

MONITORING REPORT
Version 06

Gomes de Matos Ceramic Fuel Switching
Project

Monitoring period: May 1st, 2006 to April 30th, 2009

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- 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:

Gomes de Matos Ceramic Fuel Switching Project

Monitoring report completed in 26th May 2009 – Version 06

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

The accelerating destruction of forests around the world is being recognized as one of the main causes of climate change. Carbon emissions from deforestation far outstrip damage caused by planes and automobiles and factories.

One of the main reasons for deforestation is the demand for fuel. Ceramic companies are well known for their great demand of fuel to maintain their burning processes.

Therefore, the project activity in Gomes de Matos Ceramic will indirectly contribute to minimize this problem in Caatinga¹ biome by displacing the use of native forests wood without sustainable forest management for thermal energy generation.

The project activity consists in a pioneer practice in the region of Crato – Ceará. The city of Crato, where the project activity takes place, is located in one of the prettiest regions of Brazilian northeast: the Cariri Valley², south of Ceará State. With a population of around 106,000 inhabitants³, Crato's economy is based on the commercialization of agricultural products, however the city also commercializes industrial products, such as aluminum, footwear, ceramic devices and aguardente.



Figure 1. View of the Cariri Valley

¹ The Caatinga biome has sufficiently diversified fauna and flora, being inserted in a region of approximately 800,000 km² in the northeast of Brazil. Nowadays, the uncontrolled deforestation is breaking up the firm land forest. Without necessary care, entire regions of fauna and old centers of species have the risk to be disappeared forever. Source: text adapted from: http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169 visited in: March 13, 2009

² The Cariri valley encompasses 33 municipalities.

³ According to an IBGE (Brazilian Institute of Geography and Statistics) study realized in 2007.

According to SEBRAE⁴, there are around 34 ceramic industries in the region of *Cariri Valley* and 10 located in the city of *Crato*.

The city faces a serious problem related to the environmental degradation due to the recent boom in the real state sector. Such occupation causes the devastation of gallery bush areas⁵. Therefore, the native wood from the gallery bushes can be employed in industrial processes.

The switching fuel project will reduce the greenhouse gases emissions, through substitution of native wood for wood from sustainable forest management plan, sawdust, Algaroba wood, residues from cashew tree and babaçu coconut husk which may be replaced by elephant grass and municipal garden's residues, for thermal energy generation. This fuel exchange could only be feasible when considering the carbon credits incomes, since the adaptation of kilns to the new biomasses and the purchase of new equipments required considerable investments.

The main goal of this project activity is to minimize the negative impacts of the deforestation of the Caatinga biome by discouraging the exploitation of the area through limiting the interested parties in acquiring the proper legal documents for the commercialization of the native fire wood.

A.3. Current status of the project activity:

The VCS PD has been validating by the Designated Operational Entity TÜV Nord Cert GmbH and this present monitoring report will be verified by the same DOE

The monitoring data was kept according to monitoring plan described in VCS PD. The project activity did not employ other kind of fuel till the moment, apart from wood from sustainable forest management plan, sawdust, Algaroba wood, residues from cashew tree and babaçu coconut husk. The emission reductions due to the switching from non renewable biomass to renewable biomass resulted in **146,604 tCO₂equ** during the monitoring period of 01st may 2006 to 30rd April 2009.

⁴ Brazilian Service of Support to Micro and Small Companies.

⁵ Gallery bush is the vegetations in the rivers margin. Available at: [http://pt.wikipedia.org/wiki/Crato_\(Cear%C3%A1\)](http://pt.wikipedia.org/wiki/Crato_(Cear%C3%A1)) visited in: March 13th, 2009

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 from February 01 of 2008 onwards)

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 may 1st, 2006 to April 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.
Value applied:	77.40
Justification of the choice of data or description of measurement methods and procedures actually 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.
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.

