**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)**
**Version 03 - in effect as of: 22 December 2006**

**CONTENTS**



**Annexes**

## SECTION A. General description of small-scale project activity

### A.1 Title of the small-scale project activity:

Plant-Oil Production for Usage in Vehicles, Paraguay
Version 1.9
07/07/2010

### A.2. Description of the small-scale project activity:

The project intends to substitute fossil diesel fuel used in transport with plant-oil (vegetable oil is often used as equivalent term). Emission reductions occur due to the differential of GHG emissions of plant-oil versus the amount of diesel substituted through the bio-fuel based on the relative calorific values of the two fuels. Diesel fuel is imported in Paraguay and costly. Bio-fuel is to the moment only used marginally although Paraguay has a regulation which promotes the usage of bio-fuels (law 2748 dated 07.10.2005 for the promotion of biofuels). Reasons for the marginal usage of bio-fuel are the high cost of oil-seeds making e.g. biodiesel production financially non-viable as well as lack of investment in this area.

The project consists of three parts:

- Oilseed production at various locations and farms in Paraguay. Farms include potentially those of the project owner but oilseeds are also bought from monitored 3rd parties. As of current the actual production sites of the oilseeds have not been defined as this depends on negotiations with producers which can only be realized once the project is approved. Oilseed crops include currently castor bean, crambe and oilseed radish but other oilseeds may be included in the future.
- Cold pressing and filtration of oilseeds to produce plant oil. This is currently done at two project owner facilities but other decentralized facilities will be built and operated as part of the project in the future depending on fuel demand and profitability of operations.
- Usage of plant oil as diesel blend or in modified engines as pure plant-oil in captive fleets including farm machinery. No plant-oil sale to the general public at filling stations will be realized.

#### A.2.1. Crop Production

Production of oilseed crops will be on various farms in Paraguay, gradually included during project expansion. One of the largest potential suppliers will thereby be a farm held and managed by the project owner or its affiliate company. Monitoring of all sites which deliver oil-seeds will be realized including an assessment of the applicability condition of non-deforestation in the last 10 years. Crops which shall be used primarily for plant oil production [1] are castor oil obtained from the castor plant (Ricinus communis), crambe (Abyssinian mustard) and oilseed radish (Raphanus sativus). All three oils are non-edible. All three plants are commonly used as cover crops in many countries. Farmers plant latter to improve their soil quality for their cash crop production being basically soya. These cover crops have the ability to recycle soil nutrients, suppress weeds and pathogens, break up compaction, reduce soil erosion, and produce large amounts of biomass. No obstruction of the cash crop production of farms is thus realized as crop rotation is normally soya, cover crop, soya (or e.g. sunflower). The difference is that under Business As Usual (BAU) oilseeds of the cover crop are not reaped but left on the soil. Using the oil implies

[1] In the future other crops might be used. Which crops are used and their corresponding fertilizer usage is monitored. Also for new crops the net calorific value (NCV) would be determined.

harvesting of the oilseeds, leaving the remaining part of the plant on the soil, thus not affecting its function as cover crop. It does however imply an additional effort, management and financial resources only valid for the farmer if he receives a sufficient price for the oilseeds or his crop. BAU cash crop production is thus not affected by the plant-oil for fuel production. Thus no potential negative effects on food security and food production will occur due to the project. Also the project leads to no crowding-out of traditional crop products and no additional land needs to be used for plant-oil production thus also not affecting families living on such grounds.

**Castor Oil**

Castor oil is a non-edible vegetable oil obtained from the castor plant (*Ricinus communis*). Castor oil is a colorless to very pale yellow liquid with mild or no odor or taste. Castor oil and its derivatives have applications in the manufacturing of soaps, lubricants, hydraulic and brake fluids, paints, dyes, coatings, inks, cold resistant plastics, waxes and polishes, nylon, pharmaceuticals and perfumes. India, Brazil and China are the major crop producers worldwide. Castor oil due to its good lubricity and biodegradability is an attractive alternative to petroleum-derived lubricants. Castor oil has better low temperature viscosity properties and high temperature lubrication than most vegetable oils. The national biodiesel strategy of Brazil is promoting the plantation of castor plants (Mamona). Typical productivity of the castor bean is 700-1,200kg/ha with an oil yield of 47%[2]. Cold pressed the actual usable oil yield is however estimated to be around 40% which means that per ha around 500 liters of plant oil can be generated.

**Picture 1: Castor Plant**

The project plans to produce around 30% of total plant oil from castor oil[3]. Castor plants are widely used in Brazil but yet not well known in Paraguay. The project owner intends to introduce the plant to farmers in Paraguay providing also for seeds as well as technical assistance based on demonstrating the usage of castor plants on property lands.

**Crambe Oil**

[2] See File Presentation of Biodiesel Brazil using values of 510l/ha

[3] Projections of project owner

Crambe (Crambe abyssinica), which is closely related to rapeseed and mustard, is an erect annual herb with numerous branches that grows to a height of 24 to 40 inches. The crop requires 90 to 100 days from planting to maturity[4]. Yield of Crambe is up to 2,500kg/ha. For these yields however fertilizers and other ingredients need to be used and fields need to be well managed. More realistic and conservative yields are in the range of 1,200 kg/ha[5]. Crambe is useful in crop rotations for alleviating weed, pest and disease build-up. It requires few or no pesticides. For Europe a usage of 75kg/ha of N-fertilizer is recommended (Springdale Crop Synergies, Crambe, 10/2005, p.9). The oil content is between 35 and 60% although 35% is the most common. The useful oil content with cold pressing used for this project is 30%. Crambe oil is non-edible and a good plant-oil for vehicles due to its good lubricity, and fairly good oxidative stability. The oil extracted from Crambe seed is used as an industrial lubricant, a corrosion inhibitor, and as an ingredient in the manufacture of synthetic rubber. Defatted Crambe seed meal can be used as a protein supplement in livestock feeds.

**Picture 2: Crambe Plant**

The project intends to produce around 40% of total plant-oil from Crambe oil. Crambe plants are not yet common in Paraguay. The project owner intends to introduce the plant to farmers in Paraguay providing also for seeds as well as technical assistance based on demonstrating the usage of castor plants on property lands.

[4] E.S. Oplinger et.al, University of Wisconsin-Extension, Alternative Field Crops Manual, Crambe, 1991

[5] IENICA from UK states e.g. for Crambe cultivated in the UK listed productivity levels of between 499 kg/ha up to 3,596 kg/ha (factor 7.2.) with large variations between plots and between years (cited in Springdale Crop Synergies, p. 4). The same holds true for oil yields with differences for the same crop and same country of 35-60% (factor 1.7; cited in Crop Synergies, p. 3). Crambe crop productivity in the US also shows differences of more than factor 2 with productivity ranging from 936lb/acre to 1,960lb/acre and oil yields ranging from 27.8% to 35.3%.

**Oilseed Radish**

Oilseed radish (Raphanus sativus or sativus var) is a type of mustard originally developed, as the name implies, for oil production. It is widely used e.g. in Canada and the US. Oilseed radish is a unique cover and green manure crop that farmers are planting to improve their soil quality for economic crop production. It has the ability to recycle soil nutrients, suppress weeds and pathogens, break up compaction, reduce soil erosion, and produce large amounts of biomass. Oil seed radish has a thick, deep root that can help break up compacted soil layers and scavenge nitrate that has leached beyond the rooting zone of other crops. "Cover crops are not something that a grower is intending to harvest to add value off the field," Sundermeier says. "Cover crops are meant to benefit the soil by improving water filtration, adding organic matter, improving weed control and encouraging beneficial insects."[6] Due to its fast growing ability, oilseed radish is capable of producing large amounts of biomass in a short period of time. Capturing and recycling of excess soil nutrients in biomass is one of the most important features of this cover crop. When planted after manure, sludge, or fertilizer application, oilseed radish may prevent water quality problems by storing nutrients in its biomass. Due to its fleshy composition (and low carbon: nitrogen ratio), the plant material easily decomposes and nutrients become available for the crop planted the following spring. Yields of oilseed radish are typically around 1,200kg/ha with an extractable oil content of around 20%[7].

**Picture 3: Oilseed Radish**

The project intends to produce around 30% of its plant oil from oilseed radish which is already widely used as cover crop, but without harvesting for oilseed usage, in Paraguay.

[6] Alan Sundermeier, Ohio State University Extension, Wood County, Ohio

- [7] *see e.g. OMAFRA, USA on crop productivity*

### A.2.2. Plant-Oil Production

The production path for plant-oil is relatively simple as it consists in growing and harvesting the seeds, pressing the oil at low temperature and filtering the final product to remove impurities. The cold-pressing process does not require complicated machinery. Thus the production technology can be applied on almost any scale. The characteristics of this process are low energy requirement without any use of chemical extractive agents. Decentralized production of cold pressed vegetable oil creates valuable animal feed in the form of press-cake. The local economy is thus also stimulated.

**Picture 4: Oil Expeller**

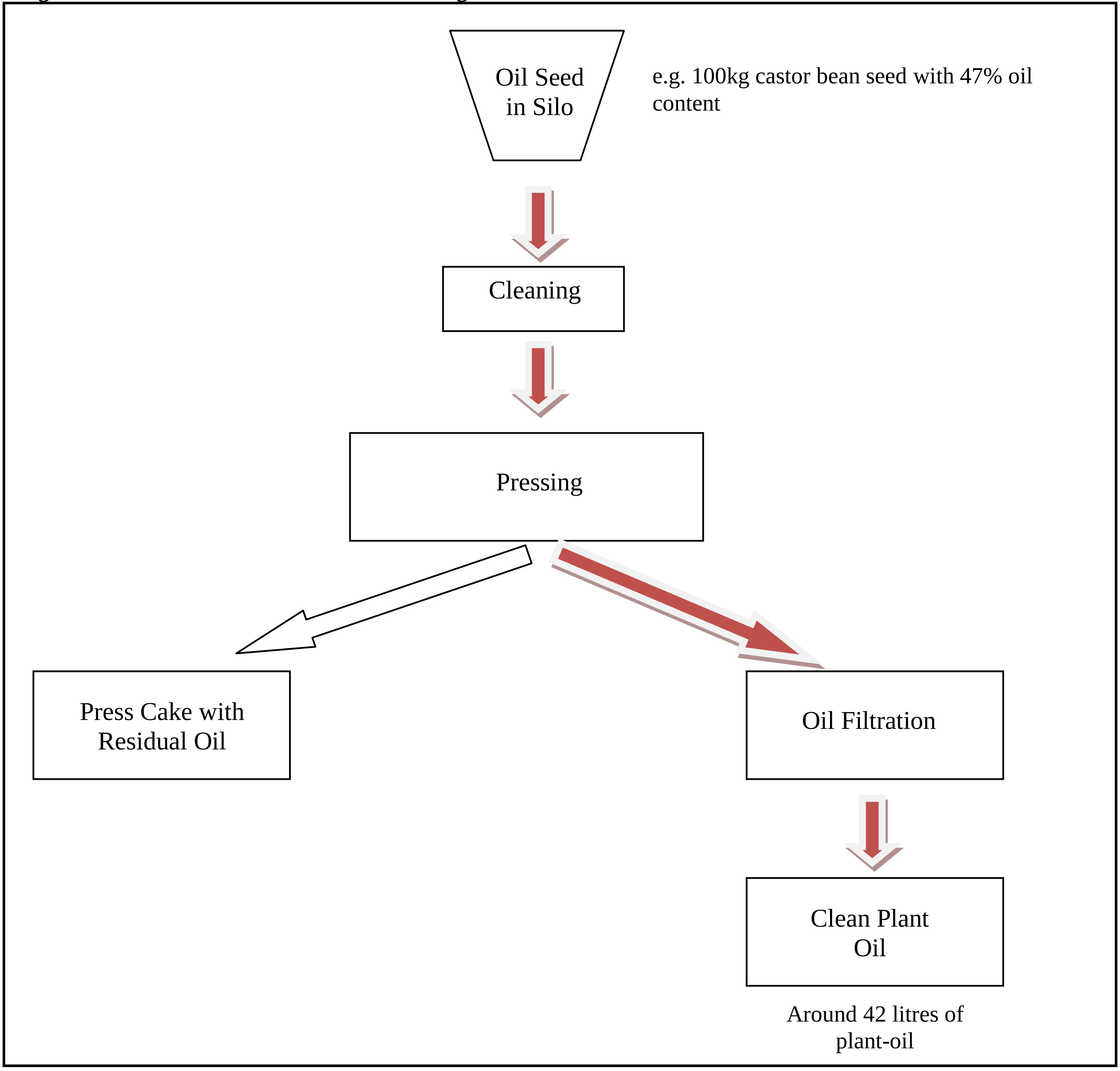
*Source: agro-micro-plant*

**Picture 5: Plate Filter**

*Source: agro-micro-plant*

Core equipments for a small plant-oil producer consist of a pressing and a filtration device. Both the oil expeller as well as the filtration equipment are imported and sold in Paraguay through the project owner or his affiliates. The oil expeller as listed below has a capacity of around 40kg/h. A plant can be built modular with the same equipment.

