DORI ALIMENTOS LTDA - BIOMASS BASED PROJECT - BRAZIL

Document Prepared By Sustainable Carbon - Projetos Ambientais Ltda.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity was developed by CantorCO2e Brazil, and is now being carried out by Sustainable Carbon - Projetos Ambientais LTDA.

The project activity is a bundle project of two production units of *Dori Alimentos LTDA* and consists in promoting the fuel switch in *Dori's* boiler. *Dori Alimentos LTDA* is a candy industry that was created in 1967. *Dori* manufactures all kinds of candies, chocolates and peanuts in different flavours, to meet domestic and international demand. The company exports its products to 50 different countries, including Latin America, Australia, South Africa, United States and some European countries. Besides that, *Dori Alimentos LTDA* has distribution center throughout Brazil.

In the candies manufacturing process, steam is used in several different stages of the production process, for example in the greenhouse providing heat to dry the final products or during the production in order to increase the humidity of some candies' ingredients.

The project activity involves the use of biomass as a source of fuel to supply steam for the production process, replacing shale oil, which is the fuel commonly used in industries at São Paulo and Paraná. In both units, Eucalyptus and Pinus wood chips are used, and in Dori's head office peanut shells are applied. The fuel switch started in December 2004; however, the regular operation of the boiler with biomass began on August 2005 in Dori's head office and on Dori's subsidiary company on January 2005.

Since 2008, the boilers in both production units have been working predominantly with renewable biomass to generate steam. There is still a minor consumption of shale oil in Rolândia, which is related to the period of equipment maintenance or cleaning, which usually lasts from two to three hours. In 2013 Dori's head office substituted the shale oil for natural gas which has a smaller CO2 Emission factor, 73.3 tCO2/TJ and 56.1 tCO2/TJ respectively. This change occurred because of the availability of a natural gas pipeline in Marilia region that brought an opportunity to Dori's Head Office to change the type of fossil fuel utilized to natural gas mainly due to its advantages regarding the decrease of environmental impacts when compared with the shale oil previously utilized. Financially, the switch to natural gas was not an advantage for the company. According to Arruda (2009)1, the price for generate 1TJ using shale oil is around R$ 5,000.00, six times cheaper than using natural gas, R$ 30,000.00.

The implementation of this project activity in *Dori Alimentos LTDA* has as objective reduce the use of fossil fuel and substitutes it by renewable biomasses to feed boilers and generate steam to sustain the production. The intention is to minimize environmental impacts related to the consumption of fossil fuels and mitigate greenhouse gas (GHG) emissions.

The emission reductions due to the switch of fossil fuel (shale oil and natural gas) to renewable biomasses were equal to **24,882 tCO_2e** during the monitoring period from 01/04/2016 to 30/06/2018.

[1] ARRUDA, M. Z. Análise de Combustíveis de Caldeiras. Universidade de Passo Fundo, 2009. Available at: < http://usuarios.upf.br/~engeamb/TCCs/2009-2/MATEUS%20ZART%20DE%20ARRUDA.pdf>. Last visit on: 15th February, 2009.

1.2 Sectoral Scope and Project Type

The project is associated to the following scope, as per UNFCCC definitions:

1 - Energy industries (renewable - / non-renewable sources);

This is not an AFOLU project.

This is not a grouped project.

1.3 Project Proponent

Organization name	***Dori Alimentos LTDA***
Contact person	*Mrs. Márcia S. Cavicchioli de Oliveira;* *Mrs Silvia Cristina Pinas.*
Title	*Mrs. Márcia S. Cavicchioli de Oliveira*, Environmental management system coordinator is responsible to provide all information of Marilia Plant and to lead the visit of the candy industry. Also, she gives detailed information on process and production lines, environmental challenges, technological challenges, research and development history and food market challenges. Furthermore, she is responsible for the monitoring data, providing the quantification of the amount of steam produced and of the amount of biomass. *Mrs Silvia Cristina Pinas* Environmental management technician responsible to provide all information of Rolândia Plant and to lead the visit of the candy industry. Also she is responsible for the monitoring data, providing all the information necessary for the Monitoring Report.
Address	*Dori Alimentos S.A. (Matriz)* Av. República, 5159/85 - Distrito Industrial Santo Barion. CEP 17512-035 - Marília/SP *Dori Alimentos S.A. (Filial Rolândia/PR)* Av. Itamaraty, 1324 - Parque Industrial. CEP 86600-000 - Rolândia/PR
Telephone	*Dori Alimentos S.A. (Matriz)* +55 14 3408-3000 *Dori Alimentos S.A. (Filial Rolândia/PR)* +55 43 3255 2400
Email	marcia.oliveira@dori.com.br silvia.pinas@dori.com.br

Organization name	Sustainable Carbon - Projetos Ambientais Ltda
Contact person	Marcelo Hector Sabbagh Haddad Fernanda Alves de Almeida Fernanda Sayuri Suzuki Guilherme Lucas Medeiros Prado Lívia Demier Mauri Luana Ribeiro Alves
Title	Marcelo Hector Sabbagh Haddad: Technical coordinator Fernanda Alves de Almeida: Technical analyst Fernanda Sayuri Suzuki: Technical analyst Guilherme Lucas Medeiros Prado: Technical analyst Lívia Demier Mauri: Technical analyst Luana Ribeiro Alves: Technical analyst
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1.4 Other Entities Involved in the Project

No other entity is involved in this project activity.

1.5 Project Start Date

According to version 02 of the VCS PD[2], project start date was defined as the date when the project began reducing or removing GHG emissions through employment of renewable biomass.

