Production, Sale and Use of Philippine Sunflower Biodiesel as a CDM Project a Feasibility Study

Summary

1. PROJECT PARTICIPANTS

Sun Care Fuels Philippines (from hereon SCF Philippines) is the main participant in this project. SCF Philippines is a company set to be established in 2007 with 50% capitalization from Sun Care Fuels Corporation, 30% from other Japanese companies or individuals and 20% from Philippine companies participating in the project. Participants are to be involved in the manufacture and sale of biodiesel.

2. PROJECT IMPLEMENTATION PLAN

The expected operational lifetime of the project is 25 years. Also, the length of the first crediting period is 7 years.

Refer to Table 1 for the detailed implementation plan. In 2007, plant construction and sunflower plantation will commence. From 2008, production will begin and plant capacity will be increased gradually, together with the expansion of areas for sunflower cultivation. In 2008, a plant of capacity 5.0 kl/day; in 2009 a capacity of 20.0 kl/day and in 2010 full capacity of 120.0 kl/day.

Table - 1 Project Implementation Plan

	2008	2009	2010	2011	2012	2013	2014
	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
Production capacity	5.0 kl/day	25.0 kl/day	145.0 kl/day	145.0 kl/day	145.0 kl/day	145.0 kl/day	145.0 kl/day
New installation cap	5.0 kl/day	20.0 kl/day	120.0 kl/day	0.0 kl/day	0.0 kl/day	0.0 kl/day	0.0 kl/day
BDF vol./Sale vol.	1,500 k?/year	7,500 k?/year	43,500 k?/year	43,500 k?/y	43,500 k?/y	43,500 k?/y	43,500 k?/y
(in t)	(1,310 t/year)	(6,548 t/year)	(37,976 t/year)	(37,976 t/year)	(37,976 t/year)	(37,976 t/year)	(37,976 t/year)
(in Gcal)	(12,401 Gcal/year)	(62,005 Gcal/year)	(359,628 Gcal/year)	(359,628 Gcal/year)	(359,628 Gcal/year)	(359,628 Gcal/year)	(359,628 Gcal/year)
Additional BDF vo	1,500 k?/year	6,000 k?/year	36,000 k?/year	0 k?/year	0 k?/year	0 k?/year	0 k?/year
Glycerine purification	137.0 t/year	685.0 t/year	3,972.9 t/year	3,972.9 t/year	3,972.9 t/year	3,972.9 t/year	3,972.9 t/year
Oil cake	2,774.0 t/year	13,869.9 t/year	80,445.5 t/year	80,445.5 t/year	80,445.5 t/year	80,445.5 t/year	80,445.5 t/year
Sunflower seed harvest	4,079 t/year	20,397 t/year	118,302 t/year	118,302 t/year	118,302 t/year	118,302 t/year	118,302 t/year
Plantation area	2,000 ha	10,000 ha	60,000 ha	60,000 ha	60,000 ha	60,000 ha	60,000 ha

3. ESTIMATED AMOUNT OF EMISSION REDUCTIONS OVER THE CHOSEN CREDITING PERIOD:

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	358,738
Total number of crediting years	7 years
Annual Average over the Crediting Period of Estimated Reductions	51,248

4. OUTLINE AND OBJECTIVE OF THE PROJECT

This project is to contribute to the reduction of GHG emissions in the Republic of the Philippines though planting sunflower as a project biomass feedstock in the Central Luzon region, making sunflower seed oil, producing bio-diesel fuel (hereafter, called BDF) at the Subic Special Economic and Freeport Zone , blending it with 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. Please refer to Figure 1 below.

