ARGIBEM, SÃO SEBASTIÃO AND VULCÃO CERAMICS FUEL SWITCHING PROJECT

SUSTAINABLE CARBON CLIMATE SOLUTIONS

Document Prepared By Sustainable Carbon – Projetos Ambientais Ltda

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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 recently 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 small and prototypical 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 industrial residues, 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 results 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 dispense the 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 **41,597 tCO_2e** during the monitoring period from 01/10/2008 to 30/06/2011. 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 proponent[1]:

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.

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 09/11/2011 by *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. 54 – Vila Clementino
Postal Code: 04.026-001
São Paulo – SP, Brazil
Phone number: +55 11 2649 0036

Web site: http://www.sustainablecarbon.com

Emails: marcelo@sustainablecarbon.com; camila@sustainablecarbon.com; marianas@sustainablecarbon.com; thiago.othero@sustainablecarbon.com.

1.4 Other Entities Involved in the Project

No other entities were involved in the project.

1.5 Project Start Date

According to version 03 of the VCS PD[2], 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
Argibem	September 1st, 2003
São Sebastião	January 1st, 2004
Vulcão	January 1st, 2004

- Date of initiating the project activity: 01/04/2006;
- Date of terminating the project: 31/03/2016;
- VCS project crediting period: 10 years renewable;

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
Argibem	*Bemposta (Três Rios District)*	*Rio de Janeiro*
São Sebastião	*Barra do Piraí*	
Vulcão	*Queimados*	

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.

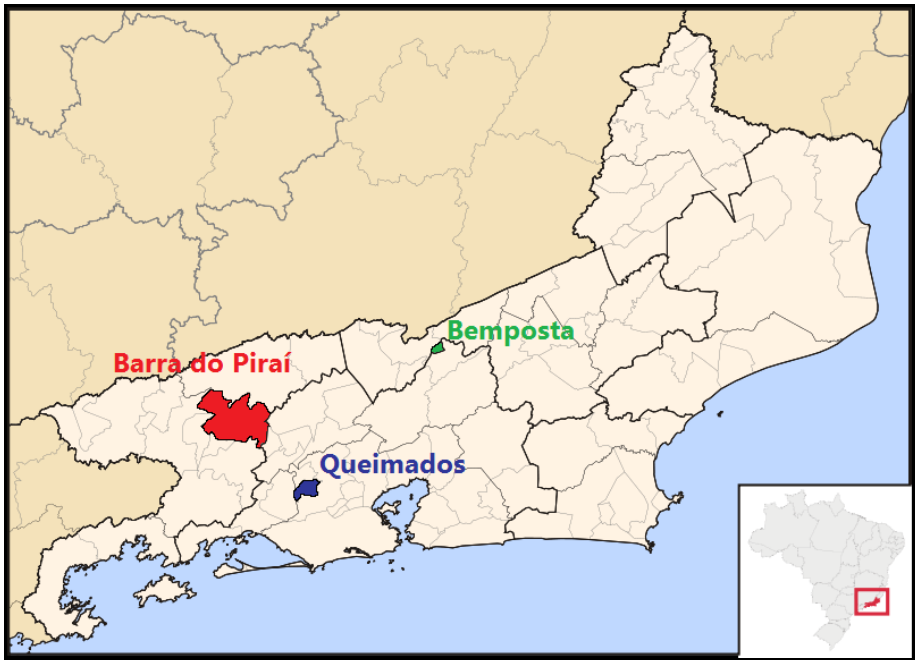


Figure 1. Geographic location of the cities of the project activity that has the following coordinates *Rio de Janeiro* State: *Bemposta*: 22º08'24" S, 43º05'46" W; *Barra do Piraí*: 22º28'12" S, 43º49'32" W and *Queimados*: 22º42'58" S, 43º33'19"W.