**Figure 1: Process Overview for Cold Pressing of Oil Seeds to Plant Oil**




According to the VwVwS (Verwaltungsvorschrift wassergefährdende Stoffe)[8], which is the national German regulation on water hazard classification, plant-oil is harmless to groundwater (class NWG) which means that oil spills cause no harm to the environment. In comparison, biodiesel belongs to water hazard class WG1 like viscous crude oil, heavy fuel oil, and a number of other mineral oils and chemicals.

The project intends to produce plant-oil in various sites in Paraguay using the fuel for farm machinery purposes and for sale to captive fleets. No sales will be made at filling stations. Two plant oil production

[8] http://www.umweltbundesamt.de/wgs/vwvws.htm

sites are already established. These two sites are owned and managed by the project owner or its affiliate companies.

The capacity of the plant is in stage 1 (year 2009) 3.5 million liters of plant oil per annum. This capacity is expanded in the year 2 to 7 million liters. This is the production capacity at Tiroleo S.A. which is the major production site. Other, smaller decentralized production sites will be included with plant oil being produced in various farms countrywide basically for internal usage as fuel for farm machinery. The project will however in no case exceed the maximum amount of 60,000t$CO_2$ reduction per annum established as limit for this kind of small-scale project.

For projection purposes it has been assumed that production equals consumption. Both values are however monitored.

**Picture 6: Plant Oil Production Site Tiróleo Vegetal S.A., Misiones**

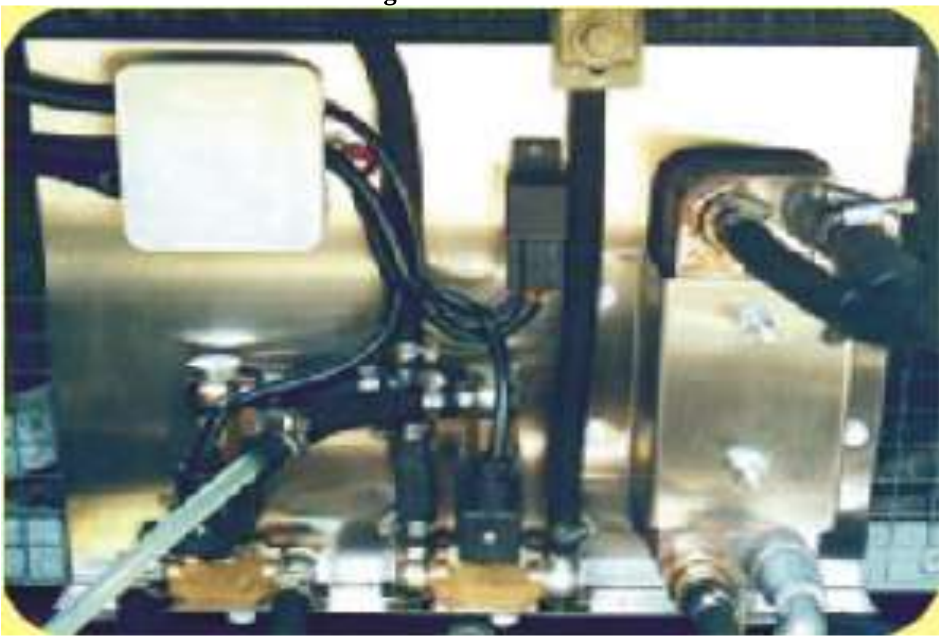
### A.2.3. Plant-Oil Usage in Transport

Usage of plant oil will either be pure using converted vehicles or as blend with diesel using a blending relation of maximum 10%. The project owner or its affiliate company has already established a company which imports, sells and installs T ÜV certified German conversion kits (ATG Germany) used widely in Europe. In Germany alone more than 7,500 vehicles run on pure plant-oil with the equipment promoted by the project owner[9] and extensive testing has taken place showing that with the appropriate conversion the usage of pure plant-oil is no major problem. The core function of the conversion kit is to cope with the lower viscosity of plant-oil. Two-tank kits as those supplied by the project pre-heat the plant-oil using

[9] http://www.diesel-therm.de/pflanzenoel-umruestsatz.htm

waste-heat from the engine. This requires to start the engine with diesel as well as to use diesel before shutting of the engine. The conversion kits include electronic measures which automatically change from diesel to plant-oil as soon as the required viscosity is achieved. When shutting off the engine the equipment informs the driver when he can turn off the equipment which pumps diesel into the engine again so as to re-start again with diesel.

**Picture 7: Conversion Kit for Usage of Pure Plant Oil**



Vehicles need to shorten their service intervals between oil-changes. Not all vehicles and engines are equally apt for usage of plant-oil. Urban buses with prolonged stops might not reach the optimal working temperature and are thus more apt for the usage of diesel-plant-oil blends instead of using pure plant-oil. Farm machinery or vehicles running longer distances e.g. trucks or overland buses on the other hand are ideal for pure plant-oil usage and wide experience with such applications have been made in Europe. For each oilseed the plant-oil quality will be checked at least once based on the fuel standard V DIN 51 605 for rapeseed in accordance also with the methodology and the therein established quality standards (no norm for plant-oil exists currently in Paraguay). Tests on engines using pure plant-oil show similar local pollutant characteristics as when using diesel. Pure plant oil however has the advantage compared to diesel of the near complete absence of sulfur[10]. For each plant-oil the NCV and the density will be determined to establish the diesel substitution rate.

Companies which will use plant-oil as blend or as pure fuel include captive fleets basically near to the production site of plant-oil as well as farm machinery at the decentralized production facilities and at farms producing the oilseeds.

**A.2.4. Contribution to Sustainable Development**

[10] According to the DIN norm V DIN 51-605 the maximum sulphur contents of plant oil is 10mg/kg (ppm) while diesel sold in Paraguay has up to 4,000ppm (Petropar gas oil comercializado decreto 11.833/08).

The project contributes to sustainable development in the environmental and social field. Positive environmental impacts of the project include reduced global warming emissions, the reduced sulfur dioxide emissions and the soil improvement through the green manure cover crops. Spillage of plant-oil also has no negative effects on soil and groundwater in contrast to diesel or bio-diesel. A positive social impact is that plant-oil production leads to additional income and jobs in the agriculture and processing chain. A positive macro-economic impact of the project is that the usage of bio-fuel reduces the dependency of Paraguay on imported diesel fuel.

**A.3. Project participants:**

| Name of Party Involved | Private and or Public Entity(ies) project participants | Indicate if the Party wishes to be considered a project participant (Yes/No) |
|---|---|---|
| Paraguay (host) | Agro Micro Plant S.A. | No |
| Switzerland | Ecotawa AG | No |

**A.4. Technical description of the small-scale project activity:**

**A.4.1. Location of the small-scale project activity:**

**A.4.1.1. Host Party(ies):**

Paraguay

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

All regions, states and provinces in Paraguay are included in the project boundary as plant oil crops will be produced in various regions of the country, plant oil production will also include various sites and usage for transportation is also country-wide. Locations will be monitored.

Various regions for crop production, plant oil production and plant-oil usage which all form part of the geographic project boundary according to the methodology AMS.III.T.

Current plant oil production is in the Provinces of Itapúa and Misiones.

**A.4.1.3. City/Town/Community etc:**

Various communities and towns are involved. New ones will be added over time. Also as crop rotation takes place exact plots will change. Therefore, according to the methodology the crop production sites will be monitored.

The current plant-oil production sites are Colonia Tirol – C.A. López, Itapúa and San Juan Bautista, Misiones.

**A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :**

As mentioned various sites (production as well as usage) will be included. Plant oil users will be self usage in farms, plant-oil production sites and captive fleets in Paraguay. All future sites will be monitored.

The current plant oil production sites are Agro Micro Plant S.A. Ruta 6, Colonia Tirol – C.A. López, Itapúa – Paraguay, geographical coordinates S 26°22'37.61", W54°58'20.67" and Tiróleo Vegetal S.A. Ruta 1 km 206, 4 Boca, San Juan Bautista, Misiones, geographical coordinates S 26°43'11", W 57°03'46".

### A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Project Type III: Other Project Activities
Sectoral scope: 07 Transport

The project reduces GHG emissions in vehicles by using plant-oil which has lower GHG emissions than the substituted diesel. Plant-oil is either used in pure form or as diesel blend.

Plant-oil production and usage are not common in Paraguay. The technology is a novelty for the country. Technology transfer from Europe, where plant-oil is used on a wider scale, thus takes place with this project. Technology transfer is basically in the field of plant-oil production for usage as fuel as well as conversion kits for vehicles to use pure plant-oil. Präventiv Produkte AG in Schaanwald (Liechtenstein) plays the catalytic role in the technology transfer process. Plant-oil is commonly used in Europe and according to the EU commission plant-oil represents an option which has some technical and environmental advantages compared to other alternative fuels (see European Commission DG JRC/IPTS, dated 27.1.2003). In Germany alone more than 5,000 vehicles are running on pure plant-oil as of 2003 (same source as former). Production and usage of plant-oil as fuel is thus a proven environmentally sound technology not yet in usage in Paraguay. The project can thus contribute substantially to the technology transfer process as intended by the CDM.

### A.4.3 Estimated amount of emission reductions over the chosen crediting period:

| **Year** | **Estimation of annual emission reductions in $tCO_{2eq}$** |
|---|---|
| 2009 | 9,313 |
| 2010 | 18,501 |
| 2011 | 18,501 |
| 2012 | 18,501 |
| 2013 | 18,501 |
| 2014 | 18,501 |
| 2015 | 18,501 |
| Total estimated reductions ($tCO_{2eq}$) | **120,319** |
| Total number of crediting years | 7 |
| Annual average of the estimated reductions over the crediting period ($tCO_{2eq}$) | 17,188 |

### A.4.4. Public funding of the small-scale project activity:

Fully private financed. No public funding from an Annex 1 country is involved.

**A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:**

There is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity with the same project participants, in the same project category and registered within the previous 2 years. The proposed project is thus not a debundled component of a large-scale project activity according to Appendix C of the simplified modalities and procedures for small-scale CDM project activities and Annex 27 EB 36 "Compendium of guidance on the debundling for SSC project activities" section B.2.

## SECTION B. Application of a baseline and monitoring methodology

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

Version 1 of AMS-III.T.: Plant oil production and use for transport applications

Additionally the following tools are used:
Tool for the demonstration and assessment of additionality (version 05.2)

**B.2 Justification of the choice of the project category:**

The project reduces GHG emissions of vehicles through the usage of plant-oil and the subsequent substitution of fossil fuel (diesel). The objective of the project is in line with the chosen methodology.

