emissions, therefore can be neglected (the leakage effect of CO_2 and CH_4 is minor in comparison to the fuel switching effect of the Bio-Fuel.).
Project Activity	Each vehicle utilizing the Bio-Fuel in the PJS	CO_2	Inside	No	Each vehicle utilizing the "blended" Bio-Fuel in the PJS (CO_2 from fossil fuel C-content (originated in "blended" fossil fuel) in the Bio-Fuel). This CO_2 from fossil fuel part of Bio-Fuel is neglected because it is common for BLS.
		CH_4		No	Small amounts of CH_4 and N_2O are emitted from fossil fuel combustion, while the difference between PJS is negligible.
		N_2O			
	Transportation of Bio-Fuel [plant to gas station]	CO_2	Inside	Yes (PE7)	Minor, but should be counted if it is not negligible.
		CH_4		No	Negligible, because it is much smaller than CO_2 part.
		N_2O			
	Bio-Fuel plant and/or steam supply plant	CO_2	Inside	Yes (PE5)	CO_2 from fossil fuel combustion and/or steam generation for in-house use (and CO_2 from C-content in non-bio feedstock combustion, if present).
		CH_4		No	Small amount of CH_4 and N_2O are emitted from fossil fuel combustion. Considered to be negligible.
		N_2O			
	Bio-Fuel plant	CO_2	Inside	No (PE6)	C-components of methanol are transfer to glycerine
		CH_4		No	Negligibly small.
		N_2O			
	Transportation of biomass [plantation site to Bio-Fuel plant]	CO_2	Inside	Yes (PE4)	Minor, but should be counted if it is not negligible.
		CH_4		No	Negligible, because it is much smaller than CO_2 part.
		N_2O			
	Plantation site	CO_2	Inside	Yes (PE1)	CO_2 from machinery use is counted.
		CH_4		No (PE3)	No field burning
		N_2O		Yes(PE2)	N_2O from organic fertilizer use (direct + indirect)
	Power plants linked to the grid	CO_2	Outside	Yes (LE1)	CO_2 from electricity used in the Bio-Fuel plant
		CH_4		No	Small amount of CH_4 and N_2O are emitted

[8] Strictly speaking, LCA effects outside of the boundary must be treated as leakage, while it is *simpler* to include such effects in the CO_2 emission factor of the fossil fuel (as "adjustment"). The methodology, therefore, treats such LCA effects as a modified emission factor of the fossil fuel.

		N_2O			from fossil fuel combustion at the power plants. Considered to be negligible.
	Synthetic fertilizer production	CO_2	Outside	No	If synthetic fertilizer is applied, related N_2O emissions from its production process are counted.
		CH_4			
		N_2O		Yes (LE2)	
	Production process of non-bio feedstock	CO_2	Outside	Yes (LE4)	GHG emissions at the feedstock production process may be monitored, if it cannot be neglected.
		CH_4		No	No need to count for CH_4 and N_2O parts because these are non-significant. See Leakage Section for details.
		N_2O			
	Exploitation, refinement, transportation of fossil fuels used at the Bio-Fuel plant and plantation site [oil field/port/ refinery/gas station]	CO_2	Outside	Yes (PE1,4,5,7)	LCA effects are common for the baseline scenario.
		CH_4			
		N_2O		No	
	Wastewater treatment system	CO_2	Outside	No	Negligible because of carbon neutrality.
		CH_4		No (LE3)	No anaerobic water treatment is applied
		N_2O		No	Negligible because it is much smaller than CH_4.
	Direct and indirect deforestation effect by the project	CO_2	Outside	Yes (LE5)	Counted if the project activity leads land clearance/deforestation
		CH_4		No	Negligibly small
		N_2O		No	

[**Note**] BLS: Baseline Scenario, PJS: Project Scenario.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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As explained in the section of the applicability condition, the methodology categorizes the project lifecycle related to GHG emission reductions into the following three stages:

Stage 1: Biomass supply,

Stage 2: Bio-Fuel production, and

Stage 3: Bio-Fuel consumption.

In order to identify the baseline scenario[9], the alternative scenario options are to be listed up for each stage under the no CER revenue condition. To simplify the logics, the procedures begin with the second "Bio-Fuel production" stage which is the core part of the proposed project activity. This

9 Several baseline scenarios may be chosen whose baseline emissions are identical. Those scenarios are regarded as the "same" or "equivalent" scenario in a sense to calculate emission reductions.

procedures are consistent with the "Additionality Tool".

[[note] BLS: Baseline scenario, PJS: project scenario]

Stage 2 [Bio-Fuel production]

Baseline Scenario Candidates in the Stage 2:

In this stage, several baseline scenario options are found as follows:

- Option 2-1: Continuation of current practice (BaU case: nothing specific happens),
- Option 2-2: Installing a Bio-Fuel production facility (project case) without CER revenue; and
- Option 2-3: Installing a Bio-Fuel production facility, whose production scale is larger or smaller than the project.

If the applicability condition (b) on the optimality of the size of the Bio-Fuel production is demonstrated, Option 2-3 cannot be the baseline scenario.

As a result, the remaining option is to continue the current practice (no Bio-Fuel production is implemented at the site) or the project activity itself.

Optimal solution in its scale of the planed production plant is demonstrated as per requirement in Applicable condition (b), and it decides from the economy and sunflower seeds availability in this project. A detailed result of study will be shown during the validation to Validator. Therefore, Option 2-3 is excluded.

As a result, the remaining option is only Option 2-1 "Continue the current practice" and Option 2-2 "Installing a Bio-Fuel production facility (project case) without CER revenue".

Next, it is necessary to assess whether the project would not be implemented in the baseline scenario (*i.e.*, additionality condition).

The method of confirming the additionality is the barrier analysis and/or by the economical analysis with calculations of the indicators used for investment decision-making at the planning stage of the Bio-Fuel production plant.

"Step 3. Barrier analysis" and/or "Step 2. Investment analysis" of the "Tool for the demonstration and assessment of additionality" can be applied. If barrier analysis well demonstrates that the project would not be implemented as the baseline scenario, the investment analysis is not needed. While, if the barrier analysis is insufficient, investment analysis is needed in addition (in this case, the barrier analysis is recognized as the supportive analysis to demonstrate additionality).

Barrier Analysis (Step 3 of the Additionality Tool) in the Stage 2:

Sub-step 3a. Identify barriers that would prevent implementation of type of the proposed project.[10]

The barriers may include barriers, *e.g.*, cumbersome/complex procedures to get approval to construct/operate the Bio-Fuel production facility, lack of acceptability of the Bio-Fuel in the market, limited access by the consumers because of fewer Bio-Fuel supply facilities, risks associated

[10] Sub-step 3b on the alternatives is not needed as no alternatives are left as shown above.

with new Bio-Fuel technology, lack of skills to produce/handle the Bio-Fuel, lack of finance suppliers to implement the Bio-Fuel production project, etc. as specific examples of the generalized expression of the "Additionality Tool" to this type of projects.

If the project is almost the "first-of-this-kind" in the host country, the project is recognized as additional.

Although BDF from coconuts are produced in Philippines, there is no BDF made from sunflower seeds.

This means the project case is the "first of its kind" in Philippines and the barrier due to prevailing practice exists.

Investment Analysis (Step 2 of the Additionality Tool) in the Stage 2:

Sub-step 2a. Determine appropriate analysis method

Sub-step 2b. – Option II. Apply investment comparison analysis, or

Sub-step 2b. – Option III. Apply benchmark analysis

Sub-step 2c. Calculation and comparison of financial indicators

Sub-step 2d. Sensitivity analysis (only applicable to options II and III)

The method to assess this investment analysis is the same as shown in the "Additionality Tool". Specific to this type of projects, for the investment analysis, all economic components—*e.g.*, costs of biomass planting/purchase, internal energy use, feedstock use, transportation of the Bio-Fuel, construction of the plant, and revenue such as from the sales of the Bio-Fuel,[11] by-products—of the Bio-Fuel production plant shall be incorporated as well as some related parameters such as a tax rate, a discount rate, and the rate of self-financing. Because the investment decision has been made before the implementation of the project, the associated value of the parameters are the expected value used at the time of investment decision-making.

Sub-step 2a. Determine appropriate analysis method

Above Option 2-2, as the baseline scenario alternative, apparently generate financial or economic benefits. Hence, in accordance with "Additionality Tool", we apply Option II, Investment comparison analysis.

Sub-step 2b. – Option II. Apply investment comparison analysis

Investment comparison analysis is applied to assess the economic efficiency of the project activity *without* CER revenue.

The calculation of IRR shows that IRR is around 5.51% (with tax) without CER revenue.

The hurdle rate for investment decision-making by SCF Philippines is 15%.

Therefore, it concludes that the project is *not* an economically attractive course of action.

[11] Through the cost to purchase the biomass and the price to sell the Bio-Fuel, this additionality check is linked to that of the Stage 1 and Stage 3.

The underlying detailed spreadsheet calculation and associated parameters used for investment decision-making, such as operation and maintenance costs, capital investment costs, interest rate and tax rate are to be disclosed to the Validator during the validation process.

The sensitivity analysis of the IRR related to the three key factors shows:

Variation.	-2%	-1%	-0.5%	0	0.5%	1%	2%
BDF sale price	-	-0.74%	2.36%	5.51%	8.70%	11.95%	18.60%
Price of sunflower seed	21.16%	13.14%	9.28%	5.51%	1.80%	-1.86%	-
Investment cost	6.78%	6.14%	5.82%	5.51%	5.20%	4.89%	4.29%

As shown in the table above, the most sensitive factor is the price of sunflower seeds. The price of sunflower seeds may not fall because the project implementer have the contract in which the lowest purchasing price is guaranteed, but may rise due to the recent shortage of biomass feedstock in the world, In addition, there is climate risk , such as typhoon which rise the price.

As for the sales price of BDF, the price might rise due to requirement of “Biofuel Act of 2006” because the Act requires BDF shall be domestic one for BDF1 (1% BDF and 99% petrodiesel). However, the demand of BDF to satisfy the necessary volume is already satisfied by the existing BDF made from coconuts. And the Act also intends to increase contents of BDF in fossil diesel oil up to 5% within two years, but accepts imported BDF. Therefore, the sales price would not rise.

Therefore, it is concluded that the conclusion in the previous sub-step is robust.

Common Practice Analysis (Step 4 of the Additionality Tool) in the Stage 2:

As in the Additionality Tool, common practice analysis is undertaken to check the above conclusion.

In case that the market penetration of the same type (differentiated by the mixing ratio or type of biomass component) of the Bio-Fuel is more than [10%] in the host country, the project participants shall demonstrate that the project would face the prohibitive barriers without the CER revenue with appropriate evidences.

In addition, the applicability condition (c) shall be checked to be true.

As the result, it is assumed that the “continuation of current practice” can be concluded as the unique feasible option in the Stage 2.

Once the Stage 2 baseline scenario is concluded as the continuation of current practice, there remain limited baseline scenario options for the Stages 1 and 3.

Although penetration of BDF produced from coconuts is about 1%, as mentioned above, penetration of the BDF produced from sunflower seeds is almost 0 % in Philippines at the time of PDD preparation. Therefore, it does not need to explain the barriers anymore. (Evidences are to be prepared)

Therefore, Option 1 is concluded as the baseline scenario.