Unity	**Project Start Date**
Dori's Head Office	01/03/2005
Dori's Subsidiary	01/12/2004

1.6 Project Crediting Period

The second crediting period for this project started on 01/04/2016 and ends on 31/03/2026.
VCS project crediting period: 10 years, two times renewable.

[2] Document available at: http://mer.markit.com/br-reg/public/project.jsp?project_id=100000000000292. Last visited on 03/01/2018.

1.7 Project Location

-Head Office

Av. República, 5.159/85 - Distrito industrial Santo Barion - CEP 17512-035 Marília, SP, Brazil;

The coordinates are: 22° 12′ 50″ S and 49° 56′ 45″ W

-Subsidiary

Av. Itamaraty, 1324 - pq. Industrial - CEP 86600-000 Rolândia, PR, Brazil.

The coordinates are: 23° 18′ 36″ S and 51° 22′ 8″ W

Figure 1. Geographic location of the cities of the project activity that has the following coordinates: *Marília*: 22° 12′ 50″ S, 49° 56′ 45″ W *Rolândia*: 23° 18′ 36″ S, 51° 22′ 8″ W

1.8 Title and Reference of Methodology

The project applies a small-scale methodology approved under the Clean Development Mechanism, as follows:

Category AMS-I.C: Thermal energy production with or without electricity - Version 20.0 (Valid from June 14th, 2014 onwards)[3].This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuels.

[3] This version of the methodology is available at: http://cdm.unfccc.int/methodologies/DB/JSEM51TG3UVKADPA25IPUHXJ85HE8A. Last visited on 03/01/2018.

1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: The project activity is not included in an emission-trading program or any other mechanism that includes GHG allowance trading.
- Other Forms of Environmental Credit: The project activity is not creating any other form of environmental credit under any specific program.
- Participation under Other GHG Programs: The project activity is not registered under any other GHG program.

1.10 Sustainable Development

The project activity contributes to the reduction of greenhouse gas (GHG) emissions by avoiding the use of non-renewable fuels. In addition, the project activity will contribute to sustainable development of the host country, such as:

- The use of clean and efficient technologies through the use of renewable biomass as fuel. By these means, the project is in accordance to Agenda 21 and with Brazilian Sustainable Development Criteria;
- A pioneer initiative that encourages the development of new technologies throughout the country, which replaces the use of non-renewable fuels with renewable biomass which presents an efficient thermal energy generation potential as shown in the project demonstration.
- The use of renewable biomasses results in GHG emission reductions. This way the project does not cause any relevant negative impacts as all generated energy is a result of the best exploitation of the natural resources available. In addition, the project improves the local environmental conditions by establishing proper treatment for the renewable biomasses and also by contributing to the reduction on the use of non-renewable fuels.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project description document of the second credit period was validated by the Designated Operational Entity Earthood Services Private Limited and this present monitoring report will be verified by Earthood Services Private Limited.

The emission reductions are achieved by displacing the use of fossil fuels to provide thermal energy in Dori candy industry that occurs with the renewable biomasses employed in this project activity. The Dori's Head Office implemented the use of natural gas during the first crediting period of the project activity, in substitution to the shale oil previously utilized. This decision was made due to the new natural gas pipeline available in Marilia region, which brings an opportunity to the Dori's Head Office to change the type of fossil fuel utilized to natural gas due to its advantages regarding the environmental impacts when compared with

the shale oil previously utilized. Thus, currently, the emission reductions are achieved by displacing the use of natural gas in the Marília site and shale oil in the Rolândia site.

The boilers have been utilized in the company since 2005 and their lifetime is more than 20 years. Considering the low utilization, since the boilers of natural gas and shale oil are only for back up use, the lifetime of the boilers would encompass all the project crediting period.

In the head office unity, wood chips are bought in bulk and discharged in a third company that realizes the bagging work, the full bags are transported to Dori Alimentos in Marília where it keeps stored under a shed until its use. The same kind of storage and bagging work happens with the peanut shells which are residues from Dori's production making this sector self-sustainable. Biomass transportation from the bags to the metallic silo will take place by means of a conveyor belt that will start and stop automatically based on the biomass amount required by the boiler.

The Dori's subsidiary unity does not make use of bags for biomass storage and the first silo feeding is made by a motorized cart which feed the wood chips directly into the first mill hopper. From there, the wood chips go through a conveyor belt into a classifier where the thicker wood chips are excluded. The selected wood chips fall into the second silo, and then they are carried by a conveyor belt to the metallic silo which feeds the boiler with the help of two screws that dose the biomass. This dosage is controlled by an automated system which controls other instruments such as pressure and flow meter.

This Monitoring Report refers to the fourth monitoring period of this project, and includes data from 01-04-2016 to 30-06-2018.

2.2 Deviations

2.2.1 Methodology Deviations

There were no methodology deviations during this monitoring period.

2.2.2 Project Description Deviations

In addition during the 4º monitoring period Rolândia unit have never calibrated the flow meter. To the periods, that the flow meter has not been calibrated an accuracy error of 0.1% was applied to the steam generation, according the manufacturer's instructions. Once Marilia unit didn't presented all the flow meter calibration evidences an accuracy error of 0.04% was applied to the data according the manufacturer's instructions.

In addition during the present monitoring period Rolândia unit did not have the road weight calibration certification. According to the "CDM validation and verification standard for project activities (CDM-EB93-

A05-STAN)[4]" due to lack of information, it was applied +5% of error ensuring the most conservative scenario regarding the generation of leakage.

