DORI ALIMENTOS LTDA - BIOMASS BASED PROJECT - BRAZIL

Document Prepared By Sustainable Carbon - Projetos Ambientais Ltda

Project Title	*Dori Alimentos LTDA - Biomass based project - Brazil*
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1. PROJECT DETAILS

1.1 Summary Description of the Project

The project activity is a bundled project of two unities of Dori Alimentos LTDA and consists in promoting the fuel switch in Dori's boilers. Dori Alimentos LTDA is a candy industry that was created in 1967 as an individual company called Doraci dos Santos Spila, but only came out of the ground in around the decade of 1990, already with the currently name and the new owners, the Barion family, with the acquisition of one of the most traditional candy factory in the State of Paraná, the "Ouro Verde", situated in Rolândia – PR and the creation of commercial subsidiary companies in Osasco – SP and Porto Alegre – RS. Nowadays, the Dori Alimentos LTDA has two production unities, the company's head office is situated in the city of Marília – SP and the subsidiary production plant is located in the city of Rolândia – PR.

At the present time, Dori manufactures all kinds of candies, chocolates and peanuts in different flavours, to meet domestic and international demand. The company exports its products to 70 different countries

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

The project activity use, in the head office both biomass (wood chips and peanut shells), and in the second office, is consumed just wood chips. In both offices is consumed shale oil to the boiler maintenance. Since 2013 Dori´s head office replaced shale oil for natural gas for the boiler maintenance. Dori´s head office started the fuel switch in March, 2005 while the second office started in December, 2004.

The project activity takes into account GHG emission reductions due to the replacement of shale oil to generate heat with biomass residues with carbon-neutral cycle. In the absence of the project, the average amount of natural gas that would be utilized in Dori's head office would be around 3,036.58 tonnes/year, which was replaced by renewable biomass to generate an average of 53,516.57 tonnes/year of steam in the boilers. In Dori's subsidiary company, the amount average of shale oil that would be utilized is around 1,513.08 tonnes/year, which was replaced by renewable biomass to generate an average of 20,426.57 tonnes/year of steam in the boilers.

The implementation of this project activity in Dori Alimentos has as objective stop using the shale oil and completely substitutes it by renewable biomasses to feed the boilers and generate steam

to sustain the production, with the intention of minimizing environmental impacts related to its consumption including the reduction of greenhouse gases (GHG) emissions.

This reduction was only feasible when considering the benefits from the commercialization of the carbon credits, since it was unattractive due to high investments on the adaptation of machineries to the new biomass and other barriers.

Different from the identified baseline scenario, Dori Alimentos will generate steam minimizing the damages caused by the use of fossil fuels and helping to preserve its reserves with the implementation of this project activity. The switching of fossil fuel to renewable biomasses is expected to reduce an average of 11,377 tCO_2e per year during the second crediting period of the Project. The second crediting period started on 01-April-2016 and will end on 31-March-2026.

Then, emissions reductions are expected to reduce **113,772 tCO_2e** in total during this crediting period.

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	- Head Office *Av. República, 5.159/85 - Distrito industrial Santo Barion - CEP 17512-035 Marília, SP, Brazil;* - Subsidiary *Av. Itamaraty, 1324 - pq. Industrial – CEP 86600-000 Rolândia, PR, Brazil.*
Telephone	+55 (43) 2101 – 8509
Email	marcia.oliveira@dori.com.br silvia.pinas@dori.com.br

Organization name	Sustainable Carbon – Projetos Ambientais Ltda.
Role in the project	Project developer, Project participant and Project proponent.
Contact person	Fernanda Alves de Almeida Fernanda Sayuri Suzuki Guilherme Lucas Medeiros Prado Luana Ribeiro Alves Lívia Demier Mauri Marcelo Hector Sabbagh Haddad
Title	Fernanda Alves de Almeida: Technical analyst Fernanda Sayuri Suzuki:Technical analyst Guilherme Lucas Medeiros Prado: Technical analyst Luana Ribeiro Alves: Technical analyst Lívia Demier Mauri: Technical analyst Marcelo Hector Sabbagh Haddad: Technical coordinator
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Telephone	+55 11 2649 0036

Email	fernanda.almeida@sustainablecarbon.com marcelo@sustainablecarbon.com

1.4 Other Entities Involved in the Project

No other entity was involved in the project activity.

1.5 Project Start Date

The substitution of shale oil by renewable biomass lead to a boiler change and in Dori's head office it started in March 2005 while in Dori's subsidiary company in December of 2004. Then, project start date was defined as 01/03/2005 for Marília´s office and as 01/12/2004 for Rolândia´s office. The project start date of the project was defined as 01/12/2004, the date corresponding to the first substitution of shale oil by renewable biomass.

1.6 Project Crediting Period

The first crediting period for this project started on 01-Apr-2006 and ended on 31-Mar-2016. The second crediting period starts on 01-April-2016 and ends on 31-March-2026.

VCS project crediting period: 10 years, two times renewable.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
From April to December 2016	8,533
2017	11,377
2018	11,377

2019	11,377
2020	11,377
2021	11,377
2022	11,377
2023	11,377
2024	11,377
2025	11,377
From January to March 2026	2,844
Total estimated ERs	113,772
Total number of crediting years	10
Average annual ERs	11,377

1.8 Description of the Project Activity

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.

There are several decisions to be made when producing steam for industrial applications at different steam loads, operating 24 hours a day during all year. There are four primary classes of biomass power systems: direct- fired, co-fired, gasification, and modular systems. Most of today's biomass power plants consist of direct-fired systems that are similar to most fossil-fuel fired power/steam plants.

The project activity technology implemented in both unities foresees a direct combustion technology. The direct combustion technology is based on the direct oxidation of biomass with excess air, producing hot flow gases that in turn produce steam in the heat exchanger.

The boiler is a steam generating equipment, it is a thermal instrument that have the purpose of transforming water into water vapor, using the burning of any type of fuel. It´s used in industrial process companies that need high temperatures, in chemical and petrochemical industries and other industrial segments[1]. The biomass boilers are model Allborg FAN12, the shale oil boiler is model ATA M3P10 and natural gas is model ATA AWN10. 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.
During the candies manufacturing process, the steam is used in several different stages of the production process, for example, during the production providing heat or increasing the humidity of some candies' ingredients.

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.

The fuel switch was made 10 years ago, and the adaptation was made successfully. For this reason, the project activity was implemented. Initially, in both unities, the substitution of shale oil by renewable biomass lead to a boiler change and in Dori's head office it started in March 2005 while in Dori's subsidiary company in December of 2004. In addition, the Dori´s head office

[1] According to <http://www.rwengenharia.eng.br/como-funciona-uma-caldeira/> Last visit in January, 2018

implemented the use of natural gas to substitute the shale oil, resulting in lower GHG project emissions.