**Table 1: Relation Applicability Conditions and Project**

| # | Applicability Condition | Project Situation |
|---|---|---|
| 1 | In the baseline situation the vehicles use diesel. | All vehicles which use plant-oil use diesel. Blending is only made with diesel. Only diesel vehicles can use pure plant oil. |
| 2 | In case of blending, plant oil is blended with pure diesel and not with biodiesel or biodiesel blends. | No bio-diesel is used. Currently Paraguay only produces small amounts of bio-diesel based on waste material (animal fats). This bio-diesel is used in captive fleets and not blended with normal diesel[11]. Biodiesel production is with inputs such as soya currently not profitable. |
| 3 | Plant oil must comply with national quality regulations or in absence of the latter with the quality standards stipulated in table III.T.1. | No national standards for plant oil exist. The standards as stipulated in table II.T.1 or the more stringent German standard for plant oil (V DIN 51 605; see Table 2) will be met by the project through controlling at a laboratory the fuel quality for each plant oil produced at least once in the crediting period. |
| 4 | The retailers, final users and the producer of the plant oil or its blend are bound by a contract that states that the retailers and final consumers shall not claim emission reductions resulting from its consumption. The contract also enables the producer to | Contracts are made with farmers producing oil-seeds, with plant oil producers as well as with consumers of plant oil to prevent double counting. Monitoring of consumption is assured with the final consumers. No CDM project is currently public concerning usage of plant oil and the UNFCCC has not approved any methodology for |

[11] Information source: C. Servin, biofuel specialist, Ministerio Industria y Comercio

| | | |
|---|---|---|
| | monitor the consumption of plant oil or its blend. Only the producer of the plant oil can claim emission reductions under this methodology. | consumers of plant oil. The absence of double counting can thus be proven easily, even in absence of such contracts, through the review of registered CDM projects in Paraguay. |
| 5 | Under this methodology only the $CO_2$ emissions from diesel displaced by plant oil is considered. | According to the methodology only $CO_2$ emissions from displaced diesel is included not however upstream (well-to-tank) diesel emissions. |
| 6 | In accordance with the approved "General guidance on leakage in biomass project activities" for small scale projects, the project participants should demonstrate that the area where the biomass is grown is not a forest (as per DNA forest definition) and has not been deforested, according to the forest definition by the national DNA, during the last 10 years prior to the implementation of the project activity. | Paraguay has a DNA forest definition[12]:<br>• Min. tree crown cover of 25%<br>• Min. area of 0.25 ha<br>• Min. height of 5 meters<br><br>For each plot which supplies oil-seeds to the project the respective condition will be monitored based on reports by independent experts, available literature or satellite imaging. If satellite imaging is used this will be complemented with a ground report to assess the criteria of minimal height. This parameter is controlled either with an independent report by a forest engineer based on an assessment of lands, available literature and reports (preferred option) or on satellite imaging comparing forest coverage (as far as identifiable as satellite pictures only allow for a rough separation of height dependent coverage of lands) together with a ground report to assess the criteria of minimum height of 5 metres in the forest definition. |
| 7 | No biomass and/or wastes generated/used in the cultivation and processing of the oilseeds will be stockpiled, disposed or treated in such a way as to allow anaerobic decay that result in methane emissions. | Biomass used (oilseeds) are stocked in silos. Side-products of the plant oil production (press cake) is sold as fertilizer or animal feed. No methane creation is possible in any parts of the production chain. |
| 8 | Measures are limited to those that result in emission reductions of less than or equal to 60 kt $CO_2$ equivalent annually. | Annual emission reductions are below the threshold value in all years. |

**Table 2: German Standard for Fuel Plant Oil V DIN 51 605**

| Parameter | Method | Specification | Unit |
|---|---|---|---|
| Total contaminates | DIN EN 12662 | max. 24 | mg/kg |
| Acid value | DIN EN 14104 | max. 2 | mg KOH/g |
| Oxidation stability 110°C | DIN EN 14112 | min. 6 | H |
| Phosphorus content | DIN EN 14107 | max. 12 | mg/kg |
| Ash content | DIN EN ISO 6245 | max. 0.01 | %(m/m) |
| Water content | DIN EN ISO 12937 | max 750 | mg/kg |

[12] http://cdm.unfccc.int/DNA/ARDNA.html?CID=168

The project thus complies with all applicability conditions and will monitor those relevant during project execution.

## B.3. Description of the project boundary:

The project boundary is the geographical area of the cultivation, production and processing of oil-seeds and the areas where plant oil is blended and sold to the final users. The vehicles of the final users where the plant oil or blend is consumed are also included in the project boundary.

Cultivation areas are various farms. At project start these are potentially the project owner farms in Itapu, however no final decision on this issue has yet been taken. Depending on local market circumstances especially concerning prices and offers a variety of production sites will be included monitoring for each and every plot the applicability condition referring to non-deforestation. .

Various production facilities for plant-oil will exist, being one of the environmental advantages of plant-oil its potential to be produced on a small scale in decentralized facilities e.g. on farms producing oil-seeds.
Consumers of plant oil will be basically at or near the plant-oil production sites. Basically these will be farm machinery plus captive truck and bus fleets. Corresponding contracts will be closed upon project operations.

Crop cultivation farms, oil production sites as well as vehicles using plant oil can be all over Paraguay as other sites are included and monitored over time in the project. The project boundary is thus all Paraguay.

## B.4. Description of baseline and its development:

Baseline emissions are calculated based on the amount of plant oil consumed by the project. For this purpose the amount of diesel fuel that would have been consumed in absence of using plant oil is calculated. Calculations are based on the relative net calorific values of the fuels used.

Formula (1)

$$FC_{D,y} = \sum_{k=1..n} \frac{NCV_k}{NCV_D} \times FC_{k,y}$$

*Where:*

| | |
|---|---|
| *$FC_{D,y}$* | *Diesel fuel which would have been consumed in absence of the project activity in the year "y" ( tons)* |
| *$NCV_k$* | *Net calorific value of plant-oil "k" (in GJ/t)* |
| *$NCV_D$* | *Net calorific value of diesel (in GJ/t)* |
| *$FC_{k,y}$* | *Plant-oil type "k" consumed in the year "y" (in tons)* |
| *k* | *Types of plant oil used (dependent on oil-seed source)* |

Under the condition of:

Formula (2)

$$FC_{k,y} \leq FP_{k,y}$$

*Where:*

| | |
|---|---|
| $FC_{k,y}$ | *Plant-oil type "k" consumed in the year "y" (tons)* |
| $FP_{k,y}$ | *Plant-oil type "k" produced in the year "y" ( tons)* |

The NCVs of the different types of plant-oil are based on measurements realized.

Formula (3)

$$BE_y = FC_{D,y} \times NCV_D \times EF_{CO2,D}$$

*Where:*

| | |
|---|---|
| $BE_y$ | *Baseline emissions in year "y" ($tCO_{2eq}$)* |
| $FC_{D,y}$ | *Diesel fuel consumed in the year "y" (tons)* |
| $NCV_D$ | *Net calorific value of diesel (GJ/t)* |
| $EF_{CO2,D}$ | *Carbon emission factor diesel ($tCO_{2eq}$/GJ)* |

The carbon emission factor diesel is based on the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

The NCV of diesel is not required when combining Formula (1) with Formula (3).

Formula (3a)

$$BE_y = FC_{D,y} \times NCV_D \times EF_{CO2,D} = \frac{\sum_{k=1..n} NCV_k \times FC_{k,y}}{NCV_D} \times NCV_D \times EF_{CO2,D} = \sum_{k=1..n} NCV_k \times FC_{k,y} \times EF_{CO2,D}$$

*Where:*

| | |
|---|---|
| $BE_y$ | *Baseline emissions in year "y" ($tCO_{2eq}$)* |
| $FC_{D,y}$ | *Diesel fuel consumed in the year "y" (tons)* |
| $NCV_D$ | *Net calorific value of diesel (GJ/t)* |
| $EF_{CO2,D}$ | *Carbon emission factor diesel ($tCO_{2eq}$/GJ)* |
| $NCV_k$ | *Net calorific value of plant-oil "k" (in GJ/t)* |
| $FC_{k,y}$ | *Plant-oil type "k" consumed in the year "y" (in tons)* |
| $k$ | *Types of plant oil used (dependent on oil-seed source)* |

Chapter B.6.1. includes for baseline, project and leakage emissions in tabular form all data used (variables, parameters, data sources etc).

**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 small-scale CDM project activity:**

The additionality of the project is determined using the "Tool for the demonstration and assessment of additionality (version 05.2 as of EB 39 Annex 10)".

**Table 3: CDM Project Chronology**

| Milestone | Date |
|---|---|
| 1. Contract signature for CDM methodology and project development with grütter consulting[13] | 18.3.2007 |
| 2. Submission of plant-oil methodology incl. draft PDD to the UNFCCC[14] | 15.5.2007 (SSC_099) |
| 3. Construction start of plant-oil production facility[15] | 18.6. 2007 |
| 4. Approval of methodology for plant oil production by UNFCCC EB[16] | 30.11.2007 (EB 36) |
| 5. Submission of PDD for validation[17] | July 2008 |
| 6. Plant-oil production facility completed and start of operations | September 2008 |

**STEP 1. IDENTIFICATION OF ALTERNATIVES TO THE PROJECT ACTIVITY CONSISTENT WITH CURRENT LAWS AND REGULATIONS**

**Sub-step 1a: Define alternatives to the project activity**

The potential alternatives are:
1. Continuation of diesel usage in vehicles i.e. oil-seeds from cover crops are not harvested or are used for alternative non-energy related purposes.
2. Producing plant-oil without CDM
3. Producing bio-diesel instead of plant-oil from oil-seeds.

Due to the additional cost and investment entailed in producing bio-diesel the production of latter is currently not considered by the project owner as being attractive in Paraguay. Bio-diesel has additional costs due to using plant-oil as input material but further processing latter through trans-esterification. Bio-diesel in Paraguay is currently only produced from waste material resources such as animal fats for captive fleet usage. This is thus not a viable alternative to the project proponent.

**Sub-step 1b. Consistency with mandatory laws and regulations**

All alternatives proposed comply with all applicable legal and regulatory requirements. While bio-fuels are promoted by the government of Paraguay (law 2748) there is no compulsory usage of latter. The incentives of government are limited to import tax exemptions for equipment used to produce bio-fuel. These incentives are however seemingly insufficient as neither ethanol-gasoline blends nor bio-diesel targets blends are currently sold to the public in Paraguay.

**STEP 2: INVESTMENT ANALYSIS**

**Sub-step 2a: Determine appropriate analysis method**

The simple cost analysis is not used as the project generates income apart from CDM. Alternatives assessed are basically producing plant-oil with or without CDM. The production of bio-diesel is far more complex and costly and is not considered by the project owner as a feasible alternative. Therefore the Option III benchmark analysis has been chosen.

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[13] Documentary proof: Signed contract between project developer and project owner

[14] Documentary proof UNFCCC website

[15] Documentary proof: Invoice for first material purchase before construction start

[1616] Documentary proof UNFCCC website

[17] Documentary proof reception of document by SGS and publication on UNFCCC website

**Sub-step 2b: Option III. Apply benchmark analysis**

An investment analysis is performed based on the IRR plus the dynamic payback (DPB) to determine the profitability of producing plant-oil for transportation purposes. The investment analysis is based on following data:

- Investment for plant-oil production
- Operational cost for producing plant-oil
- Cost for oil-seed
- Sale price of plant-oil
- 20 year time frame for analysis
- Annex 35 EB 39 "Guidance on the Assessment of Investment Analysis" has been followed
  1. Guidance: Period of assessment 10-20 years (in general). 20 years has been taken thus conservative
  2. Guidance: Fair value of asset to be included at the end of the period. 100% of the land plus building cost investment cost has been included as of end of the period of 20 years. The equipment has a technical lifespan of 25 years and has thus been depreciated. This is considered to be very conservative as buildings also tend to deteriorate
  3. Guidance: Not include depreciation and other non-cash items: No non-cash items such as depreciation have been included.
  4. Guidance: Input values and decision time needs to be consistent. For all input values 01.06.2007 was taken in the original calculation which is however in some parts based on non-documented estimations of the project owner. To assess the plausibility and validity of assumptions made the calculations have been re-made with actual and documented data consolidated as of 2$^{nd}$ semester 2008. This plausibility check has shown that estimations were conservative i.e. the project is less profitable with actual compared to projected data.
  5. Guidance: Not include loan repayments and interests. No loan repayment nor interest on the investment is considered.

