

ARGIBEM, SÃO SEBASTIÃO AND VULCÃO CERAMICS FUEL SWITCHING PROJECT



Document Prepared By Sustainable Carbon – Projetos Ambientais Ltda

Project Title	Argibem, São Sebastião and Vulcão Ceramics Fuel Switching Project
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1 PROJECT DETAILS

1.1 Summary Description of Project

This project activity was developed by *Carbono Social Serviços Ambientais LTDA*. (Social Carbon Company), which has changed its company name to *Sustainable Carbon – Projetos Ambientais LTDA*.

The project activity promotes a fuel switch at *Argibem, São Sebastião and Vulcão* ceramics, which are red ceramic industries that produce structural ceramic devices, like bricks, destined for the regional market of *Rio de Janeiro*.

The activity of this bundled project consists on utilizing wood from afforestation, woody residues and sawdust, which are all renewable biomasses, to feed their kilns rather than using a non-renewable fuel like heavy oil.

The objective of the implementation of this project activity in the ceramics was to stop using the heavy oil and completely substitute it with renewable biomasses to feed their kilns and cook their ceramic pieces so that they could minimize environmental impacts related to the fossil fuel consumption.

This fuel switching project is reducing greenhouse gas (GHG) emissions through the substitution of heavy oil for renewable biomasses to generate thermal energy. It was concluded that this was feasible when considering the income derived from commercializing the resulting carbon credits. This measure was originally unattractive due to the high investment costs of the adaptation of machineries to the new biomass and other barriers.

The emissions launched during the combustion of heavy oil were not compensated by carbon absorbance methods since fossil fuels had been stored for millions of years prior to their consumption. An opposite scenario occurs with the renewable biomasses utilized in this project activity.

Besides contributing to climate change, the use of fossil fuels brings forward concerns about the safety of the oil transportation that can result in huge environmental impacts, especially when this transportation is overseas.

The main difficulties for the ceramics due to the fuel-switch were the non-availability of human knowledge to operate and maintain the new technology implemented, as well as the internal logistic modification and the employee's resistance to the new technology.

The ceramics lost production due to the adaptation to the use of biomasses and to the new machineries, as they added significant differences to the production process. Besides, these new equipments acquired as well as the construction of sheds to stock the biomass, added an additional cost for the ceramics, as the new fuel must be stored in covered sites in order to improve the kiln's efficiency.

By diverging significantly from the identified baseline scenario, with the implementation of this project, the ceramics now generate thermal energy minimizing the damages caused by the use of fossil fuels and preserving oil reserves. Furthermore, the ceramics avoid oil transportation, which could result in huge environmental impacts.

The emission reductions due to the switching of non-renewable fuel (heavy oil) to renewable biomasses resulted in **31,521 tCO₂e** during the monitoring period from 01/07/2011 to 28/02/2013. The contribution to sustainability is being monitored applying the SOCIALCARBON® Standard, which is based in six main pointers: Technology; Natural; Financial; Human; Social and Carbon Resources.

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.

This is a bundled project of three ceramic industries located in the State of Rio de Janeiro, Brazil.

1.3 Project Proponent

Project Proponents

The project proponents contributed to the current report by assigning the following roles and responsibilities to:

Argibem Ceramic:

Industrial Establishment: Cerâmica Argibem LTDA

Mr. *Marcelo de Oliveira do Vale*, Monitoring data responsible: General data, information on inputs and outputs of the ceramic, detailed information and numbers on sales, how output data is handled, and how data is stored and kept by the *Argibem's* office.

Mr. *Cedenir Fernando Barbosa Lima*, Director: Information and visit of the ceramic, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramic devices market challenges.

Other information on the project's proponent¹:

Ceramic phone number: +55 (24) 2258-2127

Website: <http://www.argibem.com.br/>

São Sebastião Ceramic:

Industrial Establishment: Olaria São Sebastião LTDA.

Mrs. *Maria Teresa de Oliveira Gonçalves Carvalho*, monitoring data responsible: General data, information on inputs and outputs of the ceramic, detailed information and numbers on sales, how output data is handled, and how data is stored and kept by the *São Sebastião's* office.

Mr. *Cesar Virgilio*, Director: Information and visit of the ceramic, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramic devices market challenges.

Other information on the project's proponent:

Ceramic phone number: +55 (24) 3346-6544

Website: <http://www.ossl.com.br/web/>

Vulcão Ceramic:

Industrial Establishment: Cerâmica Vulcão LTDA

¹ Addresses of each ceramic can be found on Section 1.7.

Mr. *Cláudio Pelegrini*, Monitoring data responsible: General data, information on inputs and outputs of the ceramic, detailed information and numbers on sales, how output data is handled, and how data is stored and kept by the *Vulcão's* office.

Mr. *Afonso Claudio*, Director: Information and visit of the ceramic, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramic devices market challenges.

Other information on the project's proponent:

Ceramic phone number: +55 (21) 3698-8915

Project Developer

Sustainable Carbon – Projetos Ambientais Ltda.: Project developer, Project participant and Project idealizer.

As the project authorized contact, Sustainable Carbon was given the responsibility of preparing the present project report and to accompany the proponents until the end of the crediting period.