Data / Parameter:	NCV biomass
Data unit:	TJ/ton of wood
Description:	Net Calorific Value
Source of data to be used:	National data
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 will provide 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 in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf - Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir. Available in: http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf
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 biomass
Data unit:	ton/ m ³
Description:	Specific gravity
Source of data to be used:	National data
Value of data applied for the purpose of calculating expected emission reductions	0.88 ton/m³. Value average checked at: - IPCC: Intergovernmental Panel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS - chapter3 – 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. - Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) . Available in: http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf visited at: march 13th, 2009. - Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Available in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf visited at: march 13th, 2009. -

	< http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139 > visited at: march 13 th , 2009.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The amount of wood used in the baseline was measured in volume units. This datum will be 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 / Parameter:	BFy
Data unit:	m3 of wood per tonnes of ceramic devices.
Description:	Consumption of non-renewable biomass per thousand of ceramic devices
Source of data used:	Historical data from project proponent
Value of data	0.64 m3 of wood per tonnes of ceramic devices.
Justification of the choice of data or description of measurement methods and procedures actually applied :	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:	Data is in accordance with TAPIAS, 2000 ⁶ , which estimates an approximate value for the kinds of kilns utilized at CGM Ceramic (<i>Hoffman and Camara Kiln</i>) – From 0.6 to 0.9 m ³ /thousand of pieces. The value is little over the value found on literature since CGM kiln's presents low efficiency.

⁶ Source: TAPIA, R. E. C. et al. *Manual para a indústria de cerâmica vermelha*. Rio de Janeiro: SEBRAE/RJ, 2000. (Série Uso Eficiente de Energia).

B.4. Data and parameters monitored:

Data / Parameter:	$f_{NRB,y}$
Data unit:	Percentage
Description:	Fraction of biomass (wood) used in the absence of the project activity in year y can be established as non renewable biomass using survey methods
Source of data used:	Survey methods.
Value of applied:	96.7%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramics owner. <i>Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, considering that 0.11% of Caatinga biome has sustainable forest management plan, the fraction of non-renewable biomass is 99.89%. Also it was add the amount of wood saved by similar projects that are being developed by Carbono Social Serviços Ambientais Ltda. with the same methodology in the region. It was measured the amount of 6,242,408 m³ of wood in 10 years, representing around 0.04% of total Caatinga area.</i> Despite of the fact all the biomasses utilized in this project activity being renewable, CGM ceramic was not able to provide evidences in order to prove all the licences of the farm were the Eucalyptus wood is originated from. Thus, it will be discounted in this parameter, and will be monitored for its measurement as well. The average percentage of Eucalyptus consumptions is 2.7% of the total biomass consumption. Hence, the Fraction of non-renewable biomass applied in a conservative way is 96.7 %. Source: <http://www.cnip.org.br/planos_manejo.html>. Visited on March 04th, 2009.
Any comment:	It will be employed in order to estimate the amount of non renewable biomass.

Data / Parameter:	Q_{renbiomass}																			
Data unit:	tons per year																			
Description:	Amount of renewable biomasses																			
Source of data to be used:	Measured by the project proponent																			
Value of data	The project proponent preferentially employs the biomasses below: <table> <tr> <th>Biomass</th><th>Native wood from management areas</th><th>Cashew wood</th><th>Sawdust</th><th>Babaçu Coconut husk</th><th>Algaroba wood</th><th>Eucalyptus Wood provided from forest management plan</th></tr> <tr> <td>tonnes</td><td>6,761</td><td>1,257</td><td>60</td><td>60</td><td>1,531</td><td>218</td></tr> </table>						Biomass	Native wood from management areas	Cashew wood	Sawdust	Babaçu Coconut husk	Algaroba wood	Eucalyptus Wood provided from forest management plan	tonnes	6,761	1,257	60	60	1,531	218
Biomass	Native wood from management areas	Cashew wood	Sawdust	Babaçu Coconut husk	Algaroba wood	Eucalyptus Wood provided from forest management plan														
tonnes	6,761	1,257	60	60	1,531	218														
Description of measurement methods and procedures to be applied:	The amount of biomasses will be monitored in accordance to the weight described in the receipts from the providers. The values in the receipts may be described in m³, therefore it is necessary the conversion to tons through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project is: <table> <tr> <th>Biomass</th><th>Native wood from reforested areas</th><th>Residues from Cashew trees</th><th>Sawdust</th><th>Babaçu Coconut husk</th><th>Algaroba wood</th><th>Wood from Eucalyptus provided from forest management plan</th></tr> <tr> <th>Specific gravity (tonnes/m³)</th><td>0.88</td><td>0.42</td><td>0.245</td><td>1.085</td><td>0.756</td><td>0.49</td></tr> </table> The sources of these data are: Sawdust: Masses and Dead Loads of Concrete and Other Materials- http://www.cca.org.nz/pdf/Masses.pdf Residues from cashew trees: -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: The same applied in pbiomass						Biomass	Native wood from reforested areas	Residues from Cashew trees	Sawdust	Babaçu Coconut husk	Algaroba wood	Wood from Eucalyptus provided from forest management plan	Specific gravity (tonnes/m ³)	0.88	0.42	0.245	1.085	0.756	0.49
Biomass	Native wood from reforested areas	Residues from Cashew trees	Sawdust	Babaçu Coconut husk	Algaroba wood	Wood from Eucalyptus provided from forest management plan														
Specific gravity (tonnes/m ³)	0.88	0.42	0.245	1.085	0.756	0.49														

