

MONITORING REPORT
Version 05

Kitambar Switching Fuel
Project

Monitoring period: October 1st, 2008 to November 30th, 2009

CONTENTS

- A. General description of the small scale project activity
- B. Application of monitoring methodology and results

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Kitambar Switching Fuel Project

Monitoring report completed on January 14th, 2011 – Version 05

A.2. Description of the small-scale project activity:

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 is applied at *Kitambar* Ceramic, which is a small ceramic industry that produces structural ceramic devices like roof tiles, destined for the regional market. This project consists on utilizing renewable biomasses to feed their eight “Round” kilns rather than using native wood from areas without sustainable forest management from the *Caatinga* biome, which is an old practice in the region. This type of wood is considered a non- renewable biomass, once it is not originated from areas without reforestation activities.

This fuel switching project reduces the greenhouse gases (GHG) emissions through the substitution of native wood without sustainable management for renewable biomasses to generate thermal energy. The project activity also indirectly helps in reducing the Brazilian deforestation rates, the main source of greenhouse gas emissions in Brazil.

As renewable biomasses, *Kitambar* Ceramic utilized *Algaroba* wood, cashew tree residues¹, and coconut husk.

The *Caatinga* is a biome with a strong propensity to desertification and its deforestation consequently brings forward an increase in this possibility. With the loss of natural vegetation, the exposed soil becomes more susceptible to erosion and salinization. These processes are responsible for changing the system of rivers, which makes the water supply of local communities and family farming scarce.

In developing countries like Brazil, the deforestation rate is directly proportional to the greenhouse gases concentration in the atmosphere, which intensifies global warming.

The calculations regarding the quantity of non-renewable wood required in the burning process were done according to the efficiency of the kilns on the production, which would require around 2.6 m³ or 2.28 tons to produce 1,000 ceramic devices. In the baseline scenario, according to historical experience, the ceramic utilized approximately 28,800 m³ of native wood per year from *Caatinga* biome in their eight “Round” kilns produce around 11,100,000 ceramic devices per year.

The fuel substitution required some period to find out the correct burning process of the new biomasses and to get the final product with the same quantity and quality than in the baseline scenario. Thus, the ceramic had to find the best procedure to handle with the new biomass, which is far different when compared with the use of wood.

As a result of the fuel switch, capacitating and training courses were required for the staff in order to clarify new measures linked to the machinery in order to sustain the quality of the final product and find a burn cycle standard.

¹ The cashew tree's pruning occurs due to its fructification, which happens more intensely in new branches.

Another arduous barrier faced by the project developer was the employees' resistance of the changes, who were very used to the standard situation.

An initial investment was performed in order to adapt the burning with the new fuel, especially for the acquisition of new equipments as thermocouples, oxygenation machines and molten iron grills. With the project implementation, the ceramic had to withstand more costs than if it had continued employing native wood from deforestation areas as fuel, namely in the form of payment for the biomass transportation, which includes driver, diesel, freight and costs with the truck maintenance. Furthermore, there is spending with electrical energy.

The total spending has increased and 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.

The Project's contribution for the sustainable development.

The project activity contributes to the reduction of the greenhouse gas (GHG) emissions by diminishing the deforestation of the *Caatinga* biome.

Table 1 shows the approximate area of all the biomes in Brazil, and the area occupied by *Caatinga* biome is highlighted.

Table 1. Brazilian biomes in decreasing order of importance

Brazilian Biomes	Approximate Area (km ²)	Area of the biome / Total Brazilian Area (%)
<i>Amazonian</i> biome	4,196,943	49.29
<i>Cerrado</i> biome	2,036,448	23.92
<i>Atlantic Forest</i> biome	1,110,182	13.04
<i>Caatinga</i> biome	844,453	9.92
<i>Pampa</i> biome	176,496	2.07
<i>Pantanal</i> biome	150,355	1.76
Total	8,514,877	100

(Source:

<http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169&id_pagina=1>, visited on March 10th, 2010)