The monitoring report was completed on 05/04/2013 by *Cecília Garcia, Marcelo Hector Sabbagh Haddad, Camila Vaccari, Mariana dos Santos Silva, Mariana Fieri, Larissa Tega da Fonseca* and *Thiago de Avila Othero*, from *Sustainable Carbon – Projetos Ambientais LTDA*.

Other information on the project's developer's contact:

Address:

R. Doutor Bacelar, 368 – Conj. 131 – Vila Clementino

Postal Code: 04.026-001

São Paulo – SP, Brazil

Phone number: +55 11 2649 0036

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thiago.othero@sustainablecarbon.com.

marcelo@sustainablecarbon.com;

marianas@sustainablecarbon.com;

larissa@sustainablecarbon.com

1.4 Other Entities Involved in the Project

No other entity was involved in the project.

1.5 Project Start Date

According to version 03 of the VCS PD², project start date was defined as follows:

² Document available at: http://mc.markit.com/br-reg/public/project.jsp?project_id=100000000000018. Last visited on 14/07/2011.

Table 1. Project start date for each ceramic.

Ceramic	Project Start Date
<i>Argibem</i>	01/09/2003
<i>São Sebastião</i>	01/01/2004
<i>Vulcão</i>	01/01/2004

1.6 Project Crediting Period

The crediting period for this project starts on 01/04/2006 and ends on 31/03/2016.

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

1.7 Project Location

According to the applied methodology, the project boundaries for the bundled project are the physical, geographical areas of the renewable energy generation, thus, the ceramics limits.

The ceramics are located in *Brazil*, in the State of *Rio de Janeiro*, in the southeast region of the country. The geographic location is illustrated in Figure 1.

Table 2. Location of the ceramics.

Ceramic	City	State
<i>Argibem</i>	<i>Bemposta (Três Rios District)</i>	<i>Rio de Janeiro</i>
<i>São Sebastião</i>	<i>Barra do Piraí</i>	
<i>Vulcão</i>	<i>Queimados</i>	

The project sites have the postal addresses:

Argibem Ceramic

Address: Rua Matheus Salzano, 16 – *Bemposta, Três Rios, RJ* – Postal Code: 25.840-000.

São Sebastião Ceramic

Address: Rodovia Ministro Lúcio Meira, BR 393, Km 280 – *Barra do Piraí, RJ* - Postal Code: 27.165-000.

Vulcão Ceramic

Address: Estrada Campo Alegre, 200 B. Nanci – Queimados, RJ – Postal Code: 26.317-180.



Figure 1. Geographic location of the cities of the project activity that has the following coordinates *Rio de Janeiro State*: Bemposta: - 22.140000, -43.096111; Barra do Pirai: -22.470000, -43.825556 and Queimados: -22.716111, -43.555278.



Figure 2. Argibem Ceramic's boundaries: A: -22.137778, -43.097500; B: -22.138333, -43.095833; C: - 22.140000, -43.096111; D: -22.139722, -43.097222.



Figure 3. São Sebastião Ceramic's boundaries: A: -22.468889, -44.053889; B: -22.470833, -44.054167; C: -22.471111, -44.051944; D: -22.468889, -44.051944.



Figure 4. Vulcão Ceramic's boundaries: A: -22.712778, -43.618333; B: -22.715833, -43.618889; C: -22.714444, -43.615833; D: -22.712778, -43.615556.

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 for the user with or without electricity – Version 13, valid from 28/03/2008 to 07/04/2009³. 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/filestorage/C/D/M/CDMWF_AM_YL0327DQSKVFXYQREWRT3VNR58402G/EB38_repan09_A_MS_I.C_ver13.pdf?t=bEN8MTMxMDY0NjgwNS4zNw==|AFMh0cERbAtf7I0DHjTPz-3nfbw=>. Last visited on 14/07/2011.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The VCS PD project was validated by the Designated Operational Entity TÜV Nord CERT GmbH and this present monitoring report will be verified by Designated Operational Entity TÜV Rheinland do Brasil Ltda.

The project has been fully operational in all ceramics included in the project since the starting date of the crediting period. This means the ceramics are operating using exclusively renewable biomass, thus mitigating their baseline emissions.

Some alterations were made in the productive process of each ceramic after the project validation. These include the acquisition of new machinery and investments in industrial automation. In *Argibem* Ceramic, the following modifications occurred: Acquisition of a water tank, automation of biomass feeding to the kilns through mechanic feeders, construction of a new shed to store the ceramic pieces, the installation of a diesel tank to supply trucks in addition to the construction of tanks which separate the oil from the clean water and also the automation of kiln's wagons.

In *São Sebastião* Ceramic, the following changes took place: Acquisition of new wagons to transport the ceramic pieces to the dryer, construction of a second dryer chamber and deactivation of the first one for maintenance. As described in the VCS PD, *São Sebastião* ceramic is building a "Tunnel" kiln and once it is finished, the current "Hoffman" kiln will be deactivated.

Vulcão Ceramic invested in: a new furnace to dry the ceramic pieces, tanks which separate the oil from the clean water, and the construction of a waterproofed paving in the area where the trucks are fuelled.