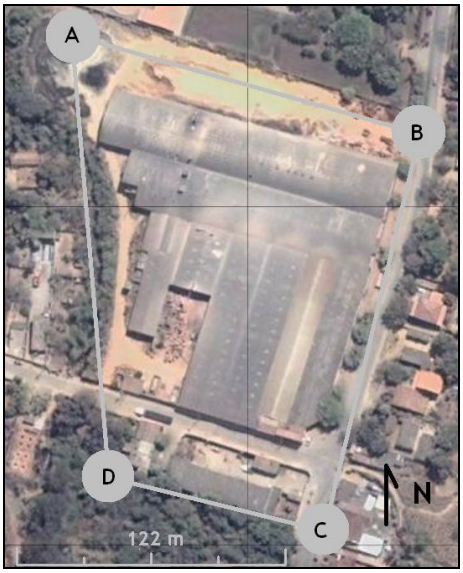


Figure 2. Argibem Ceramic's boundaries: A: 22º08'16" S, 43º05'51" W; B: 22º08'18" S, 43º05'45"W; C: 22º08'24" S, 43º05'46" W; D: 22º08'23" S, 43º05'50" W



Figure 3. São Sebastião Ceramic's boundaries: A: 22°28'08" S, 44°03'14" W; B: 22°28'15" S, 44°03'15" W; C: 22°28'16" S, 44°03'07" W; D: 22°28'08" S, 44°03'07" W



Figure 4. *Vulcão* Ceramic's boundaries: A: 22°42'46" S, 43°37'06" W; B: 22°42'57" S, 43°37'08" W; C: 22°42'52" S, 43°36'57" W; D: 22°42'46" S, 43°36'56" W

1.8 Title and Reference of Methodology

The project applies a small scale methodology approved under the Clean Development Mechanism, as follows: Category AMS-I.C.: Thermal energy for the user with or without electricity – Version 13, valid from 28/03/2008 to 07/04/2009[3]. This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuels.

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 is being verified by Designated Operational Entity Bureau Veritas Certification (BVC).

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 and the installation of a diesel tank to supply trucks in addition to the construction of tanks which separate the oil from the clean water.

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

[3] This version of the methodology is available at: <http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_YL0327DQSKVFXYQREWRT3VNR58402G >. Last visited on September 13th, 2011.

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 emission reductions. The monitoring data was kept according to the monitoring plan described in the project description document. This Monitoring Report refers to the second monitoring period of this bundled project, and includes data from 01/10/2008 to 30/06/2011.

2.2 Deviations from the Monitoring Plan

The registered VCS PD version 03 establishes that the project proponents (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 industry. This means the amount of renewable biomass is measured by each provider and controlled by the ceramic 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 23rd, 2011.
Value applied:	77.4 tCO_2/TJ
Purpose of the data:	This parameter was 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 23rd, 2011.
Value applied:	0.0404 TJ/t
Purpose of the data:	This parameter was 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 15th, 2011.
Value applied:	0.000978 t/L
Purpose of the data:	This parameter was 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:	Liter 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 Ceramic*	*Vulcão Ceramic*
BF_y	97.76	200	126.316

Purpose of the data:	This parameter was 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 previous monitoring report, the following information is available: As "*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"*. 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:	n_{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:	<table><tr><td>Ceramic</td><td>*Argibem*</td><td>*São Sebastião*</td><td>*Vulcão*</td></tr><tr><td>η_{th}</td><td>100%</td><td>100%</td><td>100%</td></tr></table>
Purpose of the data:	This parameter was 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.

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 owner 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	The amount of biomasses was monitored in accordance to the weight or volume described in the receipts from the providers. Where the

<table>
<tr><td>methods and procedures to be applied:</td><td>values in the receipts are described in m³, 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>
<tr><th>Biomass</th><th>Wood from afforestation</th><th>Woody residues</th><th>Sawdust</th></tr>
<tr><td>Specific gravity (tonne/m³)</td><td>0.510</td><td>0.35</td><td>0.245</td></tr>
</table>
The sources of these data are:

Wood from afforestation

-IPCC: Intergovernmental Pannel 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. -