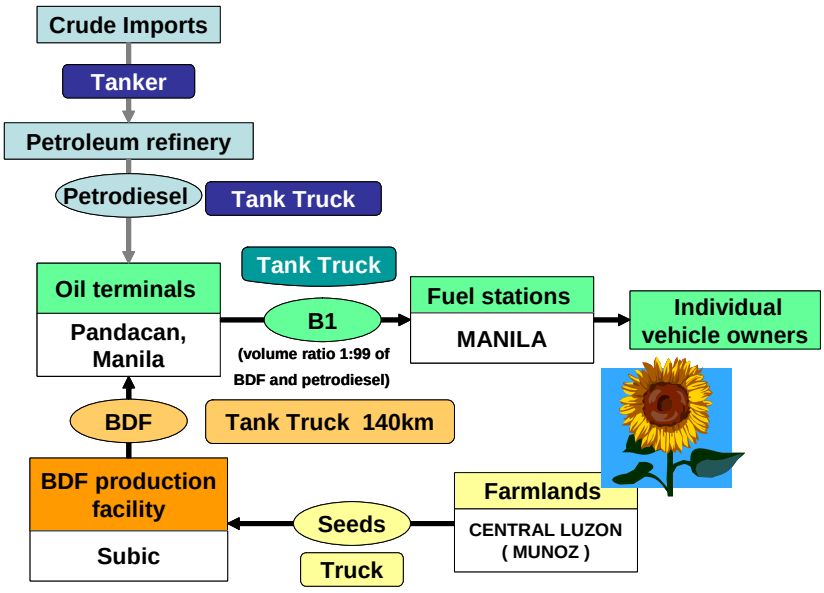

Figure - 1 Structural Framework of the BDF Project

The farmlands to supply the project sunflowers are located in the Central Luzon basin of Central Luzon region. Planting is done after harvesting rice so that the cultivation by itself contributes to sustainable development by improving the income of poor farm villages.
The farmland area is estimated at about 60,000ha, and necessary seed is 120,000 ton/year with seed yield at 2.0 ton/ha. The actual plantation of sunflower seeds is to be done by contract farmers exclusively for Sun Care Fuel Philippines (hereafter, SCF Philippines) who guarantees the lowest purchase price.

The BDF production facility is to be constructed at the Subic Special Economic and Freeport Zone in Zambales. The facility is operated by SCF Philippines. 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.
After the pressing process, the oil cakes are used as fodder, and glycerin, which is the by-product of BDF, is sold as an industrial material.

The manufactured BDF is transported and sold to the oil terminals owned by oil companies in the City of Manila, which is about 140 km from the BDF production facility.
The BDF is then blended with petrodiesel and sold to individual vehicle owners through the regular gas stations or to mass consumers (e.g., bus company, industrial consumer, etc.) as B1.

Therefore, the project activity displaces the use of petrodiesel with the use of BDF, resulting in the reduction of CO_2 emissions from use of petrodiesel.