None of these changes have significant effects on the project monitoring or on its capacity to mitigate baseline emissions. The monitoring data was kept according to the monitoring plan described in the project description document. This Monitoring Report refers to the third monitoring period of this bundled project, and includes data from 01/07/2011 to 28/02/2013.

2.2 Project Description Deviations

The registered VCS PD version 03 establishes that the project developers (meaning the ceramic owners) would measure the amount of renewable biomasses used (parameter $Q_{renbiomass}$). However, during the entire monitored period, this parameter was monitored through all the receipts and invoices of biomass received by the ceramic industries. This means the amount of renewable biomass is measured by each provider and controlled by the ceramics owners, by storing receipts and invoices.

This approach was chosen considering that it is the responsibility of the provider to measure the amount of biomass, since this information needs to be available in the sale invoice or receipt. As this information is used for commercial purposes (to calculate due financial compensations), it is considered that data from the suppliers are a reliable source for this parameter.

2.3 Grouped Project

Not applicable. This is not a grouped project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EF_{CO2}
Data unit:	tCO ₂ /TJ
Description:	CO ₂ Emission factor of residual fuel oil
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf >. Page 2.18. Table 2.3. Last visit on May 23 rd , 2011.
Value applied:	77.4 tCO ₂ /TJ
Purpose of the data:	This parameter is used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario.
Any comment:	The fuel that would have been used in the baseline scenario for this project activity would be heavy oil. The non-renewable wood would be provided from the Atlantic Forest biome. However, this fuel is not viable considering the inaccessibility of this Biome and its unavailability in the region. The natural gas has an inconstant distribution, bringing forward a lot of risks associated. Value applied is 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 income for this project activity, whichever occurs later.

Data Unit / Parameter:	NCV_{oil}
Data unit:	TJ/t of oil
Description:	Net Calorific Value
Source of data:	Value average checked at: IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf >, table 1.2. Last visit on May 23 rd , 2011.

Value applied:	0.0404 TJ/t
Purpose of the data:	This parameter is used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario. It provides the energy generated by the amount of heavy oil that would be used in the absence of the project.
Any 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 Unit / Parameter:	ρ_{oil}
Data unit:	t/L
Description:	Specific gravity of fossil fuel
Source of data:	Value average checked at: Faculdade de Engenharia Mecânica UNICAMP < http://www.fem.unicamp.br/~em672/GERVAP2.pdf >. Page 29, table 4. Last visit on April 15 th , 2011.
Value applied:	0.000978 t/L
Purpose of the data:	This parameter is used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario. The amount of oil used in the baseline was measured in volume units, so this data is used to convert measured values to tonnes of oil.
Any comment:	

Data Unit / Parameter:	BF_y			
Data unit:	Liters of oil per thousand of devices			
Description:	Consumption of fossil fuel per thousand of ceramic devices produced per year			
Source of data:	Historical data from project proponents			
Value applied:	Ceramic	Argibem Ceramic	São Sebastião	Vulcão Ceramic

				Ceramic	
	BF _y	97.76	200	126.316	
Purpose of the data:	This parameter is used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario. It is employed to calculate the real amount of heavy oil displaced to maintain the ceramic production in the baseline scenario.				
Any comment:	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramics used to consume heavy oil. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns. In the second monitoring report, the following information is available: As <i>“São Sebastião ceramic is building a “Tunnel” kiln and deactivating the current “Hoffman” kiln, in the next verification, when the “Tunnel” kiln be operating, it will be monitored the efficiency gain/loss and biomass use in the next monitoring report”</i>. However, the tunnel kiln is still under final stages of construction and was not operated during this monitoring period. Hence, no impact on the biomass use occurred from the operation of this new kiln. Such assessment will be made for the next monitoring period, in case the kiln becomes operational.				

Data Unit / Parameter:	η_{th}				
Data unit:	Percentage				
Description:	The efficiency of the ceramics using fossil fuel that would have been used in the absence of the project activity				
Source of data:	Historical data from project proponents				
Value applied:					
	Ceramic	Argibem Ceramic	São Sebastião Ceramic	Vulcão Ceramic	
	η_{th}	100%	100%	100%	
Purpose of the data:	This parameter is used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario.				
Any comment:	Efficiency should be calculated as total energy produced (electricity and steam/heat extracted) divided by thermal energy of the fuel used. As the ceramics did not use to monitor the energy produced due to the heavy oil burning, the η_{th} could not be calculated. Despite the fact that is impossible to any industry achieve the maximum efficiency to generate thermal energy, the				

	efficiencies of the ceramics using heavy oil in the absence of the project activity were adopted as 100%, as this value is the most conservative one. Furthermore, the η_{th} is in accordance with the methodology applied, which states that the efficiency of the baseline units shall be determined by adopting one of the criteria. The criterion adopted was the maximum efficiency of 100%, which is the most conservative of the options showed in the methodology.
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3.2 Data and Parameters Monitored

