Voluntary Carbon Standard
Project Description

19 November 2007

November 11th, 2009

Contents

1 Description of Project:

1.1 Project title

Bom Jesus Ceramic Fuel Switching Project

Version 04

PDD completed in: November 11th, 2009

1.2 Type/Category of the project

The voluntary project activity, although being applied at the voluntary market, encloses the following category of the simplified modalities and procedures, which is described in appendix B, for small scale type I CDM project activities.

- **Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User** – Version 01 from February 01st of 2008 onwards.
- This is not a grouped project.

This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies.

1.3 Estimated amount of emission reductions over the crediting period including project size:

The amount of emission reductions are greater than 5,000 tonnes of CO2 equivalent and less than 1,000,000 tonnes of CO2 equivalent, thus classifying as a project under the VCS 2007.1 size groups (micro project, project, mega project).

Table 1. Emission reductions estimate during the crediting period

Year	**Emission Reductions (tCO_2e)**
2007	10,370
2008	10,370
2009	10,370
2010	10,370
2011	10,370
2012	10,370
2013	10,370
2014	10,370
2015	10,370
2016	10,370
Total Emission Reductions (tCO_2e)	**103,700**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO_2e)	10,370

1.4 A brief description of the project:

The project activity is the project of *Bom Jesus* Ceramic, which is a red ceramic industry localized in *Paudalho* municipality, in the state of *Pernambuco*, northeast of Brazil. The ceramic industry produces bricks and flagstones, destined mainly for the regional market in *Pernambuco*.

The fuel utilized in the baseline scenario to cook the ceramic devices was native wood from the *Caatinga* biome, which is a pioneer practice in the region. This type of wood is considered a non- renewable biomass, once it is not originated in areas with reforestation activities or sustainable management activities.

The *Caatinga* is an exclusively Brazilian biome and occupies around 844,453 Km², equivalent to around 10% of the territory of the country[1]. Although being rich in natural resources, the *Caatinga* is one of the most threatened ecosystems on the planet. Its high calorific value causes a major cause of its decline. In a region where the shortage of rivers leads to less access to electric energy, native firewood and charcoal account for thirty percent of the total energy utilized in the industries of the region, which has intensified the local deforestation[2].

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.

This fuel switching project activity will reduce the greenhouse gases (GHG) emissions through the substitution of native wood from deforestation activity for renewable biomasses to generate thermal energy.

As renewable biomasses, the project activity consists in utilizing sugar cane briquette[3], *Algaroba* wood[4], *Eucalyptus* wood[5], native wood with sustainable management plan and wood residues from construction and industries[6] to feed the ceramic's kilns, replacing the use of wood from areas with non sustainable forest management, which did not have any kind of contribution to the level of biodiversity enrichment.

This project pointed out the possibility to switch non-renewable biomass for renewable biomasses, which was unattractive due to high investments on the adaptation of machineries to work with the new biomasses and other barriers. The ceramic owner considered the income from the commercialization of the carbon credits to become the project activity viable.

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[1] *Available at: <http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169&id_pagina=1>. Visited on July 1st, 2009.*

[2] *Available at: <http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47>. Last visit on: April 21st, 2009.*

[3] *The sugar cane has been cultivated in the state of Pernambuco for almost five centuries. Each ton of sugar cane used for alcohol production generates around 140 Kg of sugar cane bagasse, which can be either compacted into briquettes or utilized in natura for thermal energy generation. Available at: <http://www.bndes.gov.br/conhecimento/seminario/alcool_discussao.pdf>. Last visit on: May 5th, 2009.*

[4] *The wood from afforestation in the northeast region of Brazil is mainly consisted of Algaroba (Prosopis juliflora). Available at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Last visit on: August 6th, 2009.*

[5] *The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the Eucalyptus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare. Available at: <http://www.sbs.org.br/atualidades.php>. Last visit on: January 19th, 2009.*

[6] *The deficiency of a correct destination for this wood constitutes a huge problem. Pallets that are either broken or worn-out are consumed in the kiln by the ceramic. These pallets are acquired from large industries in the region, which includes Recife, the capital of Pernambuco.*

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 party in acquiring the proper legal documents for the commercialization of the native firewood. Moreover, in opposition to the identified baseline, the project activity will generate thermal energy without stimulating deforestation by using an abundant renewable biomass in the region.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The ceramic is located in the Municipality of *Paudalho* in the state of *Pernambuco* which is indicated in Figure 1. The project site has the following postal address and geographical coordinates:

Engenho Belém, without number.

Paudalho – Pernambuco, Brasil

Zip Code: 55.825-000

Ceramic’s Boundaries Coordinates (measured through GPS):

A: 7º53’35” S, 35º11’24” W;

B: 7º53’35” S; 35º11’21” W;

C: 7º53’32” S; 35º11’22” W;

D: 7º53’30” S; 35º11’17” W.

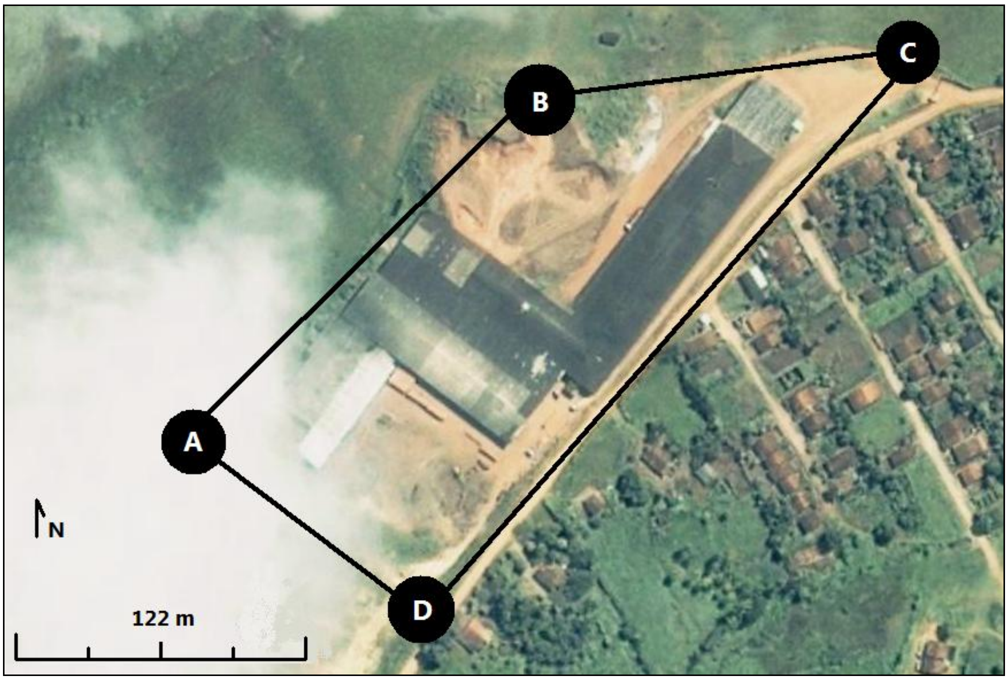

Figure 1. *Bom Jesus* Ceramic’s boundaries

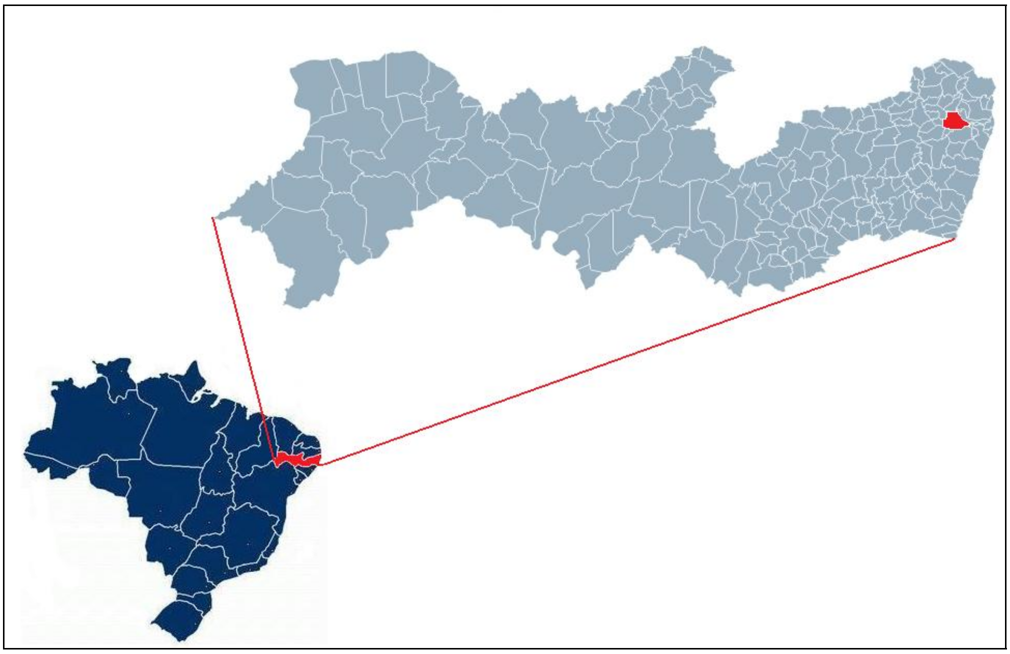

Figure 2. Geographic location of the city of the project activity that has the following coordinates in *Pernambuco* State: *Paudalho*: 07°53'48" S and 35°10'47" W

1.6 Duration of the project activity/crediting period:

- Project start date[7]: November 1st, 2006;
- Crediting period start date[8]: January 1st, 2007;
- Date of terminating the project activity[9]: December 31st, 2016;
- VCS project crediting period: 10 years, twice renewable.

1.7 Conditions prior to project initiation:

The use of native wood without sustainable management as fuel is a prevalent practice among the ceramics industries in Brazil. Wood from deforestation is delivered and utilized in the ceramic facility and this non renewable biomass is offered with low prices.

Although firewood from deforested areas has been used for many decades as fuel in Brazil, it is impossible to define a start date on which this kind of non-renewable biomass began to be applied. Firewood used to be the most employed source of primary energy until de decade of 1970, when the petroleum started to supply the majority of Brazilian´s energy needs[10]. Moreover the Brazilian´s Energy and Mine Ministry has been monitoring all energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector[11].

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[7] *Date on which the project began reducing or removing GHG emissions, i.e. when the project proponent began employing renewable biomass.*

[8] *Date on which the project proponent completed the fuel switch of Bom Jesus ceramic, thus, when the ceramic industry stopped employing native wood.*

[9] *Date on which the project activity completes 10 years after the date on which the project proponent completed the fuel switch.*

[10] *Source: BRITO, J.O.* ***Energetic use of Wood****. Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES>. Last visit on: March 9th, 2009.*

[11] *Energy Research Company. National Energy Balance - energy consumption per sector. Available at*

According to Seye (2003)[12], in Brazil, the red ceramic devices are produced through an inefficient and traditional process using wood without forest management to generate thermal energy. In this industry segment, the use of wood represents about 98% of the total fuel employed.

Therefore, the employment of this fuel stimulates the increase in Brazilian deforestation rates. The baseline identified for this project activity is the utilization of a total of around 10,485 m^3 of non-renewable native wood per year to provide thermal energy to the ceramic's kilns. The project activity focuses on the use of sugar cane briquette, *Algaroba* wood, *Eucalyptus* wood, native wood with sustainable management plan, wood from constructions residues, and sawdust as renewable biomasses for energy supply.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The emission reductions will be achieved by displacing the use of wood from areas with no sustainable forest management to provide thermal energy in the ceramic company. Therefore, the emissions launched during the combustion of native wood from deforestation activities were not offset by the replanting, which is a carbon absorbance method. An opposite scenario occurs with the renewable biomasses utilized in this project activity, which have carbon neutral cycle.

1.9 Project technologies, products, services and the expected level of activity:

Bom Jesus Ceramic produces bricks and flagstones. The production process at *Bom Jesus* Ceramic encompasses one "Hoffman" kiln[13] and one "Tunnel" kiln[14] in order to cook the ceramic devices.

The ceramic also has two dryers, in order to dry part of the devices that will be burnt at the "Tunnel" kiln. The heat generated in the "Tunnel" kiln is reused by forwarding to both dryers. The ceramic devices that will be cooked at the "Hoffman" kiln are dried naturally, using ventilators and crystal roof in order to accelerate the drying process.

The "Hoffman" kiln has 78 lines, but cooks 23 lines per day, reaching about 1,000,000 pieces monthly. The "Tunnel" kiln cooks 65 cars per day, totalizing about 1,000,000 devices monthly. Each kart has capacity for 720 pieces.

Table 2. Technical parameters of the kilns utilized in this project activity

Technical Parameters	**"Tunnel" Kiln**	**"Hoffman" Kiln**
Features	Continuous	Continuous with

<http://www.mme.gov.br/download.do?attachmentId=16555&download>. Last visit on: April 15th, 2009.

[12] *SEYE, O.* ***Análise de ciclo de vida aplicada ao processo produtivo de cerâmica estrutural tendo como insumo energético capim elefante (Pennisetum Purpureum Schaum).*** *Campinas, SP: [s.n.], 2003.*

[13] *"Hoffman" is a very old type of kiln, which has parallel chambers where the heat from one chamber is used in the next, therefore recycling the generated heat in the previous chambers, which are all linked by a central gas collector. The kiln is fuel fed from its top.*

[14] *Kind of kiln that has three sections: heating, burning and cooling, with the reutilization of heat among the sections. The ceramic pieces are transported through a conveyor belt or special karts inside the kiln. Although this kind of kiln is more efficient and modern, the "Tunnel" kiln utilized in Bom Jesus Ceramic is very old and surpassed comparing to others.*

	with rectangular shape and furnaces in the lateral part of the kiln (7 burning lines with two fuel entrances each).	rectangular shape and 78 lines (each line has three fuel entrances). The furnaces are in the upper part of the kiln.
Maximum Temperature	800°	900°
Time of loading	5 minutes	15 minutes
Burning Cycle	21 hours[15]	1 hour and 10 minutes[16]
Time of unloading[17]	5 minutes	15 minutes
Average production per burning cycle[18]	720	2,000
Number of burning cycles per month	1,735	625

Bom Jesus ceramic had to acquire a wood shredder and a circular axe in order to cut the bigger pieces of wood and permit their entrance into the kilns. Furthermore, it was acquired six mechanic burners in order to automatically inject biomasses and air into both kilns.