Stage 1 [Biomass supply]

If the baseline scenario of Stage 2 [Bio-Fuel production] is Option 2-1 Continuation of current practice, then, the baseline scenario of Stage 1 [Biomass supply] stage is to the continuation of current practice (no specific activity is taken for biomass feedstock production). Since the project activity is not implemented in the Bio-Fuel production stage, no change due to the project activity is caused or necessary in Biomass supply stage.

Stage 3 [Bio-Fuel consumption]

If the baseline scenario of Stage 2 [Bio-Fuel production] is Option 2-1 Continuation of current practice, then, the baseline scenario of Stage 1 [Biomass supply] stage is to the continuation of current practice (utilizing the target fossil fuel). Since the project activity is not implemented in the Bio-Fuel production stage, no change due to the project activity is caused or necessary in Bio-Fuel consumption stage.

As the baseline scenario of Stage 2 [Bio-Fuel production] is Option 2-1 Continuation of current practice, the baseline scenarios of stage 1 and 3 are also the continuation of current practices.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

Step 0 – Preliminary screening based on the starting date of the project activity

This step is not applicable because it is expected that the project activity will only start generating CERs in 2008.

The series of steps shown in the Section B.4. are consistent with the additionality tool in a sense that it includes the investment analysis, barrier analysis, with listing up of the possible alternatives in it.

Step 4: Common Practice Analysis

There is no production of BDF from sunflower seeds in Philippines as mentioned in B.3. Therefore, the project activity is first-of-its-kind in Philippines.

Step 5: Impact of CDM Registration

This final step requires the project developer to explain how approval and registration of the proposed project as a CDM activity will alleviate the economic hurdles and the identified barriers, and thus enable the project to be undertaken.

The key benefit to CDM registration is just the generation of CER revenue which enables the project to be come into being. Carbon credit revenue in the following table's calculation makes the project financially viable.

IRR (without CER revenues)	5.51%
IRR (with CER revenues)	18.4%

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
All numbers of formulae correspond to those in the methodology.
As this is the document for the specific project, the following suffixes are changed from the methodology.

Methodology		PDD		Methodology		PDD	
Sufffix	Stand for;	Sufffix	Stand for;	Suffix	Stand for;	Sufffix	Stand for;
BF	Biofuel	BDF	Bio Diesel Fuel	FS	Feedstock	SF	Sun flower seeds
FFT	Target fossil fuel	PD	Petro-diesel	Crop	Crop as feedstock	SF	Sun flower seeds
$FF_{1, 2, 4}$	Fossil Fuel	PD	Petro-diesel	NB	Non-biomass feedstock	Me	Methanol
FF_{3}	Fossil Fuel	HFO	Heavy fuel oil				

In addition, the following abbreviations are used in the sentences hereafter;

BDF	The project Bio Diesel
SF or BM	The project biomass feed stock or Sunflower seeds or Biomass
PD	The project target fuel or petro-diesel
HFO	Heavy fuel oil
DM	Dry matter

Baseline Emissions

For the project where no the unidentified biomass feedstock oils are expected, the baseline emissions BE_y are given in the methodology is simplified as follow;

$$BE_y = FC_{BDF,y} * Q_y * EF_{PD} * F_{LCA} \quad (1)$$

Where;

$FC_{BDF,y}$: Pure (100%) project BDF sold or consumed in non-Annex I country in a certain year [kilo-litre/yr][12]

Q : Factor showing volume of PD that is displaced by the project BDF when the project blended BDF is used [no dimension]. (See formulas (3) and (4))

EF_{PDBDF} : Emission factor of PD, which the BDF replaces [tCO_2eq/kilo-litre]

$$= CEF_{PD} * NCV_{PD} * DEN_{PD} \quad (2a)$$[13]

Where;

CEF_{PD} : CO2 emission factor of PD [[tCO_2eq/TJ]

NCV_{PD} : Net Calorific Value of PD [TJ/kilo tonne]

DEN_{PD} : Density of PD [tonne/kilo litre]

F_{LCA} : Life-cycle factor (See the explanations below)

$$= (EF_{PD,WTT} + EF_{PD,TTW}) / EF_{PD,TTW} \quad (2b)$$

As FEG and FEP are not available in the host country, we apply a value for Q may be derived based solely on energy content as below.

$$Q = \frac{ECE}{ECP} = \frac{NCV_{BDF,y} * DEN_{BDF,y}}{NCV_{PD} * DEN_{PD}} \quad (4)$$

where:

Q	:	Factor showing volume of PD that is displaced by the project BDF when the project BDF is used [no dimension]
ECE	:	Energy content of the project BDF [MJ/litre]
ECP	:	Energy content of PD [MJ/litre]
$NCV_{BDF,y}$	:	Net calorific value of the project BDF [MJ/ton]
NCV_{PD}	:	Net calorific value of PD [MJ/ton]
$DEN_{BDF,y}$	:	Density of the project BDF [klitre /ton]
DEN_{PD}	:	Density of PD [klitre /ton]

Whenever latest data on fuel efficiency become available and accepted by the verifier, the project participant can apply those data for the calculation of the baseline emissions.

<u>Life-cycle GHG emission factor of PD</u>:[14]

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[12] The methodology presents quantities of the project Bio-Fuel, the blended project Bio-Fuel and the target fossil fuel in volume. Volumetric measurement for transaction of those fuel is common and following that practice makes monitoring easy and accurate. Fuel efficiency data will also be expressed on a volumetric l/km basis or similar.

[13] This equation is applicable to all fossil fuels providing that CEF, NCV, DEN are used for the fuel used.

[14] The principal reason to incorporate LCA for the baseline (target fossil) fuel is to keep consistency in treatment, *i.e.*, the LCA is also applied for the project Bio-Fuel.

As the methodology suggests, we use the following default $EF_{PD,WWT}$ based on a reputable study carried out by L-B-Systemtechnik GmbH.[15] For $EF_{PD,TTW}$, IPCC default is used.

Table: Default $\mathbf{EF_{WWT,PD}}$ values for emissions from production and consumption of gasoline and diesel oil

Life-Cycle Stage	CO_2 emission
Well-To-Tank ($EF_{PD,WWT}$)	292.7 gCO_2e/litre
Tank-To-Wheel ($EF_{PD,TTW}$)	IPCC Default

For the IPCC default values, the country-specific and the latest values shall be prioritized.

The baseline fuel emission factor should be re-calculated at the end of each crediting period based on the latest analysis and/or studies available at that time.

Project emission

The lifecycle emissions of the project scenario are categorized in AM00XX (NMB0129) as follow:

1	Emissions associated with the project target fuel (PD) consumption during agricultural operations (preparation, planting, harvesting *etc*) - CO_2	
2	Emissions associated with fertilizer use - N_2O	
	2-1	Direct Soil N_2O emissions from organic and/or synthetic fertilizer use.
	2-2	Indirect N_2O emissions from atmospheric deposition and leaching/runoff
3	Emissions associated with the field burning of crop residues - CH_4 and N_2O	
4	Emissions associated with the transport of biomass feedstock (SF) to the project Bio-Fuel (BDF) factory - CO_2	
	4-1 Case where the project Bio-Fuel (BDF) is produced biomass feedstock (SF) directly from field	
	4-2 Case where the project Bio-Fuel (BDF) is produced from biomass residue	
5	Emissions from the industrial production of the project Bio-Fuel (BDF) - CO_2	
6	Emission associated with combustion of the non-bio feedstock contained in the (BDF) sold or consumed - CO_2	
7	Emissions associated with the transport of the project Bio-Fuel (BDF) to the place of blending/distribution - CO_2	

Categories 1–4 can be classified as "Field" emissions and are the emissions related to the production and transport of SF to the project site. Category 5 can be termed "Industrial" emissions and related to the processing of the feedstock into the project BDF. Finally, Category 7 can be classified as "Transportation to end use" emissions.

However, as mentioned in A.2, the following GHG emissions of this project are not calculated.

Item	Reason for no consideration
3	No crop residue burning will be carried out. They will be used as composts in the fields.
4-2	Biomass residue will not be used as feedstock for this project.

[15] See Section L in the AM00XX (NMB0129) for details of emission factors.

6	C- components of methanol are transfer to glycerin.[16]

<u>"Field" emissions</u>

The first step is to calculate emissions on a kgCO$_2$e/tonne of SF basis:

1. Emissions associated with PD fossil fuel consumption during agricultural operations

Emissions associated with PD consumption during agricultural operations in year *y*, is given as follow;

$$PEA_{agri,y} = EF_{PD,LCA} * F_{LCA} * \frac{FE_{AG}}{Y_y} \quad (5)$$

where:

$PEA_{agri,y}$	:	Project emissions associated with PD consumption during agricultural operations in year *y* [kgCO$_2$e/ tonne of BM]
EF_{PD}	:	Emissions factor for PD [kgCO$_2$e/kilo-litre] (See the equation (2a))
FE_{AG}	:	Average fossil PD consumption per hectare on agricultural land supplying project activity [kilo-litre/ha]
F_{LCA}	:	Life-cycle factor (See the equation (2b))
Y_y	:	Average annual SF yield at the project fields [tonnes of SF / ha]

2. Emissions associated with fertilizer use

GHG emissions relating to fertilizer use originate from two sources; those associated with direct and indirect soil N_2O emissions from nitrogen fertilizer use. The emission from the production of fertilizer is dealt as "Leakage".

<u>2-1 Direct Soil N_2O emissions from organic and/or synthetic fertilizer use</u>

For the project where

1) All sunflower residues are not burnt and turn to composts (AF_{burnt} = 0, and F_{CR} = 0[17] , and
2) Composts applied are not monitored as individual sunflower suppliers turn the residues at their fields (F_{Comp} = F_{CR} * 1.1[18]) and,
3) The project biomass is annual plant ($Frac_{Renew}$ = 1),

[16] The methanol as a non-bio feedstock for the production of BDF (trans-esterification process) is not necessary to count its use as project emission. Although C-components of methanol are transferred to the project BDF, the same number of C-components also transferred to glycerin. Therefore, non-organic carbons remain in the project BDF, production of glycerin using non-biomass feedstock is reduced at same time. The demand of glycerin can be regarded as independent of the existence of project activity (*i.e.*, common for the baseline and project scenarios).

[17] Since all residues are removed and turn to composts, F_{CR} is equal to $F_{Comp.}$. Therefore, F_{CR} is calculated in order to estimate F_{Comp}.