1.9 Project Location

The project activity is located in Marília, state of São Paulo, and Rolândia, State of Paraná, which are indicated in Figure 1. The project site has the following geographic location and postal address:

- Head Office
  Av. República, 5.159/85 - Distrito industrial Santo Barion - CEP 17512-035 Marília, SP, Brazil;
- Subsidiary
  Av. Itamaraty, 1324 - pq. Industrial – CEP 86600-000 Rolândia, PR, Brazil.

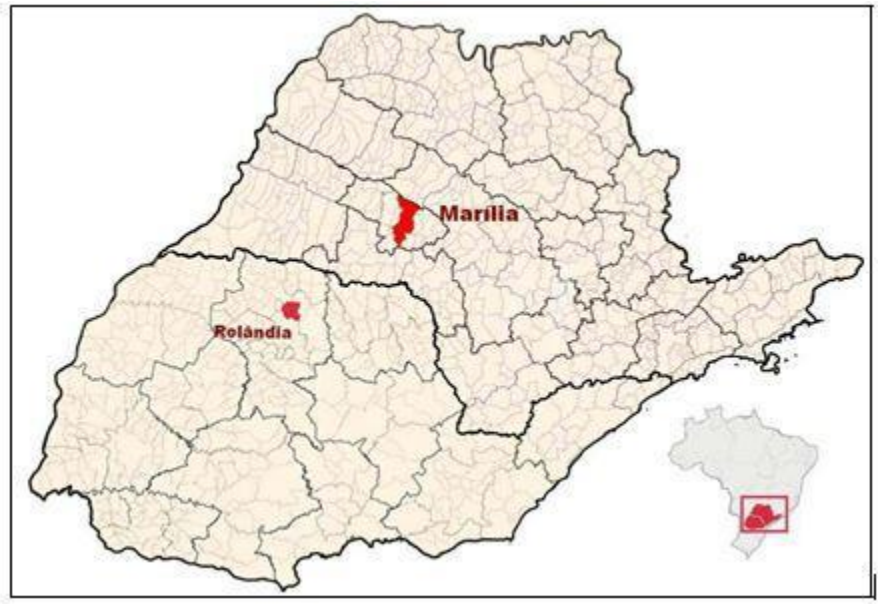

Figure 1. Geographic location of the city of the project activity that has the following coordinates: *Marília*: 22° 12′ 50″ S, 49° 56′ 45″ W *Rolândia*: 23° 18′ 36″ S, 51° 22′ 8″ W

1.10 Conditions Prior to Project Initiation

The oil supply was stable and the Company had a reliable logistic program which did not present high risks. Shale oil was employed as fuel in Dori's boilers for many years.

The project activity aims at the use of wood chips and peanut shells as renewable biomass for energy supply. Since these biomasses would otherwise be disposed in open dumps, the project

activity also reduces adverse environmental effects, of local and global order, because the methane emissions originating from the natural decay of these biomasses in on-site places are avoided. In spite of the fact that these emission reductions really occur, they will not be considered in this project.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

This project is licensed to operate in accordance to the following laws:

- Resolução nº 065/08 - CEMA - Conselho Estadual de Meio Ambiente
- Resolução CONAMA Nº 006/86
- Resolução CONAMA nº 237/97
- Resolução nº 065/08 CEMA - Conselho Estadual do Meio Ambiente (Paraná)
- Decreto Estadual nº 857/79 - Paraná
- Resolução CONAMA nº 001/90 (níveis de pressão sonora)
- Lei Federal nº 9605/98, regulamentada pelo Decreto nº 6514/2008
- Resolução SEMA nº 054/06
- Resolução CEMA nº 070/09
- Resolução SEMA nº 016/14 - Caldeira - monitoramento de emissões atmosféricas
- Resolução SEMA nº 054/2006 - Paraná - material particulado caldeira

1.12 Ownership and Other Programs

1.12.1 Project Ownership

Dori Alimentos Ltda is the owner of the operation that characterizes the activity of this project, as evidenced by its operating licenses.

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable.

1.12.3 Other Forms of Environmental Credit

This project is not creating any other form of environmental credit under any specific program.

1.12.4 Participation under Other GHG Programs

This project has not been registered under any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

This project was not rejected under any formal GHG reduction or removal program. The project report was produced to make the project public and available to voluntary measures or other opportunities of the carbon market.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

Not applicable. This is not a grouped project.

Leakage Management

Not applicable since that leakage is estimated as zero tCO_2e (see section 3.3).

Commercially Sensitive Information

None of the information exposed to the Validation and Verification Body was withheld from the public version of the report.

Sustainable Development

The project activity contributes to the level reduction of greenhouse gases (GHG) emissions by avoiding the incentive of non-renewable fuels utilization. In addition, the project activity will contribute to the 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 additional 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 fossil fuels.

Further Information

The project is eligible according to:

- Legislative: the project attends all legal requirements;
- Technical: alterations/adaptations required are technically feasible;
- Economic: carbon credits will make the project feasible;
- Sectoral: incentive of good practices to the sector;
- Environmental: the project attends all legal requirements and no environmental impacts are predicted;
- Geographic /site specific: the plant can be uniquely geographically identified with no barriers regarding logistic;
- Temporal information: the project will not double count the GHG emissions during the ten years renewable crediting period.

2. APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

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

AMS-I.C Small-scale Methodology: Thermal energy production with or without electricity Version 20.0, valid from 01-June-2014 onwards[2], Sectoral scope(s): 01. This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user.

2.2 Applicability of Methodology

The methodology chosen for this project activity is the baseline and monitoring small scale methodology AMS-I.C.: Thermal energy for the user with or without electricity – Version 20.0.

This methodology comprises renewable energy technologies that supply users i.e. residential, industrial or commercial facilities with thermal energy that displaces fossil fuel use with a thermal generation capacity less than 45 MWth. These units include technologies such as solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.

[2] This version of the methodology is available at: <https://cdm.unfccc.int/methodologies/DB/JSEM51TG3UVKADPA25IPUHXJ85HE8A>. Last visit on: January 08th, 2018.

The project activity uses renewable biomass instead of non-renewable fossil fuel. The biomasses utilized (wood chips and peanut shells) are considered renewable according to option 5 of Annex 18 – Definition of Renewable Biomass (EB 23[3]) definition of renewable biomass: "The biomass is the non-fossil fraction of an industrial or municipal waste".

Both Dori's Units (Head office in Marília and Subsidiary in Rolândia) had their thermal generation through the combustion of renewable biomass, displacing the use of fossil fuel (shale oil). Considering that this project will use only renewable biomass to feed the steam generators and also the proof of the renewable origin of the biomass used in the project activity, the project activity is applicable to the chosen baseline and monitoring methodology, which is described as "renewable energy technologies that supply users i.e. residential, industrial or commercial facilities with thermal energy that displaces fossil fuel use". Furthermore, the project activity will generate less than the limits of 45 MW thermal (MWth) for Type I small scale project activities, which confirms the applicability criteria of this small scale methodology applied.

2.3 Project Boundary

According to the applied methodology, the project boundaries for the project are the physical geographical areas of the use of biomass or the renewable energy, thus, the *Dori's* limits.