2.3 Grouped Project

Not applicable. This is not a grouped project. The project activity is a bundled project of two production units of *Dori Alimentos LTDA*: the company's head office, situated in the city of Marília - State of São Paulo, and the subsidiary production plant, located in the city of Rolândia - State of Paraná.

2.4 Safeguards

2.4.1 No Net Harm

A negative impact identified is that the project activity will generate ashes due to the burning of the biomass. Despite that, the ashes are correctly destined: The ashes generated in Marília site are used as fertilizer and in Rolândia site are destined to a worm farm to produce compost.

Other negative impact identified is that the burning of the new biomasses also emits particulate material and CO2, as well as when using fossil fuel. However, the emission reductions of GHG will be improved since they are renewable biomasses which have carbon neutral lifecycles.

In this way, the project does not cause any relevant negative impacts as all generated energy is a result of the exploitation of the natural resources available. On the contrary, the project will improve the local environmental conditions by decrease the use of fossil fuels and giving use to the waste that in another situation would be destined to landfill.

2.4.2 Local Stakeholder Consultation

The formal stakeholder consultation was carried out during the validation of the project. Currently, the company's environmental management area is available to receive any kind of suggestions and comments from the community through the website, CSC, telephone, e-mail or even personally.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter:	$\mathbf{EF_{fossilfuel}}$
Data unit:	tCO_2/TJ
Description:	CO_2 Emission factor of fossil fuel
Source of data:	Value checked at:

[4] CDM validation and verification standard for project activities Available at: https://cdm.unfccc.int/filestorage/e/x/t/extfile-20170502114945594-reg_stan06.pdf/reg_stan06.pdf?t=WVh 8cGNvcDQwfDAvJfoBNSvGS8O77sy7FM64 Last visited: 20/01/2018

	-IPCC: Intergovernmental Panel on Climate Change. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf. Last visited on 04/01/2018.
Value applied:	Baseline Emissions 73.3 tCO_2/TJ (shale oil) 56.1 tCO_2/TJ (natural gas) Project Emissions 79.2 tCO_2/TJ (shale oil) 58.3 tCO_2/TJ (natural gas)
Justification of choice of data or description of measurement methods and procedures applied	It was considered IPCC default value for fossil fuel (shale oil and natural gas). The CO_2 emissions from the consumption of fossil fuel in the project activity have to be discounted of the emission reductions (project emissions).
Purpose of the data:	This parameter calculates emissions from the use of the fossil fuel considering the amount that would be utilized in the baseline scenario. Also, it was used to calculate the project emissions.
Comment:	Applicable for stationary combustion in the manufacturing industries and construction. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**$NCV_{fossilfuel}$**
Data unit:	TJ/Tonne of fossil fuel
Description:	Net Calorific Value
Source of data:	Value average checked at: IPCC - Intergovernmental Panel on Climate Change. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf. Last visited on 04/02/2018.
Value applied:	Baseline Emissions 0.038 TJ/Tonne (shale oil) 0.048 TJ/Tonne (natural gas) Project Emissions 0.0452 TJ/Tonne (shale oil) 0.050 TJ/Tonne (natural gas)

Justification of choice of data or description of measurement methods and procedures applied	It was considered IPCC default value for fossil fuel, as recommended in the applied methodology - "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", on Data/parameter table 4[5], source of data option d.
Purpose of the data:	This value provided the energy generated by the amount of fossil fuel that would be used in the absence of the project and the energy generated by the amount of fossil fuel consumed in the current period.
Comment:	IPCC default values shall be used only when country or project specific data are not available or difficult to obtain, according to "Guidance on IPCC default values" (Extract of the report of the twenty-fifth meeting of the Executive Board, paragraph 59). Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits income for this project activity, whichever occurs later

Data / Parameter:	$\rho_{fossilfuel}$
Data unit:	tonne/L
Description:	Specific gravity of the fossil fuel
Source of data:	Value provided by the fuel provider through the technical form of the fossil fuel.
Value applied:	0.00097 (shale oil) 0.000000766 (natural gas)
Justification of choice of data or description of measurement methods and procedures applied	Project participants measured this data, as recommended in the applied methodology - "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", on Data/parameter table 3, source of data option b.
Purpose of the data:	This parameter is used to calculate baseline emissions from the use of fossil fuel, measured in liters, which would be used in the baseline scenario. This data is used to convert measured values to tonnes.
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

[5]Methodological tool – Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion. Available at http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf Last visited: 20/01/2018

Data / Parameter:	$\rho_{renbiomass}$
Data unit:	Tonne / m^3
Description:	Specific gravity of renewable biomass
Source of data:	Value measured and recorded by the project proponent.
Value applied:	**Biomasses** / **Specific Gravity (tonne/m³)** **Wood chips** / 0.350 **Peanut shells** / 0.117
Justification of choice of data or description of measurement methods and procedures applied	Project participants measured this data, as recommended in the applied methodology - "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", on Data/parameter table 3, source of data option b.
Purpose of the data:	The amount of biomasses was monitored in accordance to the weight or volume described in the receipts from the providers. Where the values in the receipts are described in m³, it is necessary the conversion to tonnes through the specific gravity of each biomass. In addition, this information was utilized to evaluate the leakage.
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Efficiency Factor**
Data unit:	Tonne of fossil fuel per tonne of steam.
Description:	Efficiency of the boiler, used for determining the amount of fossil fuel consumed, based on the amount of steam generated
Source of data:	This value was calculated through historical steam generation data and fossil fuel consumption registries provided by *Dori Alimentos LTDA*.
Value applied:	0.074074 (shale oil) 0.056741 (natural gas)
Justification of choice of data or description of measurement methods and procedures applied	This parameter was calculated through historical data provided by Dori Alimentos LTDA. The efficiency of the boiler is 0.074074 tonne of shale oil per tonne of steam generate and 0.056741 tonne of natural gas per tonne of steam generate
Purpose of the data:	Required to calculate the amount of fossil fuel generated by the amount of steam calculated with the steam flow meter.

Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**$COEF_{i,y}$**
Data unit:	tCO_2e/ tonne of fossil fuel
Description:	CO_2 emission coefficient of the fossil fuel
Source of data:	Value calculated through the parameters $NCV_{fossil\ fuel}$ and $EF_{fossil\ fuel}$ $COEF_{i,y} = NCV_{fossil\ fuel} * EF_{fossil\ fuel}$ [tCO_2e/tonne]
Value applied:	Project Emissions 3.57984 (shale oil) 2.938 (natural gas)
Justification of choice of data or description of measurement methods and procedures applied	Required by the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 03, EB 96, Annex 4).
Purpose of the data:	This parameter is utilizes to calculate the project emissions (CO_2 emissions from the consumption of shale oil and natural gas in the project activity).
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**η_{th}**
Data unit:	%
Description:	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity.
Source of data:	Value provided by the project proponent
Value applied:	100 %
Justification of choice of data or description of measurement methods and procedures applied	Dori's facilities did not monitor the energy generated by the fossil fuel consumed. However, it is well known the amount of fossil fuel and the amount of fuel required to generate one tonne of steam. Therefore, this project estimate the baseline emissions through the energy generated by the real consumption of fossil fuel and assuming that η th is 100%. The efficiency of 100% was considered in order to be more conservative.

Purpose of the data:	The purpose of this parameter is to determine the efficiency of the plant.
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

3.2 Data and Parameters Monitored

Data / Parameter:	$Q_{renbiomass}$
Data unit:	Tonnes
Description:	Amount of renewable biomass (per year)
Source of data:	Values measured and supplied by the project proponent
Description of measurement methods and procedures to be applied:	As predicted in the VCS PD, the amount of renewable biomass would be monitored in accordance to the weight described in the receipts from the providers and the number of trucks which arrives in the companies. The $Q_{renbiomass}$ was monitored by an internal control.
Frequency of monitoring/recording:	Monthly
Value monitored:	See table below

Period	Qrenbiomass			
	Wood chips consume (tonnes)		Peanut shells consume (tonnes)	
	Marília	Rolandia	Marília	Rolandia
April	1,298	868	142	0
May	1,419	628	116	0
June	1,246	1,036	144	0
July	1,051	868	135	0
August	1,201	930	168	0
September	1,151	915	115	0
October	1,191	881	133	0
November	1,223	972	139	0
December	1,135	794	96	0
2016*	10,915	**7,893**	1,187	**0**
January	1,130	661	97	0
February	820	820	96	0

	March	1,175	745	137	0
	April	658	732	128	0
	May	1,085	545	184	0
	June	824	1,065	181	0
	July	832	1,010	195	0
	August	885	824	257	0
	September	762	767	219	0
	October	754	945	204	0
	November	847	780	226	0
	December	653	423	198	0
	2017	10,424	**9,318**	2,122	**0**
	January	997	871	189	0
	February	925	774	92	0
	March	889	779	102	0
	April	1,170	820	114	0
	May	1,030	814	123	0
	June	1,117	800	103	0
	2018**	6,127	**4,858**	724	**0**
	TOTAL	27,466	**22,069**	4,034	**0**
	Total Project	**49,535**		**4,034**	

*from April of 2016 to December of 2016.

** from January of 2018 to June of 2018.

Monitoring equipment:	*Dori's* units have a road weight machine, both from Toledo (model 820J for Marília site and model 810II for Ralândia site) responsible for measurement of biomass purchased. The amount of renewable biomasses was monitored in accordance to *Dori's* internal control spreadsheet. Data regarding renewable biomass were organized by month. During the present monitoring period Rolândia unit did not have the road weight calibration certification. According to the "Guidelines For Assessing Compliance With The Calibration Frequency Requirements" Annex 60 of CDM due to lack of information, it was applied +5% of error ensuring the most conservative scenario regarding the generation of leakage

QA/QC procedures to be applied:	The weighing-machine was calibrated periodically according to the INMETRO[6]procedures and parameters, in order to guarantee the quality and precision of the amount of biomass weighted.
Purpose of the data	This parameter was used to : a) Compare the total energy produced in a monitoring period to the thermal energy that would be necessary according to the VCS PD estimates; b) Demonstrate that the Project fits in small scale category for biomass renewable energy projects (capacity < 45MWth); c) Calculation of leakage emissions due to competing use of biomass.
Calculation method:	Not applicable
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$EG_{thermal,y}$
Data unit:	TJ
Description:	Amount of heat supplied (per year)
Source of data:	The amount of steam generated (Q_{steam} - tonnes) is measured by the project developer (Dori Alimentos) and converted in TJ through the equation: $EG_{thermal,y}$ (TJ) = $Q_{shaleoil}$ (tonnes) * $NCV_{shaleoil}$ (TJ/ton) $EG_{thermal,y}$ (TJ) = $Q_{naturalgas}$ (tonnes) * $NCV_{naturalgas}$ (TJ/ton)
Description of measurement methods and procedures to be applied:	The amount of heat supplied was calculated based on the amount of fossil fuel that would be consumed in the baseline scenario and the energy generated by it, through the Net Calorific Value of fossil fuel..
Frequency of monitoring/recording:	Monthly
Value monitored:	

Period	$EG_{thermal,y}$ **- Amount of heat supplied (TJ)**	
	Marília	**Rolândia**

[6] INMETRO – Instituto Nacional de Metrologia, Normalização e Qualidade Industrial (National INstitute for metrology, normalization and indesrial quality) is a federal institution, responsible for verifiying calibration and quality procedures in Brazil.

