

GOMES DE MATTOS CERAMIC FUEL SWITCHING PROJECT



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 *Gomes de Mattos* ceramic, which is a medium-sized ceramic industry that produces ceramic devices, like tiles and bricks, destined for the regional market of *Ceará*.

The activity of this project consists on utilizing native wood from forest management plan, municipal wood residues, *Algaroba* wood, sawdust, residues from cashew trees, *Babaçu* coconut husk, and sugar cane bagasse, which are all renewable biomasses, to feed their kilns rather than using a non-renewable fuel like native wood.

The objective of the implementation of this project activity in the ceramics was to stop using the native wood and completely substitute it with renewable biomasses to feed their kilns and cook their ceramic devices 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 native wood 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 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. Furthermore, during the kilns' reform period, the ceramic companies had faced some problems and consequently had lost their production.

Besides, these new equipments acquired and the adaptation in the kilns added an additional cost for the ceramics.

The operators did not have knowledge of the ideal amount of renewable biomasses that was necessary to achieve the ideal temperature for the ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using native wood. Therefore, some training courses were required for the staffs of the three ceramics in order to clarify new measures linked to the machinery, sustaining the quality of the final product and find a burn cycle standard.

The ceramics usually have to deal with some difficulties in obtaining the renewable biomasses, which are becoming harder to find. *Gomes de Mattos* ceramic need to get them from others cities of the state of *Ceará*, and also from the bordering states of *Piauí*, *Pernambuco*, *Paraíba* and *Rio Grande do Norte*.

In case the price of the biomass increases, the ceramic cannot repass it, once it would not have competitive prices in relation to other ceramics which did not make the fuel switch. These circumstances make the commercialization of the carbon credits essential to the maintenance of the fuel switch.

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 *Caatinga* biome.

The emission reductions due to the switching of non-renewable fuel (native wood) to renewable biomasses resulted in **92,659 tCO₂e** during the monitoring period from 01/01/2010 to 31/07/2011. The contribution to sustainability will be 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.

1.3 Project Proponent

Project Proponent

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

Industrial Establishment: *Cerâmica Gomes de Mattos*

Mr. *Stephenson Ramalho de Lacerda*, Monitoring data responsible: General data and information on inputs and outputs of the ceramic, detailed information and numbers on sales and how output data is handled and how data is stored and kept by the *Gomes de Mattos's* office.

Mr. *Ronaldo Sampaio Gomes de Mattos*, 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 (88) 3521-6580

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 13/10/2011 by *Camila Vaccari*, *Larissa Tega da Fonseca*, *Mariana do Santos Silva*, *Mariana Fieri*, *Marcelo Hector Sabbagh Haddad* and *Thiago de Avila Othero*, from *Sustainable Carbon – Projetos Ambientais LTDA*.

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

¹ Addresses of ceramic can be found on Section 1.7.

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1.4 Other Entities Involved in the Project

None relevant.

1.5 Project Start Date

According to version 05 of the VCS PD², project start date was defined as 1st April, 2006.

1.6 Project Crediting Period

The crediting period for this project starts on 01/05/2006 and ends on 30/04/2016.

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

1.7 Project Location

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

The ceramics are located in *Brazil*, in the state of *Ceará*, municipality of *Crato*, in the northeast region of the country. The geographic location is illustrated in Figure 1.

The project site have the postal address: Rodovia CE 55, Km 06, Bairro Sítio Quebra – Crato, CE - Postal Code: 63 105-330.

² Document available at: http://mc.markit.com/br-reg/public/project.jsp?project_id=100000000000135. Last visited on 18/08/2011.



Figure 1. Geographic location of CGM ceramic: 7°10'36.50" S ; 39°24'49.23" 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.E: Switch from Non – Renewable Biomass for Thermal Applications by the User – Version 01 valid from 01/02/2008 to 08/04/2010. This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies.

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 the ceramic after the project validation. These include the acquisition of new machinery and investments in industrial automation. In *Gomes de Mattos Ceramic*, the following modifications occurred: Refurbish of the *Câmara*³ kiln. And currently they are refurbishing one of the *Hoffman* kilns.

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 third monitoring period of this project, and includes data from 01/01/2010 to 31/07/2011.

It is important to state that the project activity was submitted to some changes since its validation. During validation, CGM Ceramic utilized only Native wood from management plan, Algaroba wood, cashew tree

³ The “Câmara” is a kind of continuous kiln with chambers without chimney. It is usually employed to burn bricks

wood, Babaçu coconut husk, municipal wood residues, sawdust, and *Eucalyptus* wood. During the current monitored period, the company is still not using native wood. However, CGM Ceramic is also utilizing sugar cane bagasse as renewable biomasses. Therefore, it was necessary to validate the properties (NCV and specific gravity) of these biomasses, once it was not listed as a current biomass at the VCS PD. Generally, the amount of renewable biomass may vary depending on the harvest, where shortages can happen depending on natural and economic factors.

Regarding the Financial Barrier, the monitored period also must be considered additional. Therefore, it was made a sensitivity analysis for this period, once the Financial Barrier did not include sugar cane bagasse on its calculation during validation. The sensitivity analysis was made by comparing the cost per energy generated by the renewable biomass (Native wood from management plan, Algaroba wood, cashew tree wood, Babaçu coconut husk, municipal wood residues, sawdust, and sugar cane bagasse) that was acquired during the monitored period. This value was compared with the cost per energy generated in the baseline, according to VCS PD version 5, section 2.5. As can be verified in the table 1, the project is considered additional.

The Chart 1 displays the sensitivity analysis at CGM Ceramic during the monitored period. It can be observed that the non-renewable biomass is cheaper than using the renewable biomasses (Native wood from management plan, Algaroba wood, cashew tree wood, Babaçu coconut husk, municipal wood residues, sawdust, and sugar cane bagasse).

