CLEAN DEVELOPMENT MECHANISM
3RD CDM MONITORING REPORT:

MONITORING PERIOD:
1 DECEMBER 2008 – 30 SEPTEMBER 2009 (BOTH DAYS ARE INCLUDED)

PROJECT 1314: SWITCHING OF FUEL FROM COAL TO PALM OIL MILL BIOMASS WASTE RESIDUES AT INDUSTRIAL DE OLEAGINOSAS AMERICANAS S.A. (INOLASA)

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<u>Annexes</u>

SECTION A. General project activity information

A.1 Title of the project activity:

Project 1314: Switching of fuel from coal to palm oil mill biomass waste residues at Industrial de Oleaginosas Americanas S.A. (INOLASA)

A.2. CDM registration:

Registration number: 1314
Registration date: 30 Nov 2007

A.3. Short description of the project activity:

The project activity comprises the installation of a biomass fuelled boiler to supply steam for internal production processes, displacing a coal-fired boiler. Coal is replaced by palm kernel shells (PK shells) and empty fruit bunches (EFB), saving coal consumption and consequently reducing carbon emissions.

Biomass fuel is mainly purchased from three nearby palm oil mills, called Palo Seco, Naranjo and Coto. The first two mills are located in Quepos and the last one in Golfito, in the province of Puntarenas. The biomass is transported from the palm oil plants using trucks with a capacity of 25-28 tons each, making approximately 2-3 trips per day.

The proposed project activity intends to replace the current boilers by a new biomass boiler. This new boiler has a capacity to produce 35 tons of steam/hour with a design pressure of 35 bars. However, during the first years it will only produce 20 tons of steam/hour with a pressure of 12 bars.

The boiler is combusting biomass in a mixture of approximately 85% PK shells and 15% EFB. The quantity of PK shells that the plant will need is approximately 20,000 tons a year. The combustion of biomass will result in a low amount of ash production, corresponding to 3 - 4% of the feeding mass. These ashes will be used as an aggregate for cement and concrete mixtures.

A.4. Monitoring period:

Monitoring period covered by this report: *1 December 2008 – 30 September 2009* (both days are included)

A.5. Methodology applied to the project activity:

The reference for the Baseline and Monitoring methodology is the following approved small scale methodology:

Type AMS I.C. - Thermal Energy for User (Version 10; Scope: 1; 18 May 2007)[1]

[1] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_SF2SIJB6UANOO4Z7KM1WH9YEEKKK94

A.6. Status of implementation for major project parts:

The project installation is finished according to the description in the PDD and completely operational as shown already during the 1st and 2nd Periodic Verification.

During the previous periodic verifications, the DOEs could confirm that the biomass supply chain of the INOLASA project is a closed system. 100% of the biomass is supplied by Palma Tica's Palm Oil Mills (Coto, Palo Seco and Naranjo), of which INOLASA is an affiliate company. Through the respective supply contracts it is ensured that only surplus biomass is sold to INOLASA. Furthermore, the three palm oil mills have not purchased any biomass from the market. A series of efficiency measures were initiated in parallel to the INOLASA project, in order to make biomass available for INOLASA's operations and to secure that indeed the surplus would cover the total demand. The mentioned efficiency measures were explained in the documentation of the previous verifcations.

A.7. Intended deviations or revisions to the registered PDD or monitoring plan:

No deviations to the monitoring procedure documented in the registered monitoring plan occurred.

A.8. Changes since last verification:

N/A

A.9. Person(s) responsible for the preparation and submission of the monitoring report:

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SECTION B. Key monitoring activities according to the monitoring plan for the monitoring period stated in A.4.