Currently, the fraction of each renewable biomasses utilized are around: sugar cane briquette (11%), *Algaroba* wood (4%), *Eucalyptus* wood (8%), native wood with sustainable forest management plan (75%), wood residues from constructions and industries (1%), and sawdust (1%). It can be observed in the table below:

Table 3. Current scenario of *Bom Jesus* Ceramic

***Bom Jesus* Ceramic current scenario**	
Production (devices per month)	2,026,627

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[15] *The burning cycle in a "Tunnel" kiln is the number of hours that a single kart get into and out of the kiln. The average time spent with warming, burning and cooling are around 9 hours, 4 hours and 8 hours respectively.*

[16] *The burning cycle in a "Hoffman" kiln is the number of hours it takes to burn a single line inside the kiln. The average time spent with warming, burning and cooling are around 18 hours, 70 minutes and 18 hours respectively. It was only considered the burning stage in the burning cycle of this type of kiln because while one line is burning, 15 lines ahead and behind of it are warming and cooling respectively.*

[17] *The cleaning of the "Hoffman" Kiln is performed while the kiln is loaded again with other pieces to be burnt. It is not necessary to clean the "Tunnel" Kiln due to the high efficiency of this kiln, which almost does not generate ashes. Therefore, it was not considered the time spent with the cleaning of the kilns.*

[18] *It was not considered the loading and unloading time of the kilns in order to calculate this value, as while these processes are done, the kiln is burning (continuous kiln).*

Sugar cane briquette consumption (tonnes/month)	54.01
Algaroba wood consumption (tonnes/month)	18.63
Eucalyptus wood consumption (tonnes/month)	40.19
Native wood with sustainable forest management plan consumption (tonnes/month)	341.71
Wood residues from industries and constructions (tonnes/month)	0.76
Sawdust (tones/month)	0.19
Total Biomass Consumption (tonnes/month)	455.49

In the future, the proportion of these renewable biomasses may change. Probably, the proportion utilized of native wood with sustainable management plan will decrease, comparing with other renewable biomasses.

Other possible renewable biomasses that are available in the region and could be utilized in the future by *Bom Jesus* ceramic are: cashew tree pruning, coconut husk, glycerin, and elephant grass.

The current biomass providers are listed in table 4, which does not exclude the possibility of buying biomass from others:

Table 4. Main biomasses providers

Biomass	Provider	Location
Sugar cane briquette	*Una Açúcar e Energia LTDA*	*Tamandaré – PE*
	A. M. Lopes da Silva & Cia. Ltda - ME	*Palmeira dos Índios - AL*
	Comercial Santo Amaro	*Goiana - PE*
***Algaroba* wood**	*Ana Vilela Laranjeira*	*Ibimirim - PE*
	Marta Janes Bezerra	*Ibimirim - PE*
	Serraria Padre Cícero	*Jaboatão dos Guararapes - PE*

	Patrícia Xavier	*Recife - PE*
***Eucalyptus* wood**	*Serraria Padre Cícero*	*Jaboatão dos Guararapes - PE*
	D S Indústria e Comércio de Pallets	*Joboatão dos Guararapes - PE*
	Danielle Maria de Souza Silva	*São Lourenço da Mata - PE*
	Lecar Serraria	*Recife - PE*
	José Barbosa da Silva	*Recife - PE*
	Santos Transportes	*Jaboatão dos Guararapes - PE*
Native wood with sustainable forest management plan	*Oriosvaldo Barros Mangueira*	*Floresta - PE*
	Maria das Graças Cavalcanti Novaes	*Floresta - PE*
	José Paulo Sampaio	*Sertânia - PE*
	João Duque Filho	*Inajá - PE*
	Antônio Carlos Menezes Duque	*Jaboatão dos Guararapes - PE*
Constructions and industries residues	*Estaleiro Atlântico Sul*	*Ipojuca - PE*
Sawdust	*Serraria Padre Cícero*	*Jaboatão dos Guararapes - PE*

The following figures show some of the changes at the ceramic industries:

Figure 3. Sugar cane briquette in sheltered place

Figure 4. Wood residues from construction and industries

Figure 5. Mechanic burners and biomass utilized on the "Hoffman" kiln

Figure 6. Mechanic burners and biomass utilized at the "Tunnel" kiln

1.10 Compliance with relevant local laws and regulations related to the project:

This project is in accordance to the CONAMA[19] Resolution, no. 237/97 that establishes that clay extraction activities and ceramic production must be supported by specific licenses, such as operational license, clay extraction license, environmental licenses and the permission of

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[19] *CONAMA (National Environmental Council), created in 1981 by Law 6.938/81, is the* Brazilians' *department responsible for deliberation and consultation of the whole national environmental policy and it is chaired by the Minister of Environment. It is responsible for the establishment of standards and criteria relating to licensing of potentially polluting companies. More information is available at <http://www.mma.gov.br/port/conama/estr.cfm>. Last visit on May 18th, 2009.*

the State Agency of Environment and Water Resources of *Pernambuco* (CPRH[20]), which must run under the valid time.

According to the IBAMA Normative Instruction Nº 112 from August 21st, 2006;[21] the entrepreneur who uses raw material from native forests is obliged to use the DOF (Document of Origin Forestry) to control the origin, transport, and storage of forest products and by-products. Therefore, to use firewood obtained from native forests in a sustainable manner, it is necessary to use the DOF, which is required by the Operational License of the state of *Pernambuco*. The DOFs asked from *Bom Jesus* Ceramic are available for consultation at *IBAMA* website.[22]

On the other hand, the Normative Instruction N° 8, from August 24th, 2004, Article 5,[23] affirms that owners or holders of exotic forest species do not have to present information regarding the extraction of the wood. Therefore, the legal requirements regarding the use of *Algaroba* and *Eucalyptus* wood do not necessitate documents demonstrating the origin of extraction, transport and storage. However, as from January, 2009 for *Bom Jesus* Ceramic, it is required by the Operational License of the state of *Pernambuco* the cutting information for exotic and fruit species.

Furthermore, the sugar cane briquette, the constructions and industries residues do not require documents for residues which do not fall under the by-product definition of *IBAMA* Normative Instruction N° 112. Furthermore, the Operational License of the state of *Pernambuco* does not require any documents for the use of these biomasses.

The project is also in accordance to Federal Constitution, Article 20, which establishes the payment of a Financial Compensation by the Mineral Resources Exploitation. This financial compensation is annually performed to DNPM (National Department of Mineral Production[24]).

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

- Availability and price of the renewable biomasses

The thermal energy generation through the combustion of biomasses is an innovation in the ceramic industries. The future demand of this alternative fuel (e.g. by other consumers) is not easy to foresee.

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[20] *CPRH is the State Agency of Environment and Water Resources of the State of Pernambuco responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: <http://www.cprh.pe.gov.br/>. Last visit on May 18th, 2009.*

[21] *BRASIL. INSTRUÇÃO NORMATIVA IBAMA Nº 112, DE 21 DE AGOSTO DE 2006. Available at: <http://www.cetesb.sp.gov.br/licenciamentoo/legislacao/federal/inst_normativa/2006_Instr_Norm_IBAMA_112.pdf>. Visited on: July 6th, 2009.*

[22] *To check the DOF´s, it is necessary to enter the ceramic registry (CNPJ) and its password. Please visit <http://servicos.ibama.gov.br/ctf/sistema.php?modulo=aplicacao/modulo&moduloId=392> to check DOF´s.*

[23] *BRASIL. INSTRUÇÃO NORMATIVA Nº 8, DE 24 DE AGOSTO DE 2004. Available at: http://www.mda.gov.br/saf/arquivos/IN8-2004-MMA.doc.Last visit on July 6th, 2009.*

[24] *The objectives of the National Department of Mineral Production are: to foster the planning and promotion of exploration and mining of mineral resources, to supervise geological and mineral exploration and the development of mineral technology, as well as to ensure, control and monitor the exercise of mining activities throughout the national territory, in accordance with the Mining Code, the Mineral Water Code and respective legislation and regulations that complement them. Source: <http://www.dnpm.gov.br/enportal/conteudo.asp?IDSecao=168&IDPagina=222>. Last visit on: May 18th, 2009.*

There is currently a great amount of these types of biomasses available regionally, however, a demand and price increase has already been reported. If non-foreseeable reasons affect the availability of the biomasses, the ceramic owner will search for other type of renewable biomasses. Hence, it follows that the project approval will make the continue use of renewable biomasses feasible.

- Availability of the renewable biomasses

The current great amount of the biomasses available locally was already described herein, however if a non foreseeable reason affect the availability of the biomasses, the ceramic owner will search for other type of renewable biomasses, such as elephant grass.

- Closing of the ceramic business

If the ceramic company closes, it may substantially affect the project’s GHG emission reductions, once other ceramic would probably supply the products consuming non-renewable native wood which is the common practice of the region. However, there are currently good perspectives in the ceramic market and the organized administration verified at *Bom Jesus* Ceramic avoid this possibility in the short term.

- Difficulty related to the abrupt change

As affirmed before, the ceramic used non-renewable native wood in its kilns and dryers for many years. The sudden change brought difficulties to the ceramic company, as the employees were not used with the renewable biomasses; the main challenges were the reconfiguration of the internal logistic and the employees’ resistance to the new situation.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The historical of *Bom Jesus’* activities using non-renewable native wood as fuel clearly confirms that the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

Bom Jesus Ceramic used to feed the kilns with native wood from deforestation activities to generate thermal energy in order to cook ceramic devices. According to historical data from *Bom Jesus*, the ceramic facilities used to utilize non-renewable native wood from areas without any kind of management since 1986.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates.

This project is not creating any other form of environmental credit under any specific program.

Social Carbon Methodology is being applied only as a Sustainability tool in association with VCS 2007.1 standard.

Social Carbon Methodology was developed by *Ecológica* Institute (www.ecologica.org.br). It was founded on the principle that transparent assessment and monitoring of the social and environmental performance of projects improves their long-term effectiveness. The methodology uses a set of analytical tools that assess the social, environmental and economic conditions of communities affected by the project, and demonstrates through continuous monitoring the project’s contribution to sustainable development.

1.14 Project rejected under other GHG programs (if applicable):

This project was not rejected under any formal GHG reduction or removal program. The project report was produced to make the project public and available to voluntary measures or other opportunities of the carbon market.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

Project Proponent

Bom Jesus Ceramic.

Industrial Establishment: *Mario Henrique de Mattos e Silva – ME*

The project proponent contributed to the current report by assigning the following roles and responsibilities to two members of its team:

Mr. *Mário Henrique de Mattos e Silva*, Director and owner: Information about the ceramic industry, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramics devices market challenges.

Mrs*. Elisângela Maria Carneiro*, monitoring responsible: General data and information on inputs and outputs of the ceramic industry, detailed information on the acquisition of renewable biomasses and how this data is kept by the controller’s office.

Other information on the project’s proponent:
Address:

Engenho Belém, without number.
Paudalho – Pernambuco, Brasil
Zip Code: 55.825-000

Phone number: +55 (81) 3636-1200

Project Developer

Carbono Social Serviços Ambientais LTDA.: Project developer, Project participant and Project idealizer. As the project authorized contact, *Carbono Social Serviços Ambientais LTDA* was given the responsibility of preparing the present project report and to accompany the proponent until the end of the crediting period. The assessor directly involved is:

Gabriel Fernandes de Toledo Piza and *Marcelo Hector Sabbagh Haddad*, Technical Analysts: Project Design Document writers, elaboration of GHGs Emissions’ Inventory, direct contact between *Carbono Social Serviços Ambientais LTDA* and the ceramic, and responsible for collecting the necessary information.

Coordinated by:

Rafael Ribeiro Borgheresi, Technical Coordinator.

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

Address:
R. Borges Lagoa, 1065 – Conj. 144 – Vila Clementino
Zip Code: 04038-032
São Paulo – SP, Brazil
Phone number: +55 11 2649-0036
Web site: http://www.socialcarbon.com
Email: gabriel@socialcarbon.com
marcelo@socialcarbon.com

rafael@socialcarbon.com

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information):

The project is eligible according to:

- Legislative: the project attends all legal requirements;
- Technical: alterations/adaptations required are technically feasible;
- Economic: carbon credits will compensate the high investments that were necessary to achieve the fuel-switch;
- Sectoral: incentive of good practices to the sector;
- Social: social carbon methodology will be applied which will improve long term sustainability. The culture of burning wood without sustainable management as fuel will be slowly mitigated;
- Environmental: the project attends all legal requirements and no environmental impacts are predicted;
- Geographic /site specific: the plant can be uniquely geographically identified with no barriers regarding logistic;
- Temporal information: the project will not double count the GHG emissions during the ten years renewable of the crediting period.

However there is no information relevant for its eligibility which is not already described in this VCS PD.

1.17 List of commercially sensitive information (if applicable):

None of the information disclosed to the validator was withheld from the public version of the report.

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

- **Category AMS-I.E: Switch from Non-Renewable Biomass for Thermal Application by the User** – Version 01 from February 1st of 2008 onwards.

The amount of non-renewable biomass (B_y) will be determined according to the option “a” of the applied methodology.

The project’s emissions from the combustion of native wood from deforestation areas are accounted in the same way as fossil fuel combustion, once it is not renewable and emits CO_2.

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology applied is Category AMS-I.E: Switch from Non–Renewable Biomass for Thermal Applications by the User – Version 01 from February 01 of 2008 onwards which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The end-user technology in the case of this project can be established as the project proponent, who utilizes the thermal energy generated by the new renewable energy technology.

There are no similar registered small-scale CDM project activities in the region of *Paudalho* once Social Carbon Company made a research and did not find any registered small–scale CDM Project activity in the region. The sources of registered small-scale CDM project activity consulted were the United Nations Framework Convention on Climate Change (UNFCCC)[25] and Brazilian’s Technology and Science Ministry[26]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted by the other registered project activities.

The utilization of firewood from area without any kind of management can not be considered a renewable source of biomass, since it involves a decrease of carbon pools and increases the carbon emissions to the atmosphere, turning green house effect even worse. Moreover, the native wood provided from areas without a reforestation management plan does not fit any of the options of UNFCCC definition of renewable biomass in Annex 18, EB 23.

According to historical data from *Bom Jesus* ceramic industry, the ceramic facilities used to utilize non-renewable native wood from areas without any kind of management since 1986.

This way, it can be concluded that non-renewable biomass has been used since before 31st December, 1989. Thus, the project activity is in agreement under the methodology applicability requirements.

The biomasses utilized in the project, sugar cane briquette, *Algaroba* wood, *Eucalyptus* wood, native wood with sustainable management plan,

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[25] *CDM activities registered by CDM Executive board are Available at:< http://cdm.unfccc.int/Projects/registered.html>.Visited on March 27th, 2009.*

[26] *Brazilian´s Technology and Science Ministry is responsible for registry and approval of all CDM activities within Brazilian boundaries. CDM activities submitted to the Brazilian Inter-Ministerial Commission of CDM Activities are available at: <http://www.mct.gov.br/index.php/content/view/47952.html>. Visited on March 27th, 2009.*

wood residues from industries and constructions, and sawdust are common in the region generated.