In the baseline scenario, there is use of oil to generate the steam at the boilers. This practice is responsible to discharge carbon in the atmosphere.

Source		Gas	Included?	Justification/Explanation
Baseline	Emissions from the combustion of fossil fuel	CO_2	Yes	The major source of emissions in the baseline.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
		Other	No	Not applicable
Project	Emissions from the combustion of renewable biomass	CO_2	Yes	Fossil fuel use under the project scenario Is considered for project emissions. For renewable biomass, project emissions were excluded for

[3] Annex 18 – Definition of Renewable Biomass, from 23rd Executive Board meeting (from 2006 February 22 to 24). Available at: <http://cdm.unfccc.int/EB/Meetings/023/eb23_repan18.pdf>. Last visit on: January 08th, 2018.

	and fossil fuel			simplification once this emission source is assumed to be very small.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
		Other	No	Excluded for simplification. This emission source is assumed to be very small.

The following figure provides a diagram of the Project boundary:

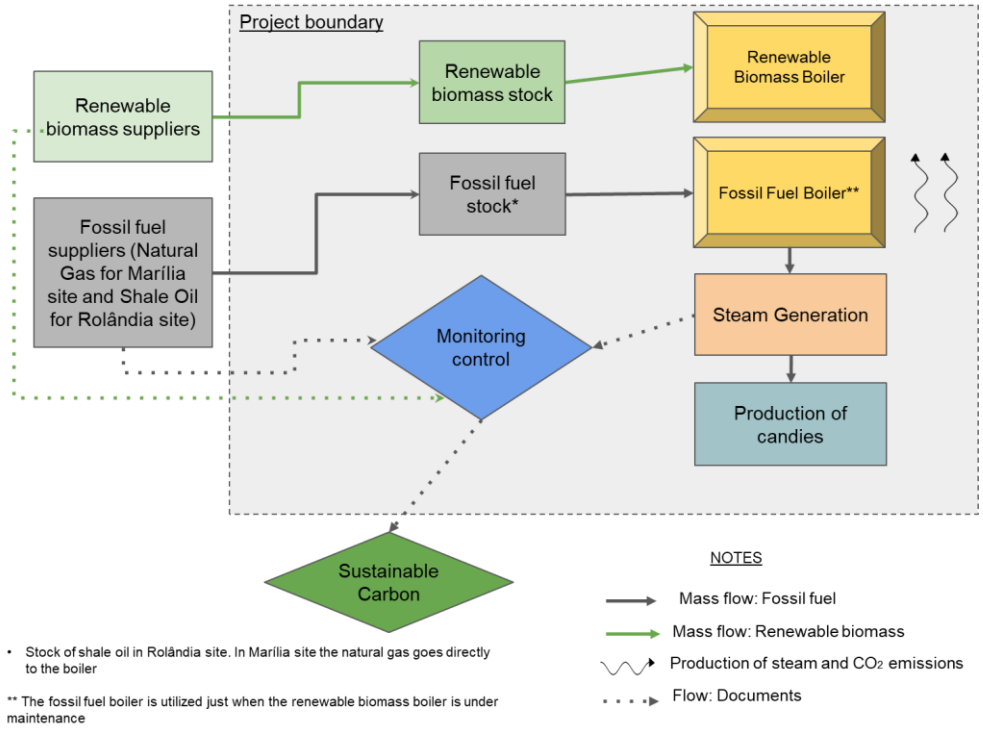

Figure 2. Diagram representing the project boundaries.

2.4 Baseline Scenario

Although the decrease of fossil fuel use in the Brazilian industrial sector in the last years, the utilization of this type of energy remains at considerable values. Fossil fuels are also consolidated among the main energy sources for Brazilian industries in general, as shown in the figure 3

below:

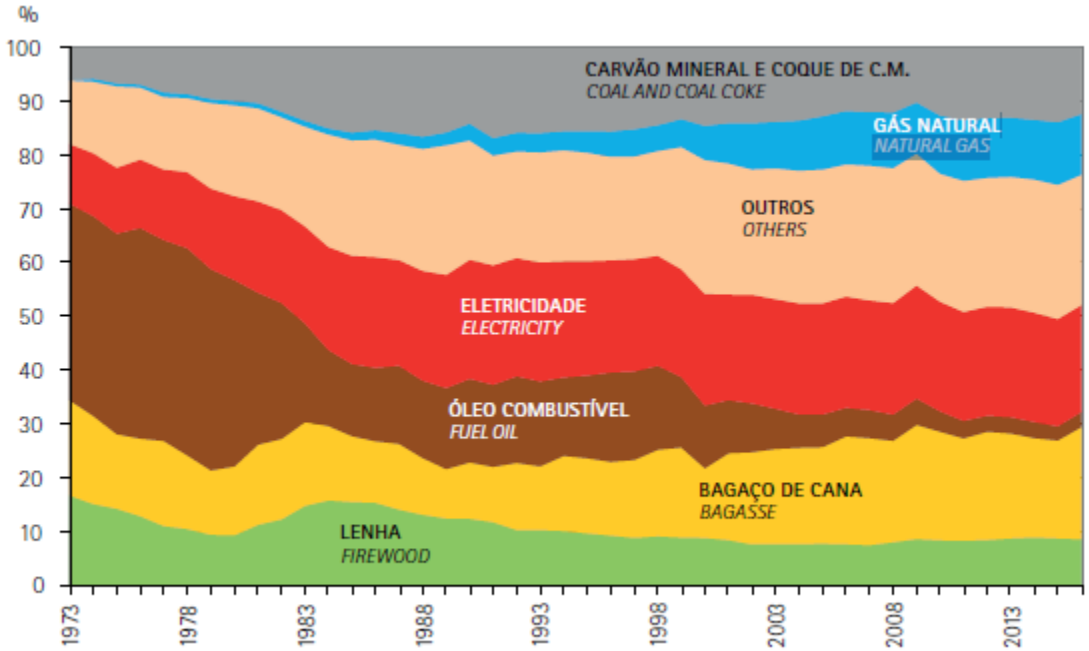

Figure 3: Industrial Sector Energy Consumption[4]

The original baseline scenario for this project activity was defined according to the Methodology AMS-I.C and comprises renewable energy technologies that displace technologies using fossil fuel. Then, the baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced.

This baseline scenario was specified during the project validation and is still valid. However, the availability of a natural gas pipeline in Marilia region 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.

[4] Brazilian Energy Balance, 2017. Available at: <https://ben.epe.gov.br/downloads/Relatorio_Final_BEN_2017.pdf>. Last visited on: 23th January, 2018.