B.1. Monitoring equipment:

B.1.1. Table providing information on the equipment used:

Identification code	Device	Manufacturer	Model	Serial number	Date of installation	Date of Initial-calibration	Date of last calibration	Period of calibration
ID 1	Mass Flow Transmitter	Rosemount	3095M	0217271	05-Nov-2007	12-Sept-2007	12-Sept-2007	according to supplier information ten year stability
ID 3	Electricity meter	SCHNEIDER ELECTRIC	CM3250	15000219	05-Nov-2007	Factory calibration	02-Jul-2009	every five years

B.1.2. Calibration procedures:

The calibration of the monitoring equipment was carried out according to the information provided in the PDD. Since the initial calibration by the manufacturer took place less than two years ago for the Rosemount mass flow transmitter, no further calibration was necessary.
The electricity meter was recalibrated on July 2, 2009.

B.2. Data collection (accumulated data for the whole monitoring period):

B.2.1. List of fixed default values:

Parameter	Default value	Description
ID 5: km_i	340 km and 133 km	Distance from Coto and Quepos to Barranca
ID 6: VF_{cons}	0.6 l/km	Vehicle fuel consumption
ID 7: CV_{Diesel}	45.91 (MJ/kg)	Calorific value of the fuel
ID 8: D_{Diesel}	0.85 kg/l	Diesel density in Costa Rica
ID 9: EF_{Diesel}	74.1 tCO_2/TJ	Emission factor diesel
ID 10: EU_y	1.07 GWh	Electricity consumption of baseline boiler (coal)
ID 11: EF_{grid}	62.86 tCO_2/GWh	Emission factor of the Costa Rican grid
ID 12: η_{th}	78 %	Efficiency of the boiler in the baseline scenario
ID 13: η_p	80 %	Efficiency of the boiler in the project scenario
ID 14: NCV_c	25.73 TJ/kt	Net calorific value of coal
ID 15: $COEF_c$	2380 tCO_2/kt coal	CO_2 Emission factor for coal
ID 16: h_{ss}	2782.73 KJ/kg	Enthalpy of saturated steam at 12 bar

B.2.2. Data concerning GHG emissions by sources of the project activity:

Data variable	Unit	Description
ID 2: $trucks_{i,y}$	number	Number of trucks and origin
ID 3: EU_y	GWh	Electricity consumption of the biomass boiler

B.2.3. Data concerning GHG emissions by sources of the baseline:

Data variable	Unit	Description
ID 1: F_{ss}	t	Steam flow
ID 4: Mc	t	Mass of coal consumption for co-incineration

In this monitoring period no co-incineration of coal took place.

B.2.4. Data concerning leakage:

Since the used technology does not involve equipment transferred from another activity and the existing equipment is not transferred to another activity, no leakage needs to be considered.

B.3. Data processing and archiving:

Data processing and archiving is described in detail in separate documents that will be available on-site.

B.4. Special event log:

Date	Special event
17.06.09 – 14.08.09	Extended yearly maintenance due to repairs at the biomass boiler tubings.

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The Project owner is Industrial de Oleaginosas Americanas S.A. (INOLASA). INOLASA is therefore responsible for the operation and the monitoring of the project activities.

C.1.2. Trainings:

During the crediting period internal trainings were performed. Receipts of these internal trainings will be available on-site.

C.2. Involvement of Third Parties:

Support and consultancy regarding the CDM obligations is provided by the company OneCarbon International B.V..
Documentation from the authorised boiler inspector during his yearly on-site visit will be available during the on-site visit.
The third party check of the electricity meter was performed and the documentation will be available to the DOE.

C.3. Troubleshooting procedures:

In case of unforeseen problems or failures of the data recording system, the operating staff will switch to manual readings of all meters. This procedure is well defined and trained to the people, since manual readings as back-up for the computerised data readings have been a part of the normal operation since the starting period of this project. Furthermore, a logbook will be written all the time recording all deviations from normal operation and including observations and all other information necessary to document. In this way, jumps or periods where operating conditions are out of range can be identified and explained.

In cases where no data are available due to failures of the monitoring equipment, the responsible for the monitoring decides as soon as possible which actions to undertake, in order to minimise the amount of not registered GHG emission reductions. In this case, the CDM-consultant OneCarbon is consulted.