[18] F_{CR} is to be multiplied by 1.1 as per the methodology since this value is not monitored.

the following equation should be used to estimate the emissions:

$$N_2O_{direct} = F_{REQ} * EF_1 = (F_{Comp} + F_{CR} + F_{SN}) * EF_1 \quad (6)$$

where:

N_2O_{direct}	:	Annual direct emissions of N_2O per hectare in units of Nitrogen [kg-N/ha/yr]
F_{REQ}	:	Annual required N per hectare for SF based on type of soil and type of land management [kg-N/ha/yr].
F_{CR}	:	Annual amount of N in the crop residue returned/applied per hectare [kg-N/ha/yr], calculated by the equation (9). However, as this Ns are returned to the field as compost, this value is used as F_{Comp}, setting “0” always.
F_{Comp}	:	Annual amount of compost N applied per hectare [kg-N/ha/yr] $= F_{CR}$[17] $*1.1$[18] (7)
F_{SN}	:	Annual amount of synthetic fertilizer N applied per hectare [kg-N/ha/yr] $= W_{SN,y} * NF_{SN}$ (8) *Where;* $W_{SN,y}$: Annual amount of synthetic fertilizer applied per hectare [kg-Fertilizer/ha/yr] NF_{SF} : N fraction of synthetic fertilizer
EF_1	:	Emission factor for emissions from N inputs [kgN_2O-N/kg N input] or latest data if updated.

and:

$$F_{CR} = Crop * [(R_{AG} * N_{AG}) + R_{BG} * N_{BG}] \quad (9)$$

where:

Crop	:	Harvested annual crop (SF) dry matter [kg DM (Dry Matter)/ha/yr] $= Y_y * FDM_{Crop}$ Where; Y_y : Crop yield, [t Crop/ha/yr] FDM_{Crop} : Fraction of crop dry matter
R_{AG}	:	Ration of above-ground residues dry matter (AG_{DM}) to harvested crop [kgDM/kgDM-Crop] $= AG_{DM}/Crop = (Crop * slope + intercept)/Crop$ *Where:* AG_{DM} : Above-ground residues dry matter = Crop * slope + intercept slope : Slope to calculate AG_{DM} intercept : Intercept to calculate AG_{DM}
N_{AG}	:	N content of above-ground residues
R_{BG}	:	Ration of above-ground residues dry matter (AG_{DM}) to harvested crop[kgDM/kgDM-Crop] $= R_{BG\text{-}Bio} * (AG_{DM} + Crop)/Crop$ *Where;* $R_{BG\text{-}Bio}$: Ratio below-ground residues to above-ground bio mass
N_{BG}	:	N content of below-ground residues

CO_2 equivalent N_2O-N direct emissions per tonne of SF, $PEA_{fertD,y}$ are calculated as follows:

$$PEA_{fertD,y} = \frac{N_2O_{direct} * (44/28)}{} * 310 \quad (11)$$

Y_y

where:

$PEA_{fertD,y}$: Direct N_2O emissions from Nitrogen fertilizer use [kgCO_2e/tonne of SF]
Y_y : Average annual SF yield at the project fields [tonnes of SF / ha]

2-2 Indirect N_2O emissions from atmospheric deposition

As per 2006 IPCC, N_2O emissions from leaching/runoff are to be considered only for the regions where leaching/runoff occur. As local reputable agronomist justified that leaching and runoff is not expected in the region where biomass feedstock for the project is produced, annual emissions from indirect N_2O emissions are calculated by the equation (12) in the methodology with simplification.

$$N_2O_{indirect,y} = N_2O_{(ATD),y} \qquad (12)$$

where:

$N_2O_{indirect}$: Emissions of N_2O in units of Nitrogen [kgN/ha/yr]
$N_2O_{(ATD),y}$: N_2O produced from volatisation of applied synthetic fertilizer and animal manure N, and its subsequent atmospheric deposition as NO_X and NH_4 [kgN/ha/yr]

$N_2O_{(ATD),y}$ are given as follow:

$$N_2O_{(ATD),y} = [(F_{SN} * Frac_{GASF}) + (F_{Comp} * Frac_{GASM})] * EF_4 \qquad (13)$$

where:

F_{SN} : Annual mass of synthetic fertilizer applied per hectare [kgN/ha/yr] given by equation (8)
$Frac_{GASF}$: Fraction of synthetic fertilizer nitrogen applied that volatises as NH_3 and NO_X, t(NH3+NOX)-N/tN input
F_{Comp} Annual mass of compost applied per hectare [kgN/ha/yr] given by equation (7)
$Frac_{GASM}$: Fraction of organic materials nitrogen applied that volatises as NH_3 and NO_X, t(NH3+NOX)-N/tN input
EF_4 : Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces [kg N_2O-N/kg N input] taken from IPCC[19], or latest data if updated.

CO2 equivalent N_2O-N indirect emissions per tonne of SF, $PEA_{fertI,y}$ are calculated as follows:

$$PEA_{fertI,y} = \frac{N_2O_{indirect\,,y} * (44/28)}{Y_y} * 310 \qquad (15)$$

where:

$PEA_{fertI,y}$: Indirect N_2O emissions from Nitrogen fertilizer use [kgCO_2e/tonne of SF]
Y_y : Average annual SF yield at the project fields [tonnes of SF / ha]

[19] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 Table 11.3

4. Emissions associated with the transport of biomass feedstock (SF) to the project** BDF **factory

For the project where transportations of SF are single mode (only by truck) to be done by the contract transporter, annual emissions from transporting SF to the project BDF factory are calculated by the equation (20a) in the methodology:

$$PET_{SF,y} = \frac{AD_{SF} * FE_{SF} * EF_{PD} * F_{LCA} * \beta}{TC_{FS} * 1,000} \qquad (18a)$$

where:

$PET_{SF,y}$	:	Emissions from the transportation of SF from the field to the project BDF factory [$kgCO_2e$ / tonne of SF]
AD_{SF}	:	Average round trip distance between field and factory [km]
$FE_{PD,SF}$	:	Fuel efficiency of transporter [litre/km]
EF_{PD}	:	CO_2 emissions factor of the truck fuel [$kgCO_2$/litre] (See the equation (2a))
F_{LCA}		Life-cycle factor (See the equation (2b))
TC_{SF}	:	Truck capacity [tonnes]
β	:	Fraction of SF transported to factory by truck

<u>“Field” emission factor</u>

For the project where feedstock is single and no biomass residue is used as feedstock and where no field burning is carried out, annual total “Field” emissions on a $kgCO_2e$ per tonne of SF are given by the equation (21a) in the methodology with simplification as follow:

$$EFF_{SF,y} = PEA_{agri,y} + PEA_{fertD,y} + PEA_{fertI,y} + PET_{SF,y} \qquad (19a)$$

Where;

$EFF_{SF,y}$	:	Emissions from “Field” operations [$kgCO_2e$ / tonne of SF]
$PEA_{agri,y}$	:	Project emissions from PD consumption in agricultural operations [$kgCO_2e$ / tonne of SF] (See the equation (5))
$PEA_{fertD,y}$	:	Direct N_2O emissions from Nitrogen fertilizer use [$kgCO_2e$ / tonne of SF] (See the equation (11))
$PEA_{fertI,y}$	:	Indirect N_2O emissions from Nitrogen fertilizer use [$kgCO_2e$ / tonne of SF] (See the equation (15)
$PET_{SF,y}$	:	Emissions from the transportation of SF from the field to the project BDF factory [$kgCO_2e$ / tonne of SF] (See the equation (18a))

<u>“Industrial” emissions</u>

***5. Emissions from the fossil fuel (HFO) combustion at the industrial production of the project** BDF*

Annual total CO_2 emissions by HFO combustion in the industrial production of the project BDF are given in the methodology as follows:

$$PEP_{BDF,y} = FCP_{HFO,y} * EF_{HFO} * F_{LCA} \qquad (21)$$

where:

$PEP_{BDF,y}$	:	Annual total emissions from the industrial production process of the project BDF [tCO_2e/y]
$FCP_{HFO,y}$	:	HFO for providing energy to the project BDF factory [kl/y]
EF_{HFO}	:	Emission factor for HFO [tCO_2e/kl] (See the equation (2a))
F_{LCA}	:	Life cycle correction factor [No dimension]

CO_2 from electricity consumption is categorized as leakage.

<u>"Transportation to end use" emissions</u>

7. Emissions associated with the transport of the project BDF to the place of blending/distribution

For the project where transportations of the project BDF are single mode (only by tank lorry) to be done by the contract transporter, annual emissions from transporting the BDF to the blending facility are calculated by the equation (27a) in the methodology:

$$PET_{BDF,y} = AD_{BDF} * (FC_{BDF,y} / TC_{BDF}) * FE_{PD,BDF} * EF_{PD} * F_{LCA} * TEC_y / 1,000 \quad (23a)$$

where:

$PET_{BDF,y}$	:	Emissions from the transportation of the project BDF to the blending/distribution location [tCO_2e/y]
AD_{BDF}	:	Average round trip distance between BDF factory to blending facilities in year *y* [km]
$FC_{BDF,y}$	:	Volume of the project BDF produced and used in transportation [kl/y]
TC_{BDF}	:	Tank lorry capacity [kl]
EF_{PD}	:	CO_2 emissions factor with LCA for transport fuel [tCO_2/l]
F_{LCA}		Life-cycle factor (See the equation (2b))
$FE_{PD,BDF}$	:	Fuel efficiency of transporter [l/km]
$TEC_{BDF,y}$	:	Whether the calculation of transport emissions required. Set 1.

<u>Total Project Emissions</u>

For the project where no biomass residue feedstock, annual total project emissions are calculated by the equation (28) in the methodology with simplification.

Total project emissions are thus calculated as:

$$PE_y = \frac{(W_{SF,y} * EFF_{SF,y})}{1000} + PEP_{BDF,y} + PET_{BDF,y} \quad (24)$$

where:

PE_y	:	Project emissions [tCO_2e/y]
$W_{SF,y}$	:	SF in weight used for BDF production [ton BM/y]
$EFF_{PD,y}$	:	Total "Field" emissions per SF weight directly from field [$kgCO_2e$/ton BM] (See the equation (19a))
$PEP_{BDF,y}$	:	Emissions from the industrial production of the project BDF [tCO_2e/y] (See the equation (21))
$PET_{BDF,y}$	:	Emissions from the transportation of the project BDF to the blending/distribution location [tCO_2e/y] (See the equation (23))

Estimated leakage

The calculation of annual lifecycle emissions LE_y is given in the methodology as follow:

$$LE_y = LEP_{LE,y} + LEP_{SN,y} + LEW_y + LEP_{Me,y} + LEDF_y \quad (25)$$

where:

LE_y	:	Annual lifecycle emissions.
$LEP_{LE,y}$	:	Emissions at power station associated with electricity use at the industrial production process.
$LEP_{SN,y}$	:	Emissions at synthetic fertilizer production process associated with project fertilizer use.
LEW_y	:	Emissions from waste water.
$LEP_{Me,y}$	:	Emissions from non-bio feedstock (Methanol) production
$LEDF_y$	:	Emissions from direct and indirect deforestation due to the project activities.

However, as mentioned in B.3, the following GHG emissions of this project are not calculated.

Item	Reason for no consideration
3	No wastewater treatment with anaerobic condition.
5	Sunflowers are planned to be planted after harvest of rice and no deforestation is expected.