In order to assess the continued validity of the baseline and to update the renewal of the crediting period, the CDM Methodological Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"[5] is applied as follows:

Step 1: Assess the validity of the current baseline for the next crediting period

The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The baseline complies with all relevant mandatory national and/or sectoral policies, since there are no restrictions regarding the use of fossil fuels such as shale oil and natural gas in Brazil.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project was the continuation of the current practice - the substitution of thermal energy production using fossil fuels for renewable biomass. However, in Marília site the type of fossil fuel utilized at project validation (shale oil) was replaced with natural gas, due to the availability of gas pipeline in Marilia region, since the end of 2013. This type of fuel was not available in the region at the time of project initiation and the new gas pipeline brings an opportunity to the Dori's Head Office to change the type of fossil fuel utilized to natural gas, which is less harmful tothe environment when compared with shale oil.

Financially, the switch to natural gas was not an advantage for the company, demonstrating that the replacement was actually carried out due to the environmental gain when compared to the use of shale oil. According to Arruda (2009)[6], the price for generate 1 TJ using shale oil is around R$ 5,000.00, six times cheaper than using natural gas, R$ 30,000.00.

Besides that, the shale oil is still available in the region, as the main shale deposit in Brazil is located in São Mateus do Sul, Parana State, the same State of *Dori's* Subsidiary Company and also relatively close to Dori's Head Office in the state of São Paulo, which corroborates the fact that the switch for natural gas was an opportunity of improvement and not the first alternative for

[5] UNFCCC Methodological Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period". Available at: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf> Last visit on: 15th February, 2018.

[6] 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.

the company. Also, the shale oil provider of *Dori* informed in an interview conducted in 2018 that during the last ten years, the shale oil consumption in the region remained constant, as well as the number of clients, mainly from industries, hospitals and asphalt plant. The provider also informed that the region they usually work comprises the states of Paraná, São Paulo, Mato Grosso and Mato Grosso do Sul and the perspective for the next years is the increasing of the shale oil market.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for which renewal is requested

Not applicable. The baseline scenario of the project activity is the continuation of use of the current equipment(s) without any investment and the project proponent will not undertake any investment later. In December 2013, the project proponent carried out an investment in the back up boiler at Marília site in order to adapt the boiler for natural gas use instead of shale oil. It is important to mention that this boiler is utilized just when the biomass boiler is under maintenance.

Step 1.4: Assessment of the validity of the data and parameters

Data and parameters determined at the start of the crediting period and not monitored during the crediting period are still valid for Rolândia site. For Marília site the data and parameters related to shale oil need to be updated for values regarding natural gas, which is the new fossil fuel utilized in the site.

Emission factors and other fixed values were determined at validation time, since these parameters were based on the historical situation at the site of the project activity prior to the implementation of the project and could not be updated because the historical situation does not exist anymore as a result of the project activity.

Step 2: Update the current baseline

The current baseline calculations need to be updated due to the replacement of the type of fossil fuel used in Marília site. For Rolândia site, all data and parameters remain the same.

Step 2.1: Update the current baseline

Considering the baseline scenario based on the applicable methodology and approved at the project validation, the current baseline emissions need to be updated without reassessing the baseline scenario. Due to the availability natural gas pipeline in the region, and consequent substitution of shale oil with natural gas, the current baseline scenario in Marília site will consider

the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the natural gas displaced.

Step 2.2: Update the data and parameters

The data and parameters EFnaturalgas, NCVnaturalgas, ρnaturalgas, COEF and efficiency factor were updated in the section 4.1 Data and Parameters Available at Validation.

In brief, the identified baseline for this project activity in Dori Alimentos head office was the average generation of 53,516.57 tonnes of steam per year and employment of 3,036.58 tonnes of natural gas per year. This baseline estimate is an average value of the period from December 2013 to March 2016(since the beginning of the natural gas uses in Marília site).

The other unity of Dori Alimentos would utilize an average of 1,513.08 tonnes of shale oil to sustain its generation of 20,427 tonnes of steam per year. These numbers are an estimated average in the absence of the project activity and are shown on table 2 below This baseline estimate is an average based on historical data on the scenario prior to the project initiation.

Table 1. Baseline information

	Dori's Head Office (Natural Gas)	Dori's Subsidiary (Shale Oil)
Average generation of steam (tonnes per year)	53,516.57	20,427
Average fossil fuel consumption in the baseline (tonnes per year)	3,036.58	1,513.08

The calculation regarding the quantity of fossil fuell required in the burning process was done according to the efficiency of the boiler, which is 0.056741 tonnes of natural gas to generate 1 tonne of steam I n Dori's Head Office in Marília and 0.074074 tonnes of shale oil to generate 1 tonne of steam in Dori's Subsidiary Company in Rolândia. The efficiency factor is provided by the project developer and it is based on the historical situation of the project activity prior to the implementation of the project. This value represents the direct relation between the fossil fuel consumption and the steam generated.

Regarding the renewable biomasses, currently, Dori utilizes wood chips and peanut shells as renewable biomasses and the boilers are able to be fed also with other renewable biomasses like sugar cane bagasse, elephant grass etc.

2.5 Additionality

The methodology applied is Category AMS-I.C: Thermal energy for the user with or without electricity – Version 20 which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

In The beginning of the project, both Dori's Head Office and Subsidiary Company utilized shale oil to generate steam. With the implementation of the project, the use of shale oil was displaced by renewable biomasses. However, a small amount of shale oil continued to be used in the boilers for maintenance purposes. During the first crediting period, this fossil fuel was replaced by natural gas in the Marília site. This substitution was carried out 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. It is important to mention that the replacement from shale oil with natural gas was not an obligation, but an improvement opportunity for the company.

Project additionality is explained according to the Voluntary Carbon Standard, v3.7[7]. The section 3.8.5 of the VCS Standard does not require a full reassessment of additionality at a project crediting period renewal. However, the Regulatory Surplus shall be demonstrated, as follows.

In addition, during the validation process carried out in the first crediting period, the additionality analysis was performed according to the Project Method predicted in the applied methodology, considering the steps regulatory surplus, implementation barriers and common practice. To demonstrate that the project was not a common practice in the region, the guidance provided in the GHG Protocol for Project Accounting[8], Chapter 7 was utilized.

As explained in the section 2.4, financially, the switch to natural gas was not an advantage for the company, as the natural gas is more expensive than the shale oil, which would clearly not change the condition that the project is additional.

[7] VCS Standard. Requirements Document, v3.7. Available at: < http://verra.org/wp-content/uploads/2018/03/VCS_Standard_v3.7.pdf>. Last visit on: 28th May, 2018.

[8] The GHG Protocol for Project Accounting. Available at: <https://ghgprotocol.org/sites/default/files/standards/ghg_project_accounting.pdf>. Last visit on: 28th May, 2018.

Step 1: Regulatory Surplus

The project is not mandated by any enforced law, statute or other regulatory framework in Federal, State and Municipal levels in the survey performed.

The consumption of fossil fuel by the industrial sector remains at considerable values, as evidenced, for example, in the Brazilian Energy Balance[9].

Legal requirements, as stated by the Constitution of the Federal Republic of Brazil[10] as well as Federal and State Regulations, do not require entrepreneurs, which utilize fossil fuels as an energy source, to switch from non-renewable biomasses to renewable biomasses. Therefore, the project activity is not a legal obligation. Moreover, in accordance with Article 5 of the Constitution of the Federative Republic of Brazil, nobody can be forced to follow a course of action if it is not addressed by law.