SECTION D. Calculation of GHG emission reductions

D.1. The used formulas:

The total emission reductions can be easily calculated with the results of the below described equations. The emission reduction is equal to the baseline emissions minus project emissions and leakage emissions. Leakage emissions in this project are considered to be zero. The general equation is as follows:

$$ER_y = BE_y - (PE_y + L_y) \quad \textbf{(1)}$$

ER_y = Emission reduction$_{year}$
BE_y = Baseline emissions$_{year}$
PE_y = Project emissions$_{year}$
L_y = Leakage$_{year}$

Baseline emissions

The baseline emissions can be calculated with the following equation:

$$BE_y = BE_{heat,y} + BE_{boiler,y} \quad \textbf{(2)}$$

Where :
$BE_{heat,y}$ = Emissions due to coal combustion. In absence of the project the heat would be generated by a coal boiler.
$BE_{boiler,y}$ = Emissions caused by grid electricity consumption (coal boiler).

The emissions due to coal combustion are determined by dividing the amount of generated heat during the project activity by the net calorific value of coal and the efficiency of the coal boiler. This is multiplied with a CO_2 emission factor for the displaced fossil fuel (coal):

$$BE_{heat,y} = \frac{Q_y}{\eta_{th} \cdot NCV_i} \cdot COEF_i \quad \textbf{(3)}$$

Where:

$BE_{heat,y}$ = the baseline emissions for fossil fuels during the year y in tons of CO_2eq.
Q_y = is the quantity of heat generated in the project plant using renewable resources only, that displaces heat generation in the fossil fuel fired boiler during the year y in TJ. This is the same variable mentioned in AMS.I-C ver. 10 as HG_y.
η_{th} = is the energy efficiency of the boiler. The energy efficiency of the boiler that would be used in absence of the project activity is based upon the manufacturer's information. (**ID 12, fixed**)
NCV_i = is the net calorific value of the fossil fuel type i per TJ/kt. In the project only coal as a fossil fuel is used. (**ID 14, fixed**)
$COEF_i$ = is the CO_2 emission factor of the fossil fuel type i fired in the boiler in the absence of the project activity in tCO_2/kt – in the project activity only coal. (**ID 15, fixed**)

In order to open the possibility of co-incinerating renewable biomass and a minor fraction of coal, Q_y should always be calculated using the following formulae (in this monitoring period no co-incineration took place):

$$Q_y = \left(Qt_y - Mc_y \cdot NCV_c \cdot \eta_p\right) \qquad \textbf{(4)}$$

Where:

Q_y	=	is the quantity of heat generated in the project plant using renewable resources only, that displaces heat generation in the fossil fuel fired boiler during the year y in TJ.
Qt_y	=	is the total quantity of heat generated in the project plant using renewable and fossil fuel resources, during year y, in TJ.
Mc_y	=	is the total mass of coal consumption for co-incineration at the project plant, during year y, in kt. (**ID 4, to be monitored**)
NCV_c	=	is the net calorific value for coal (TJ/kT). A default value of 11,404 BTU/lb will be considered based on tests done to Colombian coal (equivalent to 26.5 TJ/kt). (**ID 14, fixed**)
η_p	=	is the energy efficiency of the boiler in the project scenario. This variable is based upon the manufacturer's information. (**ID 13, fixed**)

The purpose of co-incineration for certain periods is to assure the supply of steam needed for the soybean process.