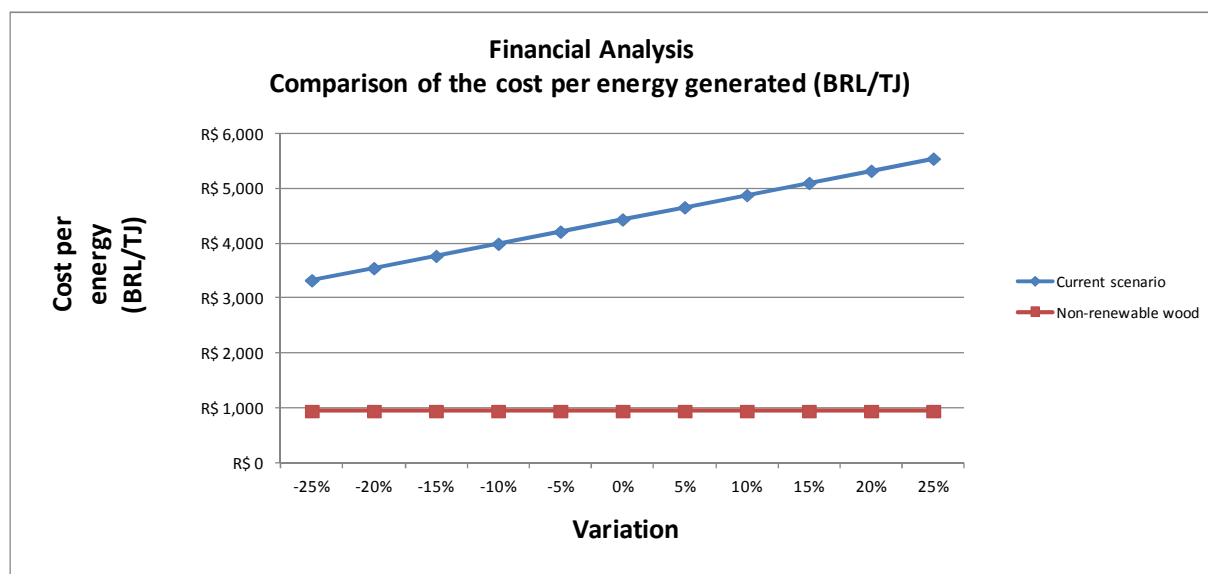


Chart 1. Sensitivity Analysis of CGM Ceramic.

The burning efficiency with biomass increased after the fuel switching (when compared to the baseline scenario), mainly due to the decrease of thermal energy loss in the kiln entrances. In addition, the small size of the biomass contributed to a better distribution of energy inside the kilns. Consequently, in order to produce the same amount of ceramic devices, the thermal energy generated by non-renewable wood is not directly equivalent to the energy generated by the amount of renewable biomasses in the project activity.

With the project activity's implementation, the total spending has increased, as can be verified above. Comparing the cost per energy generated, *CGM* ceramic spends with renewable biomass around R\$ R\$ 4,435 per TJ generated against R\$ 941 per TJ generated with non-renewable wood. Although the ceramic industry increased the burning efficiency as detailed above, the cost of the fuel has increased as well.

The income from the commercialization of the carbon credits is essential to maintain the fuel switch, as this change needs more resources than previously to maintain operations. This disparity obviously puts the ceramic in a less competitive situation, which would make the fuel switching and the continued use of the needed machinery unfeasible without the existence of the carbon markets.

Table 1. Sensitivity Analysis

	Biomasses	Biomass Costs (BRL/tonne)	Monitored consumption (tonne/year)	Energy Generated (TJ)	-25%	-15%	-5%	0%	5%	15%	25%
Monitored Period	Algaroba wood	16.02	359.07	7.0	R\$ 29	R\$ 32	R\$ 36	R\$ 38	R\$ 40	R\$ 44	R\$ 48
	Sugar Cane Bagasse	21.08	617.88	8.3	R\$ 65	R\$ 73	R\$ 82	R\$ 86	R\$ 91	R\$ 99	R\$ 108
	Babaçu Coconut husk	15.00	37.23	0.7	R\$ 3	R\$ 3	R\$ 4	R\$ 4	R\$ 4	R\$ 4	R\$ 5
	Sawdust	53.81	1,126	15.0	R\$ 301	R\$ 341	R\$ 382	R\$ 402	R\$ 422	R\$ 462	R\$ 502
	Cashew tree wood	133.86	696	13.1	R\$ 463	R\$ 525	R\$ 587	R\$ 618	R\$ 649	R\$ 711	R\$ 772
	Municipal wood residues	-	1,352	25.9	R\$ 0	R\$ 0	R\$ 0	R\$ 0	R\$ 0	R\$ 0	R\$ 0
	Native wood from forest management plan	117.39	4,225	81.0	R\$ 2,465	R\$ 2,794	R\$ 3,123	R\$ 3,287	R\$ 3,451	R\$ 3,780	R\$ 4,109
	Current scenario	-	8,413	150.9	R\$ 3,326	R\$ 3,769	R\$ 4,213	R\$ 4,435	R\$ 4,656	R\$ 5,100	R\$ 5,543
Baseline Scenario	Non-renewable wood	18.03	19,932	382	R\$ 941	R\$ 941	R\$ 941	R\$ 941	R\$ 941	R\$ 941	R\$ 941

2.2 Deviations from the Monitoring Plan

The registered VCS PD version 05 establishes that the project proponents (meaning the ceramic owner) would measure the amount of renewable biomasses used (parameter $Q_{\text{renbiomass}}$). 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 provider and controlled by the ceramic owner, 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.

Moreover, the registered VCS PD v.5 did not consider the conversion factor from mst to m³ for the amount of renewable biomass that arrives in mst unit (parameter $Q_{\text{renbiomass}}$). Therefore, in this Monitoring Report, the values presented in the table $Q_{\text{renbiomass}}$ of the VCS PD (section 3.3) for cashew wood and native wood from management areas were corrected, according to the conversion factors presented in the section 3.2 of this Monitoring Report, table $Q_{\text{renbiomass}}$.