The native wood with sustainable forest management plan and the *Eucalyptus* wood are considered renewable according to option I, as soon as they fit all the assumptions below:

“The biomass is originating from land areas that are forests where:

(a) The land area remains a forest; and

(b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and

(c) Any national or regional forestry and nature conservation regulations are complied with.”

The native wood with sustainable forest management plan fits all the three options above since the area remains a forest due to sustainable management practices that are undertaken with.

The sustainable forest management plan can be organized into three stages: firstly, the division of the property in exploitable areas and areas of permanent preservation that are inaccessible to exploitation. The second stage is the planning of roads that connect the area with the primary roads. In the third stage, the allocated area is divided for exploration in blocks in order to sustain forest exploitation annually[27].

Afterwards, a technical responsible elaborates the next stages: forest inventory, estimation of growth, the best intervention techniques, fixes the arrangement of exploration and the silvicultural treatment. An annual technical report of the sustainable forest management area is elaborated and it is necessary a yearly authorization of the environmental agency of the state to keep the activities.

In addition, the sustainable forest management promotes the conservation of biodiversity, conservation of soil and water regime, which are essential practises to combat the desertification. Moreover, there is an increment at the opportunity of employment for the rural population due to the sustainable exploration of plants destined for fruits, apiculture, medicinal, oil, ornamental and fiber production purposes[28].

Furthermore, the minimum requirements of the management plan are defined by Articles 19, 20 and 21 of Brazilian Forest Code, and are regulated by Decree 5975/06[29].

The *Eucalyptus* wood fits all the three options above since just wood from *Eucalyptus* plantation areas are utilized, i.e. the area remains a *Eucalyptus* plantation with the use of the biomass. The area destined for afforestation in *Brazil* corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare[30]. Moreover, the

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[27] *Plano de Manejo Florestal (Forest Management Plan). Available at: <http://www.manejoflorestal.org/guia/pdf/guia_cap1.pdf>. Last visit on: April 22nd, 2009.*

[28] *BRASIL. Manejo sustentável dos recursos florestais da Caatinga/MMA. Secretaria de Biodiversidade e Florestas. Departamento de Florestas. Programa Nacional de Florestas. Unidade de Apoio do PNF no Nordeste._Natal: MMA, 2008. 28p.*

[29] *BRASIL. Lei nº. 4.771, de 15 de setembro de 1965. Código Florestal.* ***Diário Oficial [da] República Federativa do Brasil****, Brasília, DF, 16 de set. 1965. Available at: <http://www.planalto.gov.br/ccivil_03/LEIS/L4771.htm>. Last visit on: April 22nd, 2009.*

[30] Brazilian *Society of Forestry. Source: <http://www.sbs.org.br/atualidades.php.>. Accessed at: January 19th, 2009.*

afforestation supplies the society demands and avoids the pressure on the remnants of natural forests[31].

In addition, sustainable management practices of the afforestation in Brazil (as the techniques of preparation, fertilization, control of weeds, improved seeds, cloning and reform) were introduced and constantly improved in order to increase its productivity[32].

The afforestation in Brazil is complied with the ABRAF [33] , which represents, promotes and defends the collective interests of the forestry companies that engage in sustainable development based on planted forests.

The cashew tree pruning is considered renewable according to option II, as soon as it fits all the following assumptions:

"The biomass is woody biomass and originates from croplands and/or grasslands where:

(a) The land area remains cropland and/or grasslands or is reverted to forest; and

(b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
(c) Any national or regional forestry, agriculture and nature conservation regulations are complied with."

Residues from cashew trees also fits all the three options above since just residues from the croplands area would be utilized, i.e. the area remains a cropland with the use of the biomass. Moreover, the areas where the cashew trees fallows sustainable management practices, according to is cultivation and harvest techniques, where the pruning of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest period [34] . This way, in cashew cultivation must be cut undesirable branches of the cashew trees.

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 nuts [35] . This way, the Brazilian sources of residues from cashew trees will increase following the Brazilian production, due the fact that cashew cultivation requests it.

The elephant grass is considered renewable according to option III, as soon as it fit all the assumptions below:

"The biomass is non-woody biomass and originates from croplands and/or grasslands where:

(a) The land area remains cropland and/or grasslands or is reverted to forest; and

(b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land

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[31] *FOLKEL. C.* ***Silvicultura e Meio Ambiente.*** *Source: <http://www.celso-foelkel.com.br/artigos/Palestras/Silvicultura%20&%20Meio%20Ambiente.%20Vers%E3o%20final.pdf>. Last visit on: May 18th, 2009.*

[32] *MCT/IPEF.* ***Silvicultura e Manejo.*** *Source: <http://www.ipef.br/mct/MCT_03.htm>. Last visit on: May 18th, 2009.*

[33] *Brazilian Association of producers of cultivated forests. Source: <http://www.abraflor.org.br/estrutura.asp>. Last visit on: May 5th, 2009.*

[34] *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>. Last visit on:May 4th, 2009.*

[35] *Checked at: <http://www.nordesterural.com.br/nordesterural/matLerdest.asp?newsId=2219>. Last visit on: May 4th, 2009.*

areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and

(c) Any national or regional forestry, agriculture and nature conservation regulations are complied with.”

Currently, elephant grass has been acquiring national importance as biomass to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions[36]. The elephant grass is cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area.

The *Algaroba* wood is considered renewable according to option IV, as soon as it fits the following assumption:

“The biomass is a biomass residue and the use of that biomass residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from.”

The utilization of *Prosopis juliflora* is in according with option IV since it is considered a biomass residue due its competitive characteristics. A research made by EMBRAPA[37], 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 impacts[38]. 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.

Sugar cane briquette, sawdust, wood residues from industries and constructions, coconut husk, and glycerin are industries residues coming from large scale reforestation or agro industrial projects, so they are considered renewable according to option V of methodology definition of renewable biomass:

“The biomass is the non-fossil fraction of an industrial or municipal waste”.

Sugar cane bagasse is generated by industries to produce sugar and alcohol, and is compacted into briquettes in order to generate thermal energy. The wood residues are resulted from construction and industries residues. Eventually, the coconut husk is widely generated due to the utilization of the coconut fruit for several finalities. The glycerin is a waste generated during a stage production of biodiesel.

Moreover, the project activity will annually generate less than 45 MWThermal.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

According to the applied methodology, the project boundary is the physical, geographical area of the use of biomass or the renewable energy.

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[36] *According to EMBRAPA (*Brazilian *Agricultural Research Corporation's). Source: <http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Last visit on: May 4th, 2009.*

[37] *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.*

[38] *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.*

In the baseline scenario, there is use of non-renewable biomass to burn ceramic devices in the ceramic's kilns. This practice is responsible to discharge in the atmosphere the carbon that was stored inside of the wood (well-known by a carbon sink).

Table 5. Gases included in the project boundary and brief explanation

	Gas	**Source**	**Included?**	**Justification/ Explanation**
Baseline	CO_2	Emission from the combustion of non-renewable fuel	Yes	The major source of emissions in the baseline
	CH_4	-	No	Renewable biomasses could be left to decay. Excluded for simplification. This is conservative.
	N_2O	-	No	Possibly emissions from wood burning will be excluded for simplification. This is conservative.
Project Activity	CO_2	-	No	Excluded for simplification. This emission source is assumed to be very small.
	CH_4	-	No	Excluded for simplification. This emission source is assumed to be very small.
	N_2O	-	No	Excluded for simplification. This emission source is assumed to be very small.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

Observing table below, the common fuels employed and therefore, the baseline candidates are: natural gas, charcoal, wood, other recuperations, diesel oil, fuel oil, liquefied petroleum gas, others from petroleum, piped gas, electricity and others non-specified.

Table 6. Distribution of fuel employed at the ceramic sector in Brazil in percentage

BRAZILIAN ENERGY BALANCE 2008 - CERAMIC SECTOR EVALUATION			
FUEL	**2005**	**2006**	**2007**

Natural Gas	24%	26%	25%
Charcoal	2%	1%	1%
Wood	**50%**	**50%**	**49%**
Other recuperations	1%	1%	1%
Diesel Oil	0%	0%	0%
Fuel Oil	8%	8%	8%
Liquified Petroleum Gas	4%	4%	4%
Others from Petroleum	2%	2%	4%
Piped gas	0%	0%	0%
Electricity	8%	8%	7%
Others non specified	0%	0%	0%

(Brazilian Energy Balance, Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download>.Last visit on: May 18th, 2009)

The most probably scenario in the absence of native wood from deforestation areas would be the use of fuel oil, which is not viable considering its higher prices when compared with other non-renewable biomass. Even though, fuel oil presents a higher Net Calorific Value when compared with non-renewable firewood; the costs with fuel oil are higher because of its expensive prices. Fuel oil presents an average price of 0.895 BRL/kg [39] and the firewood without sustainable forest management used to present an average price of 0.02346 BRL/kg[40] in the baseline scenario. These values lead us to conclude that the price of fuel oil is around 0.000090587 BRL/Kcal as long as the price of this kind of wood is around 0.00000608757 BRL/Kcal according to CAETANO[41] *et al* (2004) that utilized the Net Calorific Value and the specific gravity of both fuels. The value of price per kcal is acquired through dividing the price per weight (BRL/kg) by the NCV (kcal/kg)[42].

Therefore, the cost with the utilization of fuel oil is higher than the utilization of firewood without sustainable forest management. Besides, the fuel oil requires more technology to be inserted. The conclusion is that the use of fuel oil is not attractive, at all.

Another plausible baseline scenario would be the use of Natural Gas. Although there is distribution/gas pipe in the region[43], the inconstant distribution of natural gas made the project proponents not to trust in

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[39] *According to data values and facts from "Estudo Comparativo da Queima de Óleo BPF e de Lenha em Caldeiras". Available at: <http://www.abcm.org.br/xi_creem/resumos/TE/CRE04-TE01.pdf>. Last visit on: April 27th, 2009.*

[40] *Average value of non-renewable wood, acquired through survey at some ceramics.*

[41] *Available at: <http://www.abcm.org.br/xi_creem/resumos/TE/CRE04-TE01.pdf>. Last visit on July 2nd, 2009.*

[42] *The NCV values are considered according to CAETANO et al (2004) as 3,853.75 Kcal/kg for native firewood and 9,880 Kcal/kg for fuel oil.*

[43] *Source: <http://www.ctgas.com.br/template02.asp?parametro=2547>. Last visit on: May 4th, 2009.*

this fuel, as 40% of the natural gas consumed in Brazil proceeds from Bolivia[44], therefore excluding this possibility.

Therefore, the identified baseline for this project activity is the use of native wood without sustainable forest management, which was used by the ceramic for a long time and has a consolidated delivery system and long term supply assurance. The overall characteristics of the ceramic production are used to obtain the real amount of non-renewable biomass utilized in the baseline scenario.

The monthly consumption of native wood from deforestation activities by the ceramic was around 873.7 m³ per month. According to historical experience of the ceramic, around 61.5% was consumed in the “Tunnel” kiln and 38.5% consumed in the “Hoffman” kiln. Therefore, of a total of 873.7 m³ of native wood utilized at the baseline scenario, 537.3 m³ (or 433.7 tons) would be utilized at the “Tunnel” kiln, and 336.3 m³ (or 271.5 tons) would be utilized at the “Hoffman” kiln.

Before the project activity, the Ceramic’s monthly production was about 2,026,627 ceramic devices per month. Each kiln was responsible for producing 50% of *Bom Jesus* Ceramic production. Thus, 1,013,313 ceramic pieces are produced at the “Tunnel” kiln, and 1,013,313 ceramic pieces are produced at the “Hoffman” kiln.

Eventually, these values lead to an efficiency of 0.4279 tons of native wood to produce a thousand of ceramic pieces at the “Tunnel” kiln, and 0.2679 tons of native wood to produce a thousand of ceramic pieces at the “Hoffman” kiln.

The efficiencies of *Bom Jesus’* kilns are more efficient than average efficiency for “Hoffman” and “Tunnel” kilns[45]. These values were not expected due to the lack of technology in the region and the indiscriminate use of the native wood without sustainable forest management. Furthermore, the “Tunnel” kiln is connected with the driers, thus the heat generated in the kiln is reused by forwarding to the dryers, leading to a lower efficiency.

If afterwards, the production in the ceramic industry rises, it will be reported in the monitoring report.

Table 7. General description of the ceramic company

	“Tunnel” kiln	**“Hoffman” kiln**	***Bom Jesus* Ceramic**
Production at baseline (devices per month)	1,013,313	1,013,313	2,026,627
Non-renewable wood consumption at baseline (tons per month)	433.7	271.5	705.2
Efficiency (tons of native wood per thousand of ceramic pieces)	0.4279	0.2679	0.3479

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The methodology applied is Category AMS-I.E.: Switch from Non–Renewable Biomass for Thermal Application by the User – Version 01 from February 01 of 2008 onwards, which is applicable for project activities that

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[44] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Last visit on: May 4th, 2009.*

[45] *Source: TAPIA, R. E. C. et al.* ***Manual para a indústria de cerâmica vermelha.*** *Rio de Janeiro: SEBRAE/RJ, 2005. (Série Uso Eficiente de Energia).*

avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

Furthermore, the project activity will annually generate less than 45 MWthermal.

The production during the baseline scenario could increase, since there is no lack of non-renewable wood offer. The high devastation rate of *Caatinga* Biome makes available large amounts of wood.

According to ASPAN[46], the major industries, mainly the steel, plasterer and ceramic industries are primarily responsible for the use of native firewood as fuel in their productions. Of a total of 844,453 km², it is currently remaining 50% of the local biome, even with 365,000 hectares of annual loss of all the biome[47].

Therefore, assuming that the deforestation rate maintains constant, the native wood would be enough to ensure the increase in Ceramic Company production for at least the next 30 years, which is over the project activity life-time.

Project additionality is explained according to section 5.8 of the Voluntary Carbon Standard - Specification for the project-level quantification, monitoring and reporting as well as validation and verification of greenhouse gas emission reductions or removals. To demonstrate that the project is additional, the PD used the test 1:

Test 1 – The project test

Step 1: Regulatory Surplus

The project is not mandated by any enforced law, statute or other regulatory framework in Federal, State and Municipal levels in the survey performed.

Legal requirements, as stated by the Constitution of the Federal Republic of Brazil[48] as well as Federal and State Regulations, do not require entrepreneurs, which use raw forest materials as an energy source, to switch from non-renewable biomasses to renewable biomasses. Therefore, the project activity is not a legal obligation, and in accordance with Article 5 of the Constitution of the Federative Republic of Brazil; moreover, nobody can be forced to follow a course of action if it is not addressed by law.