**Investment Cost**
The investment cost is based on the plant-oil production facility of the project owner in Misiones, with an annual capacity of 3.5 million litres of plant-oil 2009 and 7 million in 2010 and following. The investment cost considered includes the filtration, pressing and storage facilities, and buildings.

**Operational Cost**
The operational cost for the production of plant-oil includes basically labour and energy costs.

**Input Cost Oil-Seeds**
These are based on market prices obtained for the oil-seeds used. In the baseline the crop would not have been harvested and thus zero income would have resulted. However harvesting entails additional costs for the farmer including harvesting costs, improved field management, fertilizer and transport/marketing costs.

**Sale-Price of Plant-Oil**

The project intends to sell the plant-oil at a price 10-25% below the diesel price paid by large consumers[18]. The usage of plant-fuel is not common practice in Paraguay and equipment manufactures in general prefer the usage of conventional diesel. Equipment manufacturers extend warranties if blends are used up to 5% of bio-diesel[19]. The project will however use straight vegetable oil which is not covered by warranties[20]. Potential clients will thus only be willing to use plant-oil if a substantial price incentive relative to diesel fuel is given. This holds true also for usage by the farmer for own equipment. If vehicles are adapted to the usage of plant-oil an initial investment by the vehicle owner is required in the order of 2-5,000 USD per vehicle[21]. The vehicle owner will only realize this investment if plant-oil is sold with a significant discount relative to conventional diesel. The clients for plant-oil are either the farmers themselves or captive fleets which have a discount on the fuel pump price due to being large consumers. Plant-oil needs to be significantly cheaper than diesel due to having on average a 10-% lower energy value (thus eliminating 10 percentage points of the price difference), additional risks for the user (diesel usage entails no risk while plant-oil is unknown as fuel and is thus perceived as risk by consumers), additional investment (installment of a 2nd tank in case of blending plus investment in kits for usage of pure plant oil in case of using only plant oil) and additional management cost for consumers (necessity to order at two suppliers, more working capital due to stocks of diesel and plant oil, higher logistics effort). The 10-25%[22] price reduction is based on the experience in other countries such as Austria and Germany as largest seller of plant oil. As of June 2007 plant oil was sold 10% below the price of diesel[23] while in May 2008 in Germany pure plant oil was sold between 0.95 and 1.2 Euro/liter (http://www.biotrieb.org/Kosten.113.0.html) while diesel was sold at 1.46. (http://de.statista.org/statistik/daten/studie/1691/umfrage/dieselpreis-monatsdurchschnittswerte/). This means that in Germany plant oil is sold on average 35% cheaper than diesel. Germany has experience with plant oil and Paraguay not which means that the discount which needs to be offered in Paraguay will probably have to be higher. The discounts used are thus very conservative and might well have to be higher in reality.

As benchmark 7.5% is taken which is the commercial lending rate in USD for credits of less than 1 year as of May 2007.

[18] Large diesel consumers (fleet clients with own service stations) pay around 7.5% less than the end-client pump station price. The project must thus offer plant oil to fleet customers 25% below this price or around 31% below the pump price for final clients (31%=100%*92.5%*75%)

[19] EU, EN 14214 allows blending of bio-diesel with diesel according to EN590 without declaration for concentrations up to 5%. As bio-diesel blends up to 5% need not be declared the warranty for bio-diesel is automatically extended to biodiesel blends of up to 5% as petrol station can sell these blends without declaration.

[20] EU EN 14214 referenced is specifically for bio-diesel blends and not for usage of plant oil, even less if plant oil is used in its pure form.

[21] See invoice for transformation kit dated 24.11.2007 over 10,998,000 Guarani equivalent to USD 2,200

[22] To be conservative the calculations for 1.6.2007 were based on the lowest differential of 10%

[23] UFOP Market information Germany May 2007

**Table 4a: Investment Data (USD)**

| Parameter | Value estimated in 1.6.2007 | Actual cost per August 2008 | Comment |
|---|---|---|---|
| Investment 2008 and 2009[24] | 1,500,000 (2008) + 450,000 (2009) | 1,608,000 (2008 + 508,000 (2009) | Buildings, silo, equipment; slightly lower projected cost |
| Operation cost 2008 and 2009ff | 2.9 million (2008) and 5.2 million (2009ff) | 4.2 million (2008) and 7.4 million (2009ff) | 2009 doubles production thus reducing production costs; includes seeds, staff and electricity; significantly higher cost than anticipated due to sharp increase of seed prices in 2008 |
| Income 2008 and 2009ff | 2.5 million (2008) and 5.1 million (2009ff) | 2.6 million (2008) and 5.2. million (2009ff) | Fuel price comparable 2008 to 2007 |
| IRR | negative | negative | Same result; negative cash flow in all years for both alternatives |

All data used is company internal and sensitive. All data is fully disclosed to the validator.

**Sub-step 2c: Calculation and comparison of financial indicators**

Excluding CDM the NPV (Net Present Value) of the project is over a 20-year period negative and the IRR is negative. With CDM income the NPV turns positive and the IRR is 12% thus receiving an IRR higher than the benchmark rate of 7.5% in the same currency.

Clearly the project IRR is much lower than the benchmark used. The CDM project activity thus cannot be considered as financially attractive.

**Sub-step 2d: Sensitivity analysis**

Table 4b shows the results of a sensitivity analysis made.

**Table 4b: Sensitivity Investment Analysis**

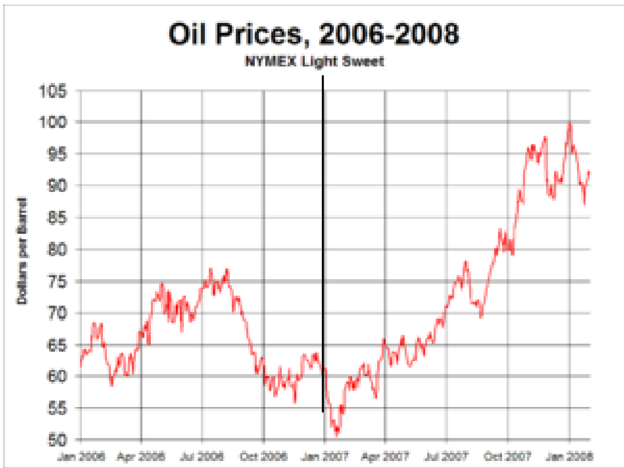
| | NPV without CDM | IRR without CDM | NPV with CDM | IRR with CDM |
|---|---|---|---|---|
| Base case | negative | -negative | Positive | 12% |
| 20% reduction investment | negative | -negative | Positive | 14% |
| 10% increase selling price and 5% increase oil-seed price | negative | 3% | Positive | 24% |
| 5% increase selling price and 10% increase oil-seed price | negative | Negative | negative | Negative |
| 10% lower selling price and 5% lower oil-seed price | negative | negative | negative | Negative |
| 5% lower selling price and 10% lower oil-seed price | Negative | 5% | Positive | 26% |

[24] 2008 capacity of 3.5 million liters, expanded to 7 million in 2009

The project is sensitive to higher diesel cum plant oil prices. However in practice higher diesel prices lead in parallel to higher oil-seed prices (input material for plant-oil production) as latter have as significant cost component fuel and fertilizer and farmers thus increase the oil-seed prices with an increase in fuel prices. The sensitivity analysis thus has to take into consideration that the two parameters are dependent. If however diesel prices increase while oil-seed prices also increase these have a countervailing impact. Margins would thus remain comparable even with higher fuel prices. The relation between the agricultural crop and the diesel price is clearly shown in the following two charts. This is also logic as diesel and fertilizer (fertilizer production is highly energy intensive and thus fertilizer prices are also linked to fuel prices) constitutes important cost components of agricultural production. The different scenarios listed in the table 4b all show that the project in absence of CDM has a negative NPV over 20 years in all cases with the IRR always below the benchmark rate of the average commercial interest rate as published by the Central Bank. In contrast with CDM the project remains in general profitable even with fluctuations of prices which are very common.

**Chart 1: Soybean Oil Prices**


**Chart 2: Oil Prices**




Sources:
Chart 1: http://tfc-charts.w2d.com/chart/SO/W
Chart 2: http://www.eia.doe.gov/emeu/international/oilprice.html

## STEP 3: BARRIER ANALYSIS

### Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity

### Barrier Due to Prevailing Practice

The project is the first of its kind in Paraguay. No other plant-oil production facilities exist and consumers have not yet used plant-oil in vehicles. This is a clear barrier due to prevailing practice. This has been confirmed by the Environmental Secretariat SEAM[25].

### Impact of CDM Registration on Barriers

[25] See letter SEAM project first of its kind dated 2.1.2009; see letter attached Annex 3

The impact of a CDM registration is on all identified barriers:
With CDM the IRR of the project is 12% while the financial benchmark used is 7.5% (http://www.bcp.gov.py/SuperBancos/TasasInteres/PromedioMensuales/2007/200705.pdf). The project is thus financially feasible and the financial barrier can be overcome with CDM[26]. The impact of CDM is thus highly relevant for the project.

Per logic with or without CDM the project is first of its kind. The associated risks and uncertainties with being a first of its kind are compensated with the additional income source of CDM as well as with additional prestige and international recognition through being a UNFCCC registered project difficult to measure in monetary terms.

**Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)**

A continuation of current practices does not face any of above mentioned barriers.

**STEP 4. COMMON PRACTICE ANALYSIS**

**Sub-step 4a. Analyze other activities similar to the proposed project activity**

The project is the first of its kind in Paraguay. No other plant-oil production facilities exist in the country. No experience exist of vehicle owners in usage of plant-oil as blend or usage of pure plant-oil in converted vehicles

**Sub-step 4b. Discuss any similar options that are occurring**

No other company implementing similar options has been identified. Bio-diesel which might be considered a comparable option is not being produced currently in Paraguay except for small facilities based on animal waste fats for usage in captive fleets.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

**Project Emissions**

Project activity emissions are the emissions related to the cultivation of oil seeds and production of plant oil (“field-to-wheel” emissions). These emissions will be attributed to the plant oil produced, and not shared over the different co-products.

Project emissions are:
a). Emissions from energy use for processing (e.g. pressing and filtering) of plant oil;
b).$N_2O$ emissions resulting from either from fertilizer application and/or from nitrogen in crop residues (above-ground and below-ground (not included currently as the crops included in the PDD are all nonN-fixing crops).

[26] See document plant oil economics calculation number 3 (with CDM)

Formula (4)

$$PE_y = \sum_k PE_{PO,k,y}$$

*Where:*

| | |
|---|---|
| $PE_y$ | *Project emissions from plant oil production in year "y" per ton plant oil ($tCO_{2eq}$/t plant oil produced)* |
| $PE_{PO,k,y}$ | *Project emissions from plant oil production of crop k in the year "y" per ton plant oil ($tCO_{2eq}$ /t plant oil 'k" produced)* |

To get total project emissions PEy needs to be multiplied with the total amount of plant oil produced.

Formula (5)

$$PE_{PO,k,y} = \frac{PE_{FA,k,y} + PE_{OFP,k,y}}{H_{k,y} + OY_{k,y}}$$

*Where:*

| | |
|---|---|
| $PE_{PO,k,y}$ | *Project emissions from plant oil production of crop k in the year "y" ($tCO_{2eq}$ /t plant oil 'k" produced)* |
| $PE_{FA,k,y}$ | *Project emissions of $N_2O$ in cultivation of crop k in the year "y" ($tCO_{2eq}$ )* |
| $PE_{OFP,k,y}$ | *Project emissions from energy use for oil seed processing of crop k in the year "y" ($tCO_{2eq}$ )* |
| $H_{k,y}$ | *Harvest of crop "k" in year 'y" (t crop)* |
| $OY_{k,y}$ | *Oil yield of crop k in the year "y" (t oil/t crop)* |

Project emissions from energy use for processing (e.g. pressing and filtering) of plant oil are determined as follows.