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.</td></tr>
<tr><td>Frequency of monitoring/recording:</td><td>Monthly</td></tr>
<tr><td>Value monitored:</td><td>Total amount during the this monitoring period:
<table>
<tr><th colspan="3">Argibem Ceramic (tonnes)</th></tr>
<tr><td>Sawdust</td><td>Wood from afforestation</td><td>Woody residues</td></tr>
<tr><td>19.668,49</td><td>18.64</td><td>799.74</td></tr>
</table>
<table>
<tr><th colspan="2">São Sebastião Ceramic (tonnes)</th></tr>
<tr><td>Wood from afforestation</td><td>Woody residues - Industrial and construction residues</td></tr>
<tr><td>2,042.70</td><td>3,906.40</td></tr>
</table></td></tr>
</table>

	<table><tr><th colspan="2">Vulcão Ceramic (tonnes)</th></tr><tr><td>Wood from afforestation</td><td>Woody residues - Industrial and construction residues</td></tr><tr><td>**2,910.88**</td><td>**4,828.70**</td></tr></table> More detailed information is available in Section 5.
Monitoring equipment:	No monitoring equipment was used to determine this parameter. The amount of renewable biomasses was monitored in accordance to the weight or volume described in the receipts and invoices from the providers.
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 was 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 developer.
Description of measurement methods and procedures to be applied:	Data concerning PR_y measurement points were taken from internal control of ceramic devices that comes out of the kiln in the *Argibem* ceramic. The ceramic organizes its production per month separated by type of ceramic device. These data are collected by internal software. *São Sebastião* ceramic controls its production data based on the number of ceramic pieces coming out of the molding machine. In order to adopt conservative production data for the current monitoring period, it was made a comparison between data from molding machine and data of ceramic devices that come out of kilns. The comparison study was made based on data from 21 months. The percentage of loss in the production process between the molding machine stage and the kiln exit stage was 5.2%. So, the parameter PR_y of the monitoring period was calculated discounted 5,2% from the molding machine production data. Please see VCS MR Calculation

<table>
<tr><td></td><td>spreadsheet.

Data of production from Vulcão ceramic were taken from sales internal control. The ceramic company has a spreadsheet fed daily with sales numbers, according to data based on the cash flow.</td></tr>
<tr><td>Frequency of monitoring/recording:</td><td>Monthly</td></tr>
<tr><td>Value monitored:</td><td>Total amount during the this monitoring period:
<table><tr><th>Argibem Ceramic</th><th>São Sebastião Ceramic</th><th>Vulcão Ceramic</th></tr><tr><td>30,422,388</td><td>26,858,094</td><td>41,739,708</td></tr></table>
More detailed information is available in Section 4.</td></tr>
<tr><td>Monitoring equipment:</td><td>No monitoring equipment was used to determine this parameter. Production was counted by trained personnel on each ceramic</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The ceramics have an internal control of the quantity of ceramic units produced. It was rechecked according to evidences and data provided by the ceramic owner.</td></tr>
<tr><td>Calculation method:</td><td>Not applicable</td></tr>
<tr><td>Any comment:</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>

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 was given by the biomasses providers. Information on the invoices was 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 was considered that all

[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>. Las visited on: April 15th, 2011.

	biomass used were renewable.
Monitoring equipment:	No monitoring equipment was used to determine this parameter.
QA/QC procedures to be applied:	The biomasses was 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 m³
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 activities[5]" 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 m³	7,776,095	2007
Woody Residues (sawdust/wood chips) in m³	5,737,174.08	2007
Industrial wood residues in tones	749,839	2006
Rice Husk in m³	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 was 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 was 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_2e
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 was 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 CO_2e. 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 $Q_{renbiomass}$ 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 assists the Ceramic 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. Non-conformities 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 (33 months) generated 514.47 TJ, or 187.08 TJ per year. Converting this number to MWh, it was generated 51,966.99 MWh per year, which corresponds to the use of 5.93 MWthermal on average of the kilns capacity during the monitored period, which is less than the limits of 45 MWthermal for Type I Small scale project activities.