In addition, the project activity will contribute to the level reduction of the greenhouse gas (GHG) emissions and also to the sustainable development of the host country, such as:

- Improving the environmental integrity of the immediate area through a more prudent use of agricultural refuse as biomass for fuel;
- Diversifying and improving sources for thermal energy generation;
- Using clean and efficient technologies, which promote the preservation of natural resources in accordance with *Agenda 21* and with Brazilian Sustainable Developments Criteria;
- Demonstrating the viability of implementing innovative technological practices to the ceramic sector as a whole, thus promoting holistic change in the more effective use of renewable biomass and the better realization of more efficient thermal energy generation potential;
- Contributing directly to the conservation of *Caatinga* biome through the use of renewable biomasses.

The *Caatinga* biome occupies around 844,453 Km², equivalent to 9.92% of the territory of the country. The First Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions² – Background Reports indicates that the major source of GHG emissions in Brazil is due to deforestation, mainly occurred in *Amazonian* (59% of the deforestation) and *Cerrado* biomes (26%), even though the deforestation in *Caatinga* has its contribution to the Brazilian GHG emissions. Another relevant issue is the concerning deforestation rate in the *Caatinga* biome, which is a biome susceptible to desertification. Currently, every part of the society sector should be involved in this, and all efforts are necessary to minimize the *Caatinga* biome scenario of degradation and prevent its extinction.

A.3. Current status of the project activity:

The VCS PD was validated by the Designated Operational Entity TÜV Nord Cert GmbH and this present monitoring report will be verified by the Designated Operational Entity Bureau Veritas Certification (BVC).

The monitoring data was kept according to monitoring plan described in the project description document. The project activity utilized as renewable biomasses *Algaroba* wood, Cashew Tree residues and coconut husk. The emission reductions due to the switching non renewable biomass (native wood from deforestation) to renewable biomass resulted in 47,191 tCO₂e during the monitoring period of October 1st, 2008 to November 30th, 2009.

²Available at: <<http://www.mct.gov.br/index.php/content/view/17341.html>>. Last visit on: March 10th, 2010.

SECTION B. Application of monitoring methodology and results

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Category AMS-I.E.: Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01, valid from February 01st, 2008 to April 08th, 2010).

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

B.2. Monitoring period

This report refers to the data registered during October 1st, 2008 to November 30th, 2009 (Days included).

B.3. Data and parameters applied:

Data / Parameter:	EF _{projected fossil fuel}
Data unit:	tCO ₂ /TJ
Description:	CO ₂ Emission factor of residual fuel oil
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. 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. Visited on March 27th, 2009.
Value applied	77.4
Justification of the choice of data or description of measurement methods and procedures to be applied:	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. The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction.

Data / Parameter:	NCV _{non-renewable wood}
Data unit:	TJ/ton of wood
Description:	Net Calorific Value of non renewable biomass
Source of data to be used:	Sources: QUIRINO, W. F. et al. Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Biomassa & Energia, v.1, n.2, p. 173-182, 2004. Available at: < http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf >. Last visit on: March 10 th , 2010. OLIVEIRA, E. et al. Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir. Revista Árvore , Viçosa-MG, v.30, n.2, p.311-318, 2006. Available at: < http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf >. Last visit on:

	June 10 th , 2010.
Value of data applied for the purpose of calculating expected emission reductions	0.019
Description of measurement methods and procedures to be applied:	This value provided the energy generated by the amount of wood that would be used in the absence of the project. Some sources of data used provide the Gross Calorific Values (GCV) of the <i>Caatinga</i> species. In order to transform the GCV to NCV, it was utilized the equation which is available at the MR Calculation spreadsheet. 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.
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 / Parameter:	ρ_{wood}
Data unit:	ton/ m ³
Description:	Specific gravity of non renewable biomass
Source of data to be used:	Sources: 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. QUIRINO, W. F. et al. Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. <i>Biomassa & Energia</i>, v.1, n.2, p. 173-182, 2004. Available at: <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf>. Last visit on: March 10th, 2010. IPCC: Intergovernmental Panel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS - chapter3 – Table 3A.1.9-2 OLIVEIRA, E. et al. Estrutura anatômica da madeira e qualidade do carvão de <i>Mimosa tenuiflora</i> (Willd.) Poir. Revista Árvore, Viçosa-MG, v.30, n.2, p.311-318, 2006. Available at: <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf>. Last visit on: June 10th, 2010. IBAMA – Madeiras Brasileiras. <http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139>. Last visit on: October 21st, 2010.
Value of data applied for the purpose of calculating expected emission reductions	0.88
Justification of the choice of data or description of measurement methods	The species used to calculate the average value are typical trees of <i>Caatinga</i> Biome that are usually employed as fuel in the ceramic industries of the region. The amount of wood used in the baseline was measured by volume

and procedures to be applied:	units, so this data was used to the unity conversion.
Any comment:	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.

Data / Parameter:	BF_y
Data unit:	Tons of wood per thousand of devices
Description:	Consumption of non renewable biomass per thousand of ceramic pieces produced in year y
Source of data to be used:	Historical data from ceramic owner
Value of data	2.28
Justification of the choice of data or description of measurement methods and procedures to be applied:	The value is utilized to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns.
Any comment:	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 utilize the same types of kiln in the region.

B.4. Data and parameters monitored:

Data / Parameter:	Q_{renbiomass}				
Data unit:	Tons				
Description:	Amount of renewable biomass utilized in the monitored period from October 1 st , 2008 to November 30 th , 2009.				
Source of data to be used:	Measured by the biomass providers and controlled by the ceramic owner. The registered VCS PD v.2 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.				
Value of data	Q_{renbiomass} (tons) October 1st, 2008 to November 30th, 2009				
	Biomass	Algaroba Wood	Cashew tree residues		Coconut husk
	Providers	Leodório Pereira da Silva	Erivonaldo Alves	José Josafa Cabral dos Santos	Osmário de Lima
	Location	Rua Sérgio de Souza	Rua do Sol, 150 –	Rua Juscelino	Rua São Fernando,

		<i>Padilha, 73 – Centro. Arco Verde - PE</i>	<i>Centro. Barra de Guabiraba - PE</i>	<i>Kubitschek, 13 - Barra de Guabiraba - PE</i>	<i>110 - Maurício Nassau. Caruaru - PE</i>								
	Quantity of biomass	12,774	2,459	188	1,822								
Description of measurement methods and procedures to be applied:	The amount of biomass was monitored in accordance to the weight described in the receipts or invoices from the providers. The values in the receipts are described in m³, therefore it was necessary the conversion to tons through the specific gravity of each biomass. The specific gravity values of the renewable biomass utilized in this project are:												
	<table><tr><td>Biomass</td><td><i>Algaroba</i> Wood</td><td>Cashew tree residues</td><td>Coconut Husk</td></tr><tr><td>Specific Gravity (tons/m³)</td><td>0.836</td><td>0.42</td><td>0.5</td></tr></table>					Biomass	<i>Algaroba</i> Wood	Cashew tree residues	Coconut Husk	Specific Gravity (tons/m³)	0.836	0.42	0.5
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	Specific Gravity (tons/m³)	0.836	0.42	0.5									
The sources of these data are:													
<i>Algaroba</i> wood: PEREIRA, J. C. D.; LIMA, P. C. F. Comparação da Qualidade da Madeira de seis Espécies de Algarobeira para a Produção de Energia . Colombo: Embrapa Florestas, 2002. p. 99-107. Available at: < http://www.cnpf.embrapa.br/publica/boletim/boletarqv/bolet45/pag-99_106.pdf >. Last visit on: June 10 th , 2010. Cashew tree residues: 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. Coconut husk: PINHEIRO, G. F.; RENDEIRO, G.; PINHO J. T. Densidade Energética de Resíduos Vegetais . 2006. Available at: < www.ufpa.br/gedae/BIOMASSAEENERGIA2006.pdf >. Last visit on: June 10 th , 2010.													
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. This internal spreadsheet was double checked with all the receipts and invoices of biomass employed.												
Any comment:	As stated in the VCS PD, the providers listed in the PDD are only a few of those that work for the ceramic; nevertheless, it does not exclude the possibility of buying biomass from others. In this MR, <i>Kitambar</i> ceramic acquired cashew tree residues from <i>José Josafa</i>												