Formula (6)

$$PE_{OFP,k} = EC_{OFP,k} \times EF_{CO2,ELEC} + \sum_i \left( FC_{OFP,i,k} \times NCV_i \times EF_{CO2,i} \right)$$

*Where:*

| | |
|---|---|
| $EC_{OFP,k}$ | *Electricity consumption in processing (e.g. pressing and filtering) for crop "k" in year "y" (MWh)* |
| $EF_{CO2,ELEC}$ | *Emissions factor for grid electricity supplied to the project plant using the calculation methods of AMS I.D ($tCO_2e$/MWh)* |
| $FC_{,OFP,i,k}$ | *Consumption of fossil fuel "i" for filtering and pressing for crop "k" in year "y" (tons)* |
| $NCV_i$ | *Net calorific value of fossil fuel "i" (GJ/ton)* |
| $EF_{CO2,i}$ | *Emissions factor of fossil fuel "i" ($tCO_2$/GJ fuel)* |

Emissions for oil-seed processing include fossil fuel and electricity used. No fossil fuel is used in the plant-oil production facility, only electricity and wood (for silo drying purposes). However the electricity factor for Paraguay (Combined Margin) is zero (see Annex 3). Thus electricity related emissions are also 0. Therefore also no monitoring of electricity consumption needs not take place as multiplying this parameter with 0 will always result in 0 emissions.

The EF electricity is determined ex-ante and is a fixed value for the entire first crediting period.
The $N_2O$ emissions from cultivation of plant oil are determined as follows:

Formula (7)

$$PE_{FA,k,y} = \left[\left(F_{ON,k,y} + F_{SN,k,y} + F_{CR,k,y}\right) \times EF_{N2O\_direct}\right] \times \frac{44}{28} \times GWP_{N2O}$$

*Where:*

| | |
|---|---|
| $PE_{FA,k,y}$ | *Project emissions of $N_2O$ in cultivation of crop k in the year "y" ($tCO_{2eq}$ )* |
| $F_{ON,k,y}$ | *Amount of organic fertilizer nitrogen applied for crop k in the year "y" (tN)* |
| $F_{SN,k,y}$ | *Amount of synthetic fertilizer nitrogen applied for crop k in the year "y" (tN)* |
| $F_{CR,k,y}$ | *Amount of N in crop residues for crop k in the year "y" (tN)* |
| $EF_{N20\_direct}$ | *Emission factor for emissions from N inputs ($tN_2O$-N/tN input)* |
| $GWP_{N2O}$ | *Global warming potential of $N_2O$ ($tCO_{2e}/tN_2O$) (value of 310)* |

The default value for $EF_{N2O\_direct}$ is 0.01 (IPCC 2006, Vol. 4, Table 11.1 p.11.26)

$F_{CR}$ is not included as the crops included currently are all nonN-fixing but N-recycling crops[27]. In case of other crops being used in the future as source of oil-seeds this factor might be include again if relevant.

Project emissions from clearance of lands are addressed by the applicability conditions of the methodology.

**Baseline Emissions**

See chapter B4.

**Leakage Emissions**

Equipment transfer does not take place.

According to the General guidance on leakage in biomass project activities Version 2 EB 28 the potential leakage to be considered in the case of biomass from croplands is a shifts of pre-project activities[28]. Shifts of pre-project activities are relevant where in the absence of the project activity the land areas would be used for other purposes. This is not the case in the project. The cash crops (such as soya or sunflower) produced by the farmers remain the same and in the same quantity. The crops used by the project are cover crops planted for soil regeneration purposes. Other farmers would not plant anything but would have fallow lands. The same cultivations as those used by the project activity are thus produced in baseline conditions with the difference that these crops are harvested (the oil-seeds only) while in absence of the project they would be left on the plot. No displacement of crops, activities as well as of people thus occur. According to the guidance project participants might thus neglect leakage effects as the land use does not change as a result of the project activity.

No plant-oil is produced to the moment in Paraguay. The biomass produced would not be harvested and not used. Thus also no competing use for biomass needs to be considered.

[27] Information provided by A. Thommen Forschungsinstitut für biologischen Landbau, Switzerland

[28] Emissions from biomass generation and cultivation have been included already as project emissions

**Emission Reductions**

Formula (8)

$$ER_y = BE_y - PE_y - LE_y$$

*Where:*

| | |
|---|---|
| $ER_y$ | *Emission reductions in the year "y" ($tCO_2$)* |
| $BE_y$ | *Baseline emissions in the year "y" ($tCO_2$)* |
| $PE_y$ | *Project emissions in the year "y" ($tCO_2$)* |
| $LE_y$ | *Leakage emissions in the year "y" ($tCO_2$)* |

**List of Data and Parameters Used for Calculations**

| Data/Parameter | Value | Source |
|---|---|---|
| $EF_{CO2,D}$ | 72,600 $kgCO_2$/TJ | IPCC 2006, Vol. 2, Table 1.4. |
| $EF_{CO2, ELEC}$ | 0 $kgCO_2$/kWh | Vice-Ministry of Energy and Mines, Government of Paraguay |
| $NCV_k$ | Castor: 39,500 kJ/kg<br>Crambe: 40,482 kJ/kg<br>Oil-seed radish: 39,709 kJ/kg | A.K. Babu, MIT, "Vegetable oil and their derivatives as fuels for CI engines: An overview" SAE 2003-01-0767, p.3 |
| $FP_k$ | Year 2009:<br>Crambe: 2,450,000 litres<br>Oilseed radish: 1,050,000 litres<br>Year 2010 onwards<br>Castor: 2,100,000 litres<br>Crambe: 2,800,000 litres<br>Oilseed radish: 2,100,000 litres | Estimates project owner |
| $FC_k$ | Year 2009:<br>Crambe: 2,450,000 litres<br>Oilseed radish: 1,050,000 litres<br>Year 2010 onwards<br>Castor: 2,100,000 litres<br>Crambe: 2,800,000 litres<br>Oilseed radish: 2,100,000 litres | Estimates project owner |
| $H_k$ | 2009<br>Crambe: 7,497 tons<br>Oilseed radish: 4,820 tons<br>2010 onwards:<br>Castor: 4,820 tons<br>Crambe: 8,568 tons<br>Oilseed radish: 9,639 tons | Project owner |
| $OY_k$ | Crambe: 30%<br>Oilseed radish: 20%<br>Castor: 40% | literature |
| $CL_k$ | 2009<br>Crambe: 6,261 ha<br>Oilseed radish: 4,025 ha<br>2010 onwards:<br>Castor: 4,025 ha<br>Crambe: 7,156 ha<br>Oilseed radish: 8,050ha | Project owner |
| $F_{ON,k}$ | 2009: 19.77 tons | Project owner |

| | | |
|---|---|---|
| | 2010 onwards: 36.95 tons | |
| $F_{SN,k}$ | 0 | Project owner |
| $FC_{,OFP,i,k}$ | 0 | Project owner |
| $F_{CR,k,y}$ | 0 | A. Thommen Forschungsinstitut für biologischen Landbau, Switzerland |
| $EF_{N2O\_direct}$ | 0.01 | IPCC 2006, Vol 4, Table 11.1p.11.26 |

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

| **Data / Parameter:** | $EF_{CO2,D}$ |
|---|---|
| Data unit: | $tCO_2$/GJ |
| Description: | Carbon emission factor of diesel |
| Source of data used: | IPCC 2006, Vol. 2, Table 1.4. |
| Value applied: | 72,600 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Lower boundary of the 95% confidence interval is used. |
| Any comment: | |

| **Data / Parameter:** | $EF_{CO2,\ ELEC}$ |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | $CO_2$ emission factor of electricity |
| Source of data used: | Vice-Ministry of Energy and Mines, Government of Paraguay |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Based on official information from the Vice-Ministry for Energy and Mines. See Annex 3 |
| Any comment: | The EF electricity is determined ex-ante and is a fixed value for the entire first crediting period. |

### B.6.3 Ex-ante calculation of emission reductions:

**Project Emissions**

Project emissions are:
a). Emissions from energy use for processing (e.g. pressing and filtering) of plant oil;
b).$N_2O$ emissions resulting from either from fertilizer application and/or from nitrogen in crop residues (above-ground and below-ground). (not included currently as the crops included in the PDD are all nonN-fixing crops).

$$PE_y = \sum_k PE_{PO,k,y}$$

*Where:*

$PE_y$ — *Project emissions from plant oil production in year "y" per ton plant oil ($tCO_{2eq}$/t plant oil produced)*

$PE_{PO,k,y}$ — *Project emissions from plant oil production of crop k in the year "y" per ton plant oil ($tCO_{2eq}$ /t plant oil 'k" produced)*

To get total project emissions $PE_y$ needs to be multiplied with the total amount of plant oil produced.

$$PE_{PO,k,y} = \frac{PE_{FA,k,y} + PE_{OFP,k,y}}{H_{k,y} + OY_{k,y}}$$

*Where:*

| | |
|---|---|
| $PE_{PO,k,y}$ | *Project emissions from plant oil production of crop k in the year "y" ($tCO_{2eq}$ /t plant oil 'k" produced)* |
| $PE_{FA,k,y}$ | *Project emissions of $N_2O$ in cultivation of crop k in the year "y" ($tCO_{2eq}$ )* |
| $PE_{OFP,k,y}$ | *Project emissions from energy use for oil seed processing of crop k in the year "y" ($tCO_{2eq}$ )* |
| $H_{k,y}$ | *Harvest of crop "k" in year 'y" (t crop)* |
| $OY_{k,y}$ | *Oil yield of crop k in the year "y" (t oil/t crop)* |

$$PE_{OFP,k} = EC_{OFP,k} \times EF_{CO2,ELEC} + \sum_i \left( FC_{OFP,i,k} \times NCV_i \times EF_{CO2,i} \right)$$

*Where:*

| | |
|---|---|
| $EC_{OFP,k}$ | *Electricity consumption in processing (e.g. pressing and filtering) for crop "k" in year "y" (MWh)* |
| $EF_{CO2,ELEC}$ | *Emissions factor for grid electricity supplied to the project plant using the calculation methods of AMS I.D ($tCO_2e/MWh$)* |
| $FC_{,OFP,i,k}$ | *Consumption of fossil fuel "i" for filtering and pressing for crop "k" in year "y" (tons)* |
| $NCV_i$ | *Net calorific value of fossil fuel "i" (GJ/ton)* |
| $EF_{CO2,i}$ | *Emissions factor of fossil fuel "i" ($tCO_2$/GJ fuel)* |

Emissions for oil-seed processing include fossil fuel and electricity used. No fossil fuel is used in the plant-oil production facility, only electricity and wood (for silo drying purposes). However the electricity factor for Paraguay (Combined Margin) is zero (see Annex 3). Thus electricity related emissions are also 0. Therefore also no monitoring of electricity consumption needs not take place as multiplying this parameter with 0 will always result in 0 emissions.

The EF electricity is determined ex-ante and is a fixed value for the entire first crediting period.

Project based emissions are based on emissions from crop cultivation as the process emissions are 0 due to a CM of electricity of 0 and 0 usage of fossil fuel. The formula below is equivalent to formula (7) of B.6.1. The parameter $PE_{OFP,k,y}$ is 0 due to the Combined Margin of Paraguay which is 0. The amount of organic fertilizer used is calculated for all crops (sum) and thus total project emissions are for all crops.

$$PE_{FA,k,y} = \left[ \left( F_{ON,k,y} + F_{SN,k,y} + F_{CR,k,y} \right) \times EF_{N2O\_direct} \right] \times \frac{44}{28} \times GWP_{N2O}$$

*Where:*

| | |
|---|---|
| $PE_{FA,k,y}$ | *Project emissions of $N_2O$ in cultivation of crop k in the year "y" ($tCO_{2eq}$ )* |
| $F_{ON,k,y}$ | *Amount of organic fertilizer nitrogen applied for crop k in the year "y" (tN)* |
| $F_{SN,k,y}$ | *Amount of synthetic fertilizer nitrogen applied for crop k in the year "y" (tN)* |
| $F_{CR,k,y}$ | *Amount of N in crop residues for crop k in the year "y" (tN)* |
| $EF_{N20\_direct}$ | *Emission factor for emissions from N inputs ($tN_2O$-N/tN input)* |
| $GWP_{N2O}$ | *Global warming potential of $N_2O$ ($tCO_{2e}/tN_2O$) (value of 310)* |

$$PE_{2009} = [(19.765 + 0 + 0) \times 0.01] \times \frac{44}{28} \times 310 = 96tCO_{2eq}$$

$$PE_{2010} = [(36.952 + 0 + 0) \times 0.01] \times \frac{44}{28} \times 310 = 180tCO_{2eq}$$

2010 and years thereafter are equivalent.