	Babaçu coconut husk: <http://www.ipef.br/publicacoes/scientia/nr34/cap04.pdf> visited at: 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 at: 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 at: march 13th, 2009.
QA/QC procedures to be applied:	The ceramics have spreadsheets of the quantity of biomass acquired. It will be rechecked according to the receipts of purchase. Even if the ceramic company receive donations their invoices will be required.
Any comment:	

Data / Parameter:	PRy		
Data unit:	Tonnes of ceramic pieces		
Description:	Production of ceramic devices		
Source of data to be used:	Controlled by the project proponent.		
Value of data applied for the purpose of calculating expected emission reductions		Period	Ceramic devices (tonnes)
		From May to December - 2006	40,682
		2007	54,919
		2008	65,053
		From January to April 2009	22,395
Description of measurement methods and procedures to be applied:	The amount was acquired by counting the total production of one year. The measurement was done by an internal control sheet monitored by the project proponent, which was filled daily. The production is a representative sample to ensure that all appliances are still in operation. 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 years ⁷ .
QA/QC procedures to be applied:	The ceramics have an internal control of the quantity of pieces produced. It will be rechecked according to the biomass employed and the kiln consumption of renewable biomass.
Any comment:	

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 proponent
Value of data	Renewable biomass
Description of measurement methods and procedures to be applied:	The guarantee of acquiring renewable wood will be achieved by invoices from the providers. The origin of the cashew tree pruning will be evidenced with a declaration from the provider that the sustainable plan had been followed. As stated in the section B.6, the biomasses (Algaroba wood, babaçu coconut husk, Elephant grass and Sawdust) are considered renewable as fulfilling the options described in the methodology applied. The origin of the native wood utilized in the project activity will be provided from Forest Origin Document (DOFs ⁸).
QA/QC procedures to be applied:	The biomass was considered as renewable if it is according to the definition given by the applied methodology. Furthermore, documents proving the origin of renewable biomass from forested resources were provided. Moreover, in order to provided documents proving the origin of the native wood utilized in this project activity it was provided DOFs from this kind of 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.

⁷ These information may be checked at < <http://www.sindusconjp.com.br/informativo/noticia.jsp?idNoticia=55>>access on May 26th of 2009 and at < <http://www.agenciabrasil.gov.br/noticias/2009/04/08/materia.2009-04-08.2710522006/view>> access on May 26th of 2009

⁸ DOF means Document of Forest Origin which necessarily comes with the wood product from native forest from origin to destination (the destination and origin must appear on the DOF), through individual transport which is: road, air, rail, river or sea. Wood industries need the DOF in order to transport products of wood and to prove its sustainable origin. Available at < <http://www.florestavivaamazonas.org.br/21331.php>> access on 26th May of 2009.