	<i>Cabral</i>, a new biomass provider. 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 / Parameter:	PR_y																																						
Data unit:	Unity of ceramic pieces																																						
Description:	Production of ceramic devices in the monitored period from October 1 st , 2008 to November 30 th , 2009.																																						
Source of data to be used:	Controlled by the project proponent.																																						
Value of data	<table> <tr> <th colspan="2">Production of ceramic units (PR_y)</th></tr> <tr> <th>Period</th><th>Kitambar Ceramic</th></tr> <tr> <td>October 2008</td><td>1,010,563</td></tr> <tr> <td>November 2008</td><td>965,328</td></tr> <tr> <td>December 2008</td><td>1,085,818</td></tr> <tr> <td>Total 2008</td><td>3,061,709</td></tr> <tr> <td>January 2009</td><td>991,776</td></tr> <tr> <td>February 2009</td><td>1,051,262</td></tr> <tr> <td>March 2009</td><td>1,057,496</td></tr> <tr> <td>April 2009</td><td>968,732</td></tr> <tr> <td>May 2009</td><td>860,124</td></tr> <tr> <td>June 2009</td><td>929,098</td></tr> <tr> <td>July 2009</td><td>1,006,095</td></tr> <tr> <td>August 2009</td><td>1,024,000</td></tr> <tr> <td>September 2009</td><td>1,124,690</td></tr> <tr> <td>October 2009</td><td>1,137,390</td></tr> <tr> <td>November 2009</td><td>949,280</td></tr> <tr> <td>Total 2009</td><td>11,099,943</td></tr> <tr> <td>Total in the period (October 1st, 2008 to November 30th, 2009)</td><td>14,161,652</td></tr> </table>	Production of ceramic units (PR _y)		Period	Kitambar Ceramic	October 2008	1,010,563	November 2008	965,328	December 2008	1,085,818	Total 2008	3,061,709	January 2009	991,776	February 2009	1,051,262	March 2009	1,057,496	April 2009	968,732	May 2009	860,124	June 2009	929,098	July 2009	1,006,095	August 2009	1,024,000	September 2009	1,124,690	October 2009	1,137,390	November 2009	949,280	Total 2009	11,099,943	Total in the period (October 1st, 2008 to November 30th, 2009)	14,161,652
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Description of measurement methods and procedures to be applied:	The measurement of production was done by an internal control sheet monitored by the project developer, which was fed daily.																																						
QA/QC procedures to be applied:	The ceramic has an internal control of the quantity of pieces produced. It was rechecked according to the biomass utilized and the kiln consumption of renewable biomass.																																						