Data Unit / Parameter:	$Q_{renbiomass}$										
Data unit:	Tonnes per month										
Description:	Amount of renewable biomasses										
Source of data:	Measured by the biomass providers and controlled by the ceramic owner. The registered VCS PD v.03 establishes that the ceramic owners would measure this parameter; however, during the entire monitored period, this parameter was monitored through all the receipts and invoices of biomass received by the ceramic industry.										
Description of measurement methods and procedures to be applied:	The amount of biomasses is monitored in accordance to the weight or volume described in the receipts from the providers. Where the values in the receipts are described in m^3, it is necessary the conversion to tonnes through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project are: <table border="1"> <thead> <tr> <th>Biomass</th><th>Wood from afforestation</th><th>Woody residues</th><th>Sawdust</th></tr> </thead> <tbody> <tr> <td>Specific gravity (tonnes/m^3)</td><td>0.510</td><td>0.35</td><td>0.245</td></tr> </tbody> </table> The sources of these data are: Wood from afforestation -IPCC: Intergovernmental Panel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS. Capítulo 3: Orientación sobre las buenas prácticas en el sector de CUTS- Woody Residues (pallets, construction residues wood, city garden residues, among others) - SIMIONI, F. J. Análise diagnóstica e prospectiva da cadeia produtiva de energia de biomassa de origem florestal no planalto sul de Santa Catarina - Curitiba: UFPR, 2007. 132p.: il. -			Biomass	Wood from afforestation	Woody residues	Sawdust	Specific gravity (tonnes/ m^3)	0.510	0.35	0.245
Biomass	Wood from afforestation	Woody residues	Sawdust								
Specific gravity (tonnes/ m^3)	0.510	0.35	0.245								

	Available at: <http://dspace.c3sl.ufpr.br/dspace/handle/1884/10294>. Last visit in: February 3rd, 2009. It was utilized the specific gravity for wood chips. Sawdust -Masses and Dead Loads of Concrete and Other Materials- <http://www.cca.org.nz/pdf/Masses.pdf>																		
Frequency of monitoring/recording:	Monthly																		
Value monitored:	Total amount during this monitoring period: <table border="1"> <thead> <tr> <th colspan="2">Argibem Ceramic</th></tr> <tr> <th>Sawdust</th><th>Woody residues</th></tr> </thead> <tbody> <tr> <td>11,881.49</td><td>948,03</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">São Sebastião Ceramic</th></tr> <tr> <th>Afforestation wood</th><th>Industrial and construction residues</th></tr> </thead> <tbody> <tr> <td>1,336.85</td><td>2,878.16</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="2">Vulcão Ceramic</th></tr> <tr> <th>Afforestation wood</th><th>Industrial and construction residues</th></tr> </thead> <tbody> <tr> <td>3,758.97</td><td>9,261.81</td></tr> </tbody> </table> More detailed information is available in Section 5.	Argibem Ceramic		Sawdust	Woody residues	11,881.49	948,03	São Sebastião Ceramic		Afforestation wood	Industrial and construction residues	1,336.85	2,878.16	Vulcão Ceramic		Afforestation wood	Industrial and construction residues	3,758.97	9,261.81
Argibem Ceramic																			
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Vulcão Ceramic																			
Afforestation wood	Industrial and construction residues																		
3,758.97	9,261.81																		
Monitoring equipment:	No monitoring equipment is used to determine this parameter																		
QA/QC procedures to be applied:	Amount of biomass was checked according to receipts of purchase. The energy balance was verified according to the amount of biomass applied.																		
Calculation method:	Not applicable																		
Any comment:	Data is measured for each purchase/acquisition of biomass and aggregated monthly. 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 Unit / Parameter:	PR _y																		

Data unit:	Unity of ceramic devices														
Description:	Production of ceramic devices per month														
Source of data:	Controlled by the project developers.														
Description of measurement methods and procedures to be applied:	The measurement was done by an internal control sheet monitored by the project proponents, which is fed daily.														
Frequency of monitoring/recording:	Monthly														
Value monitored:	Total amount during the this monitoring period: <table><tr><td>Argibem Ceramic</td><td>São Sebastião Ceramic</td><td>Vulcão Ceramic</td></tr><tr><td>38,524,927</td><td>16,849,412</td><td>25,176,600</td></tr></table> More detailed information is available in Section 4.					Argibem Ceramic	São Sebastião Ceramic	Vulcão Ceramic	38,524,927	16,849,412	25,176,600				
Argibem Ceramic	São Sebastião Ceramic	Vulcão Ceramic													
38,524,927	16,849,412	25,176,600													
Monitoring equipment:	No monitoring equipment is used to determine this parameter. Production is counted by trained personnel on each ceramic														
QA/QC procedures to be applied:	The measurement was done by an internal control sheet monitored by the project proponents. Since the ceramics must have an internal control of the production and sale at the end of every month, the PRY value cannot be manipulated. The ceramics have an internal control of the quantity of ceramic units produced.														
Calculation method:	In Argibem, due to the number of different devices produced, and its various dimensions, measurement was done according to how it was performed in the registered VCS PD v.03. The Ceramic generates a monthly report with the number of pieces produced of each type of device and the production is converted to equivalents of the standard brick (brick type 09x19x19), based on the weight of each piece. In São Sebastião, due to the number of different devices produced, and its various dimensions, measurement was done based on the conversion factors in some of the products. Most of the ceramic devices produced are converted to equivalent of the standard brick based on their volume. The devices which weight is similar to the standard brick's weight don't need to be converted. The table below shows the bricks' volume, the real conversion factor and the factor utilized in the ceramic. <table><tr><td>Type of brick</td><td>Dimensions (cm)</td><td>Volume (m³)</td><td>Conversion (Vp/Vstandard)</td><td>Conversion factor to 9x19x19</td></tr><tr><td>20x20 (Standard)</td><td>09x19x19</td><td>0.0032</td><td>1</td><td>1</td></tr></table>					Type of brick	Dimensions (cm)	Volume (m³)	Conversion (Vp/Vstandard)	Conversion factor to 9x19x19	20x20 (Standard)	09x19x19	0.0032	1	1
Type of brick	Dimensions (cm)	Volume (m³)	Conversion (Vp/Vstandard)	Conversion factor to 9x19x19											
20x20 (Standard)	09x19x19	0.0032	1	1											