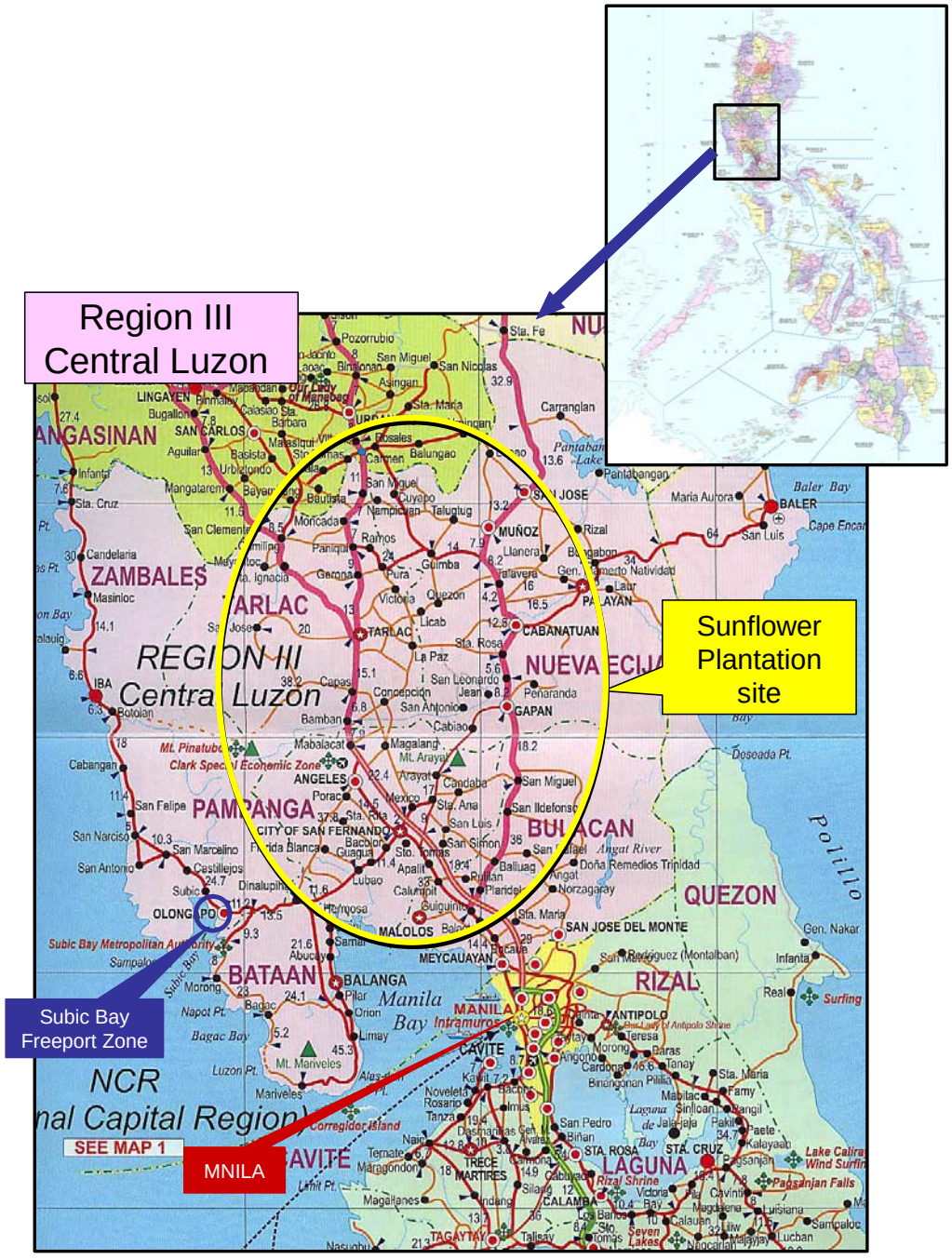

Figure - 2 Map of Central Luzon

5. CONSISTENCY WITH THE PHILIPPINE GOVERNMENT POLICY

According to the Philippine Department of Energy (DOE), the current energy demands in year 2005 were 500.5 million barrels of crude oil equivalent. It is expected that this demand will increase by 3.9% on a yearly average, and will reach the energy demand of 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 prices pushed up the energy bill for the entire country, and securing a steady energy source becomes a very important issue in the Philippines.

The self-sufficiency target rate of 60% for energy by 2010 was set in a mid-term energy development plan (2005 - 2014) of the "Philippines Energy Plan" by the DOE, and one of the major measures is the promotion of renewable energy, including the introduction of biomass in the Philippines. The “Biofuels Act of 2006”, aimed 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 months from its effectivity , a minimum 1 % of biofuel shall be blended into all diesel fuel engines, and the Energy Board, to be created by this Act, will determine the feasibility to mandate a minimum of 2 % blend of biofuel within two years.
Therefore, this project is along the government policy.

6. CONTRIBUTION TO SUSTAINABLE DEVELOPMENT OF THE 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) Does not put pressure on the national food supply system since the project sunflowers are planted as second crop of rice or on idle farmlands

Contribution to farmers

In the Philippines, there are a lot of small-scale farmers who have an average farmland of 2ha. 70% of the population lives in the provinces, and 2/3 of them are farmers. Therefore, the increase in rural employment as a result of the plantations and consequently, the increase in income, contributes to the development of the country greatly.

The sunflowers are possible to be planted by small-scale farmers unlike palm and coconuts. They can be planted as a second crop to rice and improve the harvest of rice. Furthermore, the planting of sunflowers give additional income through the sale of oil cakes as fodder and even by using for apiculture. Those advantages contribute to the improvement of the life of the poor farmers and the farm villages.

7. TECHNICAL SUMMARY

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

In this project, the BDF is fatty acid methylester made through the transesterification of triglyceride (sunflower oil) and methanol.

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 produce ester due to the existence of methanol.
Finally, the outputs of the process are BDF (ester) as final product, with oil cake after oil press, and glycerin after esterification reaction as by-products. Oil cakes are sold as fodder and glycerin is sold as a chemical material.