There are legal requirements constraints regarding the use of non-renewable biomass as exposed in Decree N.5,975 of November 30th,2006. However, it is not enforced namely due to the lack of control[49].

The consumption of non-renewable biomass by the ceramic industry was related by several authors (NERI, 2003[50]; ALBUQUERQUE *et al*, 2006[51]; BRASIL, 2001[52]; VIANA, 2006[53]; CARDOSO, 2008[54]).

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[46] *Source: Association for the nature defense of Pernambuco. Brazilian Institute of Environment and Renewable Natural Resources. <http://www.aspan.org.br/>. Last visit on: May 18th, 2009.*

[47] *Available at: <http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47>. Last visit on: May 4th, 2009.*

[48] *BRASIL. CONSTITUIÇÃO DA REPÚBLICA FEDERATIVA DO BRASIL DE 1988. Available at: http://www.planalto.gov.br/ccivil_03/constituicao/constitui%C3%A7ao.htm. Visited on July 6th, 2009.*

[49] *Corte e poda de árvores pelo Dnit na BR-158 é considerado crime ambiental, Jornal Grande CPA, Available at: http://www.grandecpa.com.br/?p=noticia&id_noticia=129. Visited on March 27th, 2009.*

Probably, the fuel switch would not be to renewable biomass, once the common practice at the ceramic sector is the use of non-renewable fuel.

Step 2: Implementation Barriers

The project shall face at least one distinct barrier compared with barriers faced by alternative projects.

- **Technological Barrier**

As affirmed before, the use of wood from areas without sustainable forest management is a traditional and well-known process, and as a result of the sudden change, a lot of effort from each employee in the ceramic was necessary. The main technological barriers were the non-availability of human knowledge to operate and maintain the new technology, the internal and external logistic modification and the employee’s resistance to the new technology.

Before the project activity, the process was noticeably different: non-renewable native wood was delivered in the plant; it was inserted in the kilns by the employees and it was not necessary any machine experience or logistic modification in order to attend the project’s needs, e.g. the new biomass must be stored in covered sites and needs to be dried in order to achieve a better burning efficiency.

This ceramic had to acquire a wood shredder and a circular axe in order to cut the bigger pieces of wood and permit their entrance into the kilns. Furthermore, it was acquired nine mechanic burners in order to automatically inject biomasses and air into the kilns.

The operators did not have knowledge of the ideal amount of renewable biomass that was necessary to achieve the correct temperature in the kilns in order to cook the ceramic devices, therefore, acquiring the final product with same quality and maintaining the optimal process as they did when using native wood. As a consequence of this barrier, there were variations in the color of the final ceramic devices, affecting the quality of the products; cracks on the ceramic devices; the explosion of some of them and cracks along the kilns; adding a significant amount of insecurity in production process. A pyrometric system (thermocouples) was installed at the “Tunnel” kiln in order to get a better control of the burning due to the lack of experience with the new fuel.

The employees must be careful not to fill the devices with large amounts of biomass, which can clog the mechanic burner and

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[50] *NERI, J.T. Energia Limpa, Sustentável ou de Subsistência?* ***Cerâmica Industrial,*** *Rio Grande do Norte;V,8, n.1,35 -6,2003.*

[51] *ALBUQUERQUE, J.L.B. et al. Águia-cinzenta (Harpyhaliaetus coronatus) e o Gavião-real-falso (Morphnus guianensis) em Santa Catarina e Rio Grande do Sul: prioridades e desafios para sua conservação.* ***Revista Brasileira de Ornitologia,*** *v.14, n.4, p. 411 – 415, dez. 2006.*

[52] *BRASIL. Ministério de Ciências e Tecnologias.* ***Levantamento da Situação e das Carências Tecnológicas dos Minerais Industriais Brasileiros****: com enfoque na mineração de: Argila para cerâmica, Barita, Bentonita, Caulim para carga, Talco / Agalmatolito e Vermiculita. Brasília, 2001. Available at: < http://www.cgee.org.br/prospeccao/doc_arq/prod/registro/pdf/regdoc710.pdf> . Visited on March 27th, 2009.*

[53] *VIANNA, F.M.A.* ***Participação Pública em Programas Ambientais: Um Estudo em Área Suscetível a Desertificação no Estado do Rio Grande do Norte.*** *2006, 109f. Dissertação (Mestrado em Engenharia de Produção) – Universidade Federal do Rio Grande do Norte, Natal, 2006. Available at: <http://www.pep.ufrn.br/publicacoes.php?enviou=1>. Visited on March 27th, 2009.*

[54] *CARDOSO, C.F.R.* ***Panorama do Setor Florestal: o que tem sido feito na esfera do Governo Federal****., Rio de Janeiro, 03 Set. 2008. Report presented in 1º SEMINÁRIO DE MADEIRA ENERGÉTICA, 2008.*

consequently, cause disorder in the burning process, which was one of the causes of the production losses throughout the adaptation period. Thus, the mechanic burner’s feeding has to be gradually done, demanding even more time and labor from the employees.

As a result of the fuel switch, some training courses were required for the staffs in order to clarify new measures linked to the machinery, sustaining the quality of the final product.

Furthermore, there was a lack of infrastructure to utilize the new technology. The northeast region of Brazil is well known for not being updated with new technologies in the Ceramic sector and very resistant to changes or improvements to its work process and general practices. This way, a set of adaptations were necessary, such as adjustments in the kilns’ entrances to embed mechanic burners and the logistic with the biomasses, which must be stored in covered sites in order to keep them dry, consequently improving their burning efficiency.

Moreover, the use of new biomasses represented a high risk to the ceramic owner as although there is currently a great amount of these types of biomasses available locally, it is possible the unavailability of the biomasses. It may happen because thermal energy generation through the combustion of renewable biomasses is an innovation in ceramic industry and their future demand (e.g. by other consumers) is not easy to foresee.

This means that *Bom Jesus* Ceramic had to find the best procedure to handle with the new technology, i.e. the new biomasses, logistic and machines.

All these changes were made counting on this project approval in order to the ceramic become able to receive the biomass to be used. *Bom Jesus* Ceramic, with this project activity, intends to develop its burning process and its machineries in order to reduce losses.

The ceramic sector is very resistant to changes and improvements in its work process. The modifications required for the fuel switch are an innovation in the region and represent a first step in the sector to revert this situation. This way, it will also stimulate regional development.

- **Financial barrier**

With the project implementation, the ceramic company had to withstand higher costs rather than if it had continued utilizing non-renewable native wood as fuel. The most important additional costs are related to biomass transportation, once the non-renewable biomass was delivered by lumberjacks and renewable biomass must be acquired from farther distances, increasing the costs with freight.

Furthermore, there are spending with electrical energy and with the equipment maintenance, so the mechanic burners can operate. Besides, due to the implementation of the project activity, the ceramic had to purchase six mechanic burners to automatically inject the biomass with air inside the kilns. The project proponent also acquired thermocouples.

Due to all the above mentioned, the ceramic industry had to deal with higher production costs.

Table 8. Main Costs before and after the project activity, including investment costs.

Bom Jesus Ceramic

Scenario	**Non-renewable wood**		**Renewable Biomass**						
Production	2,026,627	pieces/month	2,026,627						pieces/month
Monthly consumption of the fuel	873.75	m^3/month	Native wood with sustainable forest management plan (tons)	*Algaroba* wood (tons)	*Eucalyptus* wood (tons)	Sugar cane briquette (tons)	Wood Residues from industries and constructions (tons)	Sawdust (tons)	tons/month
			341.71	18.63	40.19	54.01	0.76	0.19	
Fuel price	21.45	BRL/m^3	34.69	35.53	150.00	230.00	214.29	60.00	BRL/tons
Total fuel cost	18,743.42		31,141.09						trucks/month
Electrical Energy consumption	77,755.68	kWh/month	111,251.04						kWh/month
Energy costs	11,897.40	BRL/month	17,022.52						BRL/month
Total Costs	**30,640.82**	**BRL/month**	**48,163.62**						**BRL/month**
Cost per ceramic device	0.015	**BRL/ceramic device**	0.024						**BRL/ceramic device**

Investment Costs		
Costs with mechanic burner	10,000	BRL
Costs with wood shredder	14,000	BRL
Waste of products in the testing period (3 months)	18,000	BRL
Reform in the “Hoffman” kiln	60,799	BRL
Waste of Biomass in the testing period (BRL)	9,342	BRL
Loss of revenues - period for adaptation of the kiln for biomass	40,560	BRL
Total Costs	**152,701**	**BRL**

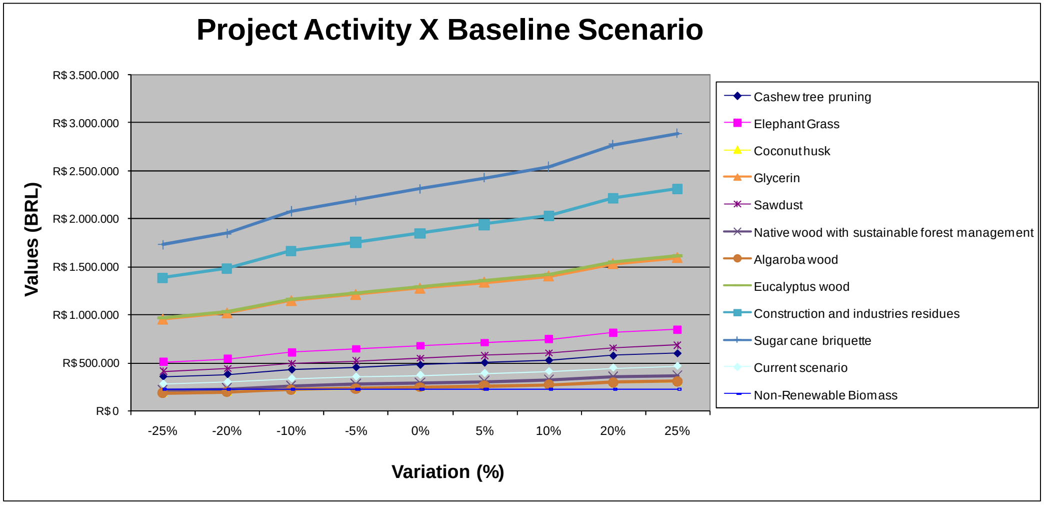
Table 9. Sensitivity Analysis

Biomasses	**Biomass Costs (BRL/ tons)**	**Estimated Amount to be Employed (tons/ year)**	**Energy Generated (TJ)**	**-25%**	**-20%**	**-10%**	**-5%**	**0%**	**5%**	**10%**	**20%**	**25%**
Cashew tree pruning	35.71	13,395	134.57	R$ 358,807	R$ 382,728	R$ 430,569	R$ 454,489	R$ 478,410	R$ 502,330	R$ 526,250	R$ 574,091	R$ 598,012
Elephant grass	67.45	10,043	134.57	R$ 508,025	R$ 541,893	R$ 609,630	R$ 643,498	R$ 677,367	R$ 711,235	R$ 745,103	R$ 812,840	R$ 846,708
Coconut husk	30.00	8,037	134.57	R$ 180,830	R$ 192,885	R$ 216,996	R$ 229,051	R$ 241,106	R$ 253,162	R$ 265,217	R$ 289,328	R$ 301,383
Glycerin	238.09	5,358	134.57	R$ 956,750	R$ 1,020,534	R$ 1,148,100	R$ 1,211,884	R$ 1,275,667	R$ 1,339,451	R$ 1,403,234	R$ 1,530,801	R$ 1,594,584
Sawdust	60.00	9,185	134.57	R$ 413,325	R$ 440,880	R$ 495,990	R$ 523,545	R$ 551,100	R$ 578,655	R$ 606,210	R$ 661,320	R$ 688,875
Native wood with sustainable forest management	34.69	8,463	134.57	R$ 220,185	R$ 234,864	R$ 264,222	R$ 278,901	R$ 293,580	R$ 308,259	R$ 322,938	R$ 352,296	R$ 366,975
Algaroba wood	35.53	6,937	134.57	R$ 184,823	R$ 197,145	R$ 221,788	R$ 234,109	R$ 246,431	R$ 258,752	R$ 271,074	R$ 295,717	R$ 308,039
Eucalyptus wood	150.00	8,626	134.57	R$ 970,453	R$ 1,035,150	R$ 1,164,544	R$ 1,229,241	R$ 1,293,938	R$ 1,358,635	R$ 1,423,331	R$ 1,552,725	R$ 1,617,422
Construction and industries residues	214.29	8,626	134.57	R$ 1,386,362	R$ 1,478,786	R$ 1,663,634	R$ 1,756,058	R$ 1,848,482	R$ 1,940,907	R$ 2,033,331	R$ 2,218,179	R$ 2,310,603
Sugar cane briquette	230.00	10,047	134.57	R$ 1,733,035	R$ 1,848,571	R$ 2,079,642	R$ 2,195,178	R$ 2,310,713	R$ 2,426,249	R$ 2,541,785	R$ 2,772,856	R$ 2,888,392
Sawdust	60.00	2.22	0.03	R$ 100	R$ 107	R$ 120	R$ 127	R$ 133	R$ 140	R$ 147	R$ 160	R$ 167
Native wood with sustainable forest	34.69	4,101	65.2	R$ 106,680	R$ 113,792	R$ 128,016	R$ 135,128	R$ 142,240	R$ 149,352	R$ 156,464	R$ 170,688	R$ 177,800

management												
Algaroba wood	35.53	224	4.3	R$ 5,958	R$ 6,355	R$ 7,150	R$ 7,547	R$ 7,944	R$ 8,341	R$ 8,738	R$ 9,533	R$ 9,930
Eucalyptus wood	150.00	482	7.5	R$ 54,262	R$ 57,879	R$ 65,114	R$ 68,731	R$ 72,349	R$ 75,966	R$ 79,584	R$ 86,818	R$ 90,436
Construction and industry residues	214.29	9	0.1	R$ 1,464	R$ 1,562	R$ 1,757	R$ 1,855	R$ 1,952	R$ 2,050	R$ 2,148	R$ 2,343	R$ 2,440
Sugar cane briquette	230.00	648	8.7	R$ 111,806	R$ 119,260	R$ 134,167	R$ 141,621	R$ 149,075	R$ 156,528	R$ 163,982	R$ 178,890	R$ 186,343
Current scenario	**-**	**5,464**	**85.9**	**R$ 280,270**	**R$ 298,955**	**R$ 336,324**	**R$ 355,008**	**R$ 373,693**	**R$ 392,378**	**R$ 411,062**	**R$ 448,432**	**R$ 467,116**

Non-renewable wood	26.58	8,463.49	135	R$ 224,921	R$ 224,921	R$ 224,921	R$ 224,921	R$ 224,921	R$ 224,921	R$ 224,921	R$ 224,921	R$ 224,921

Figure 7. Graphic with Sensitivity Analysis



With the project activity’s implementation, together with the investments cost, the total spending has increased, as can be verified at the table above. 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.

