Monitoring report form

(Version 04.0)

MONITORING REPORT	
Title of the project activity	Switching of fuel from coal to palm oil mill biomass waste residues at Industrial de Oleaginosas Americanas S.A. (INOLASA).
Reference number of the project activity	1314
Version number of the monitoring report	1
Completion date of the monitoring report	14/01/2015
Registration date of the project activity	30/11/2007
Monitoring period number and duration of this monitoring period	• Monitoring Period Number: 8 • Duration: 01/10/2013 – 29/11/2014 (first and last days included)
Project participant(s)	1. Industrial de Oleaginosas Americanas S.A. (INOLASA) 2. Vattenfall Energy Trading Netherlands N.V.
Host Party(ies)	Costa Rica
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	Sectoral scope: 1: Energy industries (renewable - / non-renewable sources) Selected methodology: "*Thermal energy for the user with or without electricity*", AMS-I.C, version 10, May 18th, 2007
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	54,929 tCO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	65,343 tCO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012 (if applicable)	0,00 tCO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable)	65,343 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of 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), empty fruit bunches (EFB) and other type of renewable biomass available in the area, 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. Furthermore it will be also purchased from another palm oil mill called Rio Escondido, located in Nicaragua. The biomass from the palm oil plants is transported using trucks with a capacity of 25-28 tons each, making approximately 3 trips per day. In addition, bagasse and wood chips will be used. Daily trips will be also done to obtain the bagasse and several trips per week to obtain wood chips.

The project activity replaced the current boilers with a new biomass boiler. This new boiler has a capacity to produce 35 tons of steam/hour with a design pressure of 35 bars.

The boiler was originally combusting biomass in a mixture of approximately 85% palm kernel (PK) shells and 15% empty fruit branches (EFB); however, during after this monitoring period new biomasses have been introduced and thus the resulting mix is approximately: 51% palm kernel shells, 28% empty fruit branches, 17% bagasse and 4% wood chips, depending on availability.

The boiler was installed and commissioned on April 15, 2007 and April 24, 2007 respectively.

The total emission reductions achieved during this monitoring period are: 65,343

A.2. Location of project activity

Country: Costa Rica
Province: Puntarenas
District: Barranca.

Coordinates: 454.5-459 North; 217.5-217.9 East.
Latitude of Barranca is N 09, 59', 23.5'' and longitude is W 084, 42', 36.9''. The altitude is sea level.

A.3. Parties and project participant(s)

Party involved	Private and/or public entity(ies) project participants	Indicate if the Party involved wishes to be considered as project participant
Costa Rica (Host)	Industrial de Oleaginosas Americanas S.A. (INOLASA).	No
Netherlands	Vattenfall Energy Trading Netherlands N.V.	No

A.4. Reference of applied methodology and standardized baseline

The small scale project activity is registered under the following methodology

a) *"Thermal energy for the user with or without electricity", AMS-I.C, version 10, May 18th, 2007*

The following tools / additional methodologies were also used in the PDD:

a) *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources", ACM0002 version 06, May 19th, 2006*

b) *"Tool for the demonstration and assessment of additionality (version 2)"*

UNFCCC CDM website:

http://cdm.unfccc.int/methodologies/DB/6EL4AG49US2S1DNH55Y4S7GDQFA2JF

A.5. Crediting period of project activity

Type: 7 years renewable crediting period

The crediting period of the project activity is from 30/11/2007 to 29/11/2014

A.6. Contact information of responsible persons/ entities

Geo Ingeniería Ingenieros Consultores S.A., San José, Costa Rica, made this Monitoring Report.

- Phone: (+506) 2290-4656
- Fax: (+506) 2290-5297
- Email: scastro@geoingenieria.co.cr

This entity is not considered as a project participant.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The project is fully implemented and operational as explained in the previous verification processes and the PDD.

The boiler was installed and commissioned on April 15, 2007 and April 24, 2007 respectively. The CDM project activity was registered and started the first crediting period on 30 November 2007. From this date onward, the project was completely implemented and operational, as shown during the 1st, 2nd, 3rd, 4th, 5th, 6th and 7th Periodic Verifications.