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 :	$EF_{\text{projected_fossil fuel}}$
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.ipccnggip.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:	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas due to risks involving natural gas distribution.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction. The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel. 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.
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Data Unit / Parameter:	NCV_{biomass}
Data unit:	TJ/tonne of wood
Description:	Net Calorific Value
Source of data:	National data
Value applied:	0.019
Purpose of the data:	This value provided the energy generated by the amount of wood that would be used in the absence of the project. The species used to calculate the average value are typical trees of <i>Caatinga</i> Biome that are usually utilized as fuel in the ceramic industries of the region. Sources: - Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Available at <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf> visited in August 19th, 2011. - Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir. Available at: <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf> visited in August 19th, 2011.
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:	P_{biomass}
Data unit:	tonne/ m ³
Description:	Specific gravity
Source of data:	National data
Value applied:	0.88 tonne/m ³ . Value average checked at: - IPCC: Intergovernmental Panel on Climate Change. Orientación del IPCC

	sobre las buenas prácticas para UTCUTS - chapter 3 – Table 3A.1.9-2 - LORENZI, H. Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002. - <i>Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd)</i>. Available at <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf> visited in August 19th, 2011. - Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Available at: <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf> visited in August 19th, 2011. - <http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139> visited in August 19th, 2011.
Purpose of the data:	The amount of wood used in the baseline was measured in volume units. This datum was used for the unit conversion.
Any comment:	The species used to calculate the average value are typical trees of <i>Caatinga</i> Biome and usually utilized as fuel in the ceramic industries of the region.

Data Unit / Parameter:	BF_y
Data unit:	m ³ of wood per tonnes of ceramic devices.
Description:	Consumption of non-renewable biomass per thousand of ceramic devices
Source of data:	Historical data from project proponent
Value applied:	0.64 m ³ of wood per tonnes of ceramic devices.
Purpose of the data:	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramic used to consume non sustainable wood. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns. The value is employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
Any comment:	The efficiency of the kiln is around 1.29m ³ of wood per thousand of ceramic devices, which presents a lower efficiency when compared with the value of Hoffman consumption found on literature which is between 0.5 and 0.9 m ³ of wood per thousand of pieces. That occurs since CGM used to employ wood in their dryers as well and because of the lower efficiency of CGM's kilns.

	Source with TAPIAS, 2000 ⁴ .
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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.5 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 methods and procedures to be applied:	The amount of biomasses was monitored in accordance to the weight described in the receipts from the providers. The values in the receipts may be described in m ³ , therefore 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 is:						
	Biomass	Native wood from forest management plan / Municipal wood residues	Cashew tree wood	Sawdust	Babaçu Coconut husk	Algaroba wood	Eucalyptus Wood from management plan
	Specific gravity (tonnes/m³)	0.88	0.42	0.245	1.085	0.756	0.49
	The sources of these data are: Sawdust: Masses and Dead Loads of Concrete and Other Materials- http://www.cca.org.nz/pdf/Masses.pdf Cashew tree wood: LORENZI, H. Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas						

Arbóreas Nativas do Brasil, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002.

Native wood from management areas / Municipal wood residues:

The same applied in $p_{biomass}$

Babaçu coconut husk:

<<http://www.ipef.br/publicacoes/scientia/nr34/cap04.pdf>>

Visited on March 13th, 2009.

Algaroba wood:

The value applied is an average among all species founded in the source:

<http://www.cnpf.embrapa.br/publica/boletim/boletarqv/bolet45/pag-99_106.pdf>

Visited on March 13th, 2009.

Wood from forest management areas (*Eucalyptus*):

The value applied is an average among all species founded in the source:

<<http://www.ipef.br/publicacoes/scientia/nr23/cap08.pdf>>

Visited on March 13th, 2009.

Receipts registered like "stereo" as unit of measure was converted to "m³" using the Conversion Factors above

Conversion factor from "st" to "m ³ "	
Native Wood from forest management areas	0.3388
Algaroba and Cashew tree wood	0.3745

The sources of these data are:

Native Wood from forest management areas:

Table 13, section 5.3.3.7, of the Boqueirão Forest Management Plan. The conversion factor was calculated according to the average of the plots described in this table.

Algaroba and Cashew tree wood:

FERRAZ, Douglas Galvão. Inventário Florestal de Três Fragmentos com Candeia (*Eremanthus erythropappus*) no Município de Itajubá - MG. 2008. 26 f. Monografia (Conclusão de Curso) - Curso de Gestão Ambiental, Escola Agrotécnica Federal, Inconfidentes-mg, 2008. Available at: <<http://docs.google.com/viewer?a=v&q=cache:mNfJBYKgNNMJ:www.ifs.ifsuldemina>>

	s.edu.br/pesquisas/TCC/TCC_Douglas.pdf+conver%C3%A7ao+mst+m3&hl=pt-BR&gl=br&pid=bl&srcid=ADGEESiMIDtbGvrwKnl888t-ddbzBkGnc2hYaTXhq3GtXUOg1wbAbYIk1f2UWhdIIHsWCyfyYtfFgNboU_qeG8hcJf5fAzliJljP3Z451eltDC6xOwmnW_X7D6HN69DDfUPbjq60wes&sig=AHIEtbTwzpj3zy7n6nlZFDM3-djyemLmDg>. Last visit on: September 28th, 2011. Moreover, the registered VCS PD v.5 did not consider the conversion factor from mst to m³ for the amount of renewable biomass that arrives in mst unit (parameter Qrenbiomass). Therefore, in this Monitoring Report, the values presented in the table Qrenbiomass of the VCS PD (section 3.3) for cashew wood and native wood from management areas were corrected, according to the conversion factors presented in the section 3.2 of this Monitoring Report, table Qrenbiomass. To testify the renewability of the native wood from forest management areas is necessary the use of DOF (Forest Origin Document) to prove the regular origin of the biomass. Besides that, the Sustainable Management Plans ensure that the native wood is taken from land areas with sustainable management practices.																																				
Frequency of monitoring/recording:	Monthly																																				
Value monitored:	<table><tr><td></td><td>Period</td><td>Total (tonnes)</td></tr><tr><td rowspan="12">2010</td><td>January</td><td>480.75</td></tr><tr><td>February</td><td>546.62</td></tr><tr><td>March</td><td>467.01</td></tr><tr><td>April</td><td>409.19</td></tr><tr><td>May</td><td>550.44</td></tr><tr><td>June</td><td>530.94</td></tr><tr><td>July</td><td>538.96</td></tr><tr><td>August</td><td>641.82</td></tr><tr><td>September</td><td>578.73</td></tr><tr><td>October</td><td>482.24</td></tr><tr><td>November</td><td>552.64</td></tr><tr><td>December</td><td>1,520.56</td></tr><tr><td></td><td>Total 2010</td><td>7,299.91</td></tr><tr><td>2011</td><td>January</td><td>577.47</td></tr></table>				Period	Total (tonnes)	2010	January	480.75	February	546.62	March	467.01	April	409.19	May	550.44	June	530.94	July	538.96	August	641.82	September	578.73	October	482.24	November	552.64	December	1,520.56		Total 2010	7,299.91	2011	January	577.47
	Period	Total (tonnes)																																			
2010	January	480.75																																			
	February	546.62																																			
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	October	482.24																																			
	November	552.64																																			
	December	1,520.56																																			
	Total 2010	7,299.91																																			
2011	January	577.47																																			