- **Institutional barriers**
    - **Risks of the project**

Since the use of native wood without sustainable management is an established and well-known process, the project activity implementation presents a risk to the project proponent because the use of a new biomass and its machines add a significant amount of insecurity to the production process. This change translates into an extensive period of fiscal vulnerability for the ceramic, since during the reconstruction of the kilns, the production of the ceramic was low. In addition, there was the transition period where the ceramic had lost production due to the adaptation to the use of biomass and to the new machineries.

Furthermore, the ceramic can go through a period in which there is a possibility that there is lack of biomass, representing another risk period.

Since there is no direct subsidy or support from the government for this project, without the income from the commercialization of the carbon credits, the fuel switch at the *Bom Jesus* ceramic would not be feasible or attractive to the project proponent.

- **Barrier due to the price of the biomass**

The thermal energy generation through the combustion of sugar cane briquette, *Algaroba* wood, *Eucalyptus* wood, native wood with sustainable forest management plan, wood residues from constructions and industries, and sawdust is an innovation in the ceramic industry. The future demand of these alternative fuels e.g. by other consumers is not easy to foresee. Although there is currently a great amount of these types of biomasses available locally, there is a possibility that the prices would increase as well, especially between harvests periods, when the problem with biomass disposal is mitigated. If the price of the biomass increases, the ceramic company could not repass it, once the company would not have competitive prices in relation to others which did not made the fuel switch.

Step 3: Common Practice

According to the GHG Protocol for Project Accounting, common practice analysis shall be carried out following:

1. **Define the product or service provided by the project activity.**

   The types of ceramic pieces produced by *Bom Jesus* Ceramic are: 9x19x19 (8 holes), 9x14x19 (6 holes), 8x19x38 (Economical block), 7x19x19 (4 holes), 12x19x19 (8 holes 12), and 8x19x28 (structural block).

2. **Identify possible types of baseline candidates.**

   Observing table below, the common fuels employed and therefore, the baseline candidates are: natural gas, charcoal, wood, other recuperations, diesel oil, fuel oil, liquefied petroleum gas, others from petroleum, piped gas, electricity, renewable biomass and others non-specified.

Table 10. Distribution of fuel employed on the ceramic sector in Brazil in percentage

BRAZILIAN ENERGY BALANCE 2008 - CERAMIC SECTOR EVALUATION			
FUEL	**2005**	**2006**	**2007**
Natural Gas	24%	26%	25%
Charcoal	2%	1%	1%
Wood	50%	50%	49%
Other recuperations	1%	1%	1%
Diesel Oil	0%	0%	0%
Fuel Oil	8%	8%	8%
Liquified Petroleum Gas	4%	4%	4%
Others from Petroleum	2%	2%	4%
Piped gas	0%	0%	0%
Electricity	8%	8%	7%
Renewable biomass	0%	0%	0%
Others non specified	0%	0%	0%

(Brazilian Energy Balance, source: http://www.mme.gov.br. Last visit on: May 18th, 2009)

3. **Define and justify the geographic area and the temporal range used to identify baseline candidates.**

Brazil was identified as the geographic area of the baseline candidates because Energy Research Company[55] from Mines and Energy Ministry of Brazil is the most representative and reliable source of information about the ceramic sector and its fuel employed. Furthermore, there was no local data regarding to the ceramic sector and its energy source in the State of *Pernambuco*. Therefore, data from table above were provided by a reliable source and it was considered 3 years of its historical data, including the most recent available data and the period when *Bom Jesus* Ceramic did its fuel switch.

4. Define and justify any other criteria used to identify baseline candidates.

The other types of criteria used to identify baseline candidates were the common practice, the costs of fuel and the local availability of technology and fuel.

The criterion common practice was used to identify baseline candidates because if a kind of fuel has already been employed with success in the ceramic sector it is an obvious baseline candidate.

Besides, the fuel cost was criterion once if a kind of fuel has high costs it will discourage the scenario of investing in this type of fuel, for example.

Equally important, the local availability of technology and fuel were pieces of criterion because the lack of technology and fuel in the region excludes them as baseline candidates. An example may be the lack of natural gas distribution in some regions.

There are legal requirements constraints regarding the use of non-renewable biomass as exposed in Decree N.5,975 of November 30th,2006. However, it is not enforced namely due to the lack of control[56]. The consumption of non-renewable biomass by ceramic industry was related by several authors (NERI, 2003[57]; ALBUQUERQUE et al, 2006[58]; BRASIL, 2001[59]; VIANA, 2006[60]; CARDOSO, 2008[61]). This is also observed in other

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[55] *Energy Research Company is a national entity which intended to provide services and researches to subsidize the energy sector planning, in areas as electric Power; oil, natural gas and their derivatives; coal; wood; renewable energy sources and energy efficiency; among others.*

[56] *Corte e poda de árvores pelo Dnit na BR-158 é considerado crime ambiental, Jornal Grande CPA, Available at: <http://www.grandecpa.com.br/?p=noticia&id_noticia=129>. Visited on March 27th, 2009.*

[57] *NERI, J.T. Energia Limpa, Sustentável ou de Subsistência?* ***Cerâmica Industrial,*** *Rio Grande do Norte;V,8, n.1,35 -6,2003.*

[58] *ALBUQUERQUE, J.L.B. et al. Águia-cinzenta (Harpyhaliaetus coronatus) e o Gavião-real-falso (Morphnus guianensis) em Santa Catarina e Rio Grande do Sul: prioridades e desafios para sua conservação.* ***Revista Brasileira de Ornitologia,*** *v.14, n.4, p. 411 – 415, dez. 2006.*

[59] *BRASIL. Ministério de Ciências e Tecnologias.* ***Levantamento da Situação e das Carências Tecnológicas dos Minerais Industriais Brasileiros****: com enfoque na mineração de: Argila para cerâmica, Barita, Bentonita, Caulim para carga, Talco / Agalmatolito e Vermiculita. Brasília, 2001. Available at: <http://www.cgee.org.br/prospeccao/doc_arq/prod/registro/pdf/regdoc710.pdf>. Visited on March 27th, 2009.*

[60] *VIANNA, F.M.A.* ***Participação Pública em Programas Ambientais: Um Estudo em Área Suscetível a Desertificação no Estado do Rio Grande do Norte.*** *2006, 109f. Dissertação (Mestrado em Engenharia de Produção) – Universidade Federal do Rio Grande do Norte, Natal, 2006. Available at: <http://www.pep.ufrn.br/publicacoes.php?enviou=1>. Visited on March 27th, 2009.*

[61] *CARDOSO, C.F.R.* ***Panorama do Setor Florestal: o que tem sido feito na esfera do Governo Federal.****, Rio de Janeiro, 03 Set. 2008. Report presented in 1º SEMINÁRIO DE MADEIRA ENERGÉTICA, 2008.*

industries as in the production of steel (BRASIL, 2005[62]), which has a much better structure and internal organization when compared with ceramic industries that are generally small and familiar enterprises. BRASIL (2001) suggests that it is important to stimulate the miner sector, especially who are respecting the environment. The incomes from carbon credits can be this incentive which would contribute to avoid the consumption of non-renewable biomass illegally. Therefore laws and regulations will not be considered as criteria to excluded baseline candidates and to constraint the geographical area and temporal range of the final list of the baseline candidates.

The project activity implementation without the carbon credits incomes is a criterion once there was biomass availability.

5. **Identify a final list of baseline candidates.**

Table 10 provides the percentage of the level of penetration of each fuel utilized in the ceramic sector during the average of the three last years available (2005, 2006 and 2007). Baseline candidates are the use of:

a) **Wood:** The fuel most employed, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006[63].

b) **Natural gas:** The Brazilian Energy Balance results showed significant percentage of natural gas consumption especially due to the production of ceramic tiles (used to finish floor or wall). Furthermore, in the case of structural ceramic, the use of natural gas is restricted by the absence of pipes, its high costs[64] and the lack of availability[65]. The risk of lack of offering as well as higher costs when compared with other fuels discourages the scenario of investing in this type of fuel even in locals with piped gas. The distribution of gas is preferentially performed to thermal power plants, increasing the risk of blackout of natural gas.

c) **Fuel oil:** This fuel is more expensive than wood, however it can be a more probable of substitute of wood than natural gas. The risks involving natural gas distribution are so considerable that PETROBRÁS[66] was offering subsidy to the consumption of fuel oil in spite of natural gas in the State of *São Paulo*. Moreover, according to the same sources, PETROBRAS is pressing the distributors of Natural Gas to sign contracts that forecast only an amount of the deliver as constant, and the rest as flexible, being cut when the power plants need to come into operation. However, in the baseline scenario, the use of fuel oil is not feasible due to the high costs associated to atomization system required to its burn, which demands frequent maintenance[67].

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[62] *BRASIL.* ***Diagnóstico do Setor Siderúrgico nos Estados do Pará e do Maranhão****. Brasília: Ministério do Meio Ambiente, 2005. 76 p.*

[63] *Source: 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. Visited on March 27th, 2009.*

[64] *Source: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>. Visited on March 27th, 2009.*

[65] *Source: <http://www.gasbrasiliano.com.br/institucional/concessao_sp.asp>. Visited on March 27th, 2009.*

[66] *PETROBRÁS performs in oil and oil by product exploration, production, refining, marketing, and transportation, both in Brazil and abroad. More information available at: <http://www2.petrobras.com.br/ingles/ads/ads_Petrobras.html> and <http://www.fecombustiveis.org.br/revista/mercado/probleminha.html>. Last visit on: August 7th, 2009.*

[67] *Source: <http://www.ctgas.com.br/template04.asp?parametro=155>. Visited on March 7th, 2009.*

d) **Renewable biomass:** despite the high biomass availability, the main problems concerning the use of renewable biomass are related to the high investments, technological and institutional barrier, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries.[68]

6. Identify baseline candidates that are representative of common practice (for the project-specific baseline procedure).

In Brazil, the red ceramic devices are produced through an inefficient and traditional process using wood without forest management plan to generate thermal energy technologies[69]. In this industry segment, the use of wood represents about 98% of the total fuel employed, therefore stimulating the increase in Brazilian deforestation and desertification rates. It happens because wood without forest management is offered with lower prices than wood from areas with forest management plan[70]. Furthermore, using non-renewable wood is a simple procedure and well known by the kilns operators.

The native forest without any kind of sustainable forest management plan has always been a source of firewood in the ceramic sector[71], which seemed inexhaustible, due to the amount generated in the expansion of the agriculture frontier bringing forward environmental impacts, with regard to the degradation of soil, change in the regime of rainfall and consequent desertification.

The ceramic industry sector has practically not evolved compared to the past, mainly due to the simplified techniques of manufacture. Moreover, the major equipments (chiefly kilns) of the production process were not improved significantly. Most of these companies still use non-renewable wood in their kilns and the drying process occurs naturally, without the utilization of energy. On the other hand, the influence of the market by improvements in this sector is very insignificant[72].

Thus, the common practice is the use of wood and its non-renewable fraction, which is the fuel most utilized and with less risk associated.

The acquiring of new equipments and the overall costs of the fuel switch represented a risk to the ceramic owner since the baseline practice was already established and well-known by the laborers. The operators did not have the knowledge of the ideal amount of renewable biomass that is necessary to use in order to achieve the correct temperature to cook its ceramic pieces, to acquire the final product with the same quality and to maintain the optimal process as they did when using the non-renewable wood. As a result of the fuel switch, an extensive training course was required for the staff in order to

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[68] *The use of renewable biomass was not included in table 10 which shows the fuel most utilized in the ceramic sector according to Brazilian Energy Balance.*

[69] *ABREU, Y. V.; GUERRA, S. M. G. Indústria de Cerâmica no Brasil e o Meio Ambiente. Chile: IV Congreso Nacional de Energía, 2000. Available at: <http://www.nuca.ie.ufrj.br/bgn/bv/abreu2.htm>. Visited on March 27th, 2009.*

[70] *SEYE, OMAR.* ***Análise de ciclo de vida aplicada ao processo produtivo de cerâmica estrutural tendo como insumo energético capim elefante (Pennisetum Purpureum Schaum)*** */ Omar Seye.-- Campinas, SP: [s.n.], 2003.*

[71] *UHLIG, A.* ***Lenha e carvão vegetal no Brasil: balance oferta-demanda e métodos para estimação de consumo****. Tese de doutorado, Universidade de São Paulo, São Paulo, 2008. 156 p. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/>. Visited on March 27th, 2009*

[72] *PAULETTI, M. C.* ***Procedimento para Introdução de Nova Tecnologia em Agrupamentos de Micro e Pequenas Empresas: Estudo de Caso das indústrias de Cerâmica Vermelha no Vale do Rio Tijucas.*** *2001. Available at: <http://biblioteca.universia.net/html_bura/ficha/params/id/597230.html>. Visited on March 27th, 2009.*

clarify new measures linked to the machinery in order to sustain the quality of the final product.

Therefore, the project activity is not a common practice.

Impact of projects approval

Presently, the ceramic industrial segment of the state of *Pernambuco* is comprised mostly by small industrial units that still use varying technological models. The grand majority of ceramic industries in the region of this project activity use native wood without sustainable forest management as fuel, mainly from *Caatinga* biome. These industries have some technological restrictions such as the energy exploitation and the efficiency of the machinery.

Brazil is the third major contributor[73] to the carbon dioxide emissions in the year of 2003, though contemporary studies generally place Brazil fourth in the ranking of the countries that emit the most GHGs.

The First Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions[74] – 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%)[75].

The *Caatinga* is an exclusively Brazilian biome and occupies 844,453 Km², equivalent to around 10% of the territory of the country[76]. Although being rich in natural resources, the *Caatinga* is one of the most threatened ecosystems on the planet. Its high calorific value causes a major cause of its decline. In a region where the shortage of rivers leads to less access to electric energy, native firewood and charcoal account for thirty percent of the total energy utilized in the industries of the region, which has intensified the local deforestation[77]. The forecast for 2010 is that it will remain less than 30% of the original area of *Caatinga*. Currently it is remaining 50% of its original structure[78].

According to ASPAN[79], the major industries, mainly the steel, plasterer and ceramic industries are primarily responsible for the use of native firewood as fuel in their productions[80].