The amount of organic fertilizer $F_{ON}$ is calculated for all crops directly.

$F_{ON}$ is based upon (for each crop): organic fertilizer per ha * N contents of organic fertilizer * ha cultivated ($Cl_k$)

Ha cultivated is based upon (for each crop): production volume plant oil ($FP_k$) * % share of crop in plant oil produced ($S_k$)/ % oil contents of crop ($OY_k$)* density of plant oil ($D_{PO}$)/ production of crop per ha $P_{k,}$)

For 2009:

$F_{ON}$ = 150 kg/ha * 12.81 grN/kgfertilizer /10^6 *10,285 = 19.765

$F_{ON,,k}$ = 150kg/ha for all crops based on estimation of project owner (actual value is monitored)
$N_{FON,k,}$ = 12.81 gr N per kg fertilizer based on laboratory analysis of organic fertilizer (doc 080135)

$CL_k$ = 3,500,000 * (0.7/0.3*0.92/1,200+0/0.4*0.92/1,200+0.3/0.2*0.92/1,200)=10,285 ha

$FP_k$ = 3,500,000 liters based on B.7.1. (sum of crambe and oilseed radish i.e. total production)
$S_k$ = 0.7 for crambe and 0.3 for oilseed radish based on percentage per crop for total plant oil production based on B.7.1. ($FP_k$)
$OY_k$ = 0.3 for crambe and 0.2 for oilseed radish based on B.7.1.
$D_{PO}$ = 0.92 kg/l for all plant oils based on B.7.1. based on laboratory analysis by ASG #155820
$P_{k,}$ = 1,200kg/ha for all crops based on B.7.1.
See B7.1. $CL_k$ sum of crambe (6,248) and oilseed radish (4,017)

For projection purposes $FP_k$ has been based on the (projected) amount of plant oil and based on that the projected average hectares to produce this amount of plant oil is calculated. ERs will however be based on the actual and monitored amount of cultivated hectares (see section B.7.1.)

The same calculation method is used for 2010. 2010 values for $FP_k$ and $S_k$ vary relative to 2009 (see all data listed in spreadsheet and B.7.1.)

**Baseline Emissions**

$$FC_{D,y} = \sum_{k=1..n} \frac{NCV_k}{NCV_D} \times FC_{k,y}$$

*Where:*

| | |
|---|---|
| $FC_{D,y}$ | *Diesel fuel which would have been consumed in absence of the project activity in the year "y" ( tons)* |
| $NCV_k$ | *Net calorific value of plant-oil "k" (in GJ/t)* |
| $NCV_D$ | *Net calorific value of diesel (in GJ/t)* |
| $FC_{k,y}$ | *Plant-oil type "k" consumed in the year "y" (in tons)* |
| $k$ | *Types of plant oil used (dependent on oil-seed source)* |

Under the condition of:

$$FC_{k,y} \leq FP_{k,y}$$

*Where:*

| | |
|---|---|
| $FC_{k,y}$ | *Plant-oil type "k" consumed in the year "y" (tons)* |
| $FP_{k,y}$ | *Plant-oil type "k" produced in the year "y" ( tons)* |

The NCVs of the different types of plant-oil are based on measurements realized.

$$BE_y = FC_{D,y} \times NCV_D \times EF_{CO2,D}$$

*Where:*

| | |
|---|---|
| $BE_y$ | *Baseline emissions in year "y" ($tCO_{2eq}$)* |
| $FC_{D,y}$ | *Diesel fuel consumed in the year "y" (tons)* |
| $NCV_D$ | *Net calorific value of diesel (GJ/t)* |
| $EF_{CO2,D}$ | *Carbon emission factor diesel ($tCO_{2eq}/GJ$)* |

$$BE_y = FC_{D,y} \times NCV_D \times EF_{CO2,D} = \frac{\sum_{k=1..n} NCV_k \times FC_{k,y}}{NCV_D} \times NCV_D \times EF_{CO2,D} = \sum_{k=1..n} NCV_k \times FC_{k,y} \times EF_{CO2,D}$$

*Where:*

| | |
|---|---|
| $BE_y$ | *Baseline emissions in year "y" ($tCO_{2eq}$)* |
| $FC_{D,y}$ | *Diesel fuel consumed in the year "y" (tons)* |
| $NCV_D$ | *Net calorific value of diesel (GJ/t)* |
| $EF_{CO2,D}$ | *Carbon emission factor diesel ($tCO_{2eq}/GJ$)* |
| $NCV_k$ | *Net calorific value of plant-oil "k" (in GJ/t)* |
| $FC_{k,y}$ | *Plant-oil type "k" consumed in the year "y" (in tons)* |
| $k$ | *Types of plant oil used (dependent on oil-seed source)* |

$$BE_{2009} = (2{,}254 * 40.482 + 966 * 39.709) * 0.0726 = 9{,}409 tCO_{2eq}$$

$$BE_{2010} = (2{,}576 * 40.482 + 1{,}932 * 39.500 + 1{,}932 * 39.709) * 0.0726 = 18{,}681 tCO_{2eq}$$

2010 and years thereafter are equivalent.

The amount of fuel (in kg) used per year is based on the total litres of plant oil multiplied with the % of the specific crop share for plant oil and multiplied with the average density of 0.92 kg/l. For values of $NCV_k$, $EF_D$ and $FC_k$ see B.7.1. To transform $FC_k$ as listed in B.7.1. from liters to kilograms the specific density is applied.

Leakage emissions are 0 $tCO_2$

See for all calculations and data used the ER spreadsheet.

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

| Year | Estimation of project activity emissions | Estimation of baseline emissions $tCO_{2eq}$ | Estimation of leakage $CO_{2eq}$ | Estimation of overall emission reductions $tCO_{2eq}$ |
|---|---|---|---|---|
| 2009 | 96 | 9,409 | 0 | 9,313 |
| 2010 | 180 | 18,681 | 0 | 18,501 |
| 2011 | 180 | 18,681 | 0 | 18,501 |
| 2012 | 180 | 18,681 | 0 | 18,501 |
| 2013 | 180 | 18,681 | 0 | 18,501 |
| 2014 | 180 | 18,681 | 0 | 18,501 |
| 2015 | 180 | 18,681 | 0 | 18,501 |
| **Total** | **1,171** | **121,495** | **0** | **120,319** |

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

### B.7.1 Data and parameters monitored:

| **Data / Parameter:** | $NCV_k$ |
|---|---|
| Data unit: | $GJ/m^3$ |
| Description: | Net calorific value of crambe oil, oil-seed radish and castor oil (in the future potentially also others) |
| Source of data to be used: | Measurements realized |
| Value of data: | Castor: 36.34 GJ/m3<br>Crambe: 37.24<br>Oil-seed radish: 36.53 |
| Description of measurement methods and procedures to be applied: | The NCV of plant oils are determined based on direct measurement of a representative sample. Laboratory measurement realized once per annum per oil type. |
| QA/QC procedures to be applied: | Comparison of laboratory result with international literature sources and with prior years. |
| Any comment: | Current values used are based on A.K. Babu, MIT, “Vegetable oil and their derivatives as fuels for CI engines: An overview” SAE 2003-01-0767, p.3<br>Values in this source are in kJ/kg:<br>Castor: 39,500<br>Crambe: 40,482<br>Oil-seed radish: 39,709<br>Density plant oil 0.92kg/l<br><br>39,500 KJ/Kg x 0.92 Kg/$10^{-3}m^3$ = 39500 x 0.92 x 1000 = 36,340,000 KJ/$m^3$ = 36.34GJ/$m^3$ |

| | |
|---|---|
| | 40,482 KJ/Kg x 0.92 Kg/$10^{-3}m^3$ = 37.24GJ/$m^3$<br>39,709 KJ/Kg x 0.92 Kg/$10^{-3}m^3$ = 36.53GJ/$m^3$<br><br>The project will perform the NCV analysis once the production site is operational.<br>Literature which analyzed the oilseed properties based on different production sites, years, and conservation methods showed that this did not alter the fuel properties of the biofuel (Widdman, p.62, http://tumb1.biblio.tu-muenchen.de/publ/diss/ww/2002/remmele.pdf). Also plant oil producers store seeds which are therefore mixed between various producers/sites/times of oilseed production. |

| **Data / Parameter:** | $FP_k$ |
|---|---|
| Data unit: | tons |
| Description: | Plant-oil produced of different crops (currently crambe, oil-seed radish and castor) |
| Source of data to be used: | Project owner |
| Value of data | Year 2009:<br>Crambe: 2,254<br>Oilseed radish: 966<br>Year 2010 onwards<br>Castor: 1,932<br>Crambe: 2,576<br>Oilseed radish: 1,932 |
| Description of measurement methods and procedures to be applied: | Measurement of filter press output per oilseed type.<br>Measurements based on calibrated volumetric metering system. |
| QA/QC procedures to be applied: | Data is checked with oilseed input to check plausibility. On average crambe results in 30% oil production, castor in 40% and oilseed radish in 20%.<br>Volumetric metering equipment will be certified and calibrated according to national or IEC standards and will be re-calibrated at appropriate intervals according to manufacturers specifications, but at least once in 3 years. |
| Any comment: | Data projection based on 3.5 million litres of plant oil in 2009 and 7 million in 2010 with a relation 70% Crambe and 30% oilseed radish in 2009 and 30% castor, 30% oilseed radish and 40% Crambe 2010 onwards<br>Density plant oil 0.92kg/l<br>If measurements are carried out in volume, the density should also be monitored by an accredited laboratory following DIN ISO EN 121185 or equivalent at $15^0$C (equivalent to EU norm for biodiesel). In this case density is measured once annually following procedures as indicated in the "General guidelines to SSC CDM Methodologies" EB 54 Annex 14 paragraphs 12(b) and 12(e). |

| **Data / Parameter:** | $FC_k$ |
|---|---|
| Data unit: | tons |

| | |
|---|---|
| Description: | Plant-oil consumed of different crops (currently crambe, oil-seed radish and castor) |
| Source of data to be used: | Filling stations |
| Value of data: | Year 2009:<br>Crambe: 2,254<br>Oilseed radish: 966<br>Year 2010 onwards<br>Castor: 1,932<br>Crambe: 2,576<br>Oilseed radish: 1,932 |
| Description of measurement methods and procedures to be applied: | Data is based on filling stations (pumps) either with volumetric or weight based metering systems  Continuous measurement reported annually. |
| QA/QC procedures to be applied: | If plant-oil is used internally for farm machinery a record of fuel used per machine can be used to cross-check data plausibility. Control with invoices for amounts delivered and possible stock changes. Overall control with production data.<br>Metering equipment will be certified and calibrated  according to national or IEC standards and will be re-calibrated at appropriate intervals according to manufacturers specifications, but at least once in 3 years.<br>Records of vehicles with pure plant oil and their conversion are kept. Records of blends of plant oil are kept by recording the total amount of diesel and the total amount of plant oil filled into tanks thus establishing blending relations. |
| Any comment: | For projection purposes production and consumption values are assumed to be identical. In practice their will be a slight annual variation due to stocks. An average density of 0.92 kg/l is used for calculation purposes. If measurements are carried out in volume, the density of each plant oil is monitored by an accredited  laboratory following DIN ISO EN 121185 or equivalent at $15^0$CThe density of each plant oil is however only monitored once either under $FP_k$ or $FC_K$  In either of these cases density is measured once annually  following procedures as indicated in the “General guidelines to SSC CDM Methodologies” EB 54 Annex 14 paragraphs 12(b) and 12(e). |