2.6 Methodology Deviations

Not applicable. No methodology deviations were applied at the time of project revalidation.

3. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 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:

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

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

Where:

[9] BRASIL. Ministério de Minas e Energia. Balanço Energético Nacional, ano-base 2016. Available at: < https://ben.epe.gov.br/downloads/Relatorio_Final_BEN_2017.pdf>. Last visito on: 28th May, 2018.

[10] BRASIL. Constituição da República Federativa do Brasil de 1988. Available at: <http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm>. Last visit on: 28th May, 2018.

$BE_{thermal,Co2,y}$	= 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 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 η_{BL} 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 ($EG_{thermal,y}$) 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):

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

Where:

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

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

3.2 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:

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

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

3.3 Leakage

The leakage from biomass projects, like this project activity, should also be estimated according to the “General guidance on leakage in biomass project activities” (attachment C of appendix

B)[11]of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on the type of biomass considered (described in the table 3 below).

Table 2: Sources of leakage according to the type of the biomass used.

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

Wood Chips

The total production of wood in 2016 in São Paulo and Paraná was 56,025,091m³, according to IBGE data[12]. The average of annual consumption of wood chips by the head office in Marília is estimated as around 34,934 m³. The average of annual consumption of wood chips in the second office in Rolândia was around 34,162m³. Considering that approximately 22% is the production of wood chips so it will generate[13] 12,325,520.02m³ of wood residues the total of wood chip, the

[11] Available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf> Last visit in January, 2018

[12] According to https://cidades.ibge.gov.br/brasil/sp/pesquisa/31/29644 Last visit: January, 2018

[13] EMBRAPA, Comunicado Técnico No, Nov/92, p.1-2. Available at: <http://www.cpatsa.embrapa.br/public_eletronica/downloads/COT51.pdf>. Last visit in January, 2018.

project wood chips consumption (69,066m³) represents around 0.56% of the São Paulo and Paraná wood chips production.

Peanut shells

In 2016 the production of peanut was 190,480 tonne in São Paulo and Paraná. Separately São Paulo produced 177,520 tonnes while Paraná produced 12,960 tonnes, according to IBGE data. The annual average consumption of peanut shell by the head office in Marília is 15,871.79 tonnes. The shell of the peanut has a weight of 30% of the total weight of the peanut[14].Then, the consumption of Marília´s office represents 0.27% of the São Paulo and Paraná peanut shell production. Rolândia does not use peanut shells.

The methodology says that the project will have leakage if the process and transportation of biomass residues is outside the project boundary and can not be transported over a distance of 200 kilometres. According to Dori´s biomass information, it is not transported over a distance of 200 kilometres. If the energy generating equipment is transferred from outside of the project boundary also can cause leakage, but the equipment was not transferred.

3.4 Net GHG Emission Reductions and Removals

Emission Reductions

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

$$ER_y = BE_y - PE_y - LE_y$$ 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)

[14] According to Atlas de bioenergia <http://www.moretti.agrarias.ufpr.br/eletrificacao_rural/livro_atlas_de_bioenergia_2008.pdf> Last visit in January, 2018

Voluntary Carbon Units Generated by the Project Activity – Marília site

Year	BEy	PEy	ER
April to December 2016	6,133	431	5,702
2017	8,177	574	7,603
2018	8,177	574	7,603
2019	8,177	574	7,603
2020	8,177	574	7,603
2021	8,177	574	7,603
2022	8,177	574	7,603
2023	8,177	574	7,603
2024	8,177	574	7,603
2025	8,177	574	7,603
January to March 2016	2,044	144	1,901
Total	81,769	5,263	76,026
Average	8,177	526	7,603

Voluntary Carbon Units Generated by the Project Activity – Rolândia site

Year	BEy	PEy	ER
April to December 2016	3,169	338	2,831
2017	4,226	451	3,775
2018	4,226	451	3,775
2019	4,226	451	3,775
2020	4,226	451	3,775
2021	4,226	451	3,775
2022	4,226	451	3,775
2023	4,226	451	3,775
2024	4,226	451	3,775

2025	4,226	451	3,775
January to March 2026	1,056	113	944
Total	42,256	4,511	37,746
Average	4,226	451	3,775

Total Voluntary Carbon Units generated by the Project Activity

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2016	9,302	769	0	8,533
2017	12,402	1,025	0	11,377
2018	12,402	1,025	0	11,377
2019	12,402	1,025	0	11,377
2020	12,402	1,025	0	11,377
2021	12,402	1,025	0	11,377
2022	12,402	1,025	0	11,377
2023	12,402	1,025	0	11,377
2024	12,402	1,025	0	11,377
2025	12,402	1,025	0	11,377
2026	3,101	1,025	0	2,844
Total	**124,025**	**10,253**	**0**	**113,772**

4. MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	**$EF_{shaleoil}$**
Data unit	tCO_2/TJ
Description	CO_2 Emission factor of shale oil
Source of data	Value checked at: -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 18/01/2018.
Value applied	**73.3** for BE calculations as per applied methodology and **79.2** for PE calculations as per "tool to calculate PE for fossil fuel consumption"
Justification of choice of data or description of measurement methods and procedures applied	In the baseline scenario, the fossil fuel that would probably be consumed in the absence of the project activity would be the shale oil. Also, a small amount of shale oil is utilized in the boilers for maintenance in Rolandia site. In Marília site this fossil fuel was replaced by natural gas for maintenance purposes. The CO_2 emissions from the consumption of shale oil and natural gas in the project activity have to be discounted of the emission reductions (project emissions). The upper limit of the uncertainty at a 95% confidence interval was considered in the calculations.
Purpose of Data	This parameter is used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario and also to calculate the project emissions.
Comments	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	**$NCV_{shaleoil}$**
Data unit	TJ/tonne of shale oil
Description	Net Calorific Value of shale oil
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: 18/01/2018.
Value applied	0.0381 for BE calculations conservatively determined by the PP/ remained fixed from the previous Crediting period and 0.0452 for PE calculations as per "tool to calculate PE for fossil fuel consumption"
Justification of choice of data or description of measurement methods and procedures applied	The source of data is the IPCC default for shale oil, as recommended in the applied methodology - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, on Data/parameter table 4, source of data option d, as this information was not provided by the fuel supplier in invoices. The upper limit of the uncertainty at a 95% confidence interval was considered in the calculations.
Purpose of Data	This value is used to calculate baseline and project emissions. The Net Calorific Value will provide the energy generated by the amount of shale oil that would be used in the absence of the project.
Comments	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	**$\rho_{shaleoil}$**