April	16	4
May	17	5
June	16	3
July	11	4
August	16	4
September	12	4
October	15	4
November	16	5
December	14	4
2016*	**133**	37
January	9	2
February	13	4
March	15	3
April	11	5
May	14	4
June	12	3
July	12	5
August	13	3
September	12	4
October	11	5
November	11	5
December	9	2
2017	**143**	45
January	16	3
February	12	2
March	12	3
April	15	4
May	15	5
June	14	3
2018**	**83**	20
TOTAL	**359**	101
Total - Project	**461**	

*from April of 2016 to December of 2016.

** from January of 2018 to June of 2018.

Monitoring equipment:	No monitoring equipment was used to determine this parameter.

QA/QC procedures to be applied:	Not applied
Purpose of the data	This data was utilized to determine the amount of heat supplied in the baseline calculations.
Calculation method:	The amount of heat supplied was calculated through the equation: $EG_{thermal,y}$ (TJ) = $Q_{shaleoil}$ (tonnes) * $NCV_{shaleoil}$ (TJ/tonne) $EG_{thermal,y}$ (TJ) = $Q_{naturalgas}$ (tonnes) * $NCV_{naturalgas}$ (TJ/tonne)
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$Q_{fossilfuel}$
Data unit:	Tonnes
Description:	Amount fossil fuel that would be consumed in the baseline scenario
Source of data:	Calculated based on the amount of steam generated by boilers of *Dori's* units and an Efficiency Factor determined by historical data.
Description of measurement methods and procedures to be applied:	The amount of fossil fuel that would be consumed was calculated through the amount of steam generated, which is measured monthly by the project proponent, and an Efficiency Factor. The Efficiency Factor was determined through historical steam generation data and fossil fuel consumption registries according to the baseline scenario.
Frequency of monitoring/recording:	Monthly
Value monitored:	

Period	**$Q_{fossilfuel}$ - Amount of fossil fuel that would be consumed in the baseline scenario (tonnes)**	
	Marília (Natural Gas)	**Rolandia (Shale Oil)**
April	343	116
May	363	121
June	331	89
July	222	114
August	328	100
September	247	100

	October	323	103
	November	325	122
	December	292	98
	2016*	2,773	963
	January	180	47
	February	265	103
	March	321	87
	April	238	121
	May	301	103
	June	244	82
	July	247	129
	August	276	86
	September	260	109
	October	231	133
	November	232	119
	December	187	60
	2017	2,981	1,181
	January	324	66
	February	260	62
	March	241	88
	April	303	97
	May	305	123
	June	302	82
	2018**	1,734	517
	TOTAL	7,489	2,660

*from April of 2016 to December of 2016.

** from January of 2018 to June of 2018.

Monitoring equipment:	No monitoring equipment was used to determine this parameter.
QA/QC procedures to be applied:	The project developer was responsible for gathering and maintaining in adequate archives all data from steam production (measured by flow meter daily).
Purpose of the data	This parameter determined the amount of fossil fuel that would be consumed in the absence of the project activity.
Calculation method:	The amount of fossil fuel that would be consumed in the baseline scenario was calculated through the equation:

	$Q_{fossilfuel} = Q_{steam}$ (tonnes of steam)* Efficiency Factor (tonnes of fossil fuel/tonne of steam)
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Q_{steam}**
Data unit:	Tonnes
Description:	Amount of steam generated by the boiler
Source of data:	Value measured daily by the project proponent (*Dori Alimentos*).
Description of measurement methods and procedures to be applied:	As described in the VCS PD, the amount of steam generated would be measured monthly by a flow meter installed in the boiler by the project proponent and registered in electronic format (Excel spreadsheets).
Frequency of monitoring/recording:	Monthly
Value monitored:	

Period	**Q_{steam} - Amount of steam generated by the boiler (tonnes)**	
	Marília	**Rolandia**
April	6,041	1,563
May	6,403	1,638
June	5,841	1,199
July	3,908	1,536
August	5,778	1,350
September	4,351	1,353
October	5,690	1,391
November	5,721	1,643
December	5,138	1,320
2016*	48,871	12,994
January	3,167	638
February	4,678	1,392
March	5,655	1,172
April	4,201	1,630
May	5,297	1,397
June	4,302	1,111

	July	4,357	1,747
	August	4,862	1,164
	September	4,579	1,478
	October	4,063	1,791
	November	4,081	1,608
	December	3,301	814
	2017	52,542	15,941
	January	5,710	894
	February	4,579	832
	March	4,249	1,182
	April	5,336	1,303
	May	5,375	1,660
	June	5,316	1,103
	2018**	30,565	6,974
	TOTAL	131,979	35,909
	Total - Project	**167,888**	

*from April of 2016 to December of 2016.