Baseline emissions are calculated as:

$$BE_y = HG_y * EF_{CO2} / \eta_{th} \quad \text{(Equation 01)}$$

Where:

BE_y: The baseline emissions from steam/heat displaced by the project activity during the year y in tCO_2e.

HG_y: The net quantity of heat supplied by the project activity during the year y in TJ.

EF_{CO2}: The CO_2 emission factor per unit of energy of the fuel that was used in the baseline plant in (tCO_2/TJ), obtained from IPCC default emission factors.[6]

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 estimated 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:

$$Q_{oil} = (PR_y/1{,}000) \times BF_y \quad \textbf{(equation 03)}$$

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:

[6] According to the source: < 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 October 31st, 2011. Please see: "Residual Fuel Oil".

Table 3. Baseline emissions for each ceramic.

		Argibem Ceramic			São Sebastião Ceramic			Vulcão Ceramic		
	Month	PR_y (thousands of ceramic pieces)	Q_{oil} (liters)	Baseline emissions (tCO_2e)	PR_y (thousands of ceramic pieces)	Q_{oil} (liters)	Baseline emissions (tCO_2e)	PR_y (thousands of ceramic pieces)	Q_{oil} (liters)	Baseline emissions (tCO_2e)
2008	October	964.34	94,273.78	288	666.77	133,354.40	407	1,467.18	185,327.68	566
	November	959.23	93,774.62	286	522.41	104,482.40	319	1,207.40	152,513.94	466
	December	663.61	64,874.71	198	552.35	110,470.00	337	1,301.26	164,369.33	502
	Total	**2,587.18**	**252,923.11**	**772**	**1,741.53**	**348,306.80**	**1,063**	**3,975.83**	**502,210.96**	**1,534**
2009	January	779.40	76,193.95	233	546.96	109,391.60	334	1,190.04	150,321.09	459
	February	628.29	61,421.34	187	565.56	113,111.60	345	1,198.85	151,433.94	463
	March	936.96	91,596.82	280	874.07	174,813.40	534	1,636.85	206,759.71	632
	April	993.74	97,148.41	297	817.82	163,564.40	500	1,199.75	151,547.62	463
	May	1,029.59	100,652.62	307	766.37	153,274.80	468	1,318.23	166,513.54	509
	June	984.60	96,254.40	294	852.75	170,549.80	521	1,144.69	144,592.66	442
	July	1,115.44	109,045.32	333	939.94	187,988.00	574	1,255.86	158,635.21	485
	August	1,190.99	116,431.08	356	932.24	186,448.00	570	1,279.10	161,570.80	494
	September	1,129.16	110,386.19	337	835.39	167,077.40	510	1,394.05	176,090.82	538
	October	1,017.88	99,507.95	304	819.80	163,959.40	501	1,277.47	161,364.90	493
	November	855.23	83,606.99	255	859.41	171,881.80	525	1,345.47	169,954.39	519
	December	926.57	90,580.99	277	895.68	179,135.20	547	1,147.50	144,947.61	443
	Total	**11,587.83**	**1,132,826.07**	**3,460**	**9,705.98**	**1,941,195.40**	**5,929**	**15,387.86**	**1,943,732.29**	**5,940**