1. Emissions at power station associated with electricity use at the industrial production process

The calculation of "Emissions from electricity" use is given in the methodology as follow:

$$LEP_{EL,y} = ECP_{BDF,y} * EF_{EL} \quad (26)$$

where:

$LEP_{EL,y}$	:	Emissions at power station associated with electricity use at the industrial production process [tCO_2e/y]
$ECP_{BDF,y}$	:	Electricity imports from the grid to the BDF factory [MWh/y]
EF_{EL}	:	Combined margin grid emission factor [$kgCO_2e/MWh$] estimated as per ACM0002 or AMS-I.D.[20]

2. Emissions at synthetic fertilizer production process associated with project fertilizer use.

For the project where the project BDF is produced directly from a single biomass and applied synthetic fertilizers are monitored directly, "Emissions at synthetic fertilizer production" is given in the methodology as follow:

$$LEP_{SN} = EFP_{SN} * F_{SN} * W_{SF,y} / Y_y = EFP_{SN} * F_{SN} * A_{Field} \quad (27)$$

Where:

$LEP_{SN,y}$	:	Emissions at synthetic fertilizer production process associated with project fertilizer use [$kgCO_2e/yr$]

[20] In case where total annual electricity consumption is less than 15 GWh, emission factor from AMS-I.D. can be used. In case that a self-generation facility is used, apply the CO_2 emission factor of that facility.

EFP_{SN} : Emissions factor for synthetic fertilizer production[21] [$kgCO_2e$/kg fertilizer]
F_{SN} : Annual amount of synthetic fertilizer N applied per hectare [kg-N/ha/yr], given by the equation (8)
A_{Field} : Area of SF fields [ha]

4. Leakage from Non-Bio Feedstock (Methanol) Production

For the project where non-biomass feedstock, Methanol is used, "Leakage from non-bio feedstock production" is given in the methodology as follow:

$$LEP_{Me,y} = EFP_{Me} * FS_{Me,y} \quad (29)$$

where:

$LEP_{Me,y}$ Leakage from non-bio feedstock production [tCO_2e/yr]

EFP_{Me} Emissions factor for methanol production [$tonCO_2e$/tonMethanol].

$FS_{Me,y}$ Methanol used for BDF production [ton/yr]

For the project where no the unidentified biomass feedstock oils are expected, the baseline emissions BE_y are given in B.6.1 for the 7th year as follow;

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	ND_{FFT}
Data unit:	kl/y
Description:	National consumption of target fossil fuel
Source of data used:	National statistics
Value applied:	6,760,000 kl/y (at 2003)
Justification of the choice of data or description of measurement methods and procedures actually applied :	National statistics
Any comment:	-

Data / Parameter:	TY
Data unit:	No unit
Description:	The project Bio-Fuel feedstock (sugar cane juice, molasses, palm, coconuts,

[21] Project participants use the review of emission factors for fertiliser production produced by Wood and Cowie (A Review of Greenhouse Gas Emission Factors for Fertiliser Production, Sam Wood and Annette Cowie for IEA Bioenergy Task 38, June 2004). This review contains a summary of a number of studies and outlines emission factors (on a gCO_2e/kg N basis) for the major fertiliser types. Project proponents should use the most conservative (*i.e.*, highest) emission factor presented in the report for each type of fertiliser used.

	sunflower, jatropha, etc.)
Source of data used:	Production plant design data
Value applied:	Sunflower seeds
Justification of the choice of data or description of measurement methods and procedures actually applied :	Production plant design data
Any comment:	-

Data / Parameter:	$EF_{PD,WTT}$
Data unit:	tCO2/kl
Description:	Well-to-Tank emission factor for target fossil fuel, petrodiesel
Source of data used:	L-B-Systemtechnik GmbH
Value applied:	292.7 gCO2/liter
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology
Any comment:	The target fossil fuel for the project is petrodiesel. Therefore, FFT = FF1 = petrodiesel and $EF_{FFT,WTT}$ & EF_{FF1} are the same.
Data / Parameter:	CEF_{PD}
Data unit:	kgCO2/TJ
Description:	Carbon emission factor of target fossil fuel, petrodiesel
Source of data used:	National regulation or standard. If not available, use 2006 IPCC Vol. 2, Table 1.4.
Value applied:	74,100 kgCO2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 2, Table 1.4. as per the methodology
Any comment:	The target fossil fuel for the project is petrodiesel. Therefore, FFT = FF1 = petrodiesel and CEF_{FFT} & CEF_{FF1} are the same.

Data / Parameter:	NCV_{PD}
Data unit:	TJ/Gg = MJ/kg
Description:	Thermal content of the target fossil fuel, petrodiesel
Source of data used:	National regulation or standard. If not available, use 2006 IPCC Vol. 2, Table 1.2.
Value applied:	43.0 MJ/kg = 36.8 MJ/l
Justification of the choice of data or	Taken from 2006 IPCC Vol. 2, Table 1.2. as per the methodology

description of measurement methods and procedures actually applied :	
Any comment:	The target fossil fuel for the project is petrodiesel. Therefore, FFT = FF1 = petrodiesel and NCV_{FFT} & NCV_{FF1} are the same.

Data / Parameter:	DEN_{PD}
Data unit:	ton/m3
Description:	Density of the target fossil fuel, petrodiesel
Source of data used:	National regulation or standard. If not available, use DEFRA (Oct. 2002, Annex A or the latest)
Value applied:	0.855 kg/kl
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from DEFRA (Oct. 2002, Annex A
Any comment:	The target fossil fuel for the project is petrodiesel. Therefore, FFT = FF1 = petrodiesel and DEN_{FFT} & DEN_{FF1} are the same.

Data / Parameter:	CCU
Data unit:	kl/ton
Description:	Conversion factor from unidentified biomass feedstock oil (UIy) to the project BDF
Source of data used:	Production plant design data
Value applied:	1.15 kl/ton
Justification of the choice of data or description of measurement methods and procedures actually applied :	Applied the production plant design yield calculated by the project BDF produced (43,500 kl/y) divided by the design feedstock, TY (37,857 ton/y)
Any comment:	The reason why apply the design plant yield is because those feedstock are not identifiable, their quantities is small, and baseline emission for them is discounted by 10 %.

Data / Parameter:	F_{LCA}
Data unit:	No dimension
Description:	LCA factor
Source of data used:	Calculation from $EF_{PD,WWT}$ and $EF_{PD,TTW}$ (NCV_{PD} and CEF_{PD})
Value applied:	1.11
Justification of the choice of data or description of measurement methods	$EF_{PD,TTW} = CEF_{PD} * NCV_{PD} * DEN_{PD}$ = 74.1 (tCO_2/TJ) * 43.0 (TJ/kton) * 0.855 (ton/kl) = 2.723 tCO2/kl $F_{LCA} = (EF_{PD,TTW} + EF_{PD,TTW}) / EF_{PD,TTW}$ = (0.293 + 2.723)/2.723 = 1.11 This factor is used not only for petrodiesel, but also HFO. As heavier oil has

and procedures actually applied :	smaller factor, this application is more conservative.
Any comment:	

Data / Parameter:	β
Data unit:	No unit
Description:	Fraction of biomass feedstock transported to factory by truck
Source of data used:	
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Transportations of sunflower seeds are provided by the project operator in the project. Therefore, no reason why the seeds suppliers to transport them. In addition, setting “1.0” is more conservative.
Any comment:	Although β is specified as “Monitored” variable in the methodology, this is not monitored. This is because in the project, transportations of sunflower seeds are provided by the project operator and there is no reason why sunflower seeds are transported by the contract supplier. In addition, Contribution of transportation to GHG emissions is very small. For example, when β reduces from 1.0 to 0.9, the project emission is reduced by 0.04%.

Data / Parameter:	Freq
Data unit:	kgN/ha
Description:	Total required N for the project biomass fields
Source of data used:	Local reputable agronomist
Value applied:	60 kgN/ha
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-
Data / Parameter:	NF_{SN}
Data unit:	%
Description:	N fraction of synthetic fertilizer
Source of data used:	Wood & Cowie (2004)
Value applied:	46%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The synthetic fertilizer used for the project is "Urea".
Any comment:	Synthetic fertilizers are supplied by the project operator

Data / Parameter:	FDM_{Crop}
Data unit:	No unit
Description:	Dry matter fraction of harvested crop
Source of data used:	2006 IPCC Vol. 4 Table 11.2
Value applied:	0.88
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 4, Table 11.2. as per the methodology
Any comment:	-

Data / Parameter:	Slope and Intercept
Data unit:	No unit
Description:	Factors to estimate crop dry matter
Source of data used:	2006 IPCC Vol. 4 Table 11.2
Value applied:	1.09 & 0.88
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 4, Table 11.2. as per the methodology
Any comment:	-

Data / Parameter:	R_{BG-BIO}
Data unit:	kgDM/kgDM
Description:	Ratio of below-ground residues to above ground biomass
Source of data used:	2006 IPCC Vol. 4 Table 11.2
Value applied:	0.22
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 4, Table 11.2. as per the methodology
Any comment:	-

Data / Parameter:	N_{AG}
Data unit:	t N/t residues DM
Description:	N content of above-ground residues
Source of data used:	2006 IPCC Vol. 4 Table 11.2
Value applied:	0.006
Justification of the choice of data or	Taken from 2006 IPCC Vol. 4, Table 11.2. as per the methodology

description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	$N_{BG,}$
Data unit:	t N/t residues DM
Description:	N content of below-ground residues
Source of data used:	2006 IPCC Vol. 4 Table 11.2
Value applied:	0.009
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 4, Table 11.2. as per the methodology
Any comment:	-

Data / Parameter:	EF_1
Data unit:	kgN2-N/kgN-input
Description:	Emission factor for emissions from N inputs,
Source of data used:	2006 IPCC Vol. 4 Table 11.1
Value applied:	0.010
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 4, Table 11.1. as per the methodology
Any comment:	-

Data / Parameter:	$Frac_{GASF}$, $Frac_{GASM}$
Data unit:	$t(NH_3+NO_X)$-N/tN input
Description:	Fraction of synthetic fertilizer nitrogen applied that volatises as NH_3 and NO_X, Fraction of organic fertilizer nitrogen applied that volatises as NH3 and NOX, Fraction of N input that is lost through leaching and runoff, respectively
Source of data used:	2006 IPCC Vol. 4 Table 11.3
Value applied:	0.1 & 0.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	As per 2006 IPCC, N2O emissions from leaching/runoff are to be considered

	only for the regions where leaching/runoff occur. As local reputable agronomist justified that leaching and runoff is not expected in the areas where biomass feedstock for the project is grown. Therefore, $Frac_{LEACH}$ is not necessary.

Data / Parameter:	EF_4
Data unit:	$tN_2O/t(NH_3+NO_X)$-N volatilised
Description:	Emission factors for N_2O emissions from atmospheric deposition of N on soils and water surfaces (EF_4) and for N_2O emissions from leaching and runoff (EF_5)
Source of data used:	2006 IPCC Vol. 4 Table 11.3
Value applied:	0.010
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 4, Table 11.3. as per the methodology
Any comment:	As per 2006 IPCC, N2O emissions from leaching/runoff are to be considered only for the regions where leaching/runoff occur. As local reputable agronomist justified that leaching and runnoff is not expected in the areas where biomass feedstock for the project is grown. Therefore, EF_5 is not necessary.