Data / Parameter:	Leakage of non-renewable biomass
Data unit:	tCO ₂ e
Description:	Leakage resulted from the non-renewable biomass
Source of data to be used:	Monitored
Value of data	0
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).
QA/QC procedures to be applied :	Data available regarding the ceramic industries fuel consumption were utilized to monitor the leakage.
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	<table border="1"> <thead> <tr> <th>Harvest</th><th>07/08</th></tr> </thead> <tbody> <tr> <td>Forest Residues (sawdust) in m³</td><td>10,775.38</td></tr> <tr> <td>Babaçu coconut husk (tonnes)</td><td>4,756</td></tr> <tr> <td>Wood from management areas(m³)</td><td>4,595,695</td></tr> <tr> <td>Residues from cashew trees (tonnes)</td><td>196,625</td></tr> <tr> <td>Algaroba wood (m³)</td><td>2,500,000</td></tr> </tbody> </table> Detailed information in section B.5 – Leakage.	Harvest	07/08	Forest Residues (sawdust) in m ³	10,775.38	Babaçu coconut husk (tonnes)	4,756	Wood from management areas(m ³)	4,595,695	Residues from cashew trees (tonnes)	196,625	Algaroba wood (m ³)	2,500,000
Harvest	07/08												
Forest Residues (sawdust) in m ³	10,775.38												
Babaçu coconut husk (tonnes)	4,756												
Wood from management areas(m ³)	4,595,695												
Residues from cashew trees (tonnes)	196,625												
Algaroba wood (m ³)	2,500,000												
Description of measurement methods and procedures to be applied:	It will be used to calculate the leakage of renewable biomass. The sources of leakages predicted in methodology applied will be monitored. The measurement of the leakage will be based in national and internal articles and database every monitoring period. The sources will provide 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 will be employed to monitor the leakage.												
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.												

B.5. Calculation of emission reductions

The **Category AMS-IE: Switch from Non – Renewable Biomass for Thermal Application by the User** (Version 01 from February 01 of 2008 onwards) 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 MWthermal for Type I Small scale project activities.

Baseline

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

Where:

ER_y :	Emission reductions during the year y in tCO ₂ e
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 tCO ₂ /TJ ⁹ .

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.

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

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

Where:

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

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

Where:

BF_y: Consumption of non renewable biomass per tonnes of ceramic devices produced in year y

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

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

B.6. Monitoring results

Leakage (LE)

The Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01 from February 01 of 2008 onwards) 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 this 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 below).

Table 1. 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 table 1, the possible sources of leakage of the present project activity is the competing use of wood from management areas, Algaroba wood, residues from cashew trees, Babaçu coconut husk, garden's residues, elephant grass and sawdust. All of these biomasses has enough disponibility as showed below demonstrating the lack of leakage for each 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.

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 in: 14th December, 2008.

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 *Algaroba*'s genre invasion, the government started to stimulate the *Algaroba* exploration in order to avoid it's noxious effects¹⁸

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)¹⁹, 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, what represents less than 0.08% of the total amount of *Algaroba* used by CGM Ceramic per year²⁰

Therefore, this kind of fuel does not encompass any type of leakage since there is current a great amount of these renewable biomasses available locally as described before.

Forest Residues

Forest Residues are 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

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 in: 14th December, 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>.

¹⁸ *Algaroba* extraction is authorized in the state of Ceará, and it may be checked at normative instruction number 08 from 24/08/2004, developed by SEMACE.

¹⁹ EMBRAPA, *Comunicado Técnico N°*, Nov/92, p.1-2. Available at: <http://www.cpatia.embrapa.br/public_eletronica/downloads/COT51.pdf>. Visited in: 14th December, 2008.

²⁰ CGM Ceramic consumes approximately 2,025 m³ of *Algaroba* wood per year.

observed in the figure 4, 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. This way, this biomass does not have potential to generate leakage emissions due to its high availability.