2010	January	958.72	93,724.86	286	841.48	168,295.40	514	1,315.55	166,175.01	508
	February	653.95	63,929.86	195	825.08	165,015.40	504	1,266.65	159,998.16	489
	March	1,077.29	105,315.48	322	850.19	170,037.80	520	1,311.33	165,642.34	506
	April	966.05	94,440.66	288	766.80	153,359.00	468	1,170.80	147,890.77	452
	May	1,042.25	101,890.46	311	821.83	164,366.40	502	1,355.25	171,189.76	523
	June	1,124.12	109,894.26	336	854.68	170,936.80	522	1,215.70	153,562.36	469
	July	1,118.00	109,295.68	334	944.81	188,961.40	577	1,431.59	180,832.72	553
	August	1,072.67	104,864.41	320	922.95	184,589.40	564	1,439.83	181,873.69	556
	September	651.43	63,683.60	194	836.00	167,199.00	511	1,407.88	177,837.77	543
	October	1,065.52	104,165.04	318	880.98	176,196.60	538	1,108.55	140,027.60	428
	November	1,002.76	98,030.21	299	866.02	173,204.00	529	1,129.25	142,642.34	436
	December	627.11	61,306.66	187	849.06	169,812.40	519	1,117.86	141,203.48	431
	Total	**11,359.87**	**1,110,541.18**	**3,390**	**10,259.87**	**2,051,973.60**	**6,268**	**15,270.24**	**1,928,876.01**	**5,894**
2011	January	465.65	45,521.75	139	810.14	162,028.20	495	1,281.25	161,842.38	494
	February	919.49	89,889.15	274	844.78	168,955.20	516	1,252.07	158,156.47	483
	March	984.31	96,226.05	294	882.29	176,458.80	539	1,174.97	148,417.51	453
	April	930.55	90,970.37	278	774.91	154,982.00	473	1,120.50	141,537.08	432
	May	1,003.87	98,137.84	300	968.59	193,718.20	592	1,189.14	150,207.41	459
	June	583.65	57,057.14	174	870.00	174,000.60	532	1,087.85	137,412.86	420
	Total	**4,887.50**	**477,802.29**	**1,459**	**5,150.72**	**1,030,143.00**	**3,147**	**7,105.78**	**897,573.71**	**2,741**

Total Monitoring Period	**30,422.39**	**2,974,092.65**	**9,081**	**26,858.09**	**5,371,618.80**	**16,407**	**41,739.71**	**5,272,392.96**	**16,109**

4.2 Project Emissions

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

4.3 Leakage

Leakage is estimated at 0 (zero) tCO_2e 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, should 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 hectare[7]. The grand major of these cultivations were established in the middle of 1970 to 1980. The *Eucalyptus* and *Pinus* genuses correspond to 80% of the afforestation in *Brazil*. Furthermore, these genuses are mainly cultivated in the southeast region of the country, where the climate is more favorable for their growing[8].

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 productivity[9]. 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 improvement[10].

The production of wood from afforestation in the state of *Rio de Janeiro* was of 368,710 m³[11] and in *São Paulo*, which is a bordering state, was of 7,407,385 m³[12] in 2007. As the consumption of this kind of fuel was equivalent to 3,545.25 m³ per year for this project activity[13], it represents less than 0.1% of the total of wood from afforestation produced in the region.

Sawdust/ Wood Chips

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 chips[14]. The

[7] Brazilian Society of Forestry. Source: <http://www.sbs.org.br/atualidades.php.>. Accessed at: 19/01/2009.

[8] 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.

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

[10] 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.

[11] 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.

[12] 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.

[13] Total consumption of this type of biomass was of 9,749.44 m³ in 33 months of monitoring period.

[14] 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.

production of wood log in the state of *Rio de Janeiro* was of 111,600 m³[15] and in *São Paulo*, which is a bordering state, was of 25,966,464 m³[16] in 2007. Thus, the production of sawdust/wood chips in the region was around 5,737,174.08 m³ per year. As the consumption of this project activity was equivalent to 29,192.57 m³ per year[17], it represented around 0.51% of the total of woody residues produced in the region.

Woody residues (including industrial and construction residues)

In order to calculate the availability of these biomasses, and considering the lack of studies regarding the inventory of residues in the state of Rio de Janeiro, it was utilized other similar cities in order to obtain the inventory of both construction and industrial residues.

The construction residues wood corresponds around 85% of the total construction residues in *Sorocaba*, city of the state of *São Paulo*. The deficiency of a correct destination for this wood constitutes a huge problem[18].

The percentage of the wood residues (such as pallets) contained within the industrial solid residues in the region of *Curitiba*, which is the capital of the state of *Paraná*, is around of 5%. Furthermore, the city garden residues correspond around 3.2% of the total of industrial solid residues[19].