	brick)				
	20X30	09x19x29	0.005	1.5625	1.5
	L25	07x25x20	0.0035	1.09375	1.07
	L12	11,5x25x20	0.0058	1.8125	1.82
	L16	15.5x25x20	0.0078	2.4375	2.68
	11.5x20	11.5x19x19	0.0042	1.3125	1.33
	15x30	14x19x29	0.0077	2.40625	2.25
	U Estrutural	14x19x29	0.0077	2.40625	2.25
	J Estrutural	14x19x29	0.0077	2.40625	2.25
	11.5x30	11.5x19x29	0.0063	1.96875	2
Since some of the conversion factors used by the ceramic were not conservative, the production value has been calculated based on the more conservative of the two conversion factors (either the real one or the one adopted by the ceramic). Therefore, the production value always represents the most conservative value in the present calculations.					
Any 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 Unit / Parameter:	Origin of renewable biomass
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data:	Controlled by the project developers.
Description of measurement methods and procedures to be applied:	This information is given by the biomasses providers. Information on the invoices will be assessed to determine if the renewable biomass complies with UNFCCC definitions of renewable biomass (as per CDM EB 23, Annex 18 ⁴)
Frequency of monitoring/recording:	Each crediting period
Value monitored:	Not directly applied for the calculation. It is considered that all biomass used is renewable.

⁴ Annex 18. Definition of renewable biomass. EB 23. CDM – Executive Board. UNFCCC/CCNUCC. Available at: <http://cdm.unfccc.int/EB/023/eb23_repan18.pdf>. Last visited on: April 15th, 2011.

Monitoring equipment:	No monitoring equipment is 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.
Calculation method:	Not applicable
Any 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 Unit / Parameter:	Renewable biomass surplus			
Data unit:	tonnes or m ³			
Description:	Amount of renewable biomass available			
Source of data:	Monitored			
Description of measurement methods and procedures to be applied:	The sources of leakages predicted in “General guidance on leakage in biomass project activities⁵” of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, were monitored. The measurement of the leakage was based in national and international articles and database every monitoring period. The sources provided information about the biomass availability in the project activity's region.			
Frequency of monitoring/recording:	Annually			
Value monitored:		Biomass surplus	Surplus	Year
		Wood from afforestation in m ³	7,776,095	2007
		Woody Residues (sawdust/wood chips) in m ³	5,737,174.08	2007
		Industrial wood residues in tonnes	749,839	2006
		Rice Husk in m ³	131.38 thousands	2007/08

⁵ Document available at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf>. Last visit on 24/01/2011.

		Elephant Grass	Not measured	-	
Monitoring equipment:	No monitoring equipment is used to determine this parameter.				
QA/QC procedures to be applied:	Data available regarding the ceramic industries fuel consumption was employed to monitor the leakage				
Calculation method:	The amount of biomass used by the project activity in each year of the crediting period is compared to total biomass available, as estimated on the VCS PD.				
Any comment:	According to the guidance applied, the project participant shall evaluate ex ante if there is a surplus of the biomass in the region of the project activity, which is not utilized. If it is demonstrated (e.g., using published literature, official reports, surveys etc.) at the beginning of each crediting period that the quantity of available biomass in the region (e.g., 50 km radius), is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions. Value monitored, hence, represents the value determined ex ante at the beginning of the current crediting period. 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 Unit / Parameter:	Leakage of fossil fuel
Data unit:	tCO ₂ e
Description:	Leakage resulted from fossil fuel
Source of data:	Monitored
Description of measurement methods and procedures to be applied:	The source of leakage predicted in the methodology applied was monitored.
Frequency of monitoring/recording:	Annually
Value monitored:	0
Monitoring equipment:	No monitoring equipment is used to determine this parameter.
QA/QC procedures to	Receipts and invoices were used to prove that the new equipments

be applied:	were acquired. The old equipments located in the ceramic prove that no equipment was transferred.
Calculation method:	Not applicable.
Any 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 Description of the Monitoring Plan

The monitoring is done with the aim of determining the most approximate quantity of heavy oil that, in the absence of the project, would be used in the ceramics' kilns and consequently the amount of GHG that would be emitted in tonnes of CO₂e. Section 3.2 describes data and parameters monitored, as well as the procedures involved on the monitoring plan.

Ceramic personnel are responsible to monitor the operating conditions on the factory, including the amount of renewable biomass consumed and the monthly production of ceramic devices (parameters $Q_{\text{renbiomass}}$ and PR_y). Ceramic personnel 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 also assists the Ceramic personnel to double check the monitored data on biomass consumption and ceramic devices production.