The total quantity of heat generated in the project plant (Qt_y), is to be based on the following equation:

$$Qt_y = h_{ss} \cdot F_{ss} / 10^6 \qquad \textbf{(5)}$$

Where

Qt_y	=	is the total quantity of heat generated in the project plant using renewable and fossil fuel resources, during year y, in TJ.
h_{ss}	=	is the enthalpy of the saturated steam at 12 bar (2782.73 MJ/t set as a default value) (**ID 16, fixed**).
F_{ss}	=	is the steam flow monitored, during year y (t/year) (**ID 1, to be monitored**)

The emissions resulting from electricity consumption by the boiler are determined by:

$$BE_{boiler,y} = EU_y \cdot EF_{grid} \qquad \textbf{(6)}$$

Where:

$BE_{boiler,,y}$	=	Baseline emissions resulting from electricity usage in year 'y'
EU_y	=	Electricity Usage in year 'y' (**ID 10, fixed**)
EFgrid	=	Emission factor of the Costa Rican grid. (**ID 11, fixed**)

Project emissions

The project emissions can be calculated with the following equation:

$PE_y = PE_{trans,y} + PE_{boiler,y}$ **(7)**

Where :

$PE_{trans,y}$	=	project emissions resulting from transportation of the biomass in year 'y'
$PE_{boiler,,y}$	=	Project emissions resulting from electricity usage in year 'y'

The CO_2 emissions from a biomass load are calculated from the quantity and the specific CO_2-emission factor of the fuel used by the trucks.

$$PE_{trans,y} = \sum trucks_{i,y} \cdot TransCOEF_i \quad \textbf{(8)}$$

Where:

$PE_{trans,y}$	=	project emissions resulting from transportation of the biomass in year 'y'
$trucks_{i,y}$	=	number of trucks supplying the biomass originating from palm oil mill i in year 'y' (**ID 2, to be monitored**)
TransCOEFi	=	Coefficient for the CO_2 emissions from 1 truck load of biomass originating from palm oil mill i

$$TransCOEF_i = km_i \cdot VF_{cons} \cdot CV_{diesel} \cdot D_{diesel} \cdot EF_{diesel} \quad \textbf{(9)}$$

Where:

Km_i	=	distance from palm oil mill i to the biomass boiler (km) (**ID 5, fixed**)
VF_{cons}	=	vehicle fuel consumption in litres per kilometre (l/km) (**ID 6, fixed**)
CV_{diesel}	=	Calorific value of the fuel (MJ/kg) (**ID 7, fixed**)
D_{diesel}	=	diesel density (kg/l) (**ID 8, fixed**)
EFdiesel	=	emission factor diesel (tCO_2/MJ) (**ID 9, fixed**)

For the transportation of biomass trucks with a load capacity of 28 ton are used. To be conservative, TransCOEFi is determined based on a full truck load. The trucks use 0.6 liter of diesel per kilometer[2], the calorific value of the fuel is 45.91 MJ/kg[3], the fuel density of diesel in Costa Rica is 0.85 kg/l[4] and the emission factor of the fuel is 20.2 tC/TJ[5].

The project emissions resulting from electricity consumption by the boiler are determined by:

$$PE_{boiler,y} = EU_y \cdot EF_{grid} \quad \textbf{(10)}$$

Where:

$PE_{boiler,,y}$	=	Project emissions resulting from electricity usage in year 'y'
EU_y	=	Electricity Usage in year 'y' (**ID 3, to be monitored**)
EF_{grid}	=	Emission factor of the Costa Rican grid. (**ID 11, fixed**)

[2] Source: truck supplier

[3] Source: Refinadora Costarricense de Petróleo, RECOPE

[4] Source: Refinadora Costarricense de Petróleo, RECOPE

[5] Source: 2006 IPCC Guidelines for National GHG inventories Table 1.3 p1.21

D.2. GHG emission reductions (referring to B.2. of this document)

D.2.1. Project emissions:

The project emissions for the project activity according to the PDD are included in the following table:

Month	ID2 number of trucks		PE_{trans} [tCO_2e]	ID3 EU_y [MWh]	PE_{boiler} [tCO_2e]	PE_{total} [tCO_2e]
	Quepos	Coto				
Dec-08	21	28	42.73	137.89	8.67	51.39
Jan-09	76	23	62.21	138.27	8.69	70.90
Feb-09	44	33	59.24	117.61	7.39	66.63
Mar-09	20	32	46.98	123.22	7.75	54.73
Apr-09	16	47	62.83	108.54	6.82	69.66
May-09	23	49	68.42	120.27	7.56	75.98
Jun-09	25	48	68.17	72.60	4.56	72.73
Jul-09	28	38	0.00	12.02	0.76	0.76
Aug-09	31	27	0.00	65.95	4.15	4.15
Sep-09	37	31	0.00	130.40	8.20	8.20
Total	321	356	410.58	1,026.76	64.54	**475.13**