It was utilized this estimative to calculate the percentage of consumption of these residues in the project activity. Moreover, it was only considered the availability of industrial wood residues, which is 749,839 tons per year (around 5% of the total of industrial solid residues). As the consumption of this kind of fuel was equivalent to 3,467.22 tonnes per year for this project activity[20], it represents around 0.46% of the total of this biomass produced in the region.

[15] 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

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

[17] Total consumption of these types of biomass was of 80,279.56 m³ in 33 months of monitoring period.

[18] MANCINI, S. D. et al. **Potencial de Reciclagem dos Resíduos da Construção Civil de Sorocaba-SP.** Available at: http://www.saneamento.poli.ufrj.br/documentos/24CBES/III-024.pdf. Last visit at: January 27th, 2009.

[19] Statewide inventory of industrial solid residues. Available at: <http://folio.mp.pr.gov.br/downloads/Meio_Ambiente/ri_iriap.pdf>. Last visit in: February 3rd, 2009.

[20] Total consumption of this type of biomass was of 9,534.84 tonnes in 33 months of monitoring period.

4.4 Summary of GHG Emission Reductions and Removals

Table below summarizes the emission reductions for this monitoring period[21].

Table 5. Emission reductions for the monitoring period.

Period		Ceramic			Total ER_y (tCO_2e)
		Argibem	*São Sebastião*	*Vulcão*	
		ER_y (tCO_2e)	ER_y (tCO_2e)	ER_y (tCO_2e)	
2008	October	288	407	566	1,261
	November	286	319	466	1,071
	December	198	337	502	1,037
	Total	**772**	**1,063**	**1,534**	**3,369**
2009	January	233	334	459	1,026
	February	187	345	463	995
	March	280	534	632	1,446
	April	297	500	463	1,260
	May	307	468	509	1,284
	June	294	521	442	1,257
	July	333	574	485	1,392
	August	356	570	494	1,420
	September	337	510	538	1,385
	October	304	501	493	1,298
	November	255	525	519	1,299
	December	277	547	443	1,267
	Total	**3,460**	**5,929**	**5,940**	**15,329**
2010	January	286	514	508	1,308
	February	195	504	489	1,188
	March	322	520	506	1,348

[21] 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 at zero tCO_2e.

	April	288	468	452	1,208
	May	311	502	523	1,336
	June	336	522	469	1,327
	July	334	577	553	1,464
	August	320	564	556	1,440
	September	194	511	543	1,248
	October	318	538	428	1,284
	November	299	529	436	1,264
	December	187	519	431	1,137
	Total	**3,390**	**6,268**	**5,894**	**15,552**
2011	**January**	139	495	494	1,128
	February	274	516	483	1,273
	March	294	539	453	1,286
	April	278	473	432	1,183
	May	300	592	459	1,351
	June	174	532	420	1,126
	Total	**1,459**	**3,147**	**2,741**	**7,347**
Total monitoring period		**9,081**	**16,407**	**16,109**	**41,597**

5 ADDITIONAL INFORMATION

5.1 Amount of renewable biomass consumed per month on each ceramic

5.1.1 Argibem Ceramic

Table 6. Amount of renewable biomass used by Argibem Ceramic.

Argibem - Renewable Biomasses (tonnes)				
Year	Period	**Sawdust**	**Woody residues**	**Wood from Afforestation**
2008	October	540.52	97.07	0.00
	November	434.10	33.47	5.18