			February	630.41			
			March	622.12			
			April	1,325.42			
			May	973.92			
			June	1,011.98			
			July	878.94			
			Total 2011	6,020.25			
						Total in the period	13,320.16
More detailed information is available in Section 5.							
The increase in the amount of the biomass consumed was due to a stock realized from January to July of 2011. According to <i>Stephenson Ramalho de Lacerda</i> employee responsible for the project in CGM Ceramic, this stock was necessary once the biomass need to be dried for a long period under the sun. Another relevant factor which can be considered is due to the biomass seasonality, which implies in the accumulation of biomass in determined months.							
Monitoring equipment:	No monitoring equipment is used to determine this parameter						
QA/QC procedures to be applied:	It was monitored through receipts of purchase from the biomass providers. The ceramic industry controls the quantity of biomass through an internal spreadsheet, which is fed with the measured values of all the biomass that arrive from the providers. These internal spreadsheets were double checked with all the receipts and invoices of biomass employed.						
Calculation method:	Not applicable						
Any comment:							

Data Unit / Parameter:	PR_y (Ceramic devices)
Data unit:	Unity of ceramic devices or tonnes of ceramic devices.
Description:	Production of ceramic pieces
Source of data:	Controlled by the project developer.
Description of measurement	The amount was acquired by counting the total production of one year. The measurement was done by an internal control sheet

methods and procedures to be applied:	monitored by the project proponent, which was daily filled. The production is a representative sample to ensure that all appliances are still in operation. The weights of the ceramic units produced in this monitoring period were measured by a calibrated scale from Federal University of Ceará⁵s Quality Laboratory. These values are used to convert production from units to tonnes. <table border="1"> <thead> <tr> <th>Ceramic device</th><th>Weight (Tonnes per thousand of ceramic units)</th></tr> </thead> <tbody> <tr> <td>Blocks with 8 orifices</td><td>1.935</td></tr> <tr> <td>Blocks with 6 orifices</td><td>1.47</td></tr> <tr> <td>Flagstones</td><td>2.541</td></tr> <tr> <td>Decor Revetment</td><td>0.286</td></tr> <tr> <td>Colonial Tile</td><td>1.282</td></tr> <tr> <td>Pressed Tile</td><td>2.836</td></tr> </tbody> </table>	Ceramic device	Weight (Tonnes per thousand of ceramic units)	Blocks with 8 orifices	1.935	Blocks with 6 orifices	1.47	Flagstones	2.541	Decor Revetment	0.286	Colonial Tile	1.282	Pressed Tile	2.836												
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⁵ National Service of Industrial Learning.

	Total 2010	70,098.14
	January 2011	5,870.18
	February 2011	6,207.47
	March 2011	6,215.19
	April 2011	6,108.84
	May 2011	5,726.39
	June 2011	6,026.37
	July 2011	6,307.67
	Total 2011	42,462.11
More detailed information is available in Section 4. The production of CGM ceramic exhibit an increase of its production during the monitoring period in order to supply the high ceramic market demand which has been increased gradually throughout the years⁶.		
Monitoring equipment:	No monitoring equipment is used to determine this parameter. Production is counted by trained personnel in the ceramic.	
QA/QC procedures to be applied:	The ceramics have an internal control of the quantity of pieces produced. It was rechecked according to the biomass employed and the kiln consumption of renewable biomass.	
Calculation method:	Not applicable	
Any comment:		

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:	The guarantee of acquiring renewable wood was achieved by invoices from the providers. The biomasses (Native wood from management plan, Algaroba wood, cashew tree wood, Babaçu coconut husk, municipal wood residues, sawdust, and sugar cane bagasse) are considered renewable as fulfilling the options described in the applied methodology.

⁶ Available at: < <http://perfilinmobiliario.com/site/?p=883>>. Last visit on: September 22nd of 2011.

Frequency of monitoring/recording:	Each crediting period
Value monitored:	Not directly applied for the calculation. It is considered that all biomass used is renewable.
Monitoring equipment:	No monitoring equipment is used to determine this parameter.
QA/QC procedures to be applied:	The biomass was considered renewable if it is according to the definition given by Methodology AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User – Version 01 valid from 01/02/2008 to 08/04/2010.
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.

Data Unit / Parameter:	Renewable biomass surplus			
Data unit:	tonne or m³			
Description:	Amount of renewable biomass available			
Source of data:	Monitored			
Description of measurement methods and procedures to be applied:	It was used to calculate the leakage of renewable biomass. The sources of leakages predicted in methodology applied were monitored. The measurement of the leakage was based on national and international articles and database every monitoring period. The sources provided information about the biomass availability in the project activity's region. More information, please see Section 4.3 – Leakage, Part A.			
Frequency of monitoring/recording:	Annually			
Value monitored:		Biomass	Surplus	Year
		Sawdust in m³	10,775.38	2007/2008
		Babaçu coconut husk (tonnes)	4,756	2007/2008
		Wood from management areas (m³)	4,595,695	2007/2008
		Residues from cashew trees (tonnes)	196,625	2007/2008