The boiler installed is a bi-drum water-tube boiler with membrane design wall and a rated capacity of 35,000 kg steam per hour. It has a designed pressure of 35.0 bars, but is currently used on 12.0 bars. The overall efficiency is given with 80%. Table 1 shows more technical specifications of the biomass boiler.

Biomass residues from the palm oil are used as fuel; these biomasses are empty fruit bunches and palm kernel shells. Additionally, the boilers used other types of biomass as fuel, namely, sugar cane bagasse and wood chips. The boiler is used for the generation of process steam for an onsite soybean refinery plant. Figure 1 provides a process scheme.

Figure 1 - Process Scheme[1]

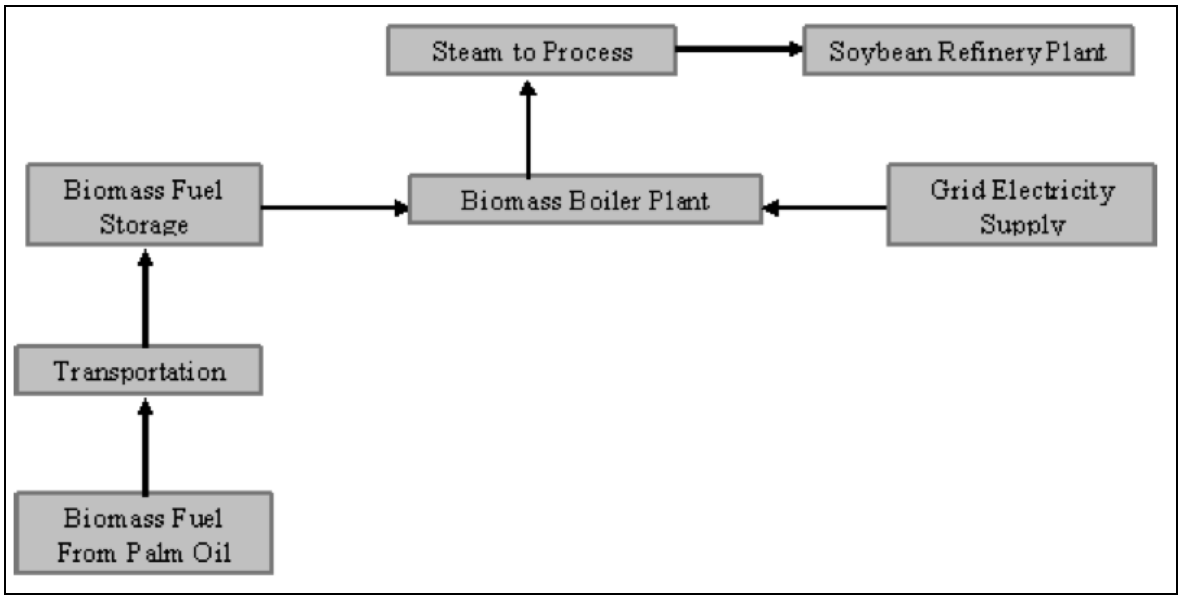


Table 1 - Technical specifications of Boiler

Technical Design Specification of Biomass Boiler	
Boiler Type	Fraser II Bi-Drum Watertube Boiler, Membrane wall design
Boiler Capacity	35,000 Kg/Hr
Boiler Model	FR 16/49
Boiler working pressure	12.0 bar resp. 31.0 bar
Design pressure	35.0 bar
Steam Temperature	192°C (Saturated) resp. 275°C (40° Superheated)
Feed water temperature	120°C +/- 5% (Economizer Water outlet temperature)
Air temperature at F.D Fan	220°C to 240°C (pre-heater air outlet temperature)
Actual steam evaporation	35,000 Kg/Hr.
Draught system	Balance Draught
Burning method	Reciprocating Step Grate; water cooled; hydraulically operated; grate material with high allow content.
Fuel to be used:	Approx: 51% PK shells, 28% EFB, 17% bagasse and 4% wood chips, depending on availability.
Dust Emissions	<=100 mg/ nm^3
Overall efficiency on Gross Calorific Value of Fuel	80%

[1] Other types of biomass used are bagasse and wood chips (discussed below).