Sustainable Carbon assists the Ceramics' personnel to double check the monitored data on biomass consumption and ceramic devices production. However, no internal auditing was performed on data related to this monitoring period. Errors identified in the double check procedures are clarified between Sustainable Carbon technical team and the monitoring responsible on each ceramic during site visits for data collection, by reassessing existing documents and sources of information.

The responsible for the monitoring plan are: *Mr. Marcelo de Oliveira do Vale* from *Argibem* ceramic, *Mrs. Maria Teresa de Oliveira Gonçalves Carvalho* from *São Sebastião* ceramic; and *Mr. Cláudio Pelegrini* from *Vulcão* ceramic. 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

Baseline emissions are estimated following procedures of the applied methodology: AMS-I.C.: Thermal energy for the user with or without electricity – Version 13, valid from 28/03/2008 to 07/04/2009. The project activity in this monitoring period (20 months) generated 469.02 TJ or 281.41 TJ per year. Converting this number to MWh, it was generated 78,169.84 MWh per year, which corresponds to the use of 8.92 MW_{thermal} on average of the kilns capacity during the monitored period, which is less than the limits of 45 MW_{thermal} for Type I Small scale project activities.

Baseline emissions are calculated as:

$$BE_y = HG_y * EF_{CO_2} / \eta_{th} \quad (\text{Equation 01})$$

Where:

- BE_y:** The baseline emissions from steam/heat displaced by the project activity during the year y in tCO₂e.
- HG_y:** The net quantity of heat supplied by the project activity during the year y in TJ.
- EF_{CO₂}:** The CO₂ emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO₂/TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used.
- η_{th}:** The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity.

The ceramic facilities did not use to monitor the energy generated by the fossil fuel consumed. However, it is well known the amount of fossil fuel consumed as well as the amount of fuel required to burn a thousand of pieces. Therefore, this project will estimate the baseline emissions through the energy generated by the real consumption of fuel oil and assuming that η_{th} is 100%.

The thermal energy generated by the fossil fuel is estimated as follows:

$$HG_y = Q_{oil} \times NCV \times \rho \quad (\text{Equation 02})$$

Where:

- Q_{oil}:** Amount of oil (L)
- NCV:** Net calorific value of oil (TJ/Tonne)
- ρ:** Specific gravity of oil (tonne/L)

The amount of oil is obtained by multiplying the production of ceramic devices (parameter PR_y) by the consumption of fossil fuel per thousand of ceramic devices (parameter BF_y), as stated below:

$$Q_{oil} = (PR_y / 1000) \times BF_y \quad (\text{equation 03})$$

Where:

- Q_{oil}:** Amount of oil (L)
- PR_y:** Production of ceramic devices (unity of ceramic devices)
- BF_y:** Consumption of fossil fuel per thousand of ceramic devices (L/thousand of ceramic devices)

Baseline emissions during the monitored period are summarized in the following table:

Table 3. Baseline emissions for each ceramic.

	Months	Argibem Ceramic			São Sebastião Ceramic			Vulcão Ceramic		
		PR _y (Thousand of ceramic devices)	Q _{oil} (liters)	ER _y (tCO ₂ e)	PR _y (Thousand of ceramic devices)	Q _{oil} (liters)	ER _y (tCO ₂ e)	PR _y (Thousand of ceramic devices)	Q _{oil} (liters)	ER _y (tCO ₂ e)
2011	July	1,884	184,195	563	1,032	206,344	631	1,260	159,209	486
	August	1,745	170,628	521	951	190,136	581	1,447	182,729	558
	September	2,113	206,518	631	938	187,676	573	1,437	181,567	555
	October	2,166	211,709	647	1,013	202,517	619	1,438	181,642	555
	November	2,041	199,485	610	880	175,970	538	1,487	187,882	574
	December	940	91,921	281	867	173,453	530	1,381	174,442	533
	Total	10,888	1,064,455	3,253	5,680	1,136,096	3,472	8,451	1,067,471	3,261
2012	January	234	22,900	70	836	167,225	511	1,406	177,600	543
	February	1,916	187,283	572	765	152,947	467	1,200	151,604	463
	March	2,109	206,144	630	887	177,490	542	1,322	166,964	510
	April	2,117	206,985	632	781	156,155	477	1,250	157,844	482
	May	2,205	215,549	659	194	38,714	118	1,119	141,373	432
	June	2,067	202,115	618	915	183,084	559	1,031	130,257	398
	July	2,212	216,270	661	910	182,083	556	1,391	175,756	537
	August	2,245	219,423	671	1,026	205,122	627	1,465	185,028	565
	September	2,258	220,750	675	827	165,473	506	1,217	153,777	470
	October	2,349	229,657	702	924	184,857	565	1,330	168,000	513
	November	2,280	222,908	681	817	163,313	499	1,040	131,369	401
	December	1,695	165,744	506	698	139,691	427	966	121,971	373
	Total	23,688	2,315,729	7,077	9,581	1,916,153	5,854	14,737	1,861,544	5,687
2013	January	1,630	159,369	487	854	170,835	522	1,135	143,318	438
	February	2,318	226,644	693	734	146,797	448	854	107,874	329
	Total	3,949	386,013	1,180	1,588	317,633	970	1,989	251,192	767
Total - Monitoring Period		38.524,93	3,766,196,86	11,510	16,849.41	3,369,882.33	10,296	25,176,600	3,180,207.41	9,715

4.2 Project Emissions

The applied methodology does not include any source of project emissions.