BDF produced at the plant, will be blended with petrodiesel 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 petrodiesel

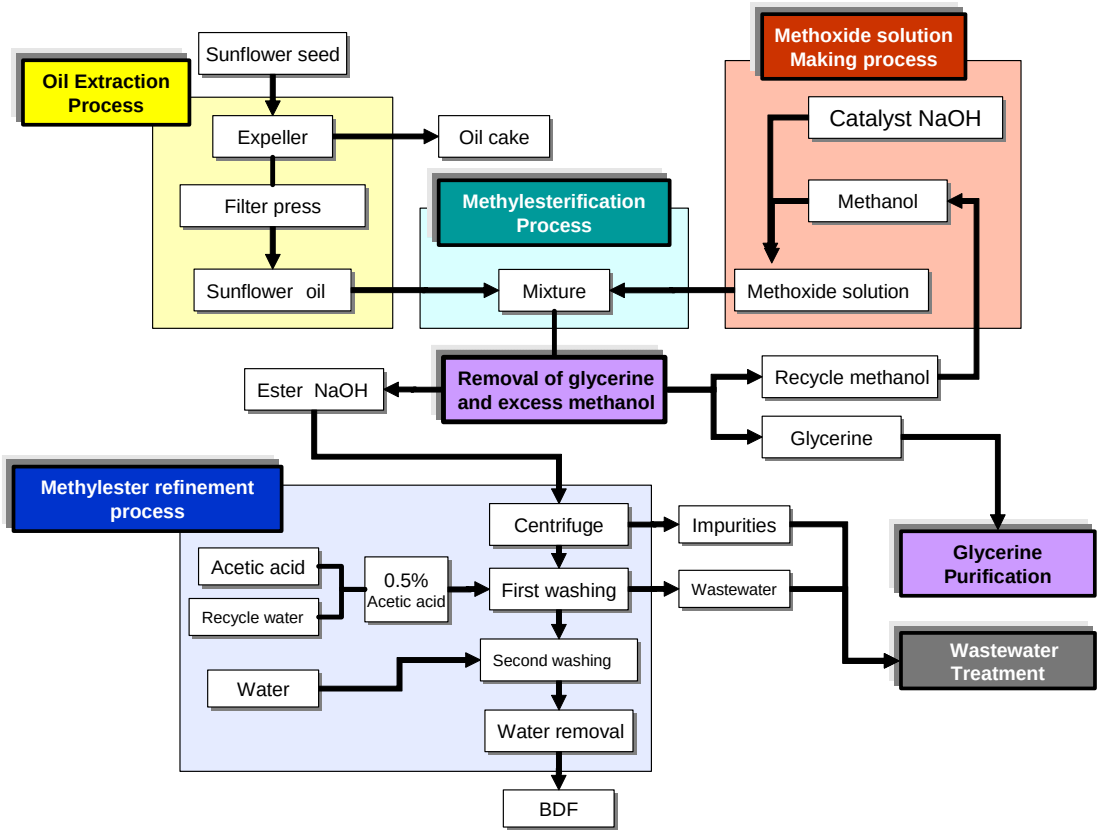

Figure - 3 Process Flow of BDF Production

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.

8. ECONOMIC EVALUATION

8.1.

Capitalization Plan for Project Implementation

Initial investment plan for the project is given in the table below. At present, sunflower cultivation (plantation) is not being done in the Philippines. Thus, there is a need to develop a system or structure that would provide sunflower seeds as source oil. Because of this, BDF plant scale-up is divided into 3 stages, with project development cost (plant specs evaluation, market research, etc.) eating up to 15% of total investment cost.

Initial investment is assumed to be provided by government financial institutions like the Japanese Bank for International Cooperation. Other investments would come from a consortium of Japanese firms, while the Philippine side would be provided by companies involved in the project.

Table - 2 Initial Investment Plan

	CAPACITY	CAPITAL OUTLAY	PROJECT DEVELOPMENT	PROJECT COST (INITIAL INVESTMENT)
First Stage 2008	1,500 kℓ/y	¥ 120M	¥ 18M	¥ 138M
SecondStage 2009	6,000 kℓ/y	¥ 480M	¥ 72M	¥ 552M
Third Stage 2010	36,000 kℓ/y	¥ 1,500M	¥ 225M	¥ 1,725M

8.2. Economic Analysis

Prerequisite conditions

i. Sunflower oil content is 40%; oil extraction efficiency is 80%.

ii. Average cost of sunflower seed is the EU rate of $ 249 ~ $ 337 per ton or PhP 15.50/kg or ¥ 37.54/kg

iii. Market selling price of BDF is the same as the Philippines Flying V company's coconut BDF production cost of PhP 44/liter.

iv. Revenue from CER could be obtained for 7 years and would continue from the 8th year thereon. CER credit is calculated ate $ 13 (¥ 1,569) for 1 ton of CO_2.