During this monitoring period the following events were recorded:

Table 2 – Event log

Date or time frame	Event description
27/11/2013 - 02/12/13	Boiler stopped for cleaning and maintenance.
24/12/13 - 26/12/13	Boiler stopped on 25th of December (Christmas)
01/1/14 - 02/1/14	The boiler stopped on first of January. Starts operation on January 2. The steam totalizer resets automatically to zero.
23/02/14 - 28/02/14	Boiler stopped for cleaning and maintenance.
01/03/14 - 03/03/14	Boiler stopped for cleaning and maintenance.
16/04/14 - 19/04/14	Boiler stopped for cleaning and maintenance.
25/06/14 - 29/06/14	Boiler stopped for cleaning and maintenance.
28/08/14 - 30/08/14	Boiler stopped for maintenance.
08/09/14 - 09/09/14	Boiler stopped for cleaning and maintenance.
15/09/14 - 16/09/14	Boiler stopped for maintenance.
27/10/14 - 28/10/14	Boiler stopped for maintenance.

The cleaning of the biomass boiler is programmed for each one and a half months, and is based on an agreement between the Costa Rican Ministry of Health and INOLASA. This maintenance, involving cleaning equipment and the boiler, it normally takes around a week.

There were no incidences or situations during the Monitoring Period, which may impact the applicability of the methodology.

Since monitoring period N. 6 and because of a low availability of palm kernel shells (PK shells) and empty fruit bunches (EFB) in the Palm oil mills, INOLASA purchases biomass from two sugar mills called Ingenio El Palmar and Ingenio Cutris S.A., the first one located in Puntarenas and the last one in San Carlos, in Alajuela Province. Furthermore, they purchased wastes from woods (wood chips), from Orotina and Santa Cruz Guanacaste. The later purchases happened in order not to stop the boiler and not use bunker instead.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

There are no temporary deviations from the registered monitoring plan or applied methodology during this monitoring period.

B.2.2. Corrections

There are no corrections in this monitoring period.

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

The monitoring plan has been revised and has been approved on 31/05/11; these modifications reflected the changes introduced in the monitoring plan in order to reflect the discontinued use of coal as a co-fired fuel. No changes were made during this monitoring period

B.2.4. Changes to project design of registered project activity

No changes to the project design of the project activity has been approved or submitted with this monitoring report.

The PDD version 3 (completion date 29/11/2013) was revised and approved on 24/04/2014.

B.2.5. Changes to start date of crediting period

There are no changes to the start date of the crediting period.

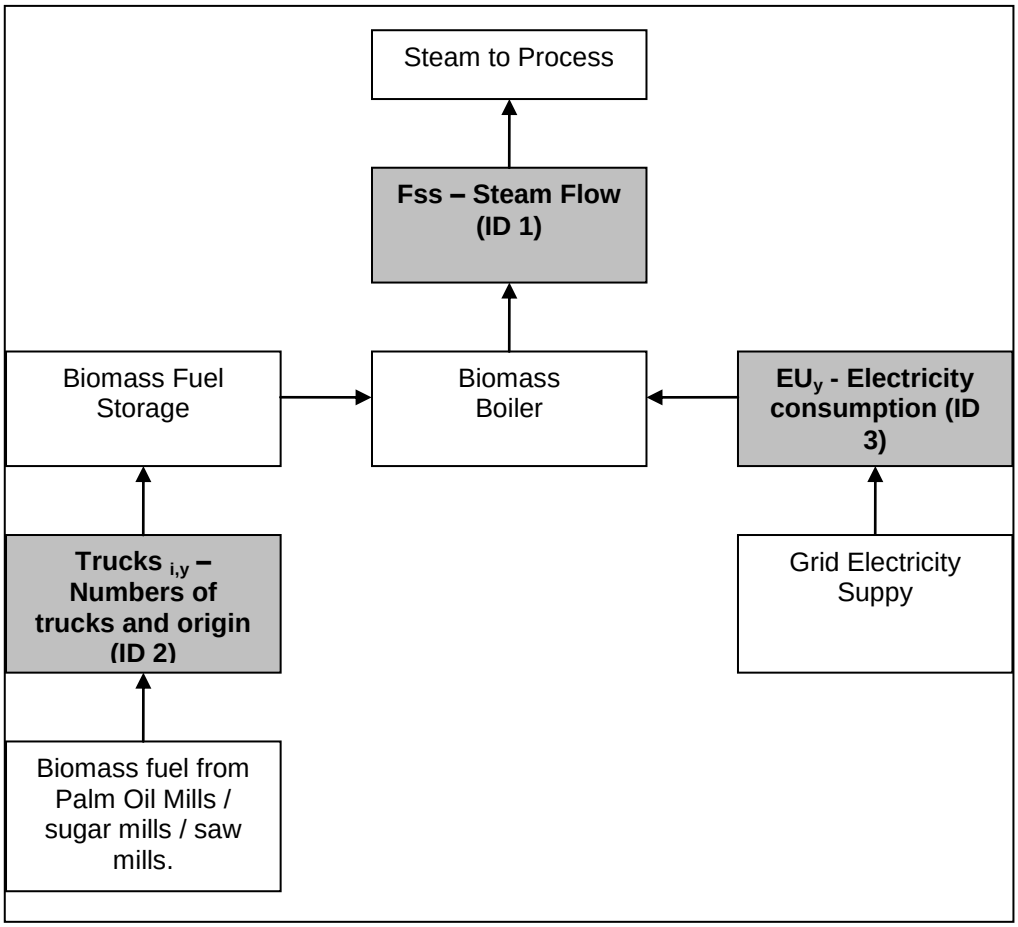
B.2.6. Types of changes specific to afforestation or reforestation project activity