D.2.2. Baseline emissions:

The baseline emissions for the project activity according to the PDD are included in the following table:

Month	ID1 F_{ss} [t]	ID4 M_c [t]	BE_{heat} [tCO_2e]	BE_{boiler} [tCO_2e]	BE_{total} [tCO_2e]
Dec-08	9,199.0	0.0	3,035.67	5.71	3,041.38
Jan-09	9,406.9	0.0	3,104.28	5.71	3,109.99
Feb-09	8,762.8	0.0	2,891.72	5.16	2,896.88
Mar-09	9,373.3	0.0	3,093.19	5.71	3,098.90
Apr-09	9,099.9	0.0	3,002.96	5.53	3,008.49
May-09	8,629.3	0.0	2,847.67	5.71	2,853.38
Jun-09	5,113.5	0.0	1,687.45	5.53	1,692.98
Jul-09	0.0	0.0	0.00	5.71	5.71
Aug-09	5,868.7	0.0	1,936.67	5.71	1,942.38
Sep-09	10,770.2	0.0	3,554.16	5.53	3,559.69
Total	76,223.6	0.0	25,153.77	56.02	**25,209.79**

D.2.3. Leakage:

Leakage is considered to be zero (see also section B.2.4).

D.2.4. Summary of the emissions reductions during the monitoring period:

According to the general equation:

$$ER_y = BE_y - (PE_y + L_y)$$

$$Emission\ reduction = Baseline\ emissions_{total} - (Project\ emissions + Leakage)$$

Month	BE_{total} [tCO_2e]	PE_{total} [tCO_2e]	ER_{total} [tCO_2e]
Dec-08	3,041.38	51.39	2,989.99
Jan-09	3,109.99	70.90	3,039.09
Feb-09	2,896.88	66.63	2,830.25
Mar-09	3,098.90	54.73	3,044.17
Apr-09	3,008.49	69.66	2,938.84
May-09	2,853.38	75.98	2,777.39
Jun-09	1,692.98	72.73	1,620.25
Jul-09	5.71	0.76	4.96
Aug-09	1,942.38	4.15	1,938.24
Sep-09	3,559.69	8.20	3,551.49
Total	**25,209.79**	**475.13**	**24,734.66**

The emission reductions for the period which is covered by this monitoring report is therefore

24,734 t CO_2e .

Please note that the ex-post achieved emission reduction is lower than the ex-ante estimate in the registered PDD. The estimate for the full year of 2009 was 35,849 tCO_2e. 29,680 tCO_2e were expected ex-ante for a ten month period in 2009, the length of the period covered by this report. This number was not reached due to several reasons:

- The PDD is not taking into account a yearly shutdown of approximately one month as this was not clear at the stage of PDD writing,
- the boiler was shut down longer than expected (two months) this year due to extensive repairs at the boiler,
- the production at the factory that is supplied with the steam from the boiler has not increased as expected during the stage of PDD writing.

Section E. Open issues from previous verifications

During the previous verification, which took place in December 2008, regarding the 2nd monitoring period, no Forward Action Requests came up.

Annex 1

Definitions and acronyms

ACM	: Approved Consolidated Methodology
CDM	: Clean Development Mechanism
DOE	: Designated Operational Entity
EFB	: Empty Fruit Bunches
FAR	: Forward Action Request (from a previous verification)
GHG	: Greenhouse Gases
IPCC	: Intergovernmental Panel on Climate Change
PDD	: Project Design Document
PKS	: Palm Kernel Shells