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

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[73] *Source: GOLDEMBERG & MOREIRA. **Política Energética no Brasil**. Estudos Avançados 19 (55), 2005. Available at: <http://www.scielo.br/pdf/ea/v19n55/14.pdf>. Last visit on: March 17th, 2009.*

[74] *Available at: <http://www.mct.gov.br/index.php/content/view/17341.html>. Last visit on: March 17th, 2009.*

[75] *Available at: <http://www.mct.gov.br/index.php/content/view/21455.html>. Last visit on: August 10th, 2009.*

[76] *Available at: <http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169&id_pagina=1>. Visited on July 1st, 2009.*

[77] *Available at: <http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47>. Last visit on: April 7th, 2009.*

[78] *Available at: <http://www.reape.pe.gov.br/not-01-2007.shtml>. Last visit on: April 7th, 2009.*

[79] *Association for the nature defense of Pernambuco. Available at: <http://www.aspan.org.br/>. Last visit on: April 7th, 2009.*

[80] *Available at: <http://www.ambienteemfoco.com.br/?p=457>. Last visit on: August 10th, 2009.*

are responsible for changing the system of rivers, which makes the water supply of local communities and family farming scarce.

The *Caatinga* biome is the fourth largest Brazilian biome. It is located in the northeast portion of Brazil and can be observed in table 11. The flora and fauna of this biome is rich once it shares frontiers with the main Brazilian biomes to its west with *Amazonian*, to the southwest with *Cerrado*, and to the southeast with *Mata Atlântica*. In spite of the size and importance of this biome, the *Caatinga* is an endangered habitat.

Table 11. Brazilian biomes in decreasing order of importance

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

(Source: IBGE – Brazilian Institute of Geography and Statistic[81])

Another relevant issue is how fast deforestation occurs in the *Caatinga* biome, representing 365,000 ha/year[82].

Therefore it can be concluded that measures should be taken to preserve this biome and the project activity represents an example that can be followed by other activities.

The party will also implement the Social Carbon Methodology, which was developed by *Instituto Ecológica*, and focuses on a sustainable development and better social conditions for the communities where it is implemented.

Brazil occupies a top position between the emitters of carbon dioxide, therefore any kind of efforts to change this scenario and take Brazil out of this uncomfortable top position, is willingly received. In addition, the project activity will contribute to the sustainable development of the host country.

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[81] *Available at: <http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169&id_pagina=1>. Visited on March 27th, 2009.*

[82] *Available at: <http://www.reporterbrasil.org.br/exibe.php?id=553 >. Last visit on April 23th, 2009.*

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

- ***Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Applications by the User*** *– Version 01 from February 01 of 2008 onwards.*

This category 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 CO_2.

The project activity will generate less than the limits of 45 MWthermal for Type I small scale project activities.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

The monitoring will be done with the aim of determining the most approximate quantity of non-renewable wood that, in the absence of the project, would be used in the ceramic's kilns and consequently, the amount of GHG that would be emitted in tons of CO2e. The following table shows the frequency of the monitoring of each parameter.

Table 12. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass	Tons	It is calculated through the receipts and invoices describing the weight of each renewable biomass	Monthly
Origin of Renewable Biomass	Renewable origin of the biomass	Not applicable	Controlled by the ceramic owner	Annually
PRy	Production of ceramic pieces	Units	Calculated through the financial transactions of the ceramic	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tons or m^3	Monitored by articles and database, which are described at leakage section, at section 4.1.	Annually
Leakage of Non-Renewable Biomass	Leakage resulted from the non-renewable biomasses	tCO2e	Monitored by articles and database, which are described at leakage section, at section 4.1.	Annually
EFprojected fossil fuel	CO2 Emission factor of residual fuel oil	tCO2/TJ	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source:	Not monitored

			<http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3.	
NCVbiomass	Net Calorific Value of non-renewable biomass	TJ/ton of Wood	Bibliography, described in respective table at section 3.3.	Not monitored
ρbiomass	Specific gravity of non-renewable biomass	Ton/m3	Bibliography, described in respective table at section 3.3.	Not monitored
ƒNRB,y	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	Percentage	KLINK, C. A. ; MACHADO, R. Conservation of the Brazilian Cerrado, Belo Horizonte, v. 1, n. 1, p. 147-155, 2005. Available at: <http://faculty.jsd.claremont.edu/emorhardt/159/pdfs/2006/Klink.pdf>. Other bibliographies utilized are described in respective table at section 3.3.	Annually
BFy	Consumption of non-renewable biomass per thousand of ceramic devices produced	tons/ thousand of ceramic devices	Data from ceramic owner	Function of PRy

In the monitoring plan, the amount of non-renewable biomass (B_y) will be determined using the option "a" of the applied methodology. It is calculated through the product of the number of appliances multiplied by the estimate of average annual consumption of biomass per appliance (tons/year).

$$B_y = PR_y \times BF_y$$

Where:

PRy = Number of ceramic pieces produced per month;

BFy = Tons of wood per thousand of pieces produced.

The exactly production (PRy) will be monitored by the financial transactions of the ceramic.

The value of BFy was determined through historical consumption of non-renewable biomass by the ceramic. It was calculated by dividing the monthly consumption at the baseline from the monthly production at the baseline, in thousands.

The responsible to monitor data provided in table 12 will be Mrs. *Elisângela Maria Carneiro.* Internal audit will guarantee data quality.

It will be realized by Mr. *Mário Henrique de Mattos e Silva,* Director of *Bom Jesus* Ceramic.

3.3 Data and parameters monitored / selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Monitored Parameters

<table>
<tr><td>Data / Parameter:</td><td>$Q_{renbiomass}$</td></tr>
<tr><td>Data unit:</td><td>tons per month</td></tr>
<tr><td>Description:</td><td>Amount of renewable biomass employed</td></tr>
<tr><td>Source of data to be used:</td><td>Measured by the ceramic owner</td></tr>
<tr><td>Value of Data applied for the purpose of calculating expected emission reductions:</td><td>The ceramic owner will preferentially utilize sugar cane briquette, <i>Algaroba</i> wood, <i>Eucalyptus</i> wood, native wood with sustainable forest management plan, and wood residues from constructions and industries in its burning process, as can be verified in the table below.
<table>
<tr><th>Biomass</th><th>Sugar cane briquette</th><th><i>Algaroba</i> wood</th><th><i>Eucalyptus</i> wood</th><th>Native wood with sustainable management plan</th><th>Wood resides from construction and industries</th><th>Sawdust</th></tr>
<tr><td>$Q_{renbiomass}$</td><td>54.01</td><td>18.63</td><td>40.19</td><td>341.71</td><td>0.76</td><td>0.19</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The amount of renewable biomass will be monitored in accordance to the weight described in the receipts or invoices from the providers.

It will be utilized the Specific Gravity in order to convert from m³ to ton. The data to be applied are:
<table>
<tr><th>Biomass</th><th><i>Algaroba</i> wood</th><th><i>Eucalyptus</i> wood</th><th>Native wood with sustainable management plan</th><th>Wood resides from construction and industries</th></tr>
<tr><td>Specific gravity (tonnes/m^3)</td><td>0.76</td><td>0.51</td><td>0.8072</td><td>0.35</td></tr>
</table>
The sources of these data are:

- Native wood with sustainable forest management plan

NASCIMENTO, W. S. A. Avaliação dos Impactos Ambientais Gerados Por Uma Indústria Cerâmica Típica da Região do Seridó/RN; Dissertação (Mestrado em Engenharia Mecânica), Universidade Federal do Rio Grande do Norte, Natal, 2007. Available at: <http://bdtd.bczm.ufrn.br/tedesimplificado//tde_busca/arquivo.php?codArquivo=1239>. Last visit on: July 04th, 2009.

LORENZI, H. Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil, vol.1. 4.ed. Nova Odessa, SP: Instituto</td></tr>
</table>

	Plantarum, 2002. 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. Associação de Plantas do Nordeste. Projeto Madeira. Available at: <http://www.plantasdonordeste.org/madeiras.pdf>. - *Algaroba* 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 April 28th, 2009. It was considered the average value of the specific gravities of the species of *Algaroba*. - Sugar cane briquette and sawdust The amount of sugar cane briquette described at the invoices is in tons. - *Eucalyptus* wood IPCC: Intergovernmental Pannel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS. Capítulo 3: Orientación sobre las buenas prácticas en el sector de CUTS. Cuadro 3A.1.9-2: Densidade de maderas básicas (D) de troncos (toneladas de materia seca/m³ de volumen recién talado) para especies arbóreas tropicales. Page: 184. It was utilized the specific gravity of *Eucalyptus robusta* at the *América Tropical* column. - Wood residues from constructions and industries SIMIONI, F. J. **Análise diagnóstica e prospectiva da cadeia produtiva de energia de biomassa de origem florestal no planalto sul de Santa Catarina** - Curitiba: UFPR, 2007. 132p.: il. - Available at: <http://dspace.c3sl.ufpr.br/dspace/handle/1884/10294>. Last visit on: May 5th, 2009. It was utilized the average value of the specific gravity for wood chips.
QA/QC procedures to be applied:	It will be rechecked according to the receipts of purchase.
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:	**PRy**
Data unit:	Unity of ceramic devices per month
Description:	Production of ceramic devices
Source of data to be used:	Controlled by the ceramic owner
Value of Data	2,026,627

applied for the purpose of calculating expected emission reductions:	
Description of measurement methods and procedures to be applied:	The amount was acquired by counting the average production of one year before the project start date (from November, 2005 to October, 2006). The production was calculated through the financial transactions of the ceramic.
QA/QC procedures to be applied:	The ceramic has 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 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 ceramic owner
Value of Data applied for the purpose of calculating expected emission reductions:	Renewable biomass
Description of measurement methods and procedures to be applied:	This information will be given by the biomasses providers. The guarantee of acquiring renewable biomass will be achieved by invoices from the providers. As stated in the section 2.2, the biomasses (sugar cane briquette, *Algaroba* wood, *Eucalyptus* wood, native wood with sustainable forest management plan, constructions residues, and sawdust) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied :	The biomass will be considered as renewable if it is according to the definition given by the methodology applied. Furthermore, documents proving the origin of renewable biomass from forested resources will be provided.
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:	**Leakage of non-renewable biomass**
Data unit:	tCO2e
Description:	Leakage resulted from the non-renewable biomass
Source of data to be used:	Monitored
Value of Data applied for the purpose of calculating expected emission reductions:	0
Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in methodology applied will be monitored. Scientific articles, official statistical data, regional and national surveys will be provided in order to ensure that there is no leakage from non-renewable biomass (or to estimate the leakage).

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.

<table>
<tr><td>Data / Parameter:</td><td>Renewable biomass surplus</td></tr>
<tr><td>Data unit:</td><td>ton or m³</td></tr>
<tr><td>Description:</td><td>Amount of renewable biomass available</td></tr>
<tr><td>Source of data to be used:</td><td>Monitored</td></tr>
<tr><td>Value of Data applied for the purpose of calculating expected emission reductions:</td><td>
<table>
<tr><th>Biomass surplus</th><th>Surplus</th><th>Year</th></tr>
<tr><td>Cashew tree pruning in tonnes</td><td>82,875</td><td>2007</td></tr>
<tr><td>Wood residues from construction and industries in tonnes</td><td>749,839</td><td>2006</td></tr>
<tr><td>Coconut husk in tonnes</td><td>6,700,000</td><td>2006</td></tr>
<tr><td>Sugar cane bagasse in tonnes</td><td>2,209,479</td><td>2007</td></tr>
<tr><td>Native wood with sustainable forest management plan in m³</td><td>519,558</td><td>2007</td></tr>
<tr><td><i>Algaroba</i> wood in m³</td><td>2,500,000</td><td>2007</td></tr>
<tr><td><i>Eucalyptus</i> wood in m³</td><td>13,259,341</td><td>2007</td></tr>
<tr><td>Sawdust in m³</td><td>2,917,055</td><td>2007</td></tr>
<tr><td>Glycerin in m³</td><td>129,370</td><td>2008</td></tr>
<tr><td>Elephant Grass</td><td>Not measured</td><td>-</td></tr>
</table>
Detailed information in section 4.1 – LEAKAGE</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>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 international articles and databases every monitoring period. These sources will provide information about the biomass availability in the project activity's region.</td></tr>
<tr><td>QA/QC procedures to be applied :</td><td>Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.</td></tr>
<tr><td>Any comment:</td><td>Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.</td></tr>
</table>

Data / Parameter:	**$f_{NRB,y}$**
Data unit:	Fraction of biomass or (percentage).
Description:	Fraction of biomass (wood) used in the absence of the project activity in year y established as non-renewable biomass using survey methods. It was also

	discounted the amount of wood saved by similar projects in the same biome.
Source of data used:	Survey methods
Value of Data applied for the purpose of calculating expected emission reductions:	0.996 or 99.6%
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. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, according to Klink (2005)[83], the *Caatinga* Biome has only 0.11% of its total area with sustainable use. According to a research made by Brazilian Environmental Ministry, there are around 20m³ of wood per hectare in *Caatinga* biome[84]. Thus, the amount of non-renewable wood available at *Caatinga* biome is around 1,471,979m³. It was made two sheets in order to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the *Caatinga* biome. The other sheet calculates the amount of wood consumed regarding only *Bom Jesus* 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 *Bom Jesus* project, respectively.[85] Afterwards, summing each value with the Sustainable use areas defined by Klink (2005), it was acquired two fraction of renewable biomass. Finally, each value was subtracted from 100% to achieve the ƒNRB,y. Therefore, it was taken the smaller value in order to be more conservative. These sheets are available at the VCU Estimative spreadsheet.
QA/QC procedures to be applied :	The monitoring of this parameter will be based in national and international articles and database. The source provided information about the sustainable use of *Caatinga* biome. Wood saved from projects with same biome and applied methodology developed by *Carbono Social Serviços Ambientais LTDA* was considered in this fraction. CDM or VCS registered projects will also be included in this fraction if placed in the same region and methodology.
Any comment:	It will be 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.