| **Data / Parameter:** | $H_k$ |
|---|---|
| Data unit: | Tons |
| Description: | Tons of oil-seed of crop k used for plant-oil production (currently crambe, oil-seed radish and castor) |
| Source of data to be used: | Project owner and plant-oil producers affiliated |
| Value of data | 2009<br>Crambe: 7,497 tons<br>Oilseed radish: 4,820 tons<br>2010 onwards:<br>Castor: 4,820 tons<br>Crambe: 8,568 tons |

| | |
|---|---|
| | Oilseed radish: 9,639 tons |
| Description of measurement methods and procedures to be applied: | Weighting per crop |
| QA/QC procedures to be applied: | Data is correlated with plant-oil production (data consistency) Weighting metering equipment will be certified and calibrated according to national or IEC standards and will be re-calibrated at appropriate intervals according to manufacturers specifications, but at least once in 3 years. |
| Any comment: | For projection purposes the useful oil contents of crambe is around 30%, of castor around 40% and for oilseed radish around 20%. Based on a density of around 0.92 kg/l the amount of crops required were calculated. 2009 70% of 3.5 million liter of plant oil by crambe and 30% by oilseed radish; 2010 onwards 7 million liters of plant oil with 30% castor, 30% oilseed radish and 40% crambe |

| **Data / Parameter:** | $OY_k$ |
|---|---|
| Data unit: | Tons oil/tons crop |
| Description: | Oil yield per crop k |
| Source of data to be used: | Project owner and plant-oil producers affiliated |
| Value of data | Crambe:0.3Oilseed radish: 0.2<br>Castor:0.4 |
| Description of measurement methods and procedures to be applied: | Calculation based on $FP_k/H_k$ i.e. division of the amount of plant oil produced for each crop and the amount of crop used |
| QA/QC procedures to be applied: | Comparison with original data source from PDD |
| Any comment: | |

| **Data / Parameter:** | $CL_k$ |
|---|---|
| Data unit: | Ha |
| Description: | Area cultivated with crop k used for plant-oil production (currently crambe, oil-seed radish and castor) |
| Source of data to be used: | Project owner and farmers |
| Value of data | 2009<br>Crambe: 6,261 ha<br>Oilseed radish: 4,025 ha<br>2010 onwards:<br>Castor: 4,025 ha<br>Crambe: 7,156 ha<br>Oilseed radish: 8,050ha |
| Description of measurement methods and procedures to be applied: | Based on plot identification of farmer and information given by farmer. Plots will be identified with geographical coordinates. Exact data value is non-critical as this data has no influence on calculated emission reductions but is used for calculating data consistency and to control applicability conditions. |
| QA/QC procedures to be applied: | Data is correlated with plant-oil production (data consistency), plant oil consumed and with crop productivity data as reported in international publications |

| | |
|---|---|
| Any comment: | Projections based on 1,200 kg/ha oilseed for all three crops. See ER spreadsheet for calculation |

| **Data / Parameter:** | $F_{ON,k}$ |
|---|---|
| Data unit: | Tons |
| Description: | Amount of organic fertilizer nitrogen applied for crop k (currently crambe, oil-seed radish and castor) |
| Source of data to be used: | Project owner and farmers |
| Value of data | 2009: 19.77 tons<br>2010 onwards: 36.95 tons |
| Description of measurement methods and procedures to be applied: | Reports by farmers per ha of crop based on plant plans, records of fertilizer usage and invoices of fertilizer bought indicating weight |
| QA/QC procedures to be applied: | Check with property data in junction with invoices. Check with previous years and compare values of different farmers using the same crop to ascertain the plausibility of the data used. |
| Any comment: | Projections based on property values used on project farm. 150 kg fertilizer per ha per crop rotation. N content of fertilizer is 12.81 gr per kg based on laboratory analysis |

| **Data / Parameter:** | $F_{SN,k}$ |
|---|---|
| Data unit: | Tons |
| Description: | Amount of synthetic fertilizer nitrogen applied for crop k (currently crambe, oil-seed radish and castor) based on plant plans, records of fertilizer usage and invoices of fertilizer bought indicating weight |
| Source of data to be used: | Project owner and farmers |
| Value of data | 0 |
| Description of measurement methods and procedures to be applied: | Reports by farmers per ha of crop based on plant plans, records of fertilizer usage and invoices of fertilizer bought indicating weight |
| QA/QC procedures to be applied: | Check with property data in junction with invoices. Check with previous years and compare values of different farmers using the same crop to ascertain the plausibility of the data used. |
| Any comment: | No synthetic fertilizer is used currently |

| **Data / Parameter:** | $FB_{PO}$ $FB_{D}$ $FC_{PO}$ |
|---|---|
| Data unit: | Litres |
| Description: | Amount of plant oil and diesel bought and the amount of blended plant-oil delivered to vehicles |
| Source of data to be used: | Consumers of blended plant-oil |
| Value of data | Na |
| Description of measurement methods and procedures to be applied: | Invoices based on calibrated volumetric or weighting metering system. In case of buying fuels (e.g. diesel) based on the data provided in the invoice of the seller (weight or volume)<br>To determine the blending ratio the amount of diesel and the amount of plant-oil which entered the tanks of the filling station shall be recorded in a logbook (with date and amount). At the same time the amount of fuel delivered to vehicles (consumed by |

| | |
|---|---|
| | latter during driving conditions) is recorded continuously and registered at daily/weekly base (depending on station turnover). Based on this the percentage of plant oil in the blend can be calculated on a daily/weekly base for each filling station. |
| QA/QC procedures to be applied: | Weighting metering equipment will be certified and calibrated according to national or IEC standards and will be re-calibrated at appropriate intervals according to manufacturers specifications, but at least once in 3 years. |
| Any comment: | Blending ratio of 10% can be controlled with this data<br>Biofuel blending is done at filling stations not on a continuous base but through mixtures in storage tanks i.e. in practice the diesel storage tank is partially filled with biofuel. The biofuel share can thus be determined based on the amount of diesel and the amount of biofuel which was filled to the storage tank. Storage tanks at filling stations in general do not have metering devices as the fuel trucks which supply the fuel have such calibrated metering devices on-board installed. Therefore the data of these service trucks, which is recorded on the invoices is used. The determination of the daily/weekly biofuel blend is simple thereafter: Inflow diesel storage tank per day; înflow biofuel storage tank per day; outflow from station filling pump of blend each day.<br><br>Filling stations such as used in farms and for captive fleets only receive periodic filling of their storage tanks, thus record keeping is simple. This method of blending (resulting in different blending mixtures) is common with captive fleets.<br><br>This method is also in line with reality as the plant oil producer is no diesel producer. Blending is thus made at the filling station when the consumer buys diesel plus plant oil (from different producers) and not at the production plant. |

In additional the following aspects will be monitored (see point I to XIV of AMSIIIT):

1. The crop harvest ($H_k$), oil content of the oil seeds ($OY_k$) and amount of plant oil produced per crop ($FP_k$) source per production location. The extent of the area ($CL_k$) where plant oil is produced should be consistent with the yield of the cultivation ($H_k$), the plant oil extraction ($FP_k$) and with the amount of plant oil consumed ($FC_K$) by end-users. See section above.
2. The energy use (electricity and fossil fuel ($FC_{OFP}$) for the production of plant oil and the amount of fertilizer ($F_{ON}$ and $F_{SN}$)applied for the cultivation of plant oil per crop source per production location. See above. Energy use is not monitored as the $EF_{elec}$ is 0. See section above. Fossil fuel consumed ($FC_{OFP}$) is not monitored by the project as no fossil fuels are used by the plant oil production facilities of the project.
3. The occurrence of shift of pre-project activities and the competing uses of biomass shall be monitored and verified. Occurrence of shift of pre-project activities and the competing use of biomass for new cultivation areas and for new crops (i.e. not castor, crambe and oil-seed radish). This control follows the General Guidance on Leakage in Biomass Project Activities latest version Section A and monitors specifically the percentage of families/households of the community involved in or affected by the

project activity displaced due to the project activity (based on available statistics or surveys using the General guidance on leakage in biomass project activities (Version 03)) and percentage of total production of the main produce within the project boundary displaced due to the generation of renewable biomass (based on crop production records of the respective farm or area).

4. The NCV of plant oils are determined based on direct measurements of a representative sample . See above
5. Compliance with quality control parameters based on a laboratory analysis for each plant-oil type . Quality control is done on an annual base for each plant oil type *k* produced based on a sample taken from the plant oil producer. The values must comply with national quality regulations or in absence of the latter with the quality standards stipulated in table III.T.1. of AMSIIT
6. The amount and type of plant oil filled into the vehicles of the final end users and captive fleets must be recorded by a calibrated metering system ($FC_k$). Records of these vehicles and the plant oil (blends) consumed by these vehicles shall be provided. See above
7. In case the plant oil is used as blend then the following shall be recorded:
    a. The amount of plant oil used ($FB_{PO}$);
    b. The amount of diesel bought ($FB_D$);
    c. The amount of blended plant oil used ($FC_{PO}$) by the captive fleet.
8. In case of blending, the maximum blending ratio of 10% shall be controlled at the sites that distribute the plant oil blends. $FB_{PO}$ can be maximally 10% of $FB_D$. In addition the procedure for blending shall ensure that the blending ratio is maximally 10% by volume. This is controlled through records stating date and quantity of diesel which entered tanks, plant oil which entered the tanks and fuel distribution. Based on quantity of incoming fuel in storage tanks and outgoing fuel from the filling pumps the daily blend ratio can be calculated easily. This is a practical and safe manner as fuel tanks are only filled on a periodical base and not necessarily the same day the tanks are filled with diesel as well as with plant oil. Variations of the blend can thus occur. However it can be controlled easily through these records that the blend does not surpass the 10% threshold. It can also be controlled and monitored through these records easily the daily blending ratio to determine the actual amount of plant oil and diesel dsitributed.
9. Identification of each farm/plot on which oilseeds for plant-oil is produced and control of the applicability criteria concerning deforestation based on satellite images of the farm/plot minimum 10 years prior to production of the oil-seeds for plant-oil production. This parameter is controlled either with an independent report by a forest engineer based on an assessment of lands, available literature and reports (preferred option) or on satellite imaging comparing forest coverage (as far as identifiable as satellite pictures only allow for a rough separation of height dependent coverage of lands) complemented with an on-ground report to assess the criteria of minimum 5 height of trees.
10. In case of using pure plant oil vehicle conversion is controlled with a random survey of units using this fuel e.g. based on spot checks of vehicles using the filling station.
11. Control if any other biofuel project from the producer side has been registered by the UNFCCC with operations in Paraguay. Monitoring is realized monthly based on the official UNFCCC website. This ensures that no double counting of emission reduction credits occurs. Contracts with all fleet owners using plant oil and farmers that the CERs can only be claimed by the project owner are realized (a norm contract is supplied to the validator). The project owner has copies of all contracts. The obligation for engine conversions in case of pure plant oil use shall be verified by random sampling (see above for case of usage of pure plant oil)
12. Verification that no export of plant oil to Non-Annex I countries is realized through inclusion only of plant-oil consumed by final consumers in Paraguay. This is verified as plant-oil consumed is monitored. If tanking occurs in Paraguay then no export occurs.

### B.7.2 Description of the monitoring plan:

The project will monitor all data listed. The project owner is a small company. The CEO is directly in charge of the CDM project and the involved monitoring. A monitoring manual has been realized for the company defining responsibilities, QA procedures and data management. An Excel spreadsheet for calculation of emission reductions has also been realized prior project commencement.

The monitoring manual contains inter alia:

- Responsibilities for data collection
- For each data/parameter data source, data collection method, data accuracy, QA and QC, data collection frequency and units
- Calculation method for determining Emission Reductions
- Forms for data collection at crop production sites (farmers), at plant-oil production sites and at consumer sites (captive fleets and farmers)
- Forms for assurance that CERs solely attributed to the project owner

The monitoring manual is company internal. The validator will be supplied with a copy of the manual.