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 / Parameter:	Leakage of non-renewable biomass
Data unit:	tCO ₂ e
Description:	Leakage resulted from non-renewable biomass
Source of data to be used:	Monitored
Value of data	0
Description of measurement methods and procedures to be applied:	The sources of leakages predicted in methodology applied were monitored.
QA/QC procedures to be applied :	Data available regarding the ceramic industry fuel consumption were employed to monitor the leakage. More information at Section B.5 – Leakage, Part B.
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 / Parameter:	Renewable biomass surplus			
Data unit:	ton or m ³			
Description:	Amount of renewable biomass available			
Source of data to be used:	Monitored			
Value of data		Biomass surplus	Surplus	Year
		<i>Algaroba</i> wood in m ³	2,500,000	2007
		Cashew tree residues in tons	196,625	2007
		Coconut husk in tons	6,700,000	2007
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 “General guidance on leakage in biomass project activities” 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.
QA/QC procedures to be applied :	Data available regarding the ceramic industry fuel consumption were utilized to monitor the leakage. More information at Section B.5 – Leakage, Part A.
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 / Parameter:	Origin of renewable biomass
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data to be used:	Controlled by the project developer
Value of data	Renewable biomass
Description of measurement methods and procedures to be applied:	This information was given by the biomasses providers. The biomasses (<i>Algaroba</i> wood, Coconut husk, and cashew tree residues) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied :	The biomasses were considered renewable as they are according to the definition given by the methodology applied. Furthermore, documents proving the origin of each renewable biomass were provided, such as receipts from the providers stating the consumption of each biomass.
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 / Parameter:	$f_{NRB,y}$
Data unit:	Percentage
Description:	Fraction of biomass (wood) used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods.
Source of data used:	Survey methods.
Value applied:	99.4%
Justification of the choice of data or description of measurement	Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramics owner. Thus, the totality of fuel employed in the baseline scenario is from

methods and procedures actually applied :	non-renewable origin. However, according to CNIP (2007)³, <i>Caatinga</i> biome has only 0.3% of its total area with sustainable use. Furthermore, considering that 0.24% 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 the amount of wood consumed regarding only <i>Kitambar</i> 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 <i>Kitambar</i> project, respectively.⁴ 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 VCU Estimates spreadsheet. The monitoring of this parameter will be based in national and international articles and database every monitoring period. The sources will provide information about the sustainable use of <i>Caatinga</i> biome. Wood saved from projects with same biome and applied methodology developed by <i>Sustainable Carbon – Projetos Ambientais LTDA.</i> was considered in this fraction. The value considered was 0.243161%.
Any comment:	It was employed in order to estimate the amount of non renewable biomass. 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.

B.5. Calculation of emission reductions

The **Category AMS-IE:** Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01, valid from February 01st, 2008 to April 08th, 2010) comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The project's emissions from the combustion of native wood are accounted in the same way as fossil fuel combustion, once it is not renewable and emits CO₂.

The project activity generates less than the limits of 45 MW_{thermal} for Type I Small scale project activities.

Baseline

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

³ 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.

⁴ According to data from project activities elaborated by *Sustainable Carbon – Projetos Ambientais LTDA.*

Where:

ER_y : Emission reductions during the year y in tCO₂e

B_y : Quantity of biomass that is substituted or displaced in tons

$f_{NRB,y}$: 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/tons

$EF_{projected\ fossil\ fuel}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO₂/TJ⁵.

B_y is determined using the option “b” of the Methodology:

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 technology 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/tons of ceramic units

PR_y : Amount of product produced in year y in quantity of ceramic units fired

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

Where:

SFE: Specific fuel energy needed for the process to produce a certain amount of ceramic devices in TJ/ tons of ceramic units

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

Where:

BF_y : Consumption of non renewable biomass per tons of ceramic units fired in year y

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

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

⁵ The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.

The exactly production (PR_y) was monitored through an internal control sheet monitored by the project developer, which was fed daily.

The value of BF_y was determined through historical consumption of non-renewable biomass by the ceramic.

Leakage

The methodology AMS-I.E.-Switch from Non-Renewable Biomass for Thermal Applications by the User (Version 01, valid from February 01st, 2008 to April 08th, 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” (attachment C of appendix B) of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on the type of biomass considered (described in the table 2).

Table 2. 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 sources of leakage of the present project activity are the competing use of biomass for biomass residues or waste and the emissions from biomass generation/cultivation in case of biomass from cropland. The source of leakage of the present project is showed below according to each type of biomass:

Algaroba wood

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* has spread through several regions of Brazilian semi-arid areas⁶.

A research made by EMBRAPA⁷, which encompass the States of *Pernambuco* and *Bahia*, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts⁸. This source stated that there were several centers of *Algaroba* operation highlighting the *San Francisco* Basin, which is comprised for many municipalities from the states of *Bahia* and *Pernambuco*, including this project region. Besides, *Algaroba* presents a considerable capacity of regeneration and dispersal⁹, which means that the plant does not die, it sprouts again stead.