Data / Parameter:	CEF_{HFO}
Data unit:	kgCO2/TJ
Description:	Carbon emission factor of heavy fuel oil used for as BF production
Source of data used:	National standard specification or 2006 IPCC Vol. 2 Table 1.4
Value applied:	77,400 kgCO2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 2, Table 1.4 as per the methodology
Any comment:	-

Data / Parameter:	NCV_{HFO}
Data unit:	TJ/Gg
Description:	Thermal content of heavy fuel oil used for as BF production
Source of data used:	National standard specification or 2006 IPCC Vol. 2 Table 1.2
Value applied:	40.4 MJ/kg
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from 2006 IPCC Vol. 2, Table 1.2 as per the methodology
Any comment:	-

Data / Parameter:	DEN_{HFO}
Data unit:	Kl/ton
Description:	Density of heavy fuel oil used for as BF production
Source of data used:	National standard specification or DEFRA Annex A
Value applied:	0.989 kg/kl
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from DEFRA (Oct. 2002, Annex A
Any comment:	-

Data / Parameter:	AD_{SF}
Data unit:	km
Description:	Average distance travelled for Sunflower seeds transportation
Source of data used:	Locations of biomass suppliers
Value applied:	200 km
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per project planning
Any comment:	-

Data / Parameter:	AD_{BDF}
Data unit:	km
Description:	Average distance travelled for BDF transportation
Source of data used:	Locations of project Bio-Fuel buyers
Value applied:	280 km
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per project planning
Any comment:	-

Data / Parameter:	TC_{BDF}
Data unit:	kl
Description:	Tank car capacity for BDF transportation
Source of data used:	Common tank car capacity at the project area
Value applied:	16 kl
Justification of the choice of data or description of	Collect data from local transporters

measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	TC_{SF}
Data unit:	ton
Description:	Truck capacity for Sunflower seeds transportation
Source of data used:	Common tank car capacity at the project area
Value applied:	14 ton
Justification of the choice of data or description of measurement methods and procedures actually applied :	Collect data from local transporters
Any comment:	-

Data / Parameter:	FE_{AG}
Data unit:	l/ha
Description:	Average diesel consumption per hectare during agricultural operation
Source of data used:	1996 Revised IPCC Guideline for National GHG Inventories, Reference Manual, Table 1-49 and power of common tractor in the area.
Value applied:	1.5 l/ha
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology as tractors use diesel oil as their fuel
Any comment:	-

Data / Parameter:	$FE_{PD,SF}$
Data unit:	litre/km
Description:	Average fuel efficiency of biomass transporter
Source of data used:	Revised IPCC Guideline for National GHG Inventories, Reference Manual, Table 1-39
Value applied:	0.15 l/km
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology as trucks are of heavy duty type (capacity of 14 ton) use diesel oil as fuel.
Any comment:	-

Data / Parameter:	$FE_{PD,BDF}$

Data unit:	litre/km
Description:	Average fuel efficiency for the project BDF transportation
Source of data used:	Section 3.7.3 of "Life cycle Inventory Analysis of Fossil Enrgies in Japan" http://eneken.ieej.or.jp/en/data/old/pdf/e161_01.pdf
Value applied:	0.15 l/km
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology as tank car capacity is 16 ton and it use desel oil as fuel.
Any comment:	-

Data / Parameter:	TEC
Data unit:	No unit
Description:	Whether the emission calculation for transportation of BDF to blending facility is required.
Source of data used:	Production plant design data
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	EF_{EL}
Data unit:	$kgCO_2/MWh$
Description:	CO2 emission factor of the grid
Source of data used:	Official statistics or data from electricity supplier
Value applied:	0.522 kgCO2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology, used AMS I.D to calculate emission factor of the grid
Any comment:	Electric consumption of the production factory is about 1.6 MW, i.e., less than 15 MW.

Data / Parameter:	EFP_{SN}
Data unit:	kgCO2e/tN
Description:	Emissions factor for synthetic fertilizer production
Source of data used:	Wood & Cowie (2004)
Value applied:	4.02 kgCO2e/tN
Justification of the	Taken the figure for "Urea" as per the methodology.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	The synthetic fertilizer used for the project is "Urea".

Data / Parameter:	EFP_{Me}
Data unit:	tCO2/tBDF
Description:	Emissions factor non-bio feedstock production
Source of data used:	For methanol production, Presentation by M. Appl at the 1998 World Conference held in Frankfurt. For others, use reputable literature.
Value applied:	2.0 CO2e/ton Methanol
Justification of the choice of data or description of measurement methods and procedures actually applied :	As the process used for the project is "Methyl Esterification" process, methanol is used to convert vegetable oil to BDF. Therefore 2.0 CO_2e/ton Methanol used for methanol production as per the methodology.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

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Calculation basis

BDF production

Year	2008	2009	2010	2011	2012	2013	2014
Production (ton/yr)	1,500	7,500	43,500	43,500	43,500	43,500	43,500
Production (%)	3.4%	17.2%	100.0%	100.0%	100.0%	100.0%	100.0%
Required Area (ha)	0.078	0.390	2.262	2.262	2.262	2.262	2.262

Calculations are shown for the 7th year (2014) only hereafter.

However, in the project where the project biomass is sunflowers which are annual plants, and newly planted in rice fields, and production is gradually increased, there are two factors which effect on the emissions, i.e.,

1) Depending on SF production (i.e., area of sunflower fields)
2) Depending on year. For the first year, as no residues is left in the fields can not be expected, all necessary N for the sunflowers are to be supplied by synthetic fertilizer.

Therefore, estimation is carried out by classifying area into two types;

Type A) Simply proportion to the area (or production quantity)

Type B) Combination of area (or production quantity) and the year, i.e., the first year of sunflower planting or the following years in which N from residues can be utilized and less synthetic fertilizers are required.

The values set to estimate are taken from B.6.2 and B.7.

Baseline emissions

For the project where no the unidentified biomass feedstock oils are expected, the baseline emissions BE_y are given in B.6.1 for the 7th year as follow;

BE_y = $FC_{BDF,y} * Q_y * EF_{PD} * F_{LCA}$ (1)

= 43,500 * 0.941 * 2.723 * 1.11 = 123,481 tCO2/yr

Where;

$FC_{BDF,y}$: Pure (100%) project BDF sold or consumed in non-Annex I country in the 7th year [kilo-litre/yr][22]

Q : Factor showing volume of PD that is displaced by the project BDF when the project blended BDF is used, Set 0.941 [no dimension].

= $(NCV_{BDF,y} * DEN_{BDF,y}) / (NCV_{PD} * DEN_{PD})$ = (43.0 * 0.855) / (39.6 * 0.873) = 0.941

Where;

$NCV_{BDF,y}$; Net calorific value of the project BDF, Set 43.0 [GJ/ton]

NCV_{PD}; Net calorific value of PD [GJ/ton]

$DEN_{BDF,y}$; Density of the project BDF [klitre /ton]

DEN_{PD}; Density of PD [klitre /ton]

EF_{FFT} : Emission factor of PD, which the project BDF replaces [tCO_2eq/kilo-litre]

= $CEF_{PD} * NCV_{PD} * DEN_{PD}$ = 74,100 * 43.0 * 0.855 / 1,000,000 = 2.723 [tCO_2/klitre]

F_{LCA} : Life-cycle factor = $(EF_{PD,WTT} + EF_{PD,TTW}) / EF_{PD,TTW}$ = (2.723 + 0.293) / 2.723 = 1.11

As the baseline emissions classified as Type A, the emission for each year are proportional to BDF production and are calculated as follow;

Year	2008	2009	2010	2011	2012	2013	2014
Production (ton/yr)	1,500	7,500	43,500	43,500	43,500	43,500	43,500
Production (%)	3.4%	17.2%	100.0%	100.0%	100.0%	100.0%	100.0%
Baseline Emission (tCO_2/yr ha)	4,258	21,290	123,481	123,481	123,481	123,481	123,481

Project emissions

As mentioned in A.2, the following items in B.6.1 above are not considered for estimation:

22 The methodology presents quantities of the project Bio-Fuel, the blended project Bio-Fuel and the target fossil fuel in volume. Volumetric measurement for transaction of those fuel is common and following that practice makes monitoring easy and accurate. Fuel efficiency data will also be expressed on a volumetric l/km basis or similar.

Item	Reason for no consideration
3	No crop residue burning will be carried out. They will used as composts in the fields
4-2	Biomass residue will not be used as feedstock for this project.
6	C-components of methanol are transfer to glycerin.[23]

<u>“Field” emissions</u>

The first step is to calculate emissions per kgCO$_2$e/tonne of SF seeds:

2. Emissions associated with PD consumption during agricultural operations

These emissions are classified as Type A.

Emission factor for PD consumption in agricultural operations are given in B.6.1 as follow;

$$PEA_{agri,y} = EF_{PD,LCA} * F_{LCA} * \frac{FE_{AG}}{Y_y} = 2.723 * 1.11 * 1.5 / 2.0 = 2.3 \text{ [kgCO2/tSF/yr]} \quad (5)$$

Where;

$PEA_{agri,y}$: Project emissions from PD consumption in agricultural operations [kgCO$_2$e / tonne of SF]
EF_{PD} : Emissions factor for PD, Set 2.723 [kgCO$_2$e/litre]
F_{LCA} : Life-cycle factor, Set 1.11
FE_{AG} : Annual average PD consumption per hectare on agricultural land supplying project activity, Set 1.5 [litre/ha] as per the methodology
Y_y : Average annual SF yield at the project fields. Set 2.0 [tonnes of SF / ha]

2. Emissions associated with fertilizer use

These emissions are classified as Type B.

<u>2-1 Direct Soil N$_2$O emissions from organic and/or synthetic fertilizer use</u>

Emission factor for direct emissions of N$_2$O per hectare, N_2O_{Direct} are given as follow:

N_2O_{Direct} = $(F_{SN} + F_{Comp} * F_{CR}) * EF_1$ (6)
For the first planting year;
= (60.0 + 0 + 0) * 0.010
= 0.60 [kg-N/ha/yr]
For the following planting years
= (34.2 + 28.4 + 0) * 0.010
= 0.63 [kg-N/ha/yr]

[23] The methanol as a non-bio feedstock for the production of BDF (trans-esterification process) is not necessary to count its use as project emission. Although C-components of methanol are transferred to the project BDF, the same number of C-components also transferred to glycerin. Therefore, non-organic carbons remain in the project BDF, production of glycerin using non-biomass feedstock is reduced at same time. The demand of glycerin can be regarded as independent of the existence of project activity (*i.e.*, common for the baseline and project scenarios).

where:

N_2O_{direct} — Annual direct emissions of N_2O per hectare in units of Nitrogen [kg-N/ha/yr]

F_{CR} — Annual amount of N in the crop residue, returned per hectare

= Crop * (R_{AG}* N_{AG} + R_{BG} * N_{BG}) (9)

= 1.76 * (1.59 * 0.006 + 0.57 * 0.009)

= 25.8[kg-N/ha/yr] → 0 [kg-N/ha/yr][24]

Where;

- Crop ; Harvested annual crop dry matter.
  = Y_y * FDM_{Crop} = 2.0 * 0.88 = 1.76 [t DM/ha/yr]
  Where;
  - Y_y ; Crop yield, Set as 2.0 [t Crop/ha/yr]
  - FDM_{Crop} Fraction of crop dry matter. Set as 0.88.
- R_{AG} ; Ratio of above-ground residues dry matter (AG_{DM}) to harvested crop
  = AG_{DM}/Crop = 2.80 / 1.76 = 1.59 [kg DM/kg DM-Crop]
  Where;
  - AG_{DM} ; Above-ground residues dry matter = Crop * slope + intercept
    = 1.76 * 1.09 + 0.88 = 2.80 [tDM/ha]
- N_{AG} ; N content of above-ground residues. Set 0.006 [kg N /kg DM]
- R_{BG} ; Ratio of below ground residues dry matter (AG_{DM}) to harvested crop
  = $R_{BG\text{-}Bio}$ * (AG_{DM} + Crop)/Crop = 0.22 * (2.80 + 1.76) / 1.76
  = 0.57 [kg DM/kg DM-Crop]
  Where
  - $R_{BG\text{-}Bio}$; Ratio below-ground residues to above-ground bio mass。 Set as 0.22 [kg DM/kg DM]
- N_{BG} ; N content of below-ground residues. Set 0.009 [kg DM/kg DM]

F_{Comp} — Annual amount of compost N applied per hectare kg-N/ha/yr]

= F_{CR} * 1.1 = 25.8 * 1.1 = 28.4 [kg-N/ha/yr] (7)

F_{SN} — Annual amount of synthetic fertilizer N applied per hectare

= $W_{SN,y}$ * NF_{SN}

However, for the estimation, the following equation is applied:

=F_{Req} - F_{Comp} - F_{CR} (8)

Where;

- F_{Req} ; Annual required N per hectare for the project biomass based on type of soil and type of land management [kg-N/ha/yr].