Data unit	tonne/m³
Description	Specific gravity of the shale oil
Source of data	Value provided by the fuel provider through the technical form of the shale oil.
Value applied	0.9700
Justification of choice of data or description of measurement methods and procedures applied	The source of data is measured by project participants, as recommended in the applied methodology - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, on Data/parameter table 4, source of data option b.
Purpose of Data	This parameter is used to calculate project emissions from the use of shale oil, measured in liters. This data is used to convert measured values to tonnes.
Comments	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	**$EF_{naturalgas}$**
Data unit	tCO_2/TJ
Description	CO_2 Emission factor of natural gas
Source of data	Value checked at: -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 18/01/2018.
Value applied	56.1 for BE calculations as per applied methodology and 58.3 for PE calculations as per “tool to calculate PE for fossil fuel consumption”
Justification of choice of	Small amounts of natural gas are utilized in the boilers for

data or description of measurement methods and procedures applied	maintenance purposes. The CO_2 emissions from the consumption of natural gas in the project activity have to be discounted of the emission reductions (project emissions). The upper limit of the uncertainty at a 95% confidence interval was considered in the calculations.
Purpose of Data	This parameter is used to calculate baseline and project emissions.
Comments	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	**$NCV_{naturalgas}$**
Data unit	TJ/tonne of natural gas
Description	Net Calorific Value of natural gas
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: 18/01/2018.
Value applied	0.048 for BE calculations conservatively determined by the PP/ remained fixed from the previous crediting period and 0.0504 for PE calculations as per “tool to calculate PE for fossil fuel consumption“
Justification of choice of data or description of measurement methods and procedures applied	The source of data is the IPCC default for natural gas, as recommended in the applied methodology - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, on Data/parameter table 4, source of data option d. The upper limit of the uncertainty at a 95% confidence interval was considered in the calculations.
Purpose of Data	This parameter is used to calculate baseline and project emissions.

Comments	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	**ρnaturalgas**
Data unit	tonne/m³
Description	Specific gravity of the natural gas
Source of data	Available at: <https://www.comgas.com.br/para-industria/caracteristicas-do-gas-natural/>. Last visited on: 18/01/2018.
Value applied	0.000766
Justification of choice of data or description of measurement methods and procedures applied	The data source of data is from regional default values, as recommended in the applied methodology - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, on Data/parameter table 4, source of data option c.
Purpose of Data	This parameter is used to calculate project emissions from the use of natural gas. This data is used to convert measured values to tonnes.
Comments	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	**ρrenbiomass**
Data unit	tonne/m³
Description	Specific gravity of renewable biomasses
Source of data	Value measured and recorded by the project proponent

Value applied	<table><tr><th>Biomasses</th><th>Specific Gravity (tonne/m³)</th></tr><tr><td>Wood Chips</td><td>0.350</td></tr><tr><td>Peanut Shells</td><td>0.117</td></tr></table>
Justification of choice of data or description of measurement methods and procedures applied	The source of data is measured by project participants, as recommended in the applied methodology - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, on Data/parameter table 4, source of data option b, as this information was not provided by the fuel supplier in invoices.
Purpose of Data	This parameter is used to calculate leakage emissions. 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.
Comments	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	The efficiency factor is provided by the project developer and it is based on the historical situation of the project activity prior to the implementation of the project. This value represents the direct

	relation between the fossil fuel consumption and the steam generated[15].
Value applied	<table><tr><th>Efficiency factor of Shale Oil Boiler (ton shale oil consumed / ton of steam generated)</th><th>Efficiency factor of Natural Gas Boiler (ton natural gas consumed / ton of steam generated))</th></tr><tr><td>0.074074</td><td>0.056741</td></tr></table>
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*. For the shale oil boiler, the average amount of steam generated is 13.5 kilogram for each kilogram of shale oil consumed. Thus, the efficiency of the boiler is 0.074074 tonne of shale oil per tonne of steam generated. For the natural gas boiler, the average consumption is13.5 kg for each m^3 of natural gas consumed. Then, the efficiency of the boiler corresponds to 0.05674 tonne of natural gas per tonne of steam generated.
Purpose of Data	This value is required to calculate to calculate Baseline Emissions, to obtain the amount of fossil fuel generated by the amount of steam calculated with the steam flow meter.
Comments	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 fossil fuel

[15] According to: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>. Last visited in: 22/01/2018.

Source of data	Value calculated through the parameters $NCV_{fossilfuel}$ and $EF_{fossilfuell}$, as follows: Shale oil: $COEF_{i,y} = NCV_{shaleoil} * EF_{shaleoil} = 0.0381(TJ/tonne) * 73.3 (tCO_2e/TJ) = 2.79273 (tCO_2e/tonne)$ Natural Gas: $COEF_{i,y} = NCV_{naturalgas} * EF_{naturalgas} = 0.048(TJ/tonne) * 56.1 (tCO_2e/TJ) = 2.6928 (tCO_2e/tonne)$
Value applied	$COEF_{shaleoil}$ (tCO_2e/ tonne): 3.57984 $COEF_{naturalgas}$ (tCO_2e/ tonne): 293832
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 Data	This parameter is utilized to calculate the project emissions (CO_2 emissions from the consumption of shale oil and natural gas in the project activity).
Comments	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	$\eta_{BL,thermal}$
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 do not 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 one tonne of steam. Therefore, this project will 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 Data	The purpose of this parameter is to determine the efficiency of the plant, to calculate Baseline Emissions.
Comments	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.

4.2 Data and Parameters Monitored

Data / Parameter	$Q_{renbiomass}$
Data unit	Tonne
Description	Amount of renewable biomass (per year)
Source of data	Values measured by the project proponent
Description of measurement methods and procedures to be applied	The amount of renewable biomass will 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 biomass weighing will be done with a government approved scale for truck weighing to commercial standards. One truck of each biomass provider will be weighed once a month. In addition to the weighing registries, the amount of biomass will also be monitored through biomass invoices/receipts in order to double

<table>
<tr><td></td><td>check the monitoring data. In case of divergence, the lower value will be employed.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Monthly</td></tr>
<tr><td>Value applied</td><td>
<table>
<tr><th></th><th>Head Office (Marília)</th><th>Subsidiary Company (Rolândia)</th></tr>
<tr><td>Wood chips (tonnes/year)*</td><td>12,216</td><td>11,957</td></tr>
<tr><td>Peanut shells (tonnes/year)*</td><td>1,857</td><td>0</td></tr>
<tr><td>Total Biomass (tonnes/year)*</td><td>14,073</td><td>11,957</td></tr>
</table>
*Values of annual average, based on data from last crediting period (from December 2013 to March 2016)
</td></tr>
<tr><td>Monitoring equipment</td><td>*Dori's* units have a weight machine responsible for measurement of biomass purchased. The amount of renewable biomasses will be monitored in accordance to *Dori's* internal control spreadsheet. Data regarding renewable biomass will be organized monthly.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The weighing-machine must be calibrated periodically according to the INMETRO[16] procedures and parameters, in order to guarantee the quality and precision of the amount of biomass weighted.</td></tr>
<tr><td>Purpose of data</td><td>This parameter will be 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);</td></tr>
</table>

[16] 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.