Not applicable.

SECTION C. Description of monitoring system

The main metering points relevant for this project can be schematically interpreted from Figure 2 below.

Figure 2 - Monitoring System



Further information on the relevant parameters that are monitored is readily available in Section D below.

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. INOLASA has appointed one person to be responsible for monitoring, Mr. Danilo Castrillo. The operational staff, the Superintendent of Production and the Superintendent of Maintenance, report to him.

Data collection and procedures:

The Superintendent of Production collects data on a daily basis, and transfers these data to weekly and final monthly reports, which are submitted to the responsible for monitoring. The Superintendent of Maintenance saves the steam flow data digitally, which he regularly crosschecks with the manual data. In addition, crosschecks of the final reports against the daily data are performed for quality assurance.

Emission reduction calculation:

The CDM spreadsheet is prepared from the original data. It comprises monthly summary sheets that contain the daily data for easy control and comparison of these against other sources. The data sheets are compiled by the person responsible for monitoring, and signed by the plant manager.

Trainings:

During the crediting period internal trainings are performed. If trainings are performed during this monitoring period, receipts of these internal trainings will be available on-site.

Involvement of Third Parties:

The company Geo Ingeniería Ingenieros Consultores S.A provided support and consultancy regarding the CDM obligations. During operation, the technology provider PETRA supports the technical team of INOLASA, if necessary.

Documentation from the authorised boiler inspector during his yearly on-site visit will be available during the on-site visit.

A third-party check of the electricity meter has been performed and the documentation will be available to the DOE.

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 by the staff, 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 maintained, recording all deviations from normal operation, 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.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	ID.5 / Km_i
Unit:	km
Description:	Distance from palm oil mill i to the biomass boiler
Source of data:	This information is provided by the contracted transport company.
Value(s) applied):	Km – distance Coto 47 to Barranca: 340 Km – distance Quepos to Barranca: 133 Km – distance Rio Escondido to Barranca: 840 Km – distance Puntarenas to Barranca:22 Km – distance Alajuela to Barranca:250 Km – distance Orotina to Barranca: 44 Km – distance Guanacaste to Barranca:320
Purpose of data:	Project emission calculation
Additional comment:	Distance was determined by the readings of the mileage counter of a representative truck. It was cross checked by measuring the distance on a 1:50,000 map. Distances values expressed above are one way only; thus, they are multiplied by two in order to obtain the round-trip distance. Palo Seco and Naranjo palm mills are both located at Quepos; only Coto palm mill is located in Coto 47.

Data / Parameter:	ID.6 / VFcons
Unit:	L/km
Description:	Vehicle fuel consumption in litres per kilometre
Source of data:	This information is provided by the contracted transport company.
Value(s) applied):	0.6
Purpose of data:	Project emission calculation
Additional comment:	It relies on specific truck data based on the contracted transport company´s fleet of trucks

Data / Parameter:	ID.7 / CVdiesel
Unit:	MJ/kg
Description:	Calorific value of the fuel
Source of data:	Diesel reference value for Costa Rica
Value(s) applied):	45.91
Purpose of data:	Project emission calculation
Additional comment:	This reference is considered as a fixed value, and based on the fuel provider´s specifications (Refinadora Costarricense de Petróleo, S.A.)