This value is set “60.0” for the first year and for the following years as well.

As F_{SN} is monitored, multiplier “1.1” is not applied.

1) For the first year of planting sunflowers (not for the project), F_{CR} and F_{Comp} are set as “0” as no residue is left.
   = 60.0 - 0 = 60.0 [kg-N/ha/yr]
2) For the following years of planting, F_{CR} is set as “0”, but F_{Comp} are set as “25.8”. [24]
   = 60.0 – 25.8 = 34.2 [kg-N/ha/yr]

EF_1 — Emission factor for emissions from N inputs

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[24] In actual operation, all residues are turned to composts. However, for estimation of this item, it is calculated as all residues are left in the field, i.e., the value of F_{CR} is set as “0” and used for F_{Comp} instead. See B.7.1 as N of residues is anyway fed back to the fields. See B.7.1.

= 0.010 [kgN_2O-N/kg N input]

CO2 equivalent N_2O-N direct emissions per tonne of SF, $PEA_{fertD,y}$ are calculated as follows:

$$PEA_{fertD,y} = \frac{N_2O_{direct} * (44/28)}{Y_y} * 310 \qquad (11)$$

For the first year;

= 0.60 * (44/28) * 310 / 2.0

= 146.1 kg CO2/tSF/yr

For the following years;

= 0.626 * (44/28) * 310 / 2.0

= 152.4 kg CO2/tSF/yr

Where;

Y_y : Annual average biomass yield at SF fields. Set 2.0 [tSF/ ha/yr]

<u>2-2 Indirect N_2O emissions from atmospheric deposition</u>

Emission factor for indirect emissions of N_2O per hectare, $N_2O_{indirect,y}$ are given as follow:

$$N_2O_{indirect,y} = N_2O_{(ATD),y} = 0.06 \text{ [kgN/ha/yr]} \qquad (12)$$

where:

$N_2O_{indirect}$: Emissions of N_2O in units of Nitrogen [kgN/ha/yr]

$N_2O_{(ATD),y}$: N_2O produced from volatisation of applied synthetic fertilizer and animal manure N, and its subsequent atmospheric deposition as NO_X and NH_4 [kgN/ha/yr]

$N_2O_{(ATD),y}$ are given as follow:

$$N_2O_{(ATD),y} = [(F_{SN} * Frac_{GASF}) + (F_{Comp} * Frac_{GASM})] * EF_4 \qquad (13)$$

For the first planting year;

= [(60.0 * 0.1) + (0 * 0.2)] * 0.010 = 0.06 kgN2O-N/ha/y

For the first planting year;

= [(34.2 * 0.1) + (28.4 * 0.2)] * 0.010 = 0.09 kgN2O-N/ha/y

Where;

F_{SN} : Annual mass of synthetic fertilizer applied per hectare [kgN/ha/yr]
For the first year (taken from 2-1);
= 60.0 [kg-N/ha/yr],
For following years (taken from 2-1);;
= 34.2 [kg-N/ha/yr]

$Frac_{GASF}$: Fraction of synthetic fertilizer nitrogen applied that volatises as NH_3 and NO_X, t(NH3+NOX)-N/tN input. Set 0.1.

F_{Comp} : Annual mass of compost applied per hectare [kgN/ha/yr]
For the first year (taken from 2-1);
= 0.0 [kg-N/ha/yr]
For the following years (taken from 2-1);
= 28.4 [kg-N/ha/yr]

$Frac_{GASM}$: Fraction of organic materials nitrogen applied that volatises as NH_3 and NO_X, t(NH3+NOX)-N/tN input, Set 0.2.

EF_4 : Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces. Set 0.010 [kg N_2O-N/kg N input]

CO2 equivalent N_2O-N indirect emissions per tonne of SF, $PEA_{fertI,y}$ are calculated as follows:

$$PEA_{fertI,y} = \frac{N_2O_{indirect,y} * (44/28)}{Y_y} * 310 \quad (15)$$

For the first year;

$$= 0.06 * (44/28) * 310 / 2.0 = 14.6 \ [kgCO_2e/tSF] \quad (15\text{-}1)$$

For the following planting years

$$= 0.09 * (44/28) * 310 / 2.0 = 22.2 \ [kgCO_2e/tSF] \quad (15\text{-}2)$$

where:

$PEA_{fertI,y}$: Indirect N_2O emissions from Nitrogen fertilizer use [$kgCO_2e/tSF$]
Y_y : Average yield agricultural land supplying the project activity [tSF/ ha]

4. Emissions associated with the transport of SF to the project BDF factory

$PET_{SF,y}$ are given as follow:

$$PET_{SF,y} = \frac{AD_{SF} * FE_{SF} * EF_{PD} * F_{LCA} * \beta}{TC_{FS} * 1{,}000} = \frac{200 * 0.15 * 2.723 * 1.11 * 1}{14 * 1{,}000} \quad (18a)$$

$$= 6.5 \ [kgCO_2e \ / \ \text{tonne of sunflower seeds}]$$

This emission is proportional to BDF production.

where:

$PET_{SF,y}$: Emissions from the transportation of SF from the field to the project BDF factory [$kgCO_2e$ / tSF]
AD_{SF} : Average round trip distance between field and factory, Set 200 [km]
$FE_{PD,SF}$: Fuel efficiency of transporter, Set 1.5 [litre/km]
EF_{PD} : CO_2 emissions factor of the truck fuel, Set 2.723 [$kgCO_2$/litre]
F_{LCA} : Life-cycle factor, Set 1.11
TC_{SF} : Truck capacity, 14 [tonnes]
β : Fraction of SF transported to factory by truck, Set 1.

<u>“Field” emission factor</u>

Total “Field” emission factor (per tonne of biomass feedstock), $EFF_{BM,y}$ are calculated by the factors above as follow:

$$EFF_{SF,y} = PEA_{agri,y} + PEA_{fertD,y} + PEA_{fertI,y} + PET_{SF,y} \quad (19a)$$

Where;

$EFF_{SF,y}$: Emissions from “Field” operations for case 4-2 above [$kgCO_2e$ / tSF]
$PEA_{agri,y}$: Project emissions from PD consumption in agricultural operations [$kgCO_2e$

/ tSF]

$PEA_{fertD,y}$: Direct N_2O emissions from Nitrogen fertilizer use [$kgCO_2e$ / tSF]
$PEA_{fertI,y}$: Indirect N_2O emissions from Nitrogen fertilizer use [$kgCO_2e$ / tSF]
$PET_{SF,y}$: Emissions from the transportation of SF from the field to the project BDF factory [$kgCO_2e$ / tSF]

However, the project emissions, $PEA_{agri,y}$ and $PET_{SF,y}$ are proportional to BDF production, and the project emissions, $PEA_{fertD,y}$ and $PEA_{fertI,y}$ are not only proportional to area of field, but also depend on which year, i.e., the first plantation or the following years. The emissions for each year are tabulated below;

Year		2008	2009	2010	2011	2012	2013	2014
Production (ton/yr)		1,500	7,500	43,500	43,500	43,500	43,500	43,500
Production (%)		3.4%	17.2%	100.0%	100.0%	100.0%	100.0%	100.0%
Required Area (ha)		2,041	10,204	59,181	59,181	59,181	59,181	59,181
$PEA_{agri,y}$		0.078	0.390	2.262	2.262	2.262	2.262	2.262
$PET_{SF,y}$		0.223	1.114	6.463	6.463	6.463	6.463	6.463
Plantation (ha)	1^{st} yr	2,041	8,163	48,977	0	0	0	0
	2^{nd} yr	0	2,041	10,204	59,181	59,181	59,181	59,181
$PEA_{fertD,y}$	1st yr	5.039	20.158	120.946	0.000	0.000	0.000	0.000
	2nd yr	0.000	5.256	26.281	152.431	152.431	152.431	152.431
$PEA_{fertI,y}$	1st yr	0.504	2.016	12.095	0.000	0.000	0.000	0.000
	2nd yr	0.000	0.764	3.821	22.160	22.160	22.160	22.160
Field emission factor ($kgCO_2$/tBM)		5.844	29.698	171.867	183.316	183.316	183.316	183.316
Field emissions (PE1-PE4) (tCO_2/yr)		24	606	20,342	21,697	21,697	21,697	21,697

<u>“Industrial” emissions</u>

5. Emissions from HFO combustion at the industrial production of the project BDF

CO_2 emissions by heavy fuel oil combustion in the industrial production of the project BDF for 7th year, is given as follows:

$$PEP_{BDF,y} = FCP_{HFO,y} * EF_{HFO} * F_{LCA} = 1,168 * 3.09 * 1.11 = 4,001 \ [tCO_2e/y] \quad (21)$$

The values set to estimate are taken from B.6.2 and B.7 and shown below:

$PEP_{BDF,y}$: Annual total CO_2 emissions by HFO combustion in the industrial production of the project BDF [tCO_2e/y]
$FCP_{HFO,y}$: HFO for providing energy to the project BDF factory. Set 1,168 [kl/y]
EF_{HFO} : Emission factor for HFO. Set 3.09 [tCO_2e/kl HFO]

F_{LCA} : Life cycle correction factor. Set 1.11[25] [No dimension]

CO_2 from electricity consumption is categorized as leakage.