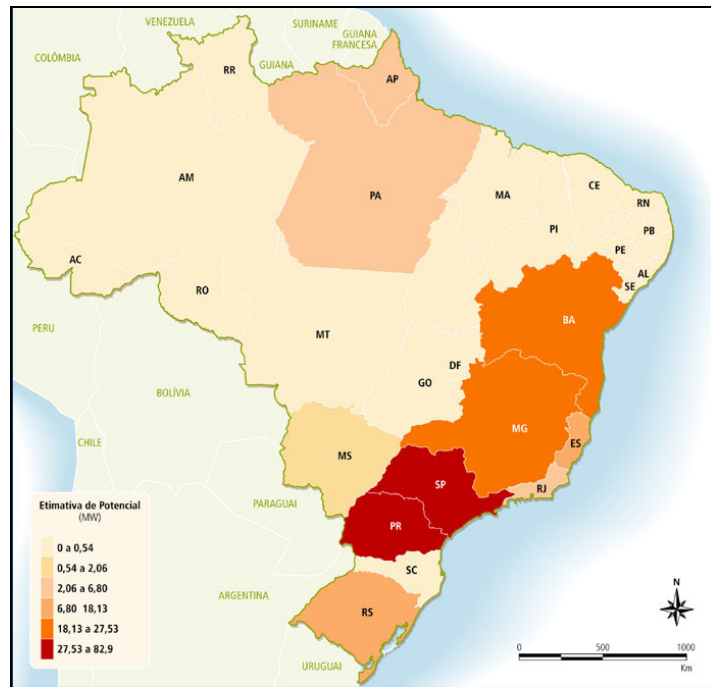


Figure 4. Forest Residues Potential for Energy Generation²¹

Considering that around 22% of the wood produced will generate sawdust²². The production of wood in the state of Ceará was of 48.979 m³²³ in 2007, thus, will generate 10,775.38 m³ of sawdust.

The project activity will employ approximately 60 tons per year, thus 244 m³ of woodchips/sawdust per year which represents 2.27% of the total of these residues generated in the State of Pará.

This way, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

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

²¹ Source: CENTRO NACIONAL DE REFERÊNCIA EM BIOMASSA - CENBIO. *Panorama do potencial de biomassa no Brasil*. Brasília; Dupligráfica, 2003. 80 p.

²² 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.

²³ According to IBGE (Geographic and Statistic Brazilian Institute) available from: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007>>

opportunities²⁴. The Brazilian production achieved 143,000 tons 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 nuts²⁵. 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 trees²⁶. 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 hectare²⁷, and the production of firewood residues from each tree is 2.5 kg per year²⁸. The cultivation of cashew is located in an area of 650,000 hectares⁶⁸. This way, the Brazilian production of residues from cashew trees is around 196,625 tons per year. Therefore, the CGM's consumption of residues from cashew trees (1,257 tons per year) represents around 0,6 % 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 provinient from *Babaçu palm* which is a Brazilian's native specie. Babaçu Palm is an 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 Ceara

²⁴ According with EMBRAPA (Brazilian Agricultural Research Corporation's) Available at :<<http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/index.htm>> visited in: 13th March , 2009

²⁵ Checked at: <http://www.nordeste rural.com.br/nordeste rural/matLerdest.asp?newsId=2219>

²⁶ According to EMBRAPA(Brazilian Agricultural Research Corporation's). Available at: <http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratoscultura is.htm> > visited in: 13th March , 2009

²⁷ According to "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/sbtr4555.pdf?PHPSESSID=76a9111889defa6787039ca56b380c58>> visited in: 13th March , 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 in: 13th March , 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 in: march 03rd of 2009.

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 will employ 60 tonnes of babaçu coconut husk per year, that means 1,3% of the total production in Ceara states. Also the ceramic may utilize babaçu coconut husk from other states in the region such as Maranhão which has a 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 its production. Thus, there is no leakage for such biomass.

Wood from management areas

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 8,131 m3 of wood from management areas per year. In this way, the project will utilize 0.2% 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.

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 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

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

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.

Emission Reductions

The crediting period according to the V-C-S 2007.1, standard which the project follows the rules, starts in the end of March 2006, this way the credits contemplates from May 2006 to May 2009:

Table 2. Production (PRy), quantity of wood that is substituted (By) and emission reductions (ERy) during the crediting period for Gomes de Matos ceramic.