	Algaroba wood (m ³)	2,500,000	2007/2008	
	Sugar Cane Bagasse (tonne)	2,387,639	2008/2009	
	Municipal garden's residues	Not measured	2007/2008	
Monitoring equipment:	No monitoring equipment is used to determine this parameter.			
QA/QC procedures to be applied:	Data available regarding the ceramic industry 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:	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 non-renewable biomass.
Data unit:	tCO ₂ e
Description:	Leakage resulted from the non-renewable biomass
Source of data:	Monitored
Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in the applied methodology were monitored. Scientific articles, official statistical data, regional and national surveys were provided in order to ensure that there was no leakage from non-renewable biomass (or to estimate the leakage). More information, please see Section 4.3 – Leakage, Part B.
Frequency of monitoring/recording:	Annually
Value monitored:	0
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 utilized to monitor the leakage.
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.
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Data Unit / Parameter:	$f_{NRB,y}$
Data unit:	Percentage
Description:	Fraction of biomass (wood) used in the absence of the project activity that is established as non-renewable biomass using survey methods
Source of data:	Survey methods.
Description of measurement methods and procedures to be applied:	However, according to CNIP (2007)⁷, <i>Caatinga</i> biome has only 0.3% of its total area with sustainable use. Furthermore, considering that 0.26% of this biome has been saved by other project activities, thus, 99.4% is considered as a fraction of non-renewable biomass. It was made two sheets to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the <i>Caatinga</i> biome. The other sheet calculates de amount of wood consumed regarding only CGM Ceramic. Dividing these values by the total of wood available, it was achieved the amount of renewable biomass that has been saved by all the project activities or only by CGM project, respectively.⁸ Afterwards, summing each value with the sustainable use areas defined by CNIP (2007), it was acquired two fraction of renewable biomass. Finally, each value was subtracted from 100% to achieve the $f_{NRB,y}$. Therefore, it was taken the smaller value in order to be more conservative. These sheets are available at the VCS MR Calculation spreadsheet.
Frequency of monitoring/recording:	Annually
Value monitored:	99.4%
Monitoring equipment:	No monitoring equipment is used to determine this parameter.
QA/QC procedures to be applied:	The monitoring of this parameter was based on national and international articles, databases, data monitored by the project developer such as project activities at the same region. The sources

⁷ Centro Nordestino de Informações sobre Plantas. Associação de Plantas do Nordeste. 2007. Available at: <http://www.cnip.org.br/planos_manejo.html>. Visited on October 21st, 2010.

⁸ According to data from project activities elaborated by Sustainable Carbon – Projetos Ambientais LTDA.

	provided information about the sustainable use of Amazonian biome. Wood saved from projects to which the same methodology was applied, which are in the same biome and applied methodology developed by <i>Sustainable Carbon – Projetos Ambientais Ltda.</i> was considered in this fraction. CDM or VCS registered projects were also included in this fraction if placed in the same region and methodology.
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 non-renewable native wood 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 $Q_{renbiomass}$ 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.

The responsible for the monitoring plan are: *Stephenson Ramalho de Lacerda*. 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.E: Switch from Non – Renewable Biomass for Thermal Application by the User – Version 01 valid from 01/02/2008 to 08/04/2010. The project activity in this monitoring period (19 months) generated 151 TJ per year. Converting this number to MWh, it was generated 41,910 MWh per year, which corresponds to the use of 4.78 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:

$$ER_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossilfuel} \quad (\text{Equation 01})$$

Where:

- ER_y:** Emission reductions during the year y in tCO₂e
- B_y:** Quantity of biomass that is substituted or displaced in tonnes
- f_{NRB,y}:** Fraction of non-renewable biomass (wood) used in the absence of the project activity in year y
- NCV_{biomass}:** Net calorific value of non-renewable biomass in TJ/tonne
- EF_{projected fossil fuel}:** Emission factor for the projected fossil fuel consumption in the baseline in tCO₂e/TJ⁹.

B_y is determined using the following option:

Calculated from the thermal energy generated in the project activity as:

$$B_y = \frac{HG_{p,y}}{\eta_{old} \times NCV_{biomass}} \quad (\text{Equation 02})$$

Where:

- HG_{p,y}:** Quantity of thermal energy generated by the renewable energy in the project in year y in TJ.
- η_{old}:** Efficiency of the system being replaced

$$HG_{p,y} = SGE \times PR_y \quad (\text{Equation 03})$$

Where:

- SGE:** Specific energy which has to be generated in the process to produce a certain amount of ceramic devices in TJ/thousand of ceramic device.
- PR_y:** Amount of product produced in year y in tonnes of ceramic devices

$$\eta_{old} = \frac{SGE}{SFE} \quad (\text{Equation 04})$$

Where:

- SFE:** Specific fuel energy needed for the process to produce a certain amount of ceramic devices in TJ/ tonne of ceramic device

$$SFE = BF_y \times NCV_{biomass} \quad (\text{Equation 05})$$

⁹ The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.

Where:

BF_y: Amount of native firewood needed to produce a certain amount of product in tonne/tonne of ceramic devices

Using the Equations 3, 4 and 5 in the Equation 2, it results to:

$$B_y = PR_y \times BF_y \quad (\text{Equation 06})$$

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

Table 2. Baseline emissions

Period	PR _y (tonnes)	B _y (tonnes)	Baseline Emissions (tCO ₂ e)
January 2010	6,809.18	3,835	5,605
February 2010	5,601.55	3,155	4,611
March 2010	5,749.06	3,238	4,733
April 2010	5,611.98	3,161	4,620
May 2010	5,794.97	3,264	4,770
June 2010	5,456.97	3,073	4,492
July 2010	5,656.91	3,186	4,657
August 2010	5,644.71	3,179	4,647
September 2010	6,078.81	3,424	5,004
October 2010	5,856.23	3,298	4,821
November 2010	5,832.29	3,285	4,801
December 2010	6,005.48	3,382	4,944
Total 2010	70,098.14	39,479	57,705
January 2011	5,870.18	3,306	4,832
February 2011	6,207.47	3,496	5,110
March 2011	6,215.19	3,500	5,116
April 2011	6,108.84	3,440	5,029
May 2011	5,726.39	3,225	4,714
June 2011	6,026.37	3,394	4,961
July 2011	6,307.67	3,552	5,192
Total 2011	42,462.11	23,915	34,954

4.2 Project Emissions

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

4.3 Leakage

Leakage is estimated at 0 (zero) tCO₂e during the entire monitoring period.

The Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01 valid from 01/02/2008 to 08/04/2010) predicts the following possible three sources of leakage:

A) If the project activity includes substitution of non-renewable biomass by renewable biomass, leakage in the production of renewable biomass must be considered.

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 3. 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 possible sources of leakage of the present project activity is the competing use of Native wood from management plan, *Algaroba* wood, cashew tree wood, *Babaçu*

coconut husk, municipal wood residues, sawdust, and sugar cane bagasse. All of these biomasses have enough availability as showed below demonstrating the lack of leakage for each biomass. The source of leakage of the present project is showed below according to each type of biomass:

Algaroba wood

According to Silva (2007)¹⁰, *Algaroba*¹¹ (*Prosopis juliflora* (Sw.) D.C.) is a tropical tree legume fairly common in the semi-arid region of Brazil, which thrives in dry environments where other plants would hardly survive.