“Transportation to end use” emissions

7. Emissions associated with the transport of the project BDF to the place of blending/distribution

CO_2 emissions from transporting the BDF to the blending facility for 7th year, are calculated as follow;

$$PET_{BDF,y} = AD_{BDF,y} * (FC_{BDF,y} / TC_{BDF}) * FE_{PD,BDF} * EF_{PD} * F_{LCA} * TEC_y \quad (23a)$$
$$= 280 * (43,500/16) * 0.15 * 2.723 * 1.11 * 1 / 1,000 = 344 \text{ [tCO}_2\text{/yr]}$$

where:

$PET_{BDF,y}$: Emissions from the transportation of the project BDF to the blending/distribution location [tCO_2e/y]
AD_{BDF} : Average round trip distance between factory to blending facilities. Set 280 [km/yr]
$FC_{BDF,y}$: Volume of the project BDF produced and used in transportation. Set 43,500 [kl/y]
TC_{BDF} : Tank lorry capacity. Set 16 [kl]
EF_{PD} : CO_2 emissions factor for transport fuel. Set 2.723 [tCO_2/l]
F_{LCA} : Life cycle correction factor. Set 1.11 [No dimension]
FE_{BDF} : Fuel efficiency of transporter. Set 0.15 [l/km]
$TEC_{BDF,y}$: Whether the calculation of transport emissions required. Set 1

Total Project Emissions

Annual total project emissions, PE_y are summarized as follow:

Year	2008	2009	2010	2011	2012	2013	2014
Field emissions (PE1-PE4) (tCO_2/yr)	24	606	20,342	21,697	21,697	21,697	21,697
PE5	138	690	4,001	4,001	4,001	4,001	4,001
PE7	12	59	344	344	344	344	344
Total PE	174	1,355	24,688	26,043	26,043	26,043	26,043

Estimated leakage

As mentioned in B.6.1, the following items above are not considered for estimation:

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[25] As mentioned in the methodology, set the same value for diesel as sata is not available and density of HFO is heavier than diesel.

Item	Reason for no consideration
LE3	No wastewater treatment with anaerobic condition.
LE5	Sunflowers are planned to be planted after harvest of rice. No Deforestation is expected.

Annual total leakage emissions are categorized as:

$$LE_y = LEP_{EL,y} + LEP_{SN,y} + LEP_{Me,y} \quad (25)$$

1. Emissions at power station associated with electricity use at the industrial production process

The calculation of "Emissions from electricity use" for 7th year is given in B.6.1 as follow:

$$LEP_{EL,y} = ECP_{BDF,y} * EF_{EL} \quad (26)$$
$$= 22,616 * 0.522 = 11,805 \ [tCO_2e/y]$$

where:

$LEP_{EL,y}$: Emissions at power station associated with electricity use at the industrial production process [tCO_2e/yr]

$ECP_{BDF,y}$: Electricity imports from the grid to the BDF factory. Set 22,616 [MWh/y]

EF_{EL} : Combined margin grid emission factor. Set 0.522 [$kgCO_2e/MWh$] as per CDM Baseline Construction for The Electricity Grids in the Philippines Klima Climate Change Center

2. Emissions at synthetic fertilizer production process associated with project fertilizer use.

For the project, where the BDF productions increase in 3 steps (years), "Emissions at synthetic fertilizer production" is calculated for emissions per area (ha) for the first and the following years.

And then multiply these figures to the corresponding areas (i.e., the first and the following years) which the project biomasss fields have in each year. The equation (31) in B.6.1 is modified in order to calculate emission per are as follow:

$$LEP_{SN} \text{ per area} = EFP_{SN} * F_{SN} * W_{SF,y} / (Y_y * A_{Field}) = EFP_{SN} * F_{SN} \quad (27')$$

For the first planting year;

$$= 4.02 * 60.0 = 241.2 \ [kgCO_2e/ha/yr]$$

For the following planting year;

$$= 4.02 * 34.2 = 137.4 \ [kgCO_2e/ha/yr]$$

Where:

$LEP_{SN,y}$: Emissions at synthetic fertilizer production process associated with project fertilizer use [$kgCO_2e/yr$]

EFP_{SN} : Emissions factor for synthetic fertilizer production[26] Set 4.02 [$kgCO_2e$/kg fertilizer]

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[26] Project participants use the review of emission factors for fertiliser production produced by Wood and Cowie (A Review of Greenhouse Gas Emission Factors for Fertiliser Production, Sam Wood and Annette Cowie for IEA Bioenergy Task 38, June 2004). This review contains a summary of a number of studies and outlines emission factors (on a gCO_2e/kg N basis) for the major fertiliser types. Project proponents should use the most conservative (*i.e.*, highest) emission factor presented in the report for each type of fertiliser used.

F_{SN} : Annual average N of synthetic fertilizer application rate. As mentioned 2-1, F_{SN} is set as "60.0 [kgN/ha]" for the first year and "34.2 [kgN/ha]" for the following years.

"Emissions at synthetic fertilizer production" is calculated for the years by adding

1) Emissions from the field where newly sunflowers are planted, i.e., the first year planting
2) Emissions from the field where sunflowers are planted in the following years

They are calculated by multiplying;

"LEP_{SN} per area (= 241.2 [kgCO_2e/ha/yr])" and the area planted in the first year for 1), and

"LEP_{SN} per area1(= 40.7 [kgCO_2e/ha/yr])" and the area planted in the following years for 2).

Year		2008	2009	2010	2011	2012	2013	2014	
Production (ton/yr)		1,500	7,500	43,500	43,500	43,500	43,500	43,500	
Production (%)		3.4%	17.2%	100.0%	100.0%	100.0%	100.0%	100.0%	
Required Area (ha)		2,041	10,204	59,181	59,181	59,181	59,181	59,181	
Plantation (ha)	1^{st} yr	2,041	8,163	48,977	0	0	0	0	
	2^{nd} yr	0	2,041	10,204	59,181	59,181	59,181	59,181	
LE2	1st yr	492	1,969	11,813	0	0	0	0	
	2nd yr	0	280	1,402	8,133	8,133	8,133	8,133	
	Total	492	2,449	13,215	8,133	8,133	8,133	8,133	2,185

4. Leakage from Non-Bio Feedstock Production

Annual emissions from non-bio feedstock production, $LEP_{Me,y}$ are given in B.6.1 by:

$$LEP_{Me,y} = EFP_{Me} * FS_{Me,y} \quad (33)$$

$$= 2.0 * 3,798 = 7,395 \text{ [t}CO_2\text{e/yr]}$$

where:

$LEP_{Me,y}$ Leakage from non-bio feedstock production [tCO_2e/yr]
EFP_{Me} Emissions factor for methanol production. Set 2.0 [tonCO_2e/tonMethanol].
$FS_{Me,y}$ Methanol used for BDF production. Set 4,213 [ton/yr]

Total Leakage

Annual total leakages are thus summarized as:

Year	2008	2009	2010	2011	2012	2013	2014
LE1	407	2,035	11,805	11,805	11,805	11,805	11,805
LE2	492	2,249	13,215	8,133	8,133	8,133	8,133
LE4	291	1,453	8,425	8,425	8,425	8,425	8,425
Total LE	1,190	5,737	33,446	28,363	28,363	28,363	28,363

Emission Reductions

Annual emission reductions (tCO_2/yr) are thus summarized as:

Year	2008	2009	2010	2011	2012	2013	2014
Baseline emissions	4,258	21,290	123,481	123,481	123,481	123,481	123,481
Project emissions	174	1,355	24,688	26,043	26,043	26,043	26,043
Leakages	1,190	5,737	33,446	28,363	28,363	28,363	28,363
Emission reductions	2,894	14,197	65,347	69,075	69,075	69,075	69,075

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2008	174	4,258	1,190	2,894
2009	1,355	21,290	5,737	14,197
2010	24,688	123,481	33,446	65,347
2011	26,043	123,481	28,363	69,075
2012	26,043	123,481	28,363	69,075
2013	26,043	123,481	28,363	69,075
2014	26,043	123,481	28,363	69,075
Total (tonnes of CO2e)	130,389	642,951	153,823	358,738

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$FP_{BDF,y}$
Data unit:	kL/yr
Description:	BDF produced
Source of data to be used:	Flow meter with totalizer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- 1,500 kl/yr for the first year - 7,500 kl/yr for 2nd year - 43,500 kl/yr for the third and after (as per project production schedule)
Description of	Measure continuously BF from the production plant by flow meter with totalizer.

measurement methods and procedures to be applied:	Daily a cumulative flow will be record manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Regular calibration and maintenance in accordance with supplier's requirement. Cross-check with tank inventory and shipped volume ($FC_{BDF,y}$). When discrepancy exceeds 1.0 %, calibrate flow meter.
Any comment:	-

Data / Parameter:	$FC_{BDF,y}$
Data unit:	kL/yr
Description:	BDF sold and/or consumed by the specific consumers or in domestic market.
Source of data to be used:	Sale documents with receipt
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- 1,500 kl/yr for the first year - 7,500 kl/yr for 2nd year - 43,500 kl/yr for the third and after (The same values as $FC_{BDF,y}$ above is set as no exportation is expected)
Description of measurement methods and procedures to be applied:	Measure the shipped volumes by flow meters with totalizer at loading spots of the production factory and used as transaction data. At the end of day, calculate total shipped volume in the sales documents and record manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Flow meters shall be calibrated at frequency required by regulation for custody transfer meters or by flow meter supplier whichever more frequent. When tank car driver complains on less loading than order, find the cause and fix it including meter calibration. In addition, cross check total amount of shipped volume measured by flow meters against the sales documents and tank inventory at the end of day. When discrepancy exceeds +/- 0.5%, check tank gauge first and then flow meters.
Any comment:	Exported portion of the project BDF to Annex I countries shall be identified and excluded from calculation of emission reduction. The identification of exported parts to Annex I countries shall be carried out basically by sale records of the project participants.

Data / Parameter:	$UI_{,y}$
Data unit:	ton/yr
Description:	Biomass feedstock whose origin is not well identified
Source of data to be used:	Purchasing documents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (no unidentified biomass feedstock is expected)
Description of measurement methods and procedures to be	Measure all biomass feedstock oil by weighbridge before unloading to feed tank of BDF production factory. And record whether origin of oil is identifiable (e.g., contracted suppliers) or not by purchase order manually on electronic data file

applied:	and log sheet as well.
QA/QC procedures to be applied:	Regular calibration and maintenance in accordance with supplier's
Any comment:	-

Data / Parameter:	$DEN_{BDF,y}$
Data unit:	ton/m3
Description:	BDF density
Source of data to be used:	Laboratory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.873 (as per BDF production plant design)
Description of measurement methods and procedures to be applied:	Take sample daily at the shipping line and send those samples monthly to obtain analysis by the oil company who is a blender of project BDF and has a qualified laboratory in order to maintain consistency with quality measurement of petroleum sector. The results are recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	As per laboratory's QA/AC
Any comment:	Daily sample is to be measured by the production factory operator to see daily fluctuation of operation and cross check with laboratory analysis.