Economic Feasibility Analysis

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

9. NEW BASELINE AND MONITORING METHODOLOGY

At present, baseline and monitoring methodology for biodiesel is not being recognized by the CDM Executive Board. Sun Care Fuels Corporation and Mr. Matsuo of Climate Experts have written and submitted a new baseline and monitoring methodology NM0129"Generalized baseline methodology for transporation Bio-Fuel production project with Life-Cycle-Assessment" to the CDM Executive Board on July 2005. It received a B rating and on May 16, 2006 submitted Version 5.0. Version 6.0 is now being written.

In this project, NM0129 Version 6.0 is used as the base to create a PDD.

9.1. Project Boundary

Project boundary for this project is shown in the table below.

Table - 2 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]*
	Exploitation, refinement, transportation of fossil fuels replaced by the Bio-Fuel [oil field/port/ refinery/gas station]	CO_2 / CH_4	Outside	Yes (BE)	LCA effects are considered. CO_2 part is larger than CH_4 part in it.
Project A	Transportation of Bio-Fuel [plant to gas	CO_2	Inside	Yes (PE7)	Minor, but should be counted if it is not negligible.

	station]				
	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).
	Transportation of biomass [plantation site to Bio-Fuel plant]	CO_2	Inside	Yes (PE4)	Minor, but should be counted if it is not negligible.
	Plantation site	CO_2	Inside	Yes (PE1)	CO_2 from machinery use is counted.
		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
	Synthetic fertilizer production	N_2O		Yes (LE2)	If synthetic fertilizer is applied, related N_2O emissions from its production process are counted.
	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.
	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			
	Direct and indirect deforestation effect by the project	CO_2	Outside	Yes (LE5)	Counted if the project activity leads land clearance/deforestation

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

9.2. Identified Baseline Scenario:

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.

10. ADDITIONALITY

(Step 2 of the Additionality Tool

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.

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

Step 3 of the Additionality Tool

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.

Common Practice Analysis (Step 4 of the Additionality Tool)

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)

10.1. Project emissions

The estimated amount of emission reductions is shown 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%
Baseline Emission (tCO_2/yr ha)	4,258	21,290	123,481	123,481	123,481	123,481	123,481
Field emissions (PE1-PE4) (tCO2/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
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	2,894	14,197	65,347	69,075	69,075	69,075	69,075

11. THE MONITORING PLAN

Following the monitoring methodology, monitoring of the project in the sunflower plantation and BDF manufacturing plant is to be done based on the items as shown below.

Data / Parameter:	$W_{SF,y}$
Data unit:	ton/yr
Description:	Sunflower seeds as feedstock
Source of data to be used:	Purchasing documents
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.

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
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.

Data / Parameter:	Y_y
Data unit:	ton/ha

Description:	Yield of sunflower seeds
Source of data to be used:	Individual contract supplier's reports
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.

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
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.

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
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.

Data / Parameter:	$A_{burnt,y}$
Data unit:	ha
Description:	Area burnt
Source of data to be used:	Individual contract supplier's reports
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.

Data / Parameter:	$FP_{BDF,y}$
Data unit:	kL/yr
Description:	BDF produced
Source of data to be used:	Flow meter with totalizer
Description of measurement methods and procedures to be applied:	Measure continuously BF from the production plant by flow meter with totalizer. Daily a cumulative flow will be record manually on electronic data file and log sheet as well.

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
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.

Data / Parameter:	$DEN_{BDF,y}$
Data unit:	ton/m3
Description:	BDF density
Source of data to be used:	Laboratory

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.

Data / Parameter:	$NCV_{BDF,y}$
Data unit:	TJ/Gg = MJ/kg
Description:	Thermal content of BDF
Source of data to be used:	Laboratory
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.

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
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.

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
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.

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
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.

12. ENVIRONMENTAL IMPACT

The BDF production facility is planned to be construcedt at the Subic Special Economic and Freeport Zone where it is already prepared as an industrial zone, i.e., there is no need for deforestation neither for the use of existing farmlands.
Raw glycerin produced as a by-product of the BDF production is sold to chemical companies after refining, and does not flow out from the production facility and has no negative environmental impact.
The wastewater from the BDF washing process contains a high density of organic matters. Common technology for waste water treatment such as lagoon is sufficient to satisfy the requirements of regulation.

Therefore, the impact on environment and ecosystem is minimal.