The research's author reported that wood from *Algaroba* exploration on *San Francisco* Basin is mainly commercialized as fuel for industries of vegetable oil, leather, ceramic and bakeries. On the other hand, *Algaroba* wood is not sold for stake¹⁰, pegs and poles uses.

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.

According to Farias Sobrinho et al (2005)¹¹ e Araújo et al (2006)¹², *Algaroba* is spread through an area of about 500 thousands hectares in the Northeast semi-arid region of Brazil. Moreover, according to EMBRAPA (1992)¹³, 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. As *Kitambar* Ceramic consumed approximately 13,097 m³ of *Algaroba* wood per year, it represented less than 1% of the total of *Algaroba* wood produced in the region.

Cashew tree pruning

⁶ 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/>>. Last visit on: June 14th, 2010.

⁷ 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.

⁸ 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. Available at: <<http://www.sober.org.br/palestra/5/371.pdf>>. Last visit on: June 14th, 2010.

⁹ 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/>>. Last visit on: June 14th, 2010.

¹⁰ Heavy pole to which cattle is tied.

¹¹ FARIAS SOBRINHO, D. W. F. et al. *Tratamento Preservativo da Madeira de Algaroba (Prosopis Juliflora (Sw) D.C.), pelo Método de Substituição de Seiva*. **Cerne**, Lavras, v. 11, n. 3, p. 225-236, jul./set. 2005. Available at: <http://www.dcf.ufla.br/cerne/artigos/11-02-20095739v11_n3_artigo%2003.pdf>. Last visit on: June 14th, 2010.

¹² 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. Available at: <<http://www.sober.org.br/palestra/5/371.pdf>>. Last visit on: June 14th, 2010.

¹³ EMBRAPA, *Comunicado Técnico Nº 51, Nov/92, p.1-2*. Available at: <http://www.cpatas.embrapa.br/public_eletronica/downloads/COT51.pdf>. Last visit on: April 28th, 2009.

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. The Brazilian production achieved 143,000 tons of cashew-nuts in 2005 spread in an area of 650,000 hectares¹⁴. Besides, 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 nuts¹⁵. 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 trees¹⁶. 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 firewood.

According to "*Plantio do Caju*" cashew trees cultivation presents a density of 121 units of trees per hectare¹⁷, and the production of firewood residues from each tree is 2.5 kg per year¹⁸. The cultivation of cashew is located in an area of 650,000 hectares. This way, the Brazilian production of residues from cashew trees is around 196,625 tons per year. This project activity was responsible for the consumption of around 2,270 tons per year, or 1.2% of the total production of residues from cashew trees. Thus, the amount of residues from cashew trees necessary to provide thermal energy in the ceramic's kiln was not significant, which avoids the possibility of leakage.

Coconut Husk

The coconut has diverse uses, which can be briefly described as for aliment, water, fiber among others. In the northeast region of Brazil, 6.7 millions of tons of coconut husks are generated yearly, which can be up to 70% of the solid residues of coastal cities¹⁹.

Coconut husk is normally disposed in open dumps, taking around eight years to be decomposed naturally. Therefore, the use of coconut residue brings economic, social and environmental gains, as 85% of the total fruit weight becomes residue.²⁰

¹⁴ Checked at:

<<http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/index.htm>>. Last visit on: June 14th, 2010.

¹⁵ Checked at: <<http://www.nordeste rural.com.br/nordeste rural/matLerdest.asp?newsId=2219>>. Last visit on: June 14th, 2010.

¹⁶ According with EMBRAPA (Brazilian Agricultural Research Corporation's). Available at: <<http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratoscultura is.htm>>. Last visit on: June 14th, 2010.