4.3 Leakage

Leakage is estimated to be 0 (zero) tCO₂e during the entire monitoring period, for all ceramics included in this bundled project.

The leakage predicted in the methodology employed is not applicable for this project activity as there was no transference of equipment in spite of new equipments had to be acquired. Furthermore, the old oil equipments are still in the ceramics, proving that these equipments were not transferred.

The leakage from biomass projects, like the project activity, shall also be estimated according to the “General guidance on leakage in biomass project activities” 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 4. Sources of leakage according to the type of the biomass.

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 use.	-	-	X

Observing the table above, the source of leakage of the present project is the competing use of afforestation wood and woody residues. All ceramics utilize some kind of wood or wood residues and the providers are mainly wood industries. There are plenty of this kind of industries in the states of *Rio de Janeiro*, *São Paulo* and *Minas Gerais*, which means that the project activity did not disturb in any aspects the wood market once there is plenty of this kind of biomass available. The source of leakage of the present project is showed below according to each type of biomass:

Wood from Afforestation

The area destined for afforestation in *Brazil* corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare⁶. The grand majority of these cultivations were established in the middle of 1970 to 1980. The *Eucalyptus* and *Pinus* genres correspond to 80% of the afforestation in *Brazil*. Furthermore, these genres are mainly cultivated in the southeast region of the country, where the climate is more favorable for their growing⁷.

In addition, sustainable management practices of the afforestation in *Brazil* (as the techniques of preparation, fertilization, control of weeds, improved seeds, cloning and reform) were introduced and constantly improved in order to increase its productivity⁸. As a consequence, *Brazil* withholds the best productivity rates (in m³/ha/year) over the world due to the adaptation of these species to the Brazilian territory and the success of the experiments of genetic improvement⁹.

The production of wood from afforestation in the state of *Rio de Janeiro* was of 368,710 m³¹⁰ and in *São Paulo*, which is a bordering state, was of 7,407,385 m³¹¹ in 2007. Therefore, the production of wood from afforestation in the project's region is 7,776,095.00. As the consumption of this kind of fuel was equivalent to 5,995.09 m³ per year for this project activity¹², it represents less than 0.1% of the total of wood from afforestation produced in the region, as it can be seen in table 5.

Woody Residues (Sawdust/ Wood Chips)

⁶Brazilian Society of Forestry. Source: <<http://web.archive.org/web/20030715233004/http://www.sbs.org.br/atualidades.php>>. Accessed at: 20/06/2013.

⁷ JUVENAL, T. L.; MATTOS, R. L. G. O setor florestal no Brasil e a importância do reflorestamento. BNDES Setorial, Rio de Janeiro, n. 16, p. 3-30, set. 2002. Available at: <http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Galerias/Arquivos/conhecimento/bnset/set1601.pdf>. Last visit in 07/06/2013.

⁸ MCT/IPEF. Silvicultura e Manejo. Source: <http://www.ipef.br/mct/MCT_03.htm>. Last visit on 25/02/2009.

⁹ JUVENAL, T. L.; MATTOS, R. L. G. O setor florestal no Brasil e a importância do reflorestamento. BNDES Setorial, Rio de Janeiro, n. 16, p. 3-30, set. 2002. Available at: <<http://www.bndes.gov.br/conhecimento/bnset/set1601.pdf>>. Last visit in: 22/01/2009.

¹⁰ According to IBGE(Geographic and Statistic Brazilian Institute) available at: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=rj&tema=extracaovegetal2007>>. Last visit on 19/01/2009.

¹¹ According to IBGE(Geographic and Statistic Brazilian Institute) available at: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=extracaovegetal2007>>. Last visit 19/01/2009.

¹² Total consumption of this type of biomass was of 9,991.81 m³ in 20 months of monitoring period.

The production of wood generates a large amount of residues, which can be reused to generate thermal energy, considering that around 22% of the wood produced will generate sawdust/wood chips¹³. The production of wood log in the state of *Rio de Janeiro* was of 111,600 m³¹⁴ and in *São Paulo*, which is a bordering state, was of 25,966,464 m³¹⁵ in 2007. Thus, the production of sawdust/woody residues in the region was around 5,737,174.08 m³ per year. As the consumption of this project activity was equivalent to 45,163.46 m³ per year (including sawdust)¹⁶, it represented around 0.79% of the total of woody residues produced in the region, as described in table 5.

Table 5. Renewable Biomass available in the region

Renewable Biomass Surplus - Period of 12 months					
Woody Residues (Sawdust / Wood chips)			Afforestation Wood		
Amount of biomass available in the region (m ³)	Total used by the Project (m ³)	Total used by the Project (%)	Amount of biomass available in the region (m ³)	Total used by the Project (m ³)	Total used by the Project (%)
5,737,174.08	45,163.46	0.79	7,776,095.00	5,995.09	0.08

4.4 Summary of GHG Emission Reductions and Removals

Table below summarizes the emission reductions for this monitoring period¹⁷.