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[83] *KLINK, C. A. ; MACHADO, R. Conservation of the Brazilian Cerrado, Belo Horizonte, v. 1, n. 1, p. 147-155, 2005. Available at: <http://faculty.jsd.claremont.edu/emorhardt/159/pdfs/2006/Klink.pdf>. Last visit on: April 9th, 2009.*

[84] *Source: Brazilian Environment Ministry, Normative Instruction nº 6 of 2006.*

[85] *According to data from project activities at Social Carbon Company.*

Fixed Parameters

Data / Parameter:	**$EF_{projected\ fossil\ fuel}$**
Data unit:	tCO_2/TJ
Description:	CO2 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 of Data applied for the purpose of calculating expected emission reductions:	77.4
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.
QA/QC procedures to be applied :	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:	**$NCV_{biomass}$**
Data unit:	TJ/Ton of wood
Description:	Net Calorific Value
Source of data used:	Brazilian study carried out with *Caatinga* wood utilized at the ceramic sector: NASCIMENTO, W. S. A. Avaliação dos Impactos Ambientais Gerados Por Uma Indústria Cerâmica Típica da Região do Seridó/RN; Dissertação (Mestrado em Engenharia Mecânica), Universidade Federal do Rio Grande do Norte, Natal, 2007. Available at: <http://bdtd.bczm.ufrn.br/tedesimplificado//tde_busca/arquivo.php?codArquivo=1239>. Last visit on: July 04th, 2009.
Value of Data applied for the purpose of calculating expected emission reductions:	0.0159
Description of measurement methods and procedures actually 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 *Caatinga* Biome that are usually employed as fuel in the ceramic industries of the region. Some sources of data used provide the Gross Calorific Values (GCV) of the *Caatinga* species. In order to transform the GCV to NCV, it was utilized the equation which is available at the VCU Estimative spreadsheet. 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).
QA/QC procedures to be applied :	It was included species that are usually employed as fuel from *Caatinga* Biome in the ceramic sector according to "NASCIMENTO, W. S. A." These species present such good characteristics in order to be applied as fuel in the ceramic kilns.
Any comment:	

Data / Parameter:	$\rho_{biomass}$
Data unit:	tonne/ m^3
Description:	Specific gravity of non-renewable wood
Source of data used:	Brazilian study carried out with *Caatinga* wood utilized at the ceramic sector: NASCIMENTO, W. S. A. **Avaliação dos Impactos Ambientais Gerados Por Uma Indústria Cerâmica Típica da Região do Seridó/RN**; Dissertação (Mestrado em Engenharia Mecânica), Universidade Federal do Rio Grande do Norte, Natal, 2007. Available at: <http://bdtd.bczm.ufrn.br/tedesimplificado//tde_busca/arquivo.php?codArquivo=1239>. Last visit on: July 04th, 2009. 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. 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. Associação de Plantas do Nordeste. Projeto Madeira. Available at: <http://www.plantasdonordeste.org/madeiras.pdf>.
Value of Data applied for the purpose of calculating expected emission reductions:	0.8072
Description of measurement methods and procedures actually applied	The amount of wood used in the baseline was measured by volume units, so this data is used to the unity conversion. The species used to calculate the average value are typical trees of *Caatinga* Biome that are usually employed as fuel in the ceramic industries of the region.
QA/QC procedures to be applied :	It was included species that are usually employed as fuel from *Caatinga* Biome in the ceramic sector according to "NASCIMENTO, W. S. A." These species present such good characteristics in order to be applied as fuel in the ceramic kilns.
Any comment:	

<table>
<tr><td>Data / Parameter:</td><td>BFy</td></tr>
<tr><td>Data unit:</td><td>Tonnes of wood per thousand of devices</td></tr>
<tr><td>Description:</td><td>Consumption of non renewable biomass per thousand of ceramic devices produced in year y</td></tr>
<tr><td>Source of data used:</td><td>Historical data from ceramic owner</td></tr>
<tr><td>Value of Data</td><td><table><tr><td>BFy</td><td>"Tunnel" kiln</td><td>"Hoffman" kiln</td></tr></table></td></tr>
</table>

<table>
<tr><td>applied for the purpose of calculating expected emission reductions:</td><td><table><tr><td>(tons/thousand of pieces)</td><td>0.4279</td><td>0.2679</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied</td><td>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.
If nowadays <i>Bom Jesus</i> ceramic still used native firewood, its ceramic consumption would be around 705.2 tons of native firewood (or 873.7 m³) per month to produce 2,026,627 ceramic pieces.
The value is utilized to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.</td></tr>
<tr><td>QA/QC procedures to be applied :</td><td>Of a total of 705.2 tons of native wood utilized at the baseline scenario, 61.5% (or 433.7 tons) would be utilized at the “Tunnel” kiln, and 38.5% (or 271.5 tons) would be utilized at the “Hoffman” kiln.
Moreover, of a total of 2,026,627 ceramic pieces produced per month, 50% are produced at the “Tunnel” kiln, and 50% are produced at the “Hoffman” kiln. Thus, the production at each kiln reaches 1,013,313 pieces per month.
Eventually, these values lead to an efficiency of 0.4279 tons of native wood to produce a thousand of ceramic pieces at the “Tunnel” kiln, and 0.2679 tons of native wood to produce a thousand of ceramic pieces at the “Hoffman” kiln.
<i>Bom Jesus</i> Ceramic’s kilns are more efficient than average for a “Hoffman” and “Tunnel” kiln.[86]. These values were not expected because of the lack of technology in the region, the indiscriminate use of the wood causing it surplus.</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan will be the owner of *Bom Jesus* Ceramic. The ceramic owner will also be responsible for developing the forms and registration formats for data collection and further classification. Data monitored will be kept during the crediting period and 2 years after. For this purpose, the authority for the registration, monitoring, measurement and reporting will be Mrs. *Elisângela Maria Carneiro* of *Bom Jesus* Ceramic. All the monitored parameter will be checked annually as requested in the methodology AMS-I.E. - Switch from Non-Renewable Biomass for Thermal Applications by the User – Version 01 from February 01 of 2008 onwards.

The management structure will rely on the local technicians with a periodical operation schedule during the project. The technical team will manage the monitoring, the quality control and quality assessment procedures.

With the carbon credits income, in order to complement the monitoring of the production of ceramic devices, equipments from *Alutal* will monitor each burning cycle of the 2 kilns through graphics of the temperature reached in each kiln versus time.

Social Carbon Company will also implement the sustainability report following the Social Carbon methodology, which was developed by *Instituto Ecológica* and focus in implementing the environmental and

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[86] *Source: TAPIA, R. E. C. et al.* ***Manual para a indústria de cerâmica vermelha.*** *Rio de Janeiro: SEBRAE/RJ, 2005. (Série Uso Eficiente de Energia).*

social activities within the fuel switching project. Social Carbon follows the Social Carbon Guidelines available at: <http://www.socialcarbon.org/Guidelines/>.

In addition, the Social Carbon Reports will be available at: TZ1/Social Carbon Registry (http://www.tz1market.com/socialpublic.php) once the project is registered.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

This category 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 CO_2.

Baseline

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

Where:

ER_y: Emission reductions during the year y in tCO_2e

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/ton

$EF_{projected\ fossil\ fuel}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO_2e/TJ[87].

B_y is determined using the following option: calculated through the product of the number of appliances multiplied by the estimate of average annual consumption of biomass per appliance.

$$B_y = PR_y \times BF_y \qquad \text{(Equation 02)}$$

Where:

PRy = Number of ceramic pieces produced per month;

BFy = Tons of wood per thousand of pieces produced.

The exactly production (PRy) will be monitored by the financial transactions of the ceramic.

The value of BFy was determined through historical consumption of non-renewable biomass by the ceramic. It was calculated by dividing the monthly consumption at the baseline from the monthly production at the baseline, in thousands.

Leakage (LE)

The methodology AMS-I.E.-Switch from Non–Renewable Biomass for Thermal Applications 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 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

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[87] *The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.*

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 13).

Table 13. 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:

Native wood with sustainable forest management plan

The sustainable forest management plan can be organized into three stages: firstly, the division of the property in exploitable areas and areas of permanent preservation that are inaccessible to exploitation. The second stage is the planning of roads that connect the area with the primary roads. In the third stage, the allocated area is divided for exploration in blocks in order to sustain forest exploitation annually[88].

Afterwards, a technical responsible elaborates the next stages: forest inventory, estimation of growth, the best intervention techniques, fixes the arrangement of exploration and the silvicultural treatment. An annual technical report of the sustainable forest management area is elaborated and it is necessary a yearly authorization of the environmental agency of the state to keep the activities. Furthermore, the minimum requirements of the management plan are defined by Articles 19, 20 and 21 of Brazilian Forest Code, and are regulated by Decree 5975/06[89].

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[88] *Plano de Manejo Florestal (Forest Management Plan). Available at: <http://www.manejoflorestal.org/guia/pdf/guia_cap1.pdf>. Last visit on: April 22nd, 2009.*

[89] *BRASIL. Lei nº. 4.771, de 15 de setembro de 1965. Código Florestal.* ***Diário Oficial [da] República Federativa do Brasil****, Brasília, DF, 16 de set. 1965.*

The total area properly regularized with sustainable forest management plan in the *Caatinga* biome corresponds to 94,287 hectares. There are around 189 sustainable forest management plans operating in this biome[90].

Considering that around 5.7% of a sustainable forest management plan can be explored per year (exploration in blocks in order to sustain forest exploitation annually)[91], the area available for exploration is around 5,374 ha per year in *Caatinga* biome. In addition, it was considered the productivity of wood in *Caatinga* biome as 96.68 m³/ha[92].

Therefore, the production of wood with sustainable forest management plan in *Caatinga* biome was around 519,558 m³ in 2007. As the ceramic industry's consumption presented in this project activity is about 5,079.6 m³ per year, the consumption of this kind of fuel represents less than 1% of the total of wood with sustainable forest management plan produced in the region.

The sustainable forest management promotes the conservation of biodiversity, conservation of soil and water regime, which are essential practices to combat the desertification. Moreover, there is an increment at the opportunity of employment for the rural population due to the sustainable exploration of plants destined for fruits, apiculture, medicinal, oil, ornamental and fiber production purposes[93].

Sugar Cane Briquette

Paudalho is marked by the monoculture of sugar cane, using much of the labor-place. The ceramic company may be supplied easily with sugar cane briquettes, due to its availability at the local market.

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 tons of cane yearly[94]. One ton 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 briquettes[95].

According to the table 14, 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 is around 648.12 tonnes per year, representing less than 1% of the total production of sugar cane bagasse in the state of *Pernambuco*.

Available at: <http://www.planalto.gov.br/ccivil_03/LEIS/L4771.htm>. Last visit on: April 22nd, 2009.

[90] *CNIP, 2007. Source: < http://www.cnip.org.br/planos_manejo.html>. Last visit on: April 29th, 2009.*

[91] *BRASIL. Manejo sustentável dos recursos florestais da Caatinga/MMA. Secretaria de Biodiversidade e Florestas. Departamento de Florestas. Programa Nacional de Florestas. Unidade de Apoio do PNF no Nordeste._Natal: MMA, 2008. 28p.*

[92] *Adapted from: BRASIL. Estatística Florestal da Caatinga/MMA. Ano 1. Vol. 1 (ago. 2008). Natal, RN: APNE, 2008. 136p.*

[93] *BRASIL. Manejo sustentável dos recursos florestais da Caatinga/MMA. Secretaria de Biodiversidade e Florestas. Departamento de Florestas. Programa Nacional de Florestas. Unidade de Apoio do PNF no Nordeste._Natal: MMA, 2008. 28p.*

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

[95] *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.*

Table 14. Production of Sugar Cane in the State of Pernambuco

Harvest	04/05	05/06	06/07	07/08
Production of Sugar Cane (in tonnes)	16,684,867	13,858,319	15,293,700	17,535,548
Sugar Cane Bagasse (in tonnes)	2,335,881	1,940,165	2,141,118	2,454,977

Source: http://www.unica.com.br/downloads/estatisticas/processcanabrasil.xls

Sugar cane bagasse is also employed for cogeneration systems. However figure 8 presents the excess of energy in Brazil from sugar cane bagasse. Please observe that the State of *Pernambuco* (PE) presents a large surplus of this biomass.

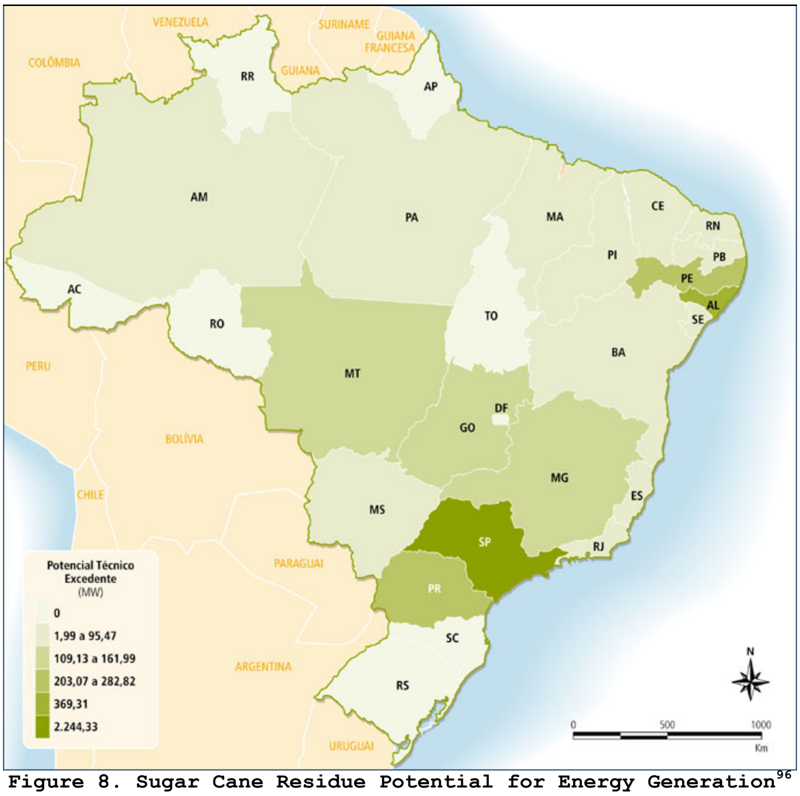

Figure 8. Sugar Cane Residue Potential for Energy Generation[96]

Algaroba wood

According to Silva (2007)[97], *Algaroba*[98] (Prosopis juliflora (Sw.) D.C.) is a tropical legume tree 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

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

[97] *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.*

[98] *Algaroba may also be known as mesquite.*

competitive skills, *Algaroba* has spread through several regions of Brazilian semi-arid areas[99].

A research made by EMBRAPA[100], 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 impacts [101] . 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 dispersal[102], 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 stake, pegs and poles uses[103].

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 IBAMA[104].

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) [105] , 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. *Bom Jesus* annual consumption of *Algaroba* wood is around 294.1 m³, what represents less than 1 % of the total of *Algaroba* wood produced in the region.

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

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[99] *EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Avaliable at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Last visit on: April 28th, 2009.*

[100] *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.*

[101] *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.*

[102] *EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Avaliable at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Last visit on: April 28th, 2009.*

[103] *Heavy pole to which cattle is tied.*

[104] *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 >. Last visit on: May 18th, 2009.*

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

Eucalyptus wood

The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tonnes of biomass per hectare[106]. The grand major of these cultivations were established in the middle of 1970 to 1980. The *Eucalyptus* and *Pinus* genuses correspond to 80% of the afforestation in Brazil.