Data / Parameter:	ID.8 / Ddiesel
Unit:	kg/l
Description:	Diesel density
Source of data:	The fuel density of Diesel in Costa Rica
Value(s) applied):	0.85
Purpose of data:	Project emission calculation
Additional comment:	National specifications for Diesel fuel in Costa Rica

Data / Parameter:	ID.9 / EFdiesel
Unit:	tCO2/MJ
Description:	Emission factor Diesel
Source of data:	IPCC
Value(s) applied):	20.2 tC/TJ x 44/12 = 74.1 tCO2/TJ = 0.0000741 tCO2/MJ
Purpose of data:	Project emission calculation
Additional comment:	The reference comes from the latest IPCC guidelines, and has been considered as representative for the current emission reduction calculation

Data / Parameter:	ID.10 / EUy
Unit:	GWh
Description:	Electricity consumption of baseline boiler annually.
Source of data:	Quotations from boiler technology provider
Value(s) applied):	1.07
Purpose of data:	Baseline emission from electricity consumption
Additional comment:	Baseline boiler: including a two week maintenance period.

Data / Parameter:	ID.11 / EFgrid
Unit:	tCO2/GWh
Description:	Emission factor Costa Rican grid
Source of data:	This factor has been calculated using ICE data and available info from other sources. See Annex 3 of the PDD
Value(s) applied):	62.86
Purpose of data:	Project emissions calculation
Additional comment:	This baseline emission factor was calculated ex-ante in a transparent and conservative manner as the average of the "approximate operating margin" and the "build margin"

Data / Parameter:	ID.12 / η_{th}
Unit:	%
Description:	Energy efficiency of the boiler in the baseline scenario
Source of data:	The energy efficiency of the boiler that would be used in absence of the project activity is based upon the manufacturer's information
Value(s) applied):	78
Purpose of data:	Baseline emission calculation
Additional comment:	The efficiency is considered as a fixed value and based on the manufacturer´s information for coal

Data / Parameter:	ID.13 / η_{p}
Unit:	%
Description:	Energy efficiency of the boiler in the project scenario
Source of data:	Is based upon the manufacturer´s information
Value(s) applied):	80

Purpose of data:	Baseline emission calculation
Additional comment:	The efficiency is considered as a fixed value, and based on the manufacturer's information for biomass fuels

Data / Parameter:	**ID.14 / NCVi = NCVc**
Unit:	TJ/kt
Description:	Is the net calorific value of the fossil fuel type i
Source of data:	Based on tests done to Colombian coal
Value(s) applied):	A default value of 10,887 BTU/lb will be considered based on tests done to Colombian coal (equivalent 25.73 TJ/kt)
Purpose of data:	Baseline emission calculation
Additional comment:	The net calorific value of the fossil fuel is determined by means of analytical results at the 'Laboratory of Puerto Bolivar, La Guajira', in accordance with the applicable ASTM standards. The resulting 'Screen Analysis Certificate' was developed by the 'Inspectorate Colombia Ltda.'

Data / Parameter:	**ID.15 / COEFi**
Unit:	tCO2/kt
Description:	Is the CO2 emission factor of the fossil fuel type i fired in the boiler in the absence of the project activity
Source of data:	Reference from Colombian provider of coal
Value(s) applied):	2.38 tCO2/t
Purpose of data:	Baseline emission calculation
Additional comment:	Carbon percentage of the Colombian coal that would have been used is stated as 64.9%

Data / Parameter:	**ID.16 / Hssi**
Unit:	kJ/kg
Description:	Is the enthalpy of the saturated steam at 12 bar
Source of data:	Set as default value provided from saturated steam table
Value(s) applied):	2782.73
Purpose of data:	Baseline emission calculation
Additional comment:	This is considered as a fixed value and will be used for emission reduction calculations

Data / Parameter	**ID. 17 / EFCO2,LE**
Unit:	tCO2/GJ
Description:	CO2 emission factor of the most carbon intensive fossil fuel used in the country
Source of data:	Src: IPCCC (2006), Chapter 1, Table 1.4 - higher value in 95% confidence interval
Value(s) applied:	coal: 0.0997 tCO2/GJ
Purpose of data:	Used for leakage emission if necessary.
Additional comment:	This is considered as a fixed value.