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

Dr. Jürg M. Grütter and Daniel Wunderlin
Ecotawa AG
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www.ecotawa.com

Completion date: October 25th 2008

## SECTION C. Duration of the project activity / crediting period

### C.1 Duration of the project activity:

#### C.1.1. Starting date of the project activity:

Construction start of the plant-oil production facility (first acquisition of construction material): 14/06/2007

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

25 years. Measures taken are basically operational (production of bio-fuel). Filter press equipment if maintained properly can easily have a life-span of 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:**

01.01.2009 or the date of CDM project registration by the UNFCCC, whichever later.

**C.2.1.2. Length of the first crediting period:**

7 years 0 months

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

**C.2.2.2. Length:**

## SECTION D. Environmental impacts

**D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:**

The production site for plant oil requires an environmental license. An environmental impact assessment is made by a consultant on behalf of the project to get the license. The corresponding study has not yet been finished. However preliminary information shows that the project has no significant environmental impact. Plant-oil, in contrast to bio-diesel or diesel has, if spilled no negative effects on water flows, building material or soil. The production process does not use any fossil fuels also and wood used for drying purposes is minimal thus air pollution is also marginal.

The usage of plant-oil compared to diesel results in comparable environmental pollution with exception of sulphur dioxide[29]. Plant-oil is comparable to ultra-low sulphur diesel (less than 10ppm sulphur) while the diesel sold currently in Paraguay has up to 4,000 ppm sulphur. The high sulphur contents of diesel also leads to additional particle emissions and prevents the introduction of new diesel engines (Euro 2 and onwards). The introduction of plant-oil to the Paraguayan market is thus a positive contribution to reduced vehicle air pollution.

**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:**

No significant impacts. Overall positive impacts due to substitution of diesel fuel.

[29] See e.g. SAE 2003-01-0767 or European Commission, DG JRC/IPTS 27.1.2003 "Short note on PPO as fuel for modified internal combustion engines"

## SECTION E. Stakeholders' comments

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

During a national agricultural trade fair the project was presented on a stand. An official stakeholder meeting took place June 9th 2008 in the installations of the new plant-oil production facility in the Province of Misiones. The facility was explained to the persons attending and the project was detailed. Thereafter the project was discussed. Invited persons included political representatives of the region, farmers, representatives of financial institutions, representatives of transport companies, the press, and representatives of associations in Misiones. In Annex 5 a detailed report on the stakeholder meeting is provided.

### E.2. Summary of the comments received:

Major concerns were how small farmers could be integrated into the project to supply oil-seeds and thus increase their income. Also how technical assistance would be given by the project in light of limited know-how of local farmers on growing crops such as castor or crambe. The project will use its own fields to give hands-on technical assistance to interested farmers. It will also supply farmers with seed material plus guaranteed buying of harvested crops to reduce risk of involved farmers. Overall the project received very positive feedback and participants suggested to keep an open communication channel. Financial institutions were also interested in cooperating closely with the project to ensure that sufficient crop would be grown and harvested to supply oil-seeds to the plant. In Annex 5 a detailed report on the stakeholder meeting is provided.

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

The project will keep communication with stakeholders. As next all stakeholders as well as the general public will be invited to the official plant inauguration. Thereafter a close contact will be sought with small farmers to provide for sufficient oil-seed material for the plant. In Annex 5 a detailed report on the stakeholder meeting is provided.

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Agro Micro Plant S.A. |
| Street/P.O.Box: | |
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| State/Region: | Itapua |
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| Represented by: | |
| Title: | CEO |
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| | |
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| Represented by: | |
| Title: | Member of the Board |
| Salutation: | Dr. |
| Last Name: | Grütter |
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**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

No public funding from an Annex 1 country is involved.

# Annex 3

## BASELINE INFORMATION

### Combined Margin Electricity in Paraguay

Paraguay produces all its electricity for the grid with hydroelectric plants. The thermal plants existing are back-up and not grid connected. Paraguay is a net electricity exporter to Argentine and Brazil.

**Electricity Power Generation Paraguay (tsd TEP[30])**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Hydroelectric gross production (primary) | 5,168 | 4,378 | 4,658 | 5,002 | 5,226 | 5,149 | 5,412 |
| Secondary electricity production | 4,599 | 3,897 | 4,145 | 4,451 | 4,465 | 4,399 | 4,625 |
| Electricity exports | 4,072 | 3,365 | 3,592 | 3,885 | 3,870 | 3,765 | 3,930 |
| Domestic consumption | 405 | 406 | 419 | 405 | 406 | 431 | 466 |

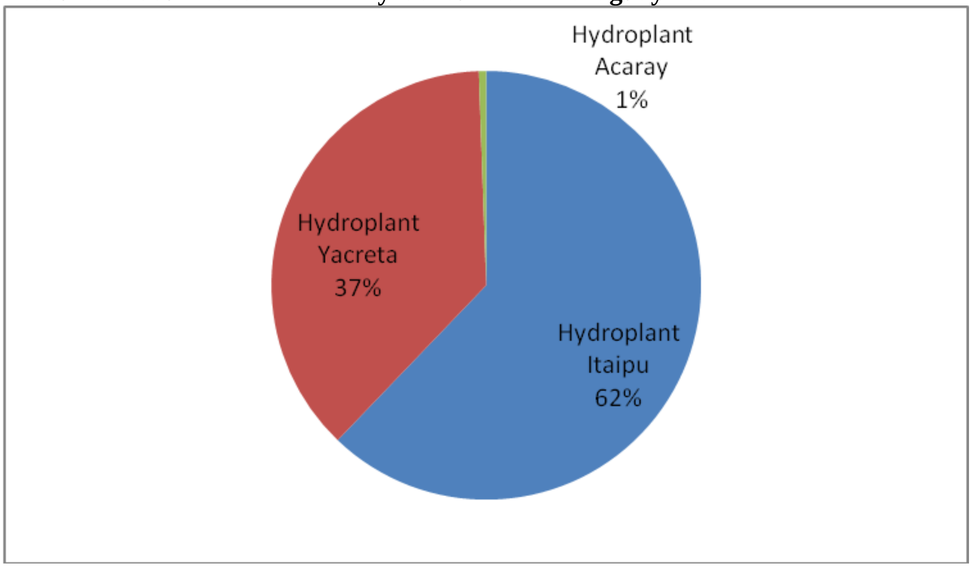
Note: remaining values are due to stock changes
Source: Ministerio de Obras Publicas y Comunicaciones, Viceministerio de Minas y Energia, 2008

**Electricity Production 2007 (provisional; GWh)**

| Total Hydropower generated (brutto) | Total thermal power generated (brutto) | Imports | Exports | Domestic Consumption |
|---|---|---|---|---|
| 53,714.3 | 0.6 | 0 | 45,031.6 | 5,575.6 |

Source: Ministerio de Obras Publicas y Comunicaciones, Viceministerio de Minas y Energia, 2008

**Production Sources for Electricity Consumed in Paraguay 2007**




Source: Ministerio de Obras Publicas y Comunicaciones, Viceministerio de Minas y Energia, 2008

### LETTER SEAM CONFIRMING FIRST OF ITS KIND

[30] 0.086 TEP per MWh

**(any oil production project needs to have an environmental permit from SEAM)**
**Original**

SEAM
Secretaría del Ambiente
*Dirección de Planificación Estratégica*

Asunción, 28 de abril del 2009

**D.P.E. N° 011/09**

Señores
**ECOTAWA LTD**
SGS
Presente

Me dirijo a Ustedes, a los efectos de dar seguimiento al proceso de validación y registro del Proyecto de Producción de Aceite Vegetal para uso vehicular, con Carta de Aprobación Nacional de la Autoridad Nacional Designada de Paraguay.

Al respecto, a solicitud de los Desarrolladores del Proyecto y la Validadora, el Proyecto Producción de Aceite Vegetal para Uso Vehicular, es el único en su tipo que ha sido presentado en la Secretaria del Ambiente- SEAM.

Hago propicia la ocasión para saludarlos con mi consideración mas distinguida.

**Ing. Lilián Portillo**
Directora
Dirección de Planificación Estratégica

**Translation**

**SEAM**
**Environmental Secretariat**
**Strategic Planning Department**

Asuncion, April 28th 2009

D.P.E. No. 011/09

Sr.
ECOTAWA LTD
SGS
Present

I'm writing to you concerning the steps to follow-up on the process of validation and registration of the Plant-Oil for Transport Project, which has an approval letter from the Designated National Authority of Paraguay.

In respect, at request of the project developer and the validator, the plant-oil for transport project is the only project of this type presented to the environmental secretariat – SEAM.

With my best regards

Ing. Lilian Portillo
Director
Strategic Planning Department

## Annex 4

### MONITORING INFORMATION

A monitoring manual in Spanish has been realized which also includes all formats used for crop production, plant-oil production and usage in transport clients. The manual is company internal and available to the Validator.

**Annex 5**

# Report of Stakeholder Meeting

Grütter, 10.6.08

**Date**

Monday 9.6.2008, 19-22.00

**Location**

Plant oil mill site, San Juan, Paraguay

**Invited persons**

- Diario ABC Color
- Estanciero. Francisco Gonzalez
- Transporte de colectivos "La Misionera"
- Gobernador de Misiones. Carlos Afara
- Intendente de San Juan. Andres Riveros
- Intendente de San Ignacio. Amado Aquino
- Presidente de Coopersanjuba. Humberto Ramon Gonzalez
- Gerente Banco Continental. Hector Gustavo Molas
- Gerente Financiera Itapua. Rafael Duarte
- Gerente Financiera El Comercio. Ruben Dario Ibarra
- Pte. de la Asociación de los sojeros de Misiones. Adolfo Becker
- Productor. Jair Hatwich
- Productor. Preto
- Productor. Cheada
- Intendente de Villa Florida

**Contents of meeting**

1. Introduction realized by Marcel Burtscher, Agro-Micro Plant S.A.
2. Presentation of the project realized by Jurg Grütter, ecotawa Ltd., including
    a. Objective of the meeting
    b. Overview of bio-fuels with special reference to straight vegetable oil (SVO)
    c. Components of SVO production incl. biomass production, oil extraction and usage in vehicles as diesel blend or as SVO in reconverted units
    d. Goals of the project
    e. Social, economic and environmental impacts of the project
3. Discussion of project with attendees

**Questions raised and answers given**

- What are the advantages of biofuels?
  *Social (labor), economic (reduced dependence, diversification), environmental (global)*

- To whom is the biofuel sold? Can blends be sold to gas stations which sell their own trademarks such as Shell?
  *In a first step basically to captive fleets which have their own filling facilities and farmers for own use plus thereafter independent gas stations*
- Has the project realized a feasibility study and a market exploration study?
  *Feasibility based on pilot trails with different plants and international experience. Market study done by discussions with various potential clients.*
- Will SVO (Straight vegetable oil = plant-oil) also be exported?
  *Currently not planned but might be a market alternative in the future.*
- Which crops are most apt for SVO?
  *With current prices oilseed radish, crampe and castor*
- How will small farmers be integrated? Is technical assistance provided? Will seeds be provided? How are farmers informed?
  *Advantages for small farmers are basically a diversification of income and crops. Not only crops for SVO would be produced. Seeds as well as other agricultural inputs can be furnished by the project as well as a contract to buy their entire production. Technical assistance is provided through discussions with experienced farmers.*
- What guarantees are given that the farmer can sell his crop production?
  *The project buys the entire production and can give corresponding contracts.*
- What is the average production per ha of oilseed radish?
  1000-1800kg/ha
- Will the project have a demonstration plot for other farmers?
  *Could potentially de done in the future. Currently on the fields of the project owner himself.*

**Suggestions/comments of participants**

- Inform farmers of potential
- Realize good contacts with cooperatives to reach small farmers
- Involved finance organizations to reach small farmers
- Stay in contact with all involved
- Very good initiative

**Persons attending**

Reunión 09.06.2008
Fabrica Tiróleo Vegetal S.A.

Tema: Aceite Vegetal para BioCombustible

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