	c. Calculation of leakage emissions due to competing use of biomass.
Calculation method	Not Applicable
Comments	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	Values measured and supplied by the project proponent.
Description of measurement methods and procedures to be applied	The amount of steam generated (Q_{steam} - tonnes) is measured by the project developer (Dori Alimentos) and converted in TJ through the Net Calorific Value.
Frequency of monitoring/recording	Monthly
Value applied	

	Head Office (Marília)	Subsidiary Company (Rolândia)
Amount of heat supplied (Annual Average*)	145.76	57.65

*Based on data from last crediting period (from December 2013 to March 2016)

Monitoring equipment	No monitoring equipment is required to determine this parameter.
QA/QC procedures to be applied	Not Applied.
Purpose of data	This data is utilized to determine the amount of heat supplied in the baseline calculations.
Calculation method	The amount of heat supplied is calculated through the equation: $EG_{thermal,y}$ (TJ) = $Q_{fossilfuel}$ (tonnes) * $NCV_{fossilfuel}$ (TJ/tonne)
Comments	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	$Q_{shaleoil}$
Data unit	Tonne
Description	Amount of shale oil that would be consumed in the baseline scenario
Source of data	Calculated based on the amount of steam generated by boiler of Dori's Rolandia unit and an Efficiency Factor determined by historical data.
Description of measurement methods and procedures to be applied	The amount of shale oil that would be consumed should be 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 shale oil consumption registries according to the baseline scenario.
Frequency of monitoring/recording	Monthly

Value applied	<table><tr><th></th><th>Subsidiary Company (Rolândia)</th></tr><tr><td>Amount of shale oil that would be consumed (Annual Average*)</td><td>1,513.08</td></tr></table> *Based on data from last crediting period (from December 2013 to March 2016)
Monitoring equipment	No monitoring equipment is required to determine this parameter.
QA/QC procedures to be applied	The project developer is responsible for gathering and maintaining in adequate archives all data from steam production (measured by flow meter daily).
Purpose of data	This parameter aims to determine the amount of shale oil that would be consumed in the absence of the project activity, in the baseline calculations.
Calculation method	The amount of shale oil that would be consumed in the baseline scenario was calculated through the equation: $Q_{shaleoil} = Q_{steam}$ (tonnes of steam)* Efficiency Factor (tonnes of shale oil/tonne of steam)
Comments	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	$\mathbf{Q_{naturalgas}}$
Data unit	Tonne
Description	Amount of natural gas that would be consumed in the baseline scenario

<table>
<tr><td>Source of data</td><td>Calculated based on the amount of steam generated by boiler of Dori's head office and an Efficiency Factor determined by historical data.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>The amount of natural gas that would be consumed should be 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 natural gas consumption registries according to the baseline scenario.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Monthly</td></tr>
<tr><td>Value applied</td><td><table><tr><td></td><td>Head Office (Marília)</td></tr><tr><td>Amount of natural gas that would be consumed (Annual Average*)</td><td>3,036.58</td></tr></table>
*Based on data from last crediting period (from December 2013 to March 2016)</td></tr>
<tr><td>Monitoring equipment</td><td>No monitoring equipment is required to determine this parameter.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The project developer is responsible for gathering and maintaining in adequate archives all data from steam production (measured by flow meter daily).</td></tr>
<tr><td>Purpose of data</td><td>This parameter aims to determine the amount of natural gas that would be consumed in the absence of the project activity, in the baseline calculations.</td></tr>
<tr><td>Calculation method</td><td>The amount of natural gas that would be consumed in the baseline scenario was calculated through the equation:
$Q_{naturalgas} = Q_{steam}$ (tonnes of steam)* Efficiency Factor (tonnes of</td></tr>
</table>

	natural gas/tonne of steam)
Comments	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	Tonne
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	The amount of steam generated will 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 applied	<table><tr><th></th><th>Head Office (Marília)</th><th>Subsidiary Company (Rolândia)</th><th>Project Activity</th></tr><tr><td>Steam Generation (Annual Average*)</td><td>53,516.57</td><td>20,426.57</td><td>73,943.14</td></tr></table> *Based on data from last crediting period (from December 2013 to March 2016)
Monitoring equipment	A flow meter equipment, installed in the boiler will be used to determine this parameter. Both Marília's and Rolândia's units have this equipment installed.

QA/QC procedures to be applied	The project developer is 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 data	This parameter is utilized to calculate the baseline emissions. Through the amount of steam generation is possible to determine the amount of shale oil that would be consumed in the baseline scenario.
Calculation method	Not applied
Comments	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 will be provided to prove the renewable origin of the biomass.
Frequency of monitoring/recording	Each monitoring period
Value applied	Not directly applied for the calculation. All biomass used is considered renewable.
Monitoring equipment	No monitoring equipment is used to determine this parameter
QA/QC procedures to be	The biomasses will be considered renewable if they are in

applied	accordance with the definition given by the Annex 18, EB 23 of UNFCCC definition.
Purpose of data	The purpose of this parameter is to prove the renewable origin of the biomasses utilized in the project.
Calculation method	Not applicable
Comments	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 due to transportation of Biomass**
Data unit	tCO_2e
Description	Leakage resulting from transportation of biomass
Source of data	Distance of biomass suppliers will be monitored through a registry of all biomass providers containing their addresses.
Description of measurement methods and procedures to be applied	The distance between the provider and *Dori's* units will be monitored through Google Maps, or similar. In case of more than 200 kilometers distance between the source and the company, leakage estimates must be calculated.
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	No monitoring equipment was used to determine this parameter
QA/QC procedures to be applied	Information about the location biomass suppliers will be monitored to check the occurrence of leakage.

Purpose of data	Calculation of leakage emissions. This parameter is used to evaluate if there is any source of indirect emission, specifically, the leakage considered in this project activity is regarding the applied methodology, version 20, which specifies that in cases where collection, processing and transportation of biomass residues is outside the project boundaries and due to the project activity, biomass residues transported over a distance of 200 kilometers CO_2 emissions shall be taken into account as leakage.
Calculation method	The distance between the provider and *Dori's* units will be monitored through Google Maps, or similar.
Comments	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 will be measured through the variation observed at SAP system which controls the amount required by the responsible for feeding the boiler. Also the total amount of fuel purchased will be registered through receipt registries archived in Dori´s units at the SAP system. The measurement is registered in kg for shale oil and m^3 for natural gás at Marília's unit, and in liter for shale oil at Rolândia's unit.
Frequency of monitoring/recording	Annually
Value applied	

<table>
<tr><td></td><td>
<table>
<tr><th></th><th>Head Office (Marília)</th><th>Subsidiary Company (Rolândia)</th><th>Project Activity</th></tr>
<tr><td>FCshaleoil (tonnes/year)*</td><td>0</td><td>126</td><td>126</td></tr>
<tr><td>FCnaturalgas (tonnes/year)*</td><td>195</td><td>0</td><td>195</td></tr>
</table>
*Based on annual average data from last crediting period (from December 2013 to March 2016)
</td></tr>
<tr><td>Monitoring equipment</td><td>No monitoring equipment is used to determine this parameter. This parameter is measured according to SAP registries.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The project developer is responsible for gathering and maintaining in adequate archives all documents related to fossil fuels consumption and purchase.</td></tr>
<tr><td>Purpose of data</td><td>The purpose of this parameter is 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.</td></tr>
<tr><td>Calculation method</td><td>Not applicable</td></tr>
<tr><td>Comments</td><td>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.</td></tr>
</table>

4.3 Monitoring Plan

The monitoring will be done with the aim of determining the most approximate quantity of shale oil that, in the absence of the project, would be consumed in the companies’ boilers and consequently the amount of GHG that would be emitted in tonnes of CO2e.