At the beginning of 40's, this specie was introduced in the Northeast region of Brazil with the aim of providing food to animals and to be utilized for reforestation actions. However, currently, due to its competitive skills, *Algaroba* spreads through several regions of Brazilian semi-arid areas¹².

A research made by EMBRAPA¹³, which encompass the States nothwest region, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts¹⁴. Besides, *Algaroba* presents a considerable capacity of regeneration and dispersal¹⁵, which means that the plant does not die, it sprouts again stead.

The research's author reported that wood from *Algaroba* exploration is mainly commercialized as fuel for industries of vegetable oil, leather, ceramic and bakeries. On the other hand, *Algaroba* wood is not sold for stake¹⁶, pegs and poles uses.

The factors which contribute most to the expansion of *Algaroba* uses, as firewood in these industries sectors, were its wide availability in the region and its legal release extraction from IBAMA¹⁷. This way, in order to control the decrease of biologic diversity in *Caatinga* biome, which has been occasioned from

¹⁰ Silva, C. G. M., Melo Filho, A. B., Pires, E. F., Stamford M. Physicochemical and microbiological characterization of mesquite flour (*Prosopis juliflora* (Sw.) DC). Ciênc. Tecnol. Aliment., Campinas, 27(4): 733-736, out.-dez. 2007.

¹¹ *Algaroba* may also be known as mesquite.

¹² EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Available at: <<http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>>. Visited on December 14th, 2008.

¹³ EMBRAPA is the Brazilian Agricultural Research Corporation's which its mission is to provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer.

¹⁴ Araujo, J. L. P., Correia, R. C., Araujo, E. P., Lima, P. C. F. Cadeia Produtiva da Algaroba no Pólo de Produção da Bacia do Submédio São Francisco. EMBRAPA. Petrolina -PE – Brazil.

¹⁵ EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Available at: <<http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>>. Visited on December 14th, 2008.

¹⁶ Heavy pole to which cattle is tied.

¹⁷ IBAMA (Brazilian Institute for Environment and the Renewable Natural Resource) is the environmental agency of Brazil affiliated with Ministry of Environment. The main missions of IBAMA are: Environmental Protection, Environmental Licensing, Environmental Quality and Sustainable Use of Forest Management and Animal Resources. More information about IBAMA is available at: <www.ibama.gov.br>.

Algaroba's genre invasion, the government started to stimulate the *Algaroba* exploration in order to avoid its noxious effects.

Furthermore, this research showed that *Algaroba* is not used as a unique source of fuel for thermal energy generation in these industries sectors, e.g. corresponding only for 30% of the fuel's source in bakeries of the region studied.

The same research estimated that in the Northeast semi-arid region there were about 500 hundreds hectares spread through every type of its region land. Moreover, according to EMBRAPA (1992)¹⁸, wood's production by *Algaroba* is at least 5 m³/ha/year, i.e. the production in the project's region is about 2,500 thousands of m³ per year. The project activity utilized during the monitoring period 474.95 m³ which represented less than 1% of the total amount of *Algaroba* used by CGM Ceramic per year¹⁹.

Therefore, this kind of fuel did not encompass any type of leakage since there was a great amount of this renewable biomass available locally as described before.

Sawdust

Sawdust is also a probable fuel to be used for the ceramic devices burning. The production of wood generates a large amount of residues, which can be reused to generate thermal energy. As can be observed in the Figure 2, the potential of energy generation in the state of Ceará is plentiful, which means that there is an enormous availability of this kind of fuel to be employed in the project activity.

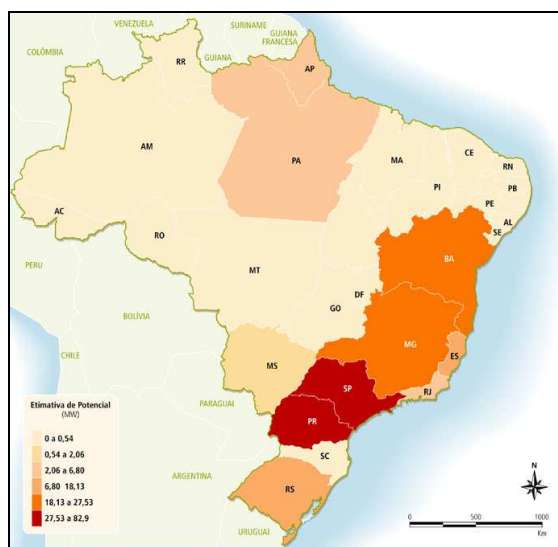


Figure 2. Forest Residues Potential for Energy Generation²⁰

¹⁸ EMBRAPA, Comunicado Técnico Nº, Nov/92, p.1-2. Available at: <http://www.cpatia.embrapa.br/public_eletronica/downloads/COT51.pdf>. Visited on December 14th, 2008.

¹⁹ CGM Ceramic consumes approximately 1,115 m³ of *Algaroba* wood per year.

²⁰ Source: CENTRO NACIONAL DE REFERÊNCIA EM BIOMASSA - CENBIO. Panorama do potencial de biomassa no Brasil. Brasília; Dupligráfica, 2003. 80 p.

Considering that around 22% of the wood produced will generate sawdust²¹. The production of wood in the state of Ceará was of 48,979 m³²² in 2007, thus, it generated 10,775.38 m³ of sawdust.

The project activity utilized approximately 4,595.96 m³ per year, which represented 42% of the total of these residues generated in the State of Ceará.

This way, this renewable biomass did not have potential to generate leakage emissions.

Cashew tree wood

Since CGM Ceramic utilizes wood residues from cashew trees, it is important to analyze the cashew scenario within Brazilian borders. The cashews cultivation is extremely important to Brazilian economy, where it is responsible for generate 150 million dollars per year. The cashew production is important especially in the northeast region, representing about 95% of Brazilian's cashew production. Besides, cashew production is responsible for generating job opportunities for 35,000 fieldworkers, 15,000 in the manufacturing process and 200,000 indirect job opportunities²³. The Brazilian production achieved 143,000 tonnes of cashew-nuts in 2005 spread in an area of 650,000 Hectares⁶⁸. Moreover, Brazilian's production presents the tendency of increasing so far, carried by the new technologies utilized and the higher national and international demand of cashew nuts²⁴. This way, the Brazilian sources of residues from cashew trees will increase following the Brazilian production, due the fact that cashew cultivation request continuous cut of cashew trees. The cut of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest time. This way, in cashew cultivation must be cut undesirable branches of the cashew trees²⁵. Moreover, dry branches on the ground compound a considerable amount of residues from cashew trees cultivation.