** from January of 2018 to June of 2018.

Monitoring equipment:	Flow meter equipment, installed in the boiler, was used to determine this parameter. A flow meter equipment was installed at *Marília's* unit is specified as SMAR LD301, technology developed by HART®. For Rolândia units the flow meter installed is specified as VLM10 by Spirax Sarco
QA/QC procedures to be applied:	The project developer was responsible for gathering and maintaining in adequate archive all data from steam generation (measured by flow meter daily) and also for controlling the flow meter calibration (according to the INMETRO requirements).
Purpose of the data	This parameter was utilized to calculate the baseline emissions. Through the amount of steam generation is possible to determine the amount of fossil fuel that would be consumed in the baseline scenario.
Calculation method:	Not applied
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Renewable Biomass origin**
Data unit:	Not applicable
Description:	Origin of renewable biomass
Source of data:	Documents proving that the biomass is renewable.
Description of measurement methods and procedures to be applied:	The documentation from renewable biomass providers was provided to prove the renewable origin of the biomass.
Frequency of monitoring/recording:	At each monitored period
Value monitored:	Not directly applied for the calculation. It was considered that all biomass used are renewable.
Monitoring equipment:	No monitoring equipment was used to determine this parameter.
QA/QC procedures to be applied:	The biomasses were considered renewable as they were in accordance with the definition given by the Annex 18, EB 23 of UNFCCC definition.
Purpose of the data	This parameter was utilized to prove the renewable origin of the biomasses utilized in the project.
Calculation method:	Not applicable
Comment:	All the renewable biomasses utilized in the monitoring period were already described in the project design document. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Leakage of non-renewable biomass**
Data unit:	tCO_2e
Description:	Leakage resulted from the implantation of the project activity
Source of data:	Estimated
Description of measurement methods and procedures to be applied:	The leakage considered in this project activity is regarding the the General guidance on leakage in biomass project activities (Annex 28, EB 47)[7],, which are in consistency with the other biomass

[7] UNFCCC. General guidance on leakage in biomass project activities - Version 03. Available at: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved/history/c_leak_biomass/guid_biomass_v03.pdf . Last visited on 04/01/2018.

	alternatives available in the project activity region (forest residues and peanut shells).
Frequency of monitoring/recording:	Annually
Value monitored:	0
Monitoring equipment:	No monitoring equipment was used to determine this parameter.
QA/QC procedures to be applied:	Information about the biomass availability in the region will be monitored to check the occurrence of leakage.
Purpose of the data	This parameter was used to evaluate if there is any source of indirect emission related to non- renewable biomass. If applicable, leakage emissions are used to adjust emission reductions resulting from the project.
Calculation method:	Not applicable.
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**$FC_{i,j,y}$**
Data unit:	Tonnes per year
Description:	Amount of fossil fuel combusted in the project activity
Source of data:	Amount of shale oil and natural gas consumed are monitored by the project proponent
Description of measurement methods and procedures to be applied:	The amount of shale oil and natural gas consumed was measured through the variation observed at SAP system which control the amount required by the responsible for feeding the boiler. Also the total amount of fuel purchased was registered through receipt registries archived in Dori´s units at the SAP system. The measurement is registered in m³ for natural gas at *Marília's* unit, and in liter for shale oil at *Rolândia's* unit.
Frequency of monitoring/recording:	Annually
Value monitored:	

Period	**$FC_{i,j,y}$ - Total of Fossil Fuel consumed (tonnes)**	
	Marília	**Rolandia**
2016*	169	83
2017	282	148

	<table><tr><td>**2018****</td><td>82</td><td>88</td></tr><tr><td>**TOTAL**</td><td>**532**</td><td>**319**</td></tr><tr><td>**Total - Project**</td><td colspan="2">**852**</td></tr></table> *from April of 2016 to December of 2016. ** from January of 2018 to June of 2018.
Monitoring equipment:	No monitoring equipment was used to determine this parameter. This parameter was measured according to SAP registries.
QA/QC procedures to be applied:	The project developer was responsible for gathering and maintaining in adequate archives all documents related to the shale oil and natural gas consumption and purchase.
Purpose of the data	The purpose of this parameter was to estimate the amount of fossil fuel utilized in Dori's units, in order to discount the project emissions of the total emission reduction of the project.
Calculation method:	Not applicable.
Comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

3.3 Monitoring Plan

The monitoring is done with the aim of determining the most approximate quantity of fossil fuel that, in the absence of the project, would be used in the *Dori*'s boilers and consequently the amount of GHG that would be emitted in tonnes of CO_2e. Section 3.2 describes data and parameters monitored, as well as the procedures involved on the monitoring plan.

Dori Alimentos personnel are responsible to monitor the operating conditions at head office and subsidiary unity, including the amount of renewable biomass consumed, amount of steam and heat generated by the boiler and amount of fossil fuel combusted. They are also responsible to store invoices, receipts of sales and other documents related to purchase or acquisition of biomass.

Based on this information, Sustainable Carbon is responsible to assess if the biomasses are from renewable origin, to evaluate if there is a surplus of renewable biomass and to calculate emission reductions, including an assessment of leakage emissions.

Sustainable Carbon assists the Dori' personnel to double check the monitored data on biomass, steam generated by the boiler and fossil fuel combusted. However, no internal auditing was performed on data related to this monitoring period. Non-conformities identified in the double check procedures are clarified between Sustainable Carbon technical team and the monitoring responsible on each unity.

The responsible for the monitoring plan is *Mrs. Márcia S. Cavicchioli* from Dori's head office unity. Sustainable Carbon technical team (including those members described on Section 1.3) was also involved in the project monitoring.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to the methodology applied to this project activity (AMSI-C, version 20), the baseline emissions calculations consider renewable energy technologies that displace technologies using fossil fuels. The calculations for this project activity consider the baseline emissions for heat production:

In this monitoring period that encompasses 27 months, the project generated 278 TJ per year. Converting this number to MWh, it was generated 106,260 MWh per year, which corresponds to the use of 12 MWthermal that is less than the limits of 45 MWthermal for Type I Small Scale project activities.