Data / Parameter:	$NCV_{BDF,y}$
Data unit:	TJ/Gg = MJ/kg
Description:	Thermal content of BDF
Source of data to be used:	Laboratory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	39.6 MJ/kg = 34.6 MJ/l (as per BDF production plant design)
Description of measurement methods and procedures to be applied:	Take sample daily at the shipping line and send those samples monthly to obtain analysis by oil company who is a blender of project BDF and has a qualified laboratory in order to maintain consistency with quality measurement of petroleum sector. If such laboratory is not available, ask analysis to the qualified or reputable laboratory. The results are recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	As per laboratory's QA/AC
Any comment:	-

Data / Parameter:	$W_{SF,y}$
Data unit:	ton/yr

Description:	Sunflower seeds as feedstock
Source of data to be used:	Purchasing documents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><td>Year</td><td>Production (ton/ty)</td></tr><tr><td>2008</td><td>4,079</td></tr><tr><td>2009</td><td>20,397</td></tr><tr><td>2010-2014</td><td>118,302</td></tr></table>As per project plan
Description of measurement methods and procedures to be applied:	Upon receipt of sunflower seeds from the contract suppliers, measure weight by weighbridge. Record all unloaded weights on electronic data file and manually on log sheet as well.
QA/QC procedures to be applied:	Cross check total amount of weight measured by weighbridge against the purchasing documents. Weighbridge shall be calibrated at frequency required by regulation for custody transfer meters or weighbridge supplier whichever more frequent.
Any comment:	-

Data / Parameter:	$A_{field,y}$
Data unit:	Ha
Description:	Area of the project sunflower fields
Source of data to be used:	Individual contract supplier's reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Total areas of the fields are proportional to the BDF production. However, fertilizing rate is not only depending on field area, but also which year which year, i.e., the first plantation year or the following years, because no crop residues for composting is available and all required Ns are to be supplied by synthetic fertilizer. The emissions for each year are tabulated below;<table><tr><td>Year</td><td>Total (ha)</td><td>The first year planting (ha)</td><td>The following year planting (ha)</td></tr><tr><td>2008</td><td>2,041</td><td>2,041</td><td>0</td></tr><tr><td>2009</td><td>10,204</td><td>8,163</td><td>2,041</td></tr><tr><td>2010</td><td>59,181</td><td>48,077</td><td>10, 204</td></tr><tr><td>2011-2014</td><td>59,181</td><td>0</td><td>59,181</td></tr></table>59,181 ha are calculated by the set values of required "W_{crop}" and expected "Y_y")
Description of measurement methods and procedures to be applied:	Obtain annually information about area used for the project sunflower seeds from the contract suppliers and calculate total area for the project. The results are recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Carry out random on-site inspection
Any comment:	Cross check suppliers yield with statistical data about Sunflower seed yield
Data / Parameter:	Y_y
Data unit:	ton/ha
Description:	Yield of sunflower seeds

Source of data to be used:	Individual contract supplier's reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2.0 ton/ha (based on local agronomist suggestion)
Description of measurement methods and procedures to be applied:	Obtain annually information about yield of seeds from the contract suppliers and calculate weighed average for the project. The results are recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Carry out random on-site inspection
Any comment:	-

Data / Parameter:	$W_{SN,y}$
Data unit:	kg/ha/yr
Description:	Synthetic fertilizer applied per area
Source of data to be used:	Factory shipping records and receipts of the contract biomass supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- 130.4 kgN-fertilizer/ha for the first planting year - 74.3 kgN-fertilizer/ha for the following planting years The above figures are obtained by dividing F_{SN} by NF_{SN}. The required N-fertilizer, F_{Req}, 60 kgN/ha is set for F_{SN} of the first planting year as no crop residues is available. For the following years, F_{SN} is calculated by subtracting F_{CR} from F_{Req}, i.e., 60 – 25.8 = 34.2 kgN/ha. The required N (F_{Req}) is given by local agronomist.available Ns from residues (as compost) are calculated by FCR (available= 60 kgN/ha are set from is set only for 1st planting year and 34.2 kg/ha for the following planting years. This is because required 60 kg/ha is given by local reputable agronomist and no N from crop residue is expected for the first year, but 25.8 kg/ha can be expected from residues (as composts, F_{Comp}) for the following years. Therefore, for the first year all F_{Req} is supplied by synthetic fertilizers and 34.2 kg/ha（$F_{REQ} – F_{comp}$ = 60 - 25.8 kg/ha）is set for the following years.
Description of measurement methods and procedures to be applied:	Measure shipped weight of synthetic fertilizers from the production factory by weighbridge and divided by the areas applied. And record types, weights and delivery destinations on electronic data file and log sheet as well.
QA/QC procedures to be applied:	- Carry out random on-site inspection to verify whether they are applying fertilizers based on the project operator's instruction. - Regular calibration and maintenance in accordance with weighbridge supplier's
Any comment:	Prepare the list of destinations (contract suppliers) and their area (ha).
Data / Parameter:	$Frac_{removed,y}$
Data unit:	No dimension
Description:	Fraction of above-ground residues of crop removed annually for purposes such as feed, bedding and construction.

Source of data to be used:	Individual contract supplier's reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Set “100”. Instead of setting “0” for W_{comp}, as mentioned in W_{Comp}.
Description of measurement methods and procedures to be applied:	Annually obtain confirmation from the contract suppliers that all residues are turned to composts and to be applied to the fields where seeds are harvested. The results are recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Carry out random on-site inspection to confirm whether the contract suppliers are actually composting and not burnt residues.
Any comment:	-

Data / Parameter:	$A_{burnt,y}$
Data unit:	ha
Description:	Area burnt
Source of data to be used:	Individual contract supplier's reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (as no field burning is expected and all residue is returned as composts)
Description of measurement methods and procedures to be applied:	Annually obtain confirmation from the contract suppliers that all residues are not burnt together with the report for $Fracr_{emove}$. The results are recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Carry out random on-site inspection at same time for $Frac_{remove}$.
Any comment:	-

Data / Parameter:	$FCP_{HFO,y}$
Data unit:	ton/yr
Description:	Heavy Fuel Oil combusted at the BDF production factory
Source of data to be used:	Flow meter with totalizer & temperature compensator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- 41.7 t/yr for the 1st year - 203.6 t/yr for the 2nd year - 1,154.4 t/yr for the 3rd and later (as per production plant design assuming HFO density is 0.989.
Description of measurement methods and procedures to be applied:	Measure continuously by flow meter with totalizer and record daily a cumulative volume manually on electronic data file and log sheet as well.

QA/QC procedures to be applied:	Regular calibration and maintenance in accordance with meter supplier's instructions. Cross-check with measured value by weighbridge at unloading, HFO tank inventory and supplier's invoice. When discrepancy exceeds 1.0 %, calibrate flow meter.
Any comment:	Temperature compensator provided with flow meter shall convert the consumed volume at flowing condition to the volume at the standard temperature, e.g., 15 °C.

Data / Parameter:	$ECP_{BDF,y}$
Data unit:	MWh/y
Description:	Electricity consumption at the plant
Source of data to be used:	Invoice from electricity supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- 804.2 MWh/yr - 3,934.6 MWh/yr - 22,615.9 MWh/yr (as per production plant design)
Description of measurement methods and procedures to be applied:	Upon receipt of the invoice, record manually the consumed electricity on electronic data fie and log sheet as well.
QA/QC procedures to be applied:	As per supplier's QA/QC
Any comment:	Cross check value in the invoice with wattage-hour meter of the production factory monthly

Data / Parameter:	$FS_{Me,y}$
Data unit:	kl/yr
Description:	Non bio feedstock (Methanol) to process
Source of data to be used:	Flow meter with totalizer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	145.3, 726.3, 4212.3 kl/yr (as per production plant design.
Description of measurement methods and procedures to be applied:	Measure continuously by flow meter. Daily a cumulative volumetric flow is recorded manually on electronic data file and log sheet as well.
QA/QC procedures to be applied:	Regular calibration and maintenance in accordance with meter supplier's instructions. Cross-check with methanol tank inventory and supplier's invoice. When discrepancy exceeds 1.0 %, calibrate flow meter.
Any comment:	-

Note

Although β is specified as "Monitored" variable in the methodology, this is not monitored and listed in B.6.2.

B.7.2 Description of the monitoring plan:

To be elaborated later.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

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Completion date of the baseline study: 31/03/2007

Note: This date is to be set when the PDD is finalized at the end of validation process.

The baseline is determined by:

Mr. Kazuo Sasaki
Sun Care Fuels Co.
sasaki@suncarefuels.com

Dr. Naoki Matsuo
Climate Experts Ltd.
n_matsuo@climate-experts.info

Mr. Yoshiji Kubo
Climate Experts Ltd.
yoshi_kubo@climate-experts.info

SECTION C. Duration of the project activity / crediting period

C.1.1. Starting date of the project activity:

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01/01/2008

C.1.2. Expected operational lifetime of the project activity:

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25 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

01/01/2008

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
N/A.

C.2.2.2. Length:

>>
N/A

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
A) Environmental impact

The BDF production facility is planed to construct at the Subic Special Economic and Freeport Zone where is already prepared as industrial zone, i.e., there is no needs to deforestation neither use of the existing farmlands.
Raw glycerin that produced as a by-product of the BDF production is sold to chemical companies after refining, and doesn't flow out from the production facility nor give any environmental impact.
The wastewater from the BDF washing process contains a high density organic matter.
Common technology for waste water treatment such as lagoon is sufficient to satisfy the requirements of regulation. The project employs advanced technology such as membrane process to comply with the following regulations;

- DENR Administrative Order No. 34, Series of 19990, Revised Water Usage and Classification / Water Quality Criteria Amending Section No. 68 and 69, Chapter III of the 1978 NPCC Rules and Regulations Criteria of Water Use Regulation
- DENR Administrative Order No. 35, Series of 1990; Revised Effluent Regulations of 1990, Revising and Amending the Effluent Regulations of 1982

Therefore, the impact on environment and ecosystem is minimal.

The BDF is made from the vegetable oil and reduces CO_2 emissions by displacing fossil fuel. In addition, since BDF is clear energy, BDF reduces emissions of hazardous materials such as SOx, PM and PAH. According to the report “Philippines Environment Monitor 2002” from World Bank, the deterioration of air pollution in the urban area in the Philippines, especially the Metro Manila is very serious. For instance, it was estimated that 2,000 people per year die prematurely and 9,000 people per year suffer from chronic bronchitis due to high concentration of PM (particulate Matter) in four cities including Metro Manila. Also it was estimated that total cost of exposure to PM in these four cities alone adds up over US$430 million. Therefore, use of BDF contributes to people's health prevention as well as mitigation of global warming greatly.

Other than use of BDF, sunflowers are planted as second crop of rice or corn so that no expansion of farmland is required and even crop yield increases because of rotating crops. In addition, farmers have an opportunity to use sunflower for apiculture. All those reads increment of farmer's income.
The project intends to return crop residues to farmlands as a compost which improve soil condition.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

As mentioned above, there is no significant environmental impact caused by this Project activity.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

To be elaborated later.

E.2. Summary of the comments received:

>>

To be elaborated later.

E.3. Report on how due account was taken of any comments received:

>>

To be elaborated later.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

To be advised later

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public fund is used for this project activity.

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

This monitoring plan includes several aspects not specified in the Section D for accurate monitoring of data to calculate emission reductions *ex post*:

Monitoring management system:

Based on the ISO9000 management system, the management system for monitoring is to be established. Internal auditing system is included in the management system.

Procedures for data collection:

For monitoring of each parameter, procedures are to be established to minimize errors and keep consistency in the data series.

Format for data reporting:

After collecting the data of each parameter, they are compiled and analyzed in a spreadsheet to calculate emission reductions as well as to check the consistency of the data.

Monitoring points:

The points where the parameters are monitored are to be specified.

For these purposes, training programme will be established before implementation of the project.

Details of the above are provided as a manual for monitoring after establishment of technical as well as personnel specification of the project.

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