D.2. Data and parameters monitored

Data / Parameter:	ID.1 / Fssi
Unit:	kg/yr
Description:	Is the steam flow monitored, during year y
Measured/ Calculated / Default:	Measured
Source of data:	Project owner, flow meter
Value(s) of monitored parameter:	230,288,000 kg (for the entire period)
Monitoring equipment:	Type: Mass Flow Transmitter Make/Model: Rosemount 3095M Accuracy class: +/-1% Serial number: 0217271 Calibration frequency: 10 years stability of +/- 0.25% according to manufacturer. The monitoring equipment was calibrated on: 26/09/2012, with validity at least until 25/09/2022. Location: The flow meter is installed in the steam output flow of the biomass boiler.
Measuring/ Reading/ Recording frequency:	Continuous measurement, daily reading and monthly recording
Calculation method (if applicable):	Flow of steam in tonnes/yr is converted to TJ by calculation.
QA/QC procedures:	The meters automatically present values in mass units (i.e. the equipment internally accounts for temperature and pressure of the gas). Flow meter will be subject to a regular maintenance and testing regime to ensure accuracy (see table in Annex 4 to the PDD).
Purpose of data:	Baseline emission calculation
Additional comment:	

Data / Parameter:	ID.2 / trucksi,y
Unit:	Number
Description:	Number of trucks and origin
Measured/ Calculated / Default:	Measured
Source of data:	Project owner, logbook
Value(s) of monitored parameter:	804 trucks arrived from Quepos 526 trucks arrived from Coto 187 trucks arrived from Rio Escondido 321 trucks arrived from Ingenio El Palmar 328 trucks arrived from Ingenio Cutris 133 trucks arrived from Orotina 84 trucks arrived from Guanacaste

Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Measured at each delivery and subsequently recorded
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The recorded data will be crosschecked on a regular basis with the invoices from the transportation service provider
Purpose of data:	Project emission calculation
Additional comment:	

Data / Parameter:	**ID.3 / EUy**
Unit:	GWh/year
Description:	Electricity consumption biomass boiler in the project scenario
Measured/ Calculated / Default:	Measured
Source of data:	Project owner,
Value(s) of monitored parameter:	3.02274 GWh (for the entire period)
Monitoring equipment:	Type: Electricity meter Make/Model: Schneider Electric CM3250 Accuracy class: IEC 687 0.5 class Serial number: 15000219 Calibration frequency: 15 years stability according to manufacturer. Date of last calibration: November 2007 Validity: At least until November 2022 Location: The electricity meter is installed in an electric substation located at the biomass boiler.
Measuring/ Reading/ Recording frequency:	Measured continuously, reading daily, recorded monthly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The electricity meter will be recalibrated periodically by the supplying firm
Purpose of data:	Project emission calculation
Additional comment:	

D.3. Implementation of sampling plan

Not applicable.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

Please note that the references used for the parameters, namely 'IDs', are defined in chapter D above and are applicable for all following chapters.

The baseline emissions can be calculated with the following equation:

$$BE_y = BE_{heat,y} + BE_{boiler,y}$$

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):

$$BE_{heat,y} = \frac{Q_y}{\eta_{th} \cdot NCV_i} \cdot COEF_i$$

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 (original notation in approved monitoring plan used for clarity).
η_{th} is the energy efficiency of the boiler that would be used in absence of the project activity. (**ID.12, fixed**)
NCV_i is the net calorific value of the fossil fuel type i per TJ/kt. In the baseline scenario, the plant only uses coal as fuel. (**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**)

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

$$Q_y = h_{ssi} \cdot F_{ssi} \cdot 10^{-9}$$

Where

Q_y is the total quantity of heat generated in the project plant using renewable 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:

$$BE_{boiler,y} = EU_y \cdot EF_{grid}$$

Where:

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

Table 3 - Total Baseline Emissions

Month	ID1 Fss [t]	BEheat [tCO2e]	BEboiler [tCO2e]	BE_{total} [tCO_2e]
Oct-13	14,996.00	4,948.68	5.71	4,954.39
Nov-13	13,710.00	4,524.30	4.98	4,529.27
Dec-13	14,263.00	4,706.79	5.53	4,712.31
Jan-14	14,495.00	4,783.35	5.71	4,789.06
Feb-14	11,066.00	3,651.78	3.69	3,655.46
Mar-14	14,379.00	4,745.07	5.34	4,750.41
Apr-14	14,974.00	4,941.42	5.16	4,946.58
May-14	15,534.00	5,126.22	5.71	5,131.93
Jun-14	13,731.00	4,531.23	4.98	4,536.20
Jul-14	15,258.00	5,035.14	5.71	5,040.85
Aug-14	15,410.00	5,085.30	5.16	5,090.46
Sep-14	13,795.00	4,552.35	5.53	4,557.88
Oct-14	16,210.00	5,349.30	5.53	5,354.82
Nov-14	15,467.00	5,104.11	5.34	5,109.45
Total	203,288.00	67,084.99	74.08	**67,159.07**

E.2. Calculation of project emissions or actual net GHG removals by sinks

The project emissions can be calculated with the following equation:

$$PE_y = PE_{trans,y} + PE_{boiler,y}$$

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.

$$PE_{trans,y} = \sum trucks_{i,y} \cdot TransCOEF_i$$

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**)
$TransCOEF_i$ Coefficient for the CO_2 emissions from 1 truck load of biomass originating from palm oil mill i

$$TransCOEF_i = km_i \cdot VF_{cons} \cdot CV_{diesel} \cdot D_{diesel} \cdot EF_{diesel}$$

Where:

Km_i Distance from palm oil mill i to the biomass boiler (km) (**ID.5, fixed;** double of the values reported in D.1 are considered in order to account for a round-trip.)
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**)
EF_{diesel} Emission factor diesel (tCO_2/MJ) (**ID.9, fixed**)

For the transportation of biomass trucks with a load capacity of 28 tonnes are used. To be conservative, $TransCOEF_i$ is determined based on a full truck load. The trucks use 0.6 litre of diesel per kilometre, the calorific value of the fuel is 45.91 MJ/kg, the fuel density of diesel in Costa Rica is 0.85 kg/l and the emission factor of the fuel is 74.1 tCO_2/TJ.

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

$$PE_{boiler,y} = EU_y \cdot EF_{grid}$$

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**)

Table 4 – Total Project Emissions

	ID2 number of trucks							PE_{trans}	ID3 EU_y	PE_{boiler}	PE_{total}
Month	Quepos	Coto	Rio Esc.	Ing. El Palmar	Ing. Cutris S.A.	Orot.	Guanac.	[tCO_2e]	[MWh]	[tCO_2e]	[tCO_2e]
Oct-13	70	31	11	0	24	16	0	113	216	14	126.17
Nov-13	110	27	13	0	34	20	0	0	214	13	13.47
Dec-13	101	26	10	8	5	24	0	111	210	13	123.93
Jan-14	74	32	8	90	0	13	14	107	253	16	123.33
Feb-14	21	39	3	60	0	16	25	82	183	12	93.37
Mar-14	19	40	1	73	8	15	21	78	214	13	91.37
Apr-14	56	42	6	50	25	20	10	113	206	13	125.64
May-14	44	48	21	40	56	9	13	172	221	14	185.77
Jun-14	27	42	15	0	105	0	0	151	194	12	163.49
Jul-14	29	57	15	0	68	0	1	154	227	14	168.65
Aug-14	47	39	12	0	3	0	0	104	196	12	116.28
Sep-14	59	45	25	0	0	0	0	153	205	13	166.06
Oct-14	75	42	19	0	0	0	0	140	237	15	154.42
Nov-14	72	16	28	0	0	0	0	134	247	16	149.27
Total	804	526	187	321	328	133	84	1,611.21	3,022.74	190.01	**1,801.22**

Other emissions occurring within CDM project activity

A bulldozer for on-site transportation of biomass was used. The vessel consumed 31,486 litres of diesel.