	December	462.44	10.58	0.00
	Total 2008	**1,437.07**	**141.13**	**5.18**
2009	January	315.61	0.00	0.00
	February	526.59	0.00	0.00
	March	449.38	0.00	0.00
	April	127.17	8.34	0.00
	May	615.63	0.00	0.00
	June	616.85	41.76	0.00
	July	596.35	16.64	0.00
	August	1,074.14	92.55	0.00
	September	638.49	14.60	0.00
	October	770.41	43.79	0.00
	November	602.47	29.35	0.00
	December	564.70	0.00	0.00
	Total 2009	**6,897.80**	**247.03**	**0.00**
2010	January	558.43	28.75	0.00
	February	450.40	0.00	0.00
	March	520.96	0.00	0.00
	April	472.07	0.00	0.00
	May	662.67	45.42	0.00
	June	680.81	15.32	0.00
	July	641.88	29.94	0.00
	August	664.53	44.91	0.00
	September	644.78	14.36	0.00
	October	752.65	14.56	13.45
	November	897.56	73.17	0.00
	December	793.84	0.00	0.00
	Total 2010	**7,740.58**	**266.43**	**13.45**
2011	January	230.72	0.00	0.00
	February	616.91	31.03	0.00
	March	480.68	0.00	0.00
	April	605.29	29.03	0.00
	May	910.72	70.97	0.00
	June	748.73	14.11	0.00
	Total 2011	**3,593.05**	**145.14**	**0.00**
Total during the monitored period		**19,668.49**	**799.74**	**18.64**

5.1.2 São Sebastião Ceramic

Table 7. Amount of renewable biomass used by São Sebastião Ceramic.

São Sebastião - Renewable Biomasses (tonnes)			
Year	Period	**Woody residues – Industrial and Construction Residues**	**Wood from Afforestation**
2008	October	167.01	11.22
	November	2.64	20.40
	December	147.65	30.60
	Total 2008	**317.30**	**62.22**
2009	January	0.00	30.60
	February	0.00	0.00
	March	3.50	29.48
	April	7.00	0.00
	May	7.00	0.00
	June	4.50	36.21
	July	136.67	71.08
	August	46.89	28.56
	September	44.96	52.84
	October	38.45	42.84
	November	23.55	73.95
	December	115.50	153.00
	Total 2009	**428.02**	**518.55**
2010	January	182.27	133.11
	February	185.42	12.75
	March	190.96	56.65
	April	174.60	108.63
	May	161.32	41.35
	June	130.86	35.70
	July	148.43	102.00
	August	139.98	166.26
	September	139.11	119.85
	October	196.21	71.46
	November	234.17	97.54
	December	196.79	81.60
	Total 2010	**2,080.12**	**1,026.90**
2011	January	209.89	55.08
	February	219.05	88.23
	March	124.18	74.46
	April	178.53	102.00
	May	187.39	49.47
	June	161.92	65.79
	Total 2011	**1,080.96**	**435.03**

Total during the monitored period	**3,906.40**	**2,042.70**

5.1.3 Vulcão Ceramic

Table 8. Amount of renewable biomass used by Vulcão Ceramic

Vulcão - Renewable Biomasses (tonnes)			
Year	Period	**Woody residues - Industrial and Construction Residues**	**Wood from Afforestation**
2008	October	292.05	25.50
	November	69.98	79.05
	December	195.80	219.30
	Total 2008	**557.83**	**323.85**
2009	January	249.30	25.50
	February	338.00	12.75
	March	381.80	12.75
	April	290.10	0.00
	May	135.55	71.40
	June	128.75	264.69
	July	169.35	100.47
	August	212.80	109.65
	September	206.75	175.95
	October	293.50	140.25
	November	195.80	86.70
	December	20.80	99.45
	Total 2009	**2,622.50**	**1,099.56**
2010	January	100.85	76.50
	February	67.10	74.46
	March	99.15	144.33
	April	129.65	42.33
	May	83.30	100.98
	June	116.50	73.95
	July	78.05	117.30
	August	121.18	99.45
	September	155.09	34.68
	October	76.96	89.76
	November	83.47	90.02
	December	45.60	77.06
	Total 2010	**1,156.90**	**1,020.82**
2011	January	78.19	25.50
	February	49.02	98.07
	March	33.62	89.45
	April	47.65	90.22

	May	140.86	103.02
	June	142.13	60.38
	Total 2011	**491.48**	**466.65**
Total during the monitored period (t)		**4,828.70**	**2,910.88**