There is no estimated amount of residues from cashew trees, however its abundant availability is well-known all over the country. Besides, in order to destine the great amount of residues from cashew trees, the Brazilian's government allowed the utilization of this residue as firewood²⁶.

According to "*Plantio do Caju*" cashew trees cultivation presents a density of 121 units of trees per hectare²⁷, and the production of firewood residues from each tree is 2.5 kg per year²⁸. The cultivation of

²¹ 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.

²² According to IBGE (Geographic and Statistic Brazilian Institute) available from: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007>>

²³ According with EMBRAPA (Brazilian Agricultural Research Corporation's) Available at :<<http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/index.htm>> visited on March 13th, 2009.

²⁴ Checked at: <<http://www.nordesterrural.com.br/nordesterrural/matLerdest.asp?newsId=2219>>. Accessed on March 04th, 2009.

²⁵ According to EMBRAPA(Brazilian Agricultural Research Corporation's). Available at: <http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratosculturais.htm>> visited on March 13th, 2009

²⁶ Source: <<http://tribunadonorte.com.br/motoresrn/noticias.php?id=83885>>. Visited on May 06th, 2009.

cashew is located in an area of 650,000 hectares⁶⁸. This way, the Brazilian production of residues from cashew trees is around 196,625 tonnes per year. Therefore, the CGM's consumption of residues from cashew trees (696.43 tonnes per year) was around 0.35% of the total production of residues from cashew trees. Thus, the amount of residues from cashew trees necessary to provide thermal energy in CGM's kilns represents a non-representative quantity of this kind of biomass, which avoids the possibility of leakage.

Babaçu Coconut Husk

Babaçu coconut is a fruit from *Babaçu palm* which is a Brazilian's native species. *Babaçu* Palm is important specie in Brazilian economy and culture where it occupies nine states mainly in north and northeast region²⁹. *Babaçu* coconut husk may have different employments such as manufacturing of vegetal oil, food, or source of biomasses energy supply. For these reasons *babaçu* coconut shows a high and continuous production. According to IBGE the Brazilian's *babaçu* coconut almond reaches the number of 358 tonnes during 2007 just in Ceará state³⁰. Besides, the almond derived from *babaçu* coconut represents just 7% of its total weight the other 93% of *babaçu* coconut represent its husk³¹ which is utilized as fuel in this present project. These facts lead to conclude that the production of *babaçu* coconut husk is 4,756 tonnes per year. The proposed project activity employed 37.22 tonnes of *babaçu* coconut husk per year, that means 0.78% of the total production in Ceará states. Also the ceramic may utilize *babaçu* coconut husk from other states in the region such as *Maranhão* which has an annual production of 108,745 tonnes of almond from *babaçu* coconut³². For all these reasons the utilization of this biomass represents a non-representative quantity of these kind of biomass when compared with it production. Thus, there is no leakage for such biomass.

Native wood from forest management plan

Ceará state presents a production of 4,595,695 m³ of fire wood³³, being one of the largest productions among Brazilian's states. The present project intends to utilize around 4,800.61 m³ of wood from

²⁷ According to "Resposta Técnica" from CETEC (Technologic Center of Minas Gerais) considering a space of 10 meters from each tree. Available at: <<http://sbrtv1.ibict.br/upload/sbrt4555.pdf?PHPSESSID=76a9111889defa6787039ca56b380c58>> visited on March 13th, 2009

²⁸ According to "Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural" Available at: <<http://www.cepel.br/~per/download/rer/rt-789-00.pdf>> visited on March 13th, 2009.

²⁹ According to "Carvão de babaçu como fonte termica para sistema de refrigeração por absorção no estado do Maranhão" Available at: <<http://libdigi.unicamp.br/document/?code=vtls000348640>> visited on March 03rd, 2009.

³⁰ According to IBGE(Geographic and Statistic Brazilian Institute) available from: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007>> visited on March 13th, 2009.

³¹ According to "Carvão de babaçu como fonte termica para sistema de refrigeração por absorção no estado do Maranhão" Available at: <<http://libdigi.unicamp.br/document/?code=vtls000348640>> visited on March 03rd of 2009.

³² According to IBGE (Geographic and Statistic Brazilian Institute) available from: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007>> visited on March 13th, 2009.

³³ According to IBGE(Geographic and Statistic Brazilian Institute) available from: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007>> visited on March 13th, 2009.

management areas per year. In this way, the project utilized 0.1% of the total biomass availability in Ceará state. Thus, the amount of fire wood from management areas necessary to provide thermal energy in CGM's kilns represents a non-representative quantity of this kind of biomass, which avoids the possibility of leakage.

Municipal wood residues

Urban gardens residues are very usual residue over Brazilian's countries where around 70% of the amount of this kind of biomass is left in open dumps or landfills. This way the urban garden residue does not have any kind of utilization turning out in an residue which may originate problems such as high costs for its correct disposal or treatment or result in negative environmental effects when not disposed correctly³⁴.

For all this reasons the utilization of Urban gardens residues as fuel turn out be a considerable destination for these kind of residue, and would provide an abundant source of renewable biomass if utilized in the proposed project activity.

Sugar Cane Bagasse

A study made by *Universidade Estadual de Campinas* and *Universidade de São Paulo* (two of the most respected universities in Brazil) showed that in Brazil there are around three hundred sugar cane plants. Each plant produces around 1.5 million tonnes of cane yearly³⁵. One tonne of sugar cane produces about 140 kilograms of cane bagasse and finally 90% of this amount can be used to energy production, either in natura or compacted into briquettes³⁶.

Sugar cane bagasse is also employed for cogeneration systems. However Figure 3 presents the excess of energy in Brazil from sugar cane bagasse. Please observe that the State of Pernambuco, which is a bordering state, has a large surplus of this biomass.

³⁴ Source: <http://cenbio.iee.usp.br/download/documentos/notatecnica_ix.pdf> visited on March 13th, 2009.