Table 5 - Other project emissions

Fuel consumed by on-site bulldozer	31,486	lts
calorific value of diesel (CV_{diesel})	45.91	MJ/kg
Density of diesel (D_{diesel})	0.85	kg/l
Emission factor diesel (EF_{diesel})	0.0000741	tCO_2 / MJ
Additional Project Emissions	91.05	tCO2
as % of ERs claimed	0.14	%

The overall amount of emissions arising from this source is 91.05 tCO2, around 0.14% of the emission reductions claimed for this period (65,343 tCO_2 – see E.5 below). In accordance with the CDM Validation and Verification Standard, only emissions which are expected to contribute more than 1% of the emission reductions should be addressed.

E.3. Calculation of leakage

No sources of leakage were identified; therefore the leakage is zero.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total[2]	**67,152**	**1,809**	**0**	**65,343**

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	**54,929**[3]	**65,343**

E.6. Remarks on difference from estimated value in registered PDD

Table 6-Emissions reductions

Period		tCO_2		
		expected[4]	achieved[5]	difference
30/11/2007	31/12/2007	2,803	1,531	-45%
01/01/2008	30/11/2008	31,071	19,695	-37%
01/12/2008	30/09/2009	29,688	24,561	-17%
01/10/2009	31/08/2010	34,307	32,848	-4%
01/09/2010	30/09/2011	42,753	39,498	-8%
01/10/2011	30/09/2012	42,086	40,498	-4%
01/10/2012	30/09/2013	44,454	51,560	16%
01/10/2013	29/11/2014	54,929	65,343	19%
Total (entire monitoring period)		**282,092**	**275,534**	**-2.3%**

[2] BE value after rounding down, and PE value after rounding up.

[3] The original PDD contemplates a crediting period from 2007 to 2013, with a 5.9% increase in energy demand from the plant that translates into an equivalent increase in emission reductions per year (PDD p.26). However, due to delays in the registration of the project, the crediting period actually went from 30/11/2007 to 29/11/2014, thus displacing the timeframe almost a year. Thus, a 2014 estimate is obtained in order to calculate an expected value for the period 01/10/2013 to 29/11/2014. The 2014 estimate is obtained in the same fashion as the previous estimates from the PDD, i.e. simply by adding 5.9% to the previous estimate (this value is already provided in the original PDD estimate – see PDD p. 27-28). The expected emission reductions for the last crediting period is obtained in direct proportion to the 2013 and 2014 estimates, corresponding to a value of 54,929 TCO2e (92*45,090 + 333*47,750)/365.

[4] Expected emission reductions are based on PDD estimates, which were in turn adjusted by the number of days in each year.

[5] *Source*: final version of the respective Monitoring Reports.

During the seven year crediting period, the project displaced 275,534 tCO_2, whereas the PDD expects for the same period 282,092 tCO_2. Notice however that the ex-ante estimate presented on section B.6.4 of the PDD considers round-years from 2007 to 2013, with an annual 5.9% yearly increase due to increased production. However, due to delays in the registration process the actual crediting period went from 30/11/2007 to 29/11/2014 (almost an entire year delay respect to the timeframe considered in section B.6.4 of the PDD), the original estimate had to be adjusted. Section B.6.3 of the PDD provides an estimate that goes as far as 2016; hence, baseline and project emissions from tables B.5 and B.6 of the PDD are used to adjust the timeframe. The previous estimate (267,484 tCO_2 as per PDD) becomes 282,092 tCO_2 once adjusted as per footnote 3. With this adjustment the difference between the original estimate and the actual performance of the project for the entire period becomes -2.3%, which is reasonable for a project of this type and scale.

This way, the underperformance of the initial years is compensated by the over-performance of the last periods without affecting the long-term estimate for the project. This implies that no key elements in the project's eligibility (e.g. regarding to the project's additionality) have been compromised.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	0,00	**65,343**

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	NOLASA Industrial de Oleaginosas Americanas S.A.
Street/P.O. Box	Barranca
Building	
City	Puntarenas
State/Region	
Postcode	
Country	Costa Rica
Telephone	
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E-mail	cgonzalez@numar.net
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Contact person	Carlos González May
Title	
Salutation	
Last name	González May
Middle name	-
First name	Carlos
Department	Vicepresidente Desarrollo de Negocios
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Document information

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
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