"For thermal energy produced using fossil fuels and/or grid electricity the baseline emissions are calculated as follows:"

$$BE_{thermal,Co2,y} = \left(\frac{EG_{thermal,y}}{\eta_{BL,thermal}}\right) \times EF_{FF,CO2} \quad \text{Equation (01)}$$

Where:

$BE_{thermal,Co2,y}$	= Baseline emissions from thermal energy displaced by the project activity during the year y (tCO_2)
$EG_{thermal,y}$	= Net quantity of thermal energy supplied by the project activity during the year y (TJ)
$EF_{FF,CO2}$	= CO_2 emission factor of the fossil fuel that would have been used in the baseline plant (tCO_2/TJ)
$\eta_{BL,thermal}$	= Efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

Dori's Rolândia unit facilities do not use to monitor the energy generated by the shale oil consumed. However, it is well known the amount of shale oil consumed as well as the amount of fuel required to generate a tonne of steam. Therefore, this project estimated baseline emissions through the energy generated by the real consumption of fossil fuel and assuming that ηBL is 100%.

As no specific equation is mandatory under the methodology applied to this project activity (AMS.I-C: Thermal energy for the user with or without electricity, version 20) to calculate the net quantity of heat

supplied by the project activity (EGthermal,y) during the year y (in TJ), this parameter was calculated according to the equation 02, which is an equation established by the project proponent based on the amount of fossil fuel consumed by the project (specific data available at the project activity sites) and on the net calorific value of the fossil fuel (default value provided by the IPCC):

$$EG_{thermal,y} = Q_{fossilfuel} \times NCV_{fossilfuel} \qquad \text{Equation (02)}$$

Where:

$Q_{fossilfuel}$ = Amount of fossil fuel (shale oil or natural gas) consumed (tonne)

$NCV_{fossilfuel}$ = Net calorific value of fossil fuel (shale oil or natural gas) (TJ/tonne)

The baseline emission for the current monitoring period are described as follow:

Year	Baseline emissions (tCO_2e)
2016*	10,155
2017	11,324
2018**	6,112
Total	27,591

4.2 Project Emissions

The project emissions are those related to the CO2 emissions from the consumption of fossil fuels shale oil in Rolândia site and Natural Gas in Marília site. The project emissions are calculated according to the third version of the methodological tool "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (EB 96, annex 4).

Both shale oil and natural gas consumption are considered a minor emission source in the project activity, once the small amount of fossil fuel consumption is required only to perform cleaning and maintenance of the steam generation equipment, so it is a sporadic routine.

The project emissions (PEy) are calculated through equation 03:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y} \qquad \text{Equation (03)}$$

Where:

$FC_{i,j,y}$ = quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

$COEF_{i,y}$ = CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)

i = fuel types combusted in process j during the year y

The parameter COEF i,y is calculated as per the following equation, based on net calorific value and CO2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad \text{Equation (04)}$$

Where:

$EF_{CO2,i,y}$ = Weighted average CO2 emission factor of fuel type i in year y (tCO2/TJ)

$NCV_{i,y}$ = Weighted average net calorific value of the fuel type in year y (TJ/ mass or volume unit)

i = fuel types combusted in process j during the year y

The project emission for the current monitoring period are described as follow:

Year	Project emissions (tCO_2e)
2016*	794
2017	1,358
2018**	557
Total	2,709

Emission Reductions

According to the methodology applied the emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (05)}$$

Where:

ER_y = Emission Reductions in year y (tCO2e)

BE_y = Baseline Emissions in year y (tCO2e)

PE_y = Project emissions in year y (tCO2e)

LE_y = Leakage emissions in year y (tCO2e)

The emission reduction for the current monitoring period are described as follow:

Year	Emission reductions (tCO_2e)
2016*	9,361
2017	9,966
2018**	5,555
Total	24,882

4.3 Leakage

The leakage predicted in the baseline and monitoring methodology AMS-I.C - Thermal energy for the user with or without electricity (version 13, EB 38) is not applicable for this project activity as there is no transference of equipment.

The leakage from biomass projects, like the project activity, shall also be estimated according to the "General guidance on leakage in biomass project activities (Annex 28, EB 47)[8]" of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on type of biomass being considered. Table below identifies the sources of leakage applicable to each type of biomass.

Table 01. Sources of leakage according to the type of the biomass used

[8] UNFCCC. General guidance on leakage in biomass project activities - Version 03. Available at: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved/history/c_leak_biomass/guid_biomass_v03.pdf. Last visited on 04/01/2018.

Biomass Type	Activity/ Source	Shift of pre project activities	Emissions from biomass generation/ cultivation	Competing use of biomass
Biomass from forests	Existing forests	-	-	X
	New forests	X	X	-
Biomass from croplands or grasslands (woody or non-woody)	In the absence of the project the land would be used as a cropland/wetland	X	X	-
	In the absence of the project the land will be abandoned	-	X	-
Biomass residues or waste	Biomass residues or wastes are collected and used.	-	-	X

Observing table above, the source of leakage of the present project is showed below according to each type of biomass applied to the *Dori*'s units.