³⁵ Triangulo Mineiro.com - Universidades unem pesquisas sobre biomassa da cana. Available at: <<http://www.triangulomineiro.com/noticia.aspx?catNot=59&id=3097&nomeCatNot=Ci%C3%A4ncia>>. Last visit on: April 9th, 2009.

³⁶ Source: Centro de Gestão e Estudos Estratégicos (CGEE), 2001. Available at: <www.cgee.org.br/arquivos/estudo003_02.pdf>. Last visit on: April 9th, 2009.



Figure 3. . Sugar Cane Residue Potential for Energy Generation³⁷

According to the table 4, the state of *Pernambuco* presents a great amount of cane bagasse, i.e. the ceramic company has enough availability of this kind of biomass, what avoid the possibility of leakage generation in case of the sugar cane utilization as fuel source. The consumption of this kind of biomass for this project activity was around 617.88 tonnes per year, which represented less than 1% of the total production of sugar cane bagasse in the state of *Pernambuco*.

Table 4. Production of Sugar Cane in the State of Pernambuco

Harvest	05/06	06/07	07/08	08/09
Production of Sugar Cane (in tonnes)	13,858,319	15,293,700	19,844,415	18,949,518
Sugar Cane Bagasse (in tonnes)	1,746,148	1,927,006	2,500,396	2,387,639

Source: <http://www.unica.com.br/dadosCotacao/estatistica/>

B) Leakage relating to the non-renewable biomass shall be assessed from ex-post surveys of users and areas from where biomass is sourced.

³⁷ Source: CENTRO NACIONAL DE REFERÊNCIA EM BIOMASSA - CENBIO. Panorama do potencial de biomassa no Brasil. Brasília; Dupligráfica, 2003. 80 p.

The following potential sources of this type of leakage could be identified:

- Use/diversion of non-renewable biomass saved under the project activity by non-project households/users who previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable biomass used by the non-project households/users attributable to the project activity then baseline is adjusted to account for the quantified leakage.
- Use of non-renewable biomass saved under the project activity to justify the baseline of other project activities can also be potential source of leakage. If this leakage assessment quantifies a portion of non-renewable biomass saved under the project activity that is used as the baseline of other project activity then baseline is adjusted to account for the quantified leakage.
- Increase in the use of non-renewable biomass outside the project boundary to create non-renewable biomass baselines can also be potential source of leakage. If this leakage assessment quantifies an increase in use of non-renewable biomass outside the project boundary then baseline is adjusted to account for the quantified leakage

The carbon credits incomes stimulate the use of renewable biomass to other ceramic companies presenting a huge possibility for sustainable development in the region. Therefore, the sources of leakages mentioned above are not applicable as the project activity does not displace the use of renewable biomass of a non-project user, due to the likely decrease in the use of non-renewable biomass in the region and there is current great amount of renewable biomasses available locally as described before. The non-renewable biomass employed which would be employed in this project activity is not being saved for other project activity, since other ceramics was already consuming wood from non sustainable forest management (common practice).

It will decrease the using of non-renewable biomass, especially due to the incentive of carbon credits.

Therefore, it can be concluded that this source of leakage, until the date of this monitoring report, is not considered in this project activity.

This leakage was monitored in order to guarantee the project conservativeness.

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

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

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

4.4 Summary of GHG Emission Reductions and Removals

Table below summarizes the emission reductions for this monitoring period³⁸.

Table 5. Emission reductions for the monitoring period

Period	PR _y (tonnes)	B _y (tonnes)	ER _y (tCO ₂ e)
January to December - 2010	70,098	39,479	57,705
January to July - 2011	42,462	23,915	34,954
Emission Reductions from January 2010 to July 2011 - methodology AMS-I.E.-Switch from Non-Renewable Biomass for Thermal Applications by the User – version 01 valid from 01/02/2008 to 08/04/2010.			92,659

5 ADDITIONAL INFORMATION

5.1 5.1 Amount of renewable biomass consumed per month on each ceramic

Table 6. Amount of renewable biomass used by CGM Ceramic

Biomass Consumption in CGM Ceramic (tonnes)									
Period \ Biomass	Algaroba Wood	Sugar Cane Bagasse	Babaçu Coconut Husk	Sawdust	Cashew tree Wood	Municipal Wood Residues	Native Wood from Forest Management Plan	Total in the period	
2010	January	127.89	190.26	58.94	25.26	65.58	12.83	0.00	480.75
	February	204.82	77.38	0.00	191.63	72.79	0.00	0.00	546.62
	March	0.00	104.74	0.00	200.53	127.10	24.21	10.44	467.01
	April	0.00	0.00	0.00	69.53	174.87	143.92	20.87	409.19
	May	0.00	189.43	0.00	35.72	177.91	147.38	0.00	550.44
	June	58.86	76.21	0.00	51.25	175.60	134.74	34.29	530.94
	July	28.31	112.12	0.00	6.90	48.21	151.11	192.30	538.96
	August	63.70	87.18	0.00	160.11	60.56	148.03	122.24	641.82
	September	35.39	86.48	0.00	20.90	52.69	144.75	238.52	578.73

³⁸ 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 tCO₂e.

	October	28.31	54.51	0.00	182.24	71.88	145.30	0.00	482.24
	November	21.23	0.00	0.00	162.63	75.50	145.70	147.58	552.64
	December	0.00	0.00	0.00	0.00	0.00	143.13	1,377.43	1,520.56
	Total 2010	568.52	978.31	58.94	1,106.70	1,102.69	1,341.10	2,143.66	7,299.91
2011	January	0.00	0.00	0.00	158.39	0.00	126.90	292.18	577.47
	February	0.00	0.00	0.00	165.54	0.00	154.80	310.07	630.41
	March	0.00	0.00	0.00	85.33	0.00	165.60	371.19	622.12
	April	0.00	0.00	0.00	266.89	0.00	147.70	910.83	1,325.42
	May	0.00	0.00	0.00	0.00	0.00	173.40	800.52	973.92
	June	0.00	0.00	0.00	0.00	0.00	28.10	983.88	1,011.98
	July	0.00	0.00	0.00	0.00	0.00	2.40	876.54	878.94
	Total 2011	0.00	0.00	0.00	676.15	0.00	798.90	4,545.20	6,020.25
Total in the period		568.52	978.31	58.94	1,782.85	1,102.69	2,140.00	6,688.86	13,320.16