In order to generate the same sum of steam, the thermal energy generated by fossil fuel is not directly equivalent to the energy generated by the amount of biomass used in the project activity, once the net calorific values of the fossil fuel and the renewable biomasses are different. Therefore the amount of fossil fuel that would be used in the absence of the project will be

estimated through the amount of steam generated in a month, which is specified below taking Dori's Head Office as example.

Tonnes of natural gas consumed = Tonnes of steam generated/year * Efficiency Factor
Qnaturalgasl = Qsteam * efficiency factor
Qnaturalgas = 53,516.57 tonne of steam * 0.056741 tonne of natural gas/tonne of steam = 3,036.58tonne of natural gas/year

The project developer provides the efficiency factor and it is based on the historical situation of the project activity prior to the implementation of the project. This value represents the direct relation between the oil consumption and the steam generated and represents the direct relation between the oil consumption and the steam generated. The amount of steam generated (Qsteam) is also a value provided by the project proponent and is monitored monthly and archived electronically (Excel sheets).

The following table 3 shows the frequency of the monitoring of each parameter.

Table 3: Details of the monitoring plan in terms of frequency of data

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass consumed	Tonnes	Measured by the project developer	Monthly
ρrenbiomass	Specific gravity of renewable biomass	Tonne/m³	Estimated by *Dori Alimentos*	Not mentioned
Renewable biomass origin	Origin of renewable biomass	Not applicable	Controlled by the project proponent	Annually
$Q_{shaleoil}$	Amount of shale oil that would be consumed in the baseline scenario	Tonnes	Estimated through calculations based on the amount of steam generated and a conversion factor provided by *Dori Alimentos*	Monthly
$Q_{naturalgas}$	Amount of natural gas that would be consumed in the baseline scenario	Tonnes	Estimated through calculations based on the amount of steam generated and a conversion factor provided by *Dori Alimentos*	Monthly
$EG_{thermal,y}$	Amount of heat produced (production of steam)	TJ	Calculated through equation: HGy(TJ) = Qfossilfuel(tonne) * NCVfossilfuel(TJ/tonn	Annually

			e)	
Q_{steam}	Amount of steam generated	Tonnes	Measured by a flow meter - monitored by the project proponent	Monthly
Leakage due to the biomass transportation	Leakage resulted from biomass transportation	tCO_2e	Monitored	Annually
FC i,j,y	Amount of fossil fuel combusted in the project activity	Tonnes/ year	Monitored	Monthly
EF_{FFCO2}	CO_2 Emission factor of fossil fuel	tCO_2e/TJ	-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>.	Not monitored
NCV_{FF}	Net Calorific Value of fossil fuel	TJ/tonne	-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>.	Not monitored
ρ_{FF}	Specific gravity of fossil fuel	tonne/ m^3	Bibliography	Not monitored
Efficiency factor	Conversion factor for determining the amount of shale oil consumed based on the amount of steam generated	Tonne of shale oil/ ton of steam	Data from project developer	Not monitored
$\eta_{BL,thermal}$	Efficiency of the plant using fossil fuel that would have been used in the absence of the project activity	%	Estimated by *Dori Alimentos*	Not monitored

$COEF_{i,y}$	CO2 emission coefficient of the fossil fuel	tCO_2e / tonne of fossil fuel	Value calculated through the parameters $NCV_{fossilfuel}$ and $EF_{fossilfuell}$	Not monitored

The party responsible for implementing the monitoring plan shall be the owners of the companies. The project developer will also be responsible for developing the forms and registration formats for data collection and further classification. For this purpose the authorities for the registration, monitoring, measurement and reporting will be Márcia S. Cavicchioli de Oliveira, responsible for Dori's head office and for Dori's subsidiary unity.

The management structure will rely on the local technicians with a periodical operation schedule during the project. The technical team will manage the monitoring, the quality control and quality assessment procedures and the different auditory will be responsible to carry the project premises.

The boilers in both unities have a flow meter that registers the amount of steam produced. Having the quantity of steam produced, and using the efficiency[17] of tonnes of shale oil per tonnes of steam generated, it is possible to obtain the total of oil that would be used by the boiler in the absence of the project activity. Those data will be monitored by the project proponent. In addition to the monitoring of the steam generation, the amount of biomass will also be monitored through biomass invoices/receipts in order to double check the monitoring data. Data monitored will be kept during the crediting period and 2 years after.

The calibration of the equipments used in the project activity will occur for all the equipments listed in table 4, following the determinations of the INMETRO (National Institute for metrology, normalization and industrial quality), the federal institution responsible for verifying calibration and quality procedures in Brazil. The calibration certificates will be archived in Dori's head office and kept as record for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Table 4: List of equipments that will be calibrated.

Equipment	Use	Calibration Purpose
Weighing Machine	Used to weight the trucks containing renewable biomass that enter the project activity site - registration of the amount of renewable biomass bought.	Guarantee the quality and precision of the amount of biomass weighted.
Flow Meter	Used to determine the amount of steam generated in the boilers (in kg)	Guarantee the quality and precision of the amount of

[17] Amount of oil per tonnes of steam generated.

		steam generated daily.

5. SAFEGUARDS

5.1 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.

The burning of biomasses also emits particulate material and CO2, as well as when using fossil fuel. However, GHG emission reductions will be reduced since they are renewable biomasses which have carbon neutral lifecycles.

5.2 Environmental Impact

Table 5: Environmental Impact analysis

Environmental Factor	Environmental Impact	Classification
Soil	Improvements of soil conditions because of the use of ashes as fertilizer	Positive
Soil	Improvements of soil conditions due to the use of effluent from the factory for irrigation of the eucalyptus farm in Rolândia site	Positive
Climate	GHG emission reduction	Positive
Water/ hydric resources	Preservation of hydric resources and water quality by avoiding the use of shale oil – shale oil is obtained by injecting large quantities of	Positive

	water and chemicals under high pressure onto the rock[18]	
Energy	Reduction of fossil fuel use for energy production	Positive

5.3 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.

5.4 Public Comments

Not applicable

[18] Pensamento Verde. O óleo e petróleo de xisto e seus impactos no meio ambiente, 2014. Available at: <http://www.pensamentoverde.com.br/meio-ambiente/o-oleo-e-petroleo-de-xisto-e-seus-impactos-meio-ambiente/>. Last visit on: 15th February, 2018.