Period	PRy	By (Tonnes)	ERy(tCO2e)
May 2006	5,112.21	2,879	4,094
June 2006	4,955.21	2,791	3,968
July 2006	5,039.47	2,838	4,036
August 2006	4,658.33	2,624	3,730
September 2006	4,912.98	2,767	3,934
October 2006	5,456.83	3,073	4,370
November 2006	5,307.96	2,989	4,251
December 2006	5,239.22	2,951	4,196
Total 2006	40,682.22	22,912	32,582
January 2007	4,945.27	2,785	3,960
February 2007	3,640.69	2,050	2,915
March 2007	4,025.13	2,267	3,223
April 2007	4,624.42	2,604	3,703
May 2007	4,129.84	2,326	3,307
June 2007	4,861.02	2,738	3,893
July 2007	5,046.83	2,842	4,042
August 2007	5,358.74	3,018	4,291
September 2007	4,986.18	2,808	3,993
October 2007	4,280.03	2,411	3,427
November 2007	4,805.42	2,706	3,848
December 2007	4,215.49	2,374	3,376
Total 2007	54,919.07	30,930	43,985
January 2008	4,610.04	2,596	3,692
February 2008	4,854.96	2,734	3,888
March 2008	5,495.72	3,095	4,401
April 2008	5,551.84	3,127	4,446
May 2008	5,642.04	3,178	4,518
June 2008	5,596.78	3,152	4,482
July 2008	6,235.84	3,512	4,994
August 2008	5,616.64	3,163	4,498
September 2008	5,530.82	3,115	4,429
October 2008	5,537.50	3,119	4,435
November 2008	4,941.89	2,783	3,958

December 2008	5,439.08	3,063	4,356
Total 2008	65,053.15	36,638	52,101
January 2009	5,332.92	3,004	4,271
February 2009	5,148.76	2,900	4,123
March 2009	5,915.64	3,332	4,737
April 2009	5,998.43	3,378	4,804
Total 2009	22,395.75	12,613	17,936

Production was double checked with the amount of biomass acquired, as showed in table 3 which intends to demonstrate that the biomass consumption was enough to maintain the production during the monitoring period. The thermal energy per tonnes of pieces produced is larger in the monitoring period than the predicted in VCS PD, therefore, there is enough biomass to produce the amount of pieces monitored. The surplus of thermal energy can be explained due to biomass stock.

Table 3. Production and biomass predicted and monitored.

	VCS PD	Monitoring Period (average value per month)	Double Check (QA/QC Procedure)
Production (tonnes)	2,949	5,085	Biomass consumption was enough to maintain the referred production
Sawdust Consumption (tonnes per month)	5	12.00	
Amount of renewable native wood (tonnes per month)	563	826.70	
Eucalipto (tonnes per month)	18	38.65	
Algaroba(tonnes per month)	128	378.98	
Amount of cashew tree (tonnes per month)	105	161.97	
Babaçu coconut husk (tonnes per month)	5	10.60	
Thermal Energy (TJ per month)	16	27	
Thermal energy per tonnes of pieces produced (TJ/tonnes of pieces)	0.00534	0.00537	

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 years. For that reason the production is different from the production predicted in the VCS PD.

Table 4. Production (PRy), quantity of wood that is substituted (By) and emission reductions (ERy) during the crediting period.

Period	PRy	By (tonnes)	ERy
May to December 2006	40,682	22,912	32,582
2007	54,919	30,930	43,985
2008	65,053	36,638	52,101
January to April- 2009	22,396	12,613	17,936
Emission Reductions from May 2006 to April 2009 - methodology AMS-I.E.-Switch from Non-Renewable Biomass for Thermal Applications by the User – version 01 from February 01 of 2008 onwards			146,604

Therefore, based on Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01 from February 01 of 2008 onwards) 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 **146,604 tCO₂e**. The contribution to sustainability will be monitored applying the Social Carbon 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 *Ronaldo Sampaio Gomes De Matos* from Gomes de Matos Ceramic.

The monitoring report version was completed in May 26st, 2009 by *César Braga Alves and Rafael Ribeiro Borgheresi* from *Carbono Social Serviços*.