¹⁷ According with "Resposta Técnica" from CETEC (Technologic Center of Minas Gerais) considering a space of 10 meters from each tree. Available at: <<http://sbtrv1.ibict.br/upload/sbrt4555.pdf?PHPSESSID=76a9111889defa6787039ca56b380c58>>. Last visit on: April 28th, 2009.

¹⁸ According with "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>>.

¹⁹ Source: <www.sbpnet.org.br/livro/60ra/textos/SI-GoreteMacedo.pdf>. Last visit on: June 15th, 2010.

This project activity was responsible for the consumption of around 1,560 tons of coconut husks per year, or less than 1% of the coconut husk availability. Therefore, as this biomass is widely available in the region, using it to generate thermal energy may be a solution to the problem of solid waste disposal in cities.

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

The following potential sources of this type of leakage were 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.

It is expected that the carbon credits incomes will stimulate the use of renewable biomass to other ceramics presenting a huge possibility for sustainable development in the region. Therefore, the sources of leakages mentioned above were not be applicable as the project activity did 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 currently great amount of renewable biomasses available locally as described before. The non-renewable biomass that would be utilized in this project activity was not saved for other project activity, since other ceramic companies were already consuming wood from non sustainable forest management (common practice).

With the implementation of the project activity, Kitambar Ceramic avoided the consumption of non-renewable wood, helping the conservation of the *Caatinga* biome, besides the ecological and social benefits to the region.

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

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

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

Emission Reductions

The crediting period according to the V-C-S 2007.1, standard which the project follows the rules, contemplates from October 1st, 2008 to November 30th, 2009 for this project activity.

²⁰ CARRIJO, O.A.; LIZ, R.S.; MAKISHIMA, N. *Fibra da casca do coco verde como substrato agrícola. Horticultura Brasileira*, Brasília, v. 20, n. 4, p. 533-535, Dec. 2002.

Table 3. Quantity of non-renewable native wood that would be utilized in the absence of the project and emission reductions due to the project activity of Kitambar Ceramic

Kitambar Ceramic			
Period	PR_y - Production (ceramic units)	B_y (tons)	ER_y (tCO₂e)
October 2008	1,010,563	2,304	3,368
November 2008	965,328	2,201	3,217
December 2008	1,085,818	2,476	3,618
Total 2008	3,061,709	6,981	10,203
January 2009	991,776	2,261	3,305
February 2009	1,051,262	2,397	3,503
March 2009	1,057,496	2,411	3,524
April 2009	968,732	2,209	3,228
May 2009	860,124	1,961	2,866
June 2009	929,098	2,118	3,096
July 2009	1,006,095	2,294	3,353
August 2009	1,024,000	2,335	3,412
September 2009	1,124,690	2,564	3,748
October 2009	1,137,390	2,593	3,790
November 2009	949,280	2,164	3,163
Total 2009	11,099,943	25,308	36,988

Total Emission Reductions**Table 4. Total Emission Reductions for the project activity**

Period	PR_y (ceramic units)	B_y (tons)	ER_y (tCO₂e)
October to December, 2008	3,061,709	6,981	10,203
January to November, 2009	11,099,943	25,308	36,988
Total	14,161,652	32,289	47,191

B.6. Monitoring results

Therefore, based on Category AMS-I.E.: Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01, valid from February 01st, 2008 to April 08th, 2010) and on monitored data as well considering the high contribution to sustainability, the project participants request carbon credits due to emissions reductions achieved by the project activity resulted in **47,191 tCO₂e**.

The contribution to sustainability will be monitored applying the SOCIALCARBON methodology, which is based in six main pointers: Technology; Natural; Financer; Human; Social and Carbon Resources.

B.7. Date of completion of the monitoring report and the name of the responsible person(s)/entity(ies)

The responsible for project monitoring is Mr. *Antônio Marcos Tavares Barbosa*, from *Kitambar Ceramic*.

The monitoring report was completed on January 14th, 2011 by *Marcelo Hector Sabbagh Haddad* from *Sustainable Carbon – Projetos Ambientais LTDA*.