Forest Residues (Sawdust/wood chips)

Forest Residues are used for steam generation in both production units of the project activity. The production of wood generates a large amount of residues, which can be reused to generate thermal energy. As can be observed in the figure 2, the potential of energy generation in the states of *São Paulo* and *Paraná* are extremely high, which means there is an enormous availability of this kind of fuel to be employed in the production units (*Rolândia - Paraná* and *Marília - São Paulo*).

During the current monitoring period, the average amount of wood chips consumed yearly by the project activity was 62,902m³. This value represented less than 1% of the total of woody residues produced in the region. Therefore, the project activity did not disturb in any aspects this renewable fuel market once there is plenty of this kind of biomass available.

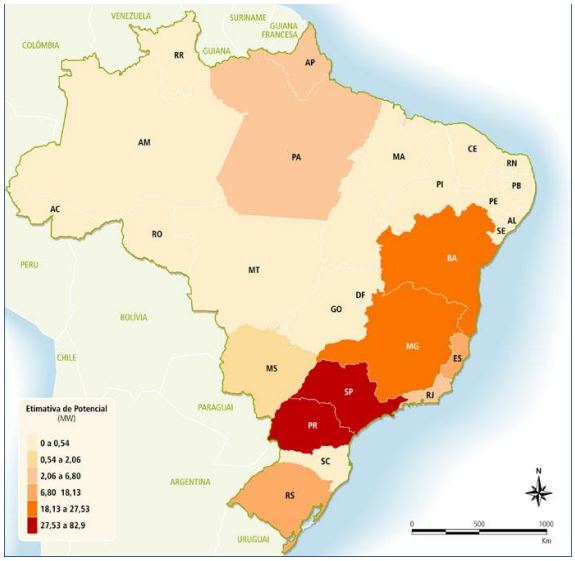

Figure 2. Forest Residues Potential for Energy Generation[9].

Table 02. Production of wood residues in the States of *São Paulo* and *Paraná.*

	São Paulo	Paraná
Production of wood log - 2007 (m^3)	*25,966,464*[10]	*23,759,668*[11]
Amount of wood chips produced per m3 of wood log (%)[12]	65	
Total residues generated (m^3)	26,627	22,069
Average amount of wood chips consumed by the project activities (m^3/ year)	62,902	

Peanut Shell

[9] Source: *CENTRO NACIONAL DE REFERÊNCIA EM BIOMASSA - CENBIO. Panorama do potencial de biomassa no Brasil. Brasília*; Dupligráfica, 2003. 80p. – Map available at: <http://www.aneel.gov.br/aplicacoes/Atlas/biomassa/5_2.htm>. Last visited on 04/01/2018.

[10] According to IBGE (Geographic and Statistic Brazilian Institute) Available at: http://www.sidra.ibge.gov.br/bda/silvi/default.asp?t=2&z=t&o=29&u1=1&u3=1&u4=1&u2=31. Last visited on 04/01/2018.

[11] According to IBGE (Geographic and Statistic Brazilian Institute) Available at: http://www.sidra.ibge.gov.br/bda/silvi/default.asp?t=2&z=t&o=29&u1=1&u3=1&u4=1&u2=32. Last visited on 04/01/2018.

[12] According to Brand (et. al 1999), 65% of all forestry produced yearly becomes waste biomass - BRAND, M.A; MUNIZ, G.I.B.; SILVA, D.A.; KLOCK. U. Caracterização do rendimento e quantificação dos resíduos gerados em serrarias através do balanço de materiais. Revista Floresta 32(2) 247-259. Paraná, 2001 (Characterization of the income and measurement of the waste generated in sawmills through the material balance. "Floresta" Magazine 32(2).

Peanut Shell is used in Dori's *Marília* unit. The state of *São Paulo* is the biggest producer of peanut of Brazil. Table 03 shows the total amount of peanut produced between the years 2005 and 2007 in the state of *São Paulo* and Brazil. According to CENBIO the shell represents 30 % of peanut's weight[13].

Table 03. Peanut Production in the state of *São Paulo*

Peanut production in *São Paulo* State		
Harvest	2005/2006	2006/2007
Peanut production (in thousand of tonnes)[14]	207.8	188.3
Peanut shells (in thousand of tonnes)	62.34	56.49
Average amount of peanut shells consumed by the project activities (Thousand tonnes/year)	1.79	

As the peanut shells used in Dori Alimentos head office are a residue of the peanut production process, they are classified as a "biomass residue or waste". The average consumption of peanut shells by the project activity, during the current monitoring period, was 15,324 m³ per year or 1,793 tonnes, considering the specific gravity of peanut shell is 0.117 tonne/m³ (described on section 3.1). This value represented around 3% of the total of peanut shells produced in São Paulo State. Therefore, the project activity did not disturb in any aspects this renewable fuel market once there is plenty of this kind of biomass available.

If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

The leakage is not applicable for this project activity as there was no transference of equipment, in spite of new equipment had to be acquired.

Due to all the explanations described above, the present project activity does not encompass any type of leakage.

[13] According to CENBIO (Nacional Biomass Reference Center) last visited on 04/01/2018 http://www.iee.usp.br/sites/default/files/biblioteca/producao/2009/Livros/coelhoatlasbioenergia.pdf >. Last visited on 04/01/2018

[14] According to MAPA (Brazilian Ministry of Agriculture, Livestock and Supplies) last visited on 04/01/2018.

4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2016*	10,155	794	0	9,361
2017	11,324	1,358	0	9,966
2018**	6,112	557	0	5,555
Total	27,591	2,709	0	24,882

*from April of 2016 to December of 2016.

** from January of 2018 to June of 2018.