Table 6. Emission reductions for the monitoring period.

Year	Period	Total for the ceramics			Total ER _y (tCO ₂ e)
		<i>Argibem</i>	<i>São Sebastião</i>	<i>Vulcão</i>	
		ER _y (tCO ₂ e)	ER _y (tCO ₂ e)	ER _y (tCO ₂ e)	
2011	July	563	631	486	1,680
	August	521	581	558	1,660
	September	631	573	555	1,759
	October	647	619	555	1,821
	November	610	538	574	1,722
	December	281	530	533	1,344
	Total 2011	3,253	3,472	3,261	9,987
2012	January	70	511	543	1,124
	February	572	467	463	1,502
	March	630	542	510	1,682

¹³ BRITO EO. Estimativa da produção de Resíduos na Indústria Brasileira de Serraria e Laminação de Madeira. Rev. da Madeira. v.4. n.26. 1995, pp. 34-39.

¹⁴ 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=30&u3=1&u4=1&u2=30>>. Last visit on 07/06/2013

¹⁵ 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=30&u2=31&u3=1&u4=1>>. Last visit on 07/06/2013.

¹⁶ Total consumption of these types of biomass was of 75,272.44 m³ in 20 months of monitoring period.

¹⁷ Emission reductions are equal to the baseline emissions, since there are no project emissions according to the applied methodology and since leakage emissions are estimated as zero tCO₂e.

	April	632	477	482	1,591
	May	659	118	432	1,209
	June	618	559	398	1,575
	July	661	556	537	1,754
	August	671	627	565	1,863
	September	675	506	470	1,651
	October	702	565	513	1,780
	November	681	499	401	1,581
	December	506	427	373	1,306
	Total 2012	7,077	5,854	5,687	18,618
2013	January	487	522	438	1,447
	February	693	448	329	1,470
	Total 2013	1,180	970	767	2,917
Total - Monitoring Period		11,510	10,296	9,715	31,521

5 ADDITIONAL INFORMATION

5.1 Amount of renewable biomass consumed per month on each ceramic

5.1.1 Argibem Ceramic

Table 7. Amount of renewable biomass used by Argibem Ceramic.

Argibem - Renewable Biomass			
Year	Period	Total Sawdust (t)	Total Woody residues (t)
2011	July	530.22	0.00
	August	714.78	0.00
	September	564.73	27.30
	October	739.42	13.30
	November	620.82	16.60
	December	592.97	0.00
	Total 2011	3,762.95	57.20
2012	January	131.60	0.00
	February	525.84	0.00
	March	785.15	0.00
	April	739.63	59.85
	May	717.69	89.02
	June	610.08	59.76
	July	507.64	97.60
	August	665.33	80.66
	September	474.52	104.11

	October	695.95	125.27
	November	818.72	136.06
	December	485.05	51.92
	Total 2012	7,157.19	804.25
2013	January	534.93	47.68
	February	426.42	38.90
	Total 2013	961.35	86.58
Total during the monitored period (t)		11,881.49	948.03
Total during the monitored period (t)			12,829.53

5.1.2 São Sebastião Ceramic

Table 8. Amount of renewable biomass used by São Sebastião Ceramic.

São Sebastião - Renewable Biomass			
Year	Period	Total Woody Residues (t)	Afforestation Wood (t)
2011	July	156.64	89.25
	August	139.70	80.07
	September	134.18	51.00
	October	170.74	102.00
	November	123.62	64.26
	December	178.81	43.35
	Total 2011	903.69	429.93
2012	January	190.19	61.20
	February	126.65	40.80
	March	143.10	85.25
	April	118.65	86.70
	May	123.44	66.30
	June	131.25	59.16
	July	191.75	81.60
	August	220.01	78.54
	September	168.08	89.96
	October	171.50	87.07
	November	116.52	56.10
	December	128.30	95.88
	Total 2012	1,829.43	888.56
2013	January	141.84	18.36

	February	3.20	0.00
	Total 2013	145.04	18.36
Total during the monitored period (t)		2,878.16	1,336.85
Total during the monitored period (t)			4,215.02

5.1.3 Vulcão Ceramic

Table 9. Amount of renewable biomass used by Vulcão Ceramic

Vulcão - Renewable Biomass			
Year	Period	Total Woody Residues (t)	Afforestation Wood (t)
2011	July	67.85	254.75
	August	85.04	383.66
	September	39.34	306.67
	October	44.20	271.39
	November	69.28	286.01
	December	88.48	202.37
	Total 2011	394.19	1,704.85
2012	January	220.18	354.81
	February	312.89	305.47
	March	555.21	160.55
	April	479.49	269.39
	May	569.07	182.61
	June	480.86	260.00
	July	705.04	291.79
	August	717.73	0.00
	September	779.20	65.59
	October	908.51	125.45
	November	741.57	26.31
	December	743.69	12.17
	Total 2012	7,213.44	2,054.12
2013	January	902.47	0.00
	February	751.71	0.00
	Total 2013	1,654.18	0.00
Total during the monitored period (t)		9,261.81	3,758.97
Total during the monitored period (t)			13,020.78