In addition, sustainable management practices of the afforestation in Brazil (as the techniques of preparation, fertilization, control of weeds, improved seeds, cloning and reform) were introduced and constantly improved in order to increase its productivity[107]. As a consequence, Brazil withholds the best productivity taxes (in m³/ha/year) over the world due to the adaptation of these species to the Brazilian territory and the success of the experiments of genetic improvement[108].

The production of wood from afforestation in the state of *Bahia*, which is a bordering state in the northeast region of Brazil, was of 13,259,341 m³ [109] in 2007. The consumption of this kind of fuel by *Bom Jesus* Ceramic is around 945.6 m³ per year, representing less than 1% of the total of *Eucalyptus* wood produced in the region.

Glycerin

The glycerin is a residue generated at the biodiesel process, which is named transesterification.[110] As the production of biodiesel is growing in Brazil, the offering of glycerin is also growing.[111] The combustion of the glycerin could be a solution to the biodiesel production, however the high investments necessaries and difficulties related with the burning process prevented this from becoming a chosen solution among industries.[112]

A study carried out by *Universidade Federal do Rio de Janeiro* states that for 90 m³ of biodiesel, it is generated 10 m³ of glycerin.[113] As

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[106] Brazilian *Society of Forestry. Source: <http://www.sbs.org.br/atualidades.php>. Visited on: January 19th, 2009.*

[107] *MCT/IPEF.* ***Silvicultura e Manejo.*** *Source: <http://www.ipef.br/mct/MCT_03.htm>. Last visit on: April 9th, 2009.*

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

[109] *According to IBGE (Geographic and Statistic* Brazilian *Institute). Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ba&tema=extracaovegetal2007>. Last visit on: April 9th, 2009.*

[110] *AUTH, et. al;* ***Estudo e preparação do biodiesel.*** *UNIVATES – Centro Universitário; Programa de Pós-graduação em Ensino de Ciências Exatas. Available at: http://www.univates.br/ppgece/docs/PT_Eniz1.pdf. Last visit on: September 23rd, 2009.*

[111] *MELLLO et al.* ***Visões Ambientais para o Financiamento de Biocombustíveis no Brasil.*** *Departamento de Meio Ambiente do BNDES. Available at: http://www.conservacao.org/publicacoes/files/15_Finaciamento_Biocombust_BNDES.pdf. last visit on September 23rd, 2009.*

[112] *METZGER, B.* ***Glycerol Combustion****. A thesis submitted to the Graduate Faculty of North Carolina State University – Mechanical Engineering. Raleigh, 2007. Available at: <http://www.lib.ncsu.edu/theses/available/etd-07312007-153859/unrestricted/etd.pdf>. Last visit on: October 15th, 2009.*

[113] *GONÇALVES, et. al. Universidade Federal do Rio de Janeiro – Instituto de Química. Biogasolina:* ***Produção de Éteres e Ésteres da Glicerina****. Rio de Janeiro,*

the Brazilian production of biodiesel in 2008 was 1,164,332 m³,[114] the amount of glycerin generated was 129,370 m³.

Bom Jesus Ceramic would utilize around 5,358 tons of glycerin per year, which corresponds to 4,252 m³ of the glycerin availability. Thus, the project activity would utilize around 3.2 % of glycerin availability.

It can be concluded that the biomass available is widely superior than the amount required for this project i.e. leakage from glycerin can be neglected.

Cashew tree pruning

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 opportunities[115]. The Brazilian production achieved 143,000 tons of cashew-nuts in 2005 spread in an area of 650,000 Hectares. 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 nuts[116]. 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 trees[117]. 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 51 units of trees per hectare[118], and the production of firewood residues from each tree is 2.5 kg per year[119]. The cultivation of cashew is located in an area of 650,000 hectares. This way, the

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[114] *SÃO PAULO, Estado - Instituto de Economia Agrícola.* ***Desempenho da Produção Brasileira de Biodiesel em 2008.*** *Avaiable at: http://www.iea.sp.gov.br/out/verTexto.php?codTexto=10115. Last visit on: September 24th, 2009.*

[115] *According with EMBRAPA (Brazilian Agricultural Research Corporation's). Available at: <http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/index.htm>. Last visit on: April 28th, 2009.*

[116] *Checked at: <http://www.nordesterural.com.br/nordesterural/matLerdest.asp?newsId=2219>. Last visit on: April 28th, 2009.*

[117] *According with EMBRAPA (Brazilian Agricultural Research Corporation's). Available at: <http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratosculturais.htm>. Last visit on: April 28th, 2009.*

[118] *According with "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>. Last visit on: April 28th, 2009.*

[119] *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>. Last visit on: May 18th, 2009.*

Brazilian production of residues from cashew trees is around 82,875 tonnes per year. Comparing with other ceramic that has similar production capacity[120], this project activity would be responsible for the consumption of around 4,320 tonnes per year, or around 5 % 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 kilns would not be significant, which avoids the possibility of leakage.

Wood residues from constructions and industries

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

The construction residues wood corresponds around 85% of the total construction residues in *Sorocaba*, city of the state of *São Paulo*. The deficiency of a correct destination for this wood constitutes a huge problem[121].

The percentage of the wood residues (such as pallets) contained within the industrial solid residues in the region of *Curitiba*, which is the capital of the state of *Paraná*, is around of 5%. Furthermore, the city garden residues correspond around 3.2% of the total of industrial solid residues[122].

It was utilized this estimative to calculate the percentage of consumption of these residues in the project activity. Moreover, it was only considered the availability of industrial wood residues, which is 749,839 tons per year (around 5% of the total of industrial solid residues). The consumption of these kinds of biomasses by this project activity is around 12 tons per year, which is less than 1% of the total. Initiatives like these should be stimulated in order to attenuate the solid residues final disposal in cities.

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 cities[123]. Comparing with other ceramic that has similar production capacity[124], this project activity would be responsible for the consumption of around 2,160 tonnes per year, or less than 1% of the coconut husk availability. Therefore, this biomass is widely available in the region, once its use for generate thermal energy may be a solution for the solid waste disposal in these cities.

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[120] *According to Kitambar ceramic – Caruaru – PE, which utilizes around 200 tons per month of cashew tree pruning as fuel to maintain a 1.8 smaller production.*

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

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

[123] *Source: <www.sbpcnet.org.br/livro/60ra/textos/SI-GoreteMacedo.pdf>. Last visit on: April 9th, 2009.*

[124] *According to Kitambar ceramic – Caruaru – PE, which utilizes around 100 tons of coconut husk as fuel to maintain a 1.8 smaller production.*

Sawdust

The production of wood generates a large amount of residues, which can be reused to generate thermal energy, considering that around 22% of the wood produced will generate sawdust[125]. The production of wood in the state of *Bahia (BA),* which is a bordering state in the northeast region of Brazil, was of 13,259,341 m³[126] in 2007. Thus, the production of sawdust was around 2,917,055 m³ per year.

Bom Jesus ceramic utilizes around 2.28 tons of sawdust per year, i.e. the ceramic utilizes 9.3 m³ of sawdust.[127] Thus, the project activity utilizes less than 1% of the biomass availability in the state of *Bahia*. This way, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

As can be observed in the figure below, the potential of energy generation in the state of *Bahia* is considered high, which means that there is an enormous availability of this kind of fuel to be employed in the project activity.

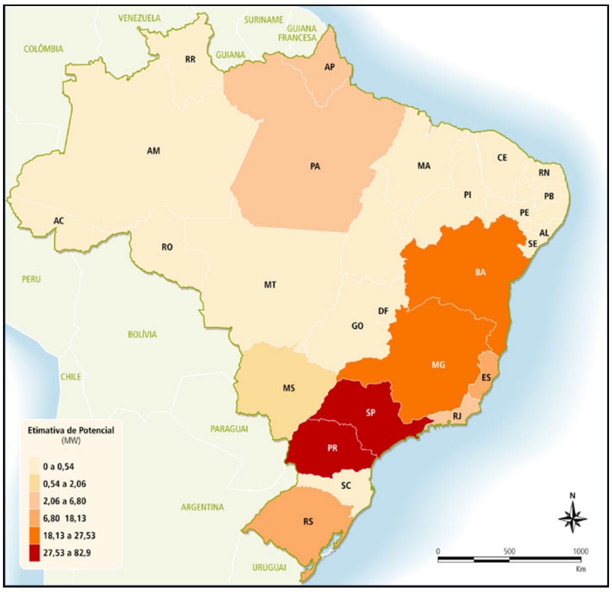

Figure 9. Woody Residues Potential for Energy Generation[128]

Elephant grass

In case of using elephant grass[129] it will be cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and

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[125] *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.*

[126] *According to IBGE (Geographic and Statistic Brazilian Institute). Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ba&tema=extracaovegetal2007>. Last visit on: April 9th, 2009.*

[127] *It was considered specific gravity of 0.245 ton/m³, according to:* ***Masses and Dead Loads of Concrete and Other Materials****. Available at: <http://www.cca.org.nz/pdf/Masses.pdf>. Last visit on: October 20th, 2009.*

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

[129] *An African grass mostly used to feed cattle which its fast growing can promote four harvests per year. It was verified, after many studies, that the Elephant Grass when dried is a great source of biomass that can be used to energy generation purposes.*

it will not deforest a vegetated area, therefore the leakage that would be applicable is the emissions from biomass generation/cultivation. Currently, elephant grass has been acquiring national importance as biomass[130] to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions; it also dismisses the use of fertilizers (NPK)[131]. In case of using this kind of biomass, the ceramic company will cultivate, by itself, elephant grass in abandoned areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, i.e. only the leakage from biomass cultivation will be monitored in case of its use.

Moreover, studies of drying elephant grass in order to employ it as fuel are being done and there are possibilities of start using this as renewable biomass in the project. Elephant grass has an excellent net calorific value when it is dried, although its drying process is still a problem for the project proponents.

This way, these renewable biomasses do not have potential to generate leakage emissions due to their high availability.

***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.

To ensure that the project activity at *Bom Jesus* Ceramic will not cause the type of leakage described in item B, *Carbono Social Serviços Ambientais LTDA* made a research about the ceramics industries in the state of *Pernambuco*, and the result was that there are around 150 ceramic facilities in the state, nevertheless around 90% use native wood without sustainable management[132]. Furthermore, there are many studies regarding the consumption of non-renewable native wood at the ceramic industries[133]. Therefore, it can be concluded that the wood

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[130] *Source: <www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Last visit on: April 9th, 2009.*

[131] *Source: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Last visit on: April 9th, 2009.*

[132] *Programa de Apoio à Competividade das Micro e Pequenas Indústrias (PROCOMPI) – Tecnologia Cerâmica. SENAI (PE), 2008.*

[133] *Some studies regarding the consumption of non-renewable native wood at the ceramic industries: <http://www.ambienteemfoco.com.br/?p=457>, last visit on*

which was avoided by the present project activity is not being used by other ceramists.

Of a total of around 844,453 km^2 in *Caatinga* biome, it is currently remaining 50% of the local biome, even with an annual loss of about 365,000 hectare of all the biome[134] . Therefore, assuming that the deforestation rate maintains constant, the native wood would be enough to ensure the increase in Ceramic production for at least the next 30 years, which is over the project activity life-time.

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 will probably not be applicable as it is predicted the project activity will 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 will not being 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, the ceramic company will avoid the consumption of about 10,485 m^3 per year of non-renewable wood helping the conservation of forests in *Caatinga* biome, besides the ecological and social benefits to the region.

This leakage will be 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.*

This leakage is not applicable for this project activity as it has not been any 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.

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

The applied methodology does not predict project emissions; therefore, the baseline emissions are equivalent to emission reductions, which is demonstrated below.

$$\boxed{ER_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel}}$$

Bom Jesus Ceramic

ERy, total = 8,461 tonnes of wood x 0.996 x 0.0159 TJ/tonne x 77.4 tCO2/TJ

ERy, total = 10,370 tonnes of CO2e

October 09th, 2009; <http://ambienteacreano.blogspot.com/2008/04/produo-de-lenha-em-pernambuco-e-rio.html>, last visit on October 09th, 2009; <http://noticias.ambientebrasil.com.br/noticia/?id=41624>, last visit on October 09th, 2009; among others.

[134] *Source: <http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47>. Last visit on: April 29th, 2009.*

Table 15. Emission reductions without considering the leakage

Year	Baseline Emissions (tCO2e)
2007	10,370
2008	10,370
2009	10,370
2010	10,370
2011	10,370
2012	10,370
2013	10,370
2014	10,370
2015	10,370
2016	10,370
Total Emission Reductions (tCO2e)	**103,700**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO2e)	10,370

4.3 Quantifying GHG emissions and/or removals for the project:

The applied methodology does not predict project emissions and leakage was considered to be zero.

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Table 16. Estimation of overall emission reductions

Year	Baseline Emissions (tonnes of CO2e)	Leakage (tonnes of CO2e)	Emission Reductions (tonnes of CO2e)
2007	10,370	0	10,370
2008	10,370	0	10,370
2009	10,370	0	10,370
2010	10,370	0	10,370
2011	10,370	0	10,370
2012	10,370	0	10,370
2013	10,370	0	10,370
2014	10,370	0	10,370
2015	10,370	0	10,370
2016	10,370	0	10,370
Total			**103,700**
Average			10,370

5 Environmental Impact:

As can be observed in table 17, the only negative impact identified is that the project activity will generate ashes due to the burning of the biomass, but this impact will be mitigated by incorporating the ashes into the clay mixture used as thermal insulator in the kilns entrance. In addition, they also use the ashes as fertilizer in the *crops* next to the Ceramic.

The burning of the new biomasses also emits particulate material and CO2, as well as when using wood. However, the emission reductions of GHG will improve since they are renewable biomasses.

If utilized by the ceramic industry, the combustion of glycerin would need to have special precautions. Beyond the storage tank and pipelines must be correctly built in order to prevent leakages, the glycerin would be only injected into the kilns once the temperature would reach 280ºC. It happens because when glycerine is burned, the reaction has a product named acrolein, which is toxic. However, acrolein is unstable and flammable at higher temperatures. Thus, burning glycerine at temperatures higher than 280°C avoids the emission of acrolein[135].

This way the project does not cause any additional negative impacts as all generated energy is a result of the best and unique exploitation of the natural resources available. On the other hand, the project activity will improve the local environmental conditions by establishing proper treatment for the renewable biomasses and also by contributing to the reduction of the deforestation rate.

Table 17. Summary of the environmental impacts

Environmental Factor	Environmental Impact	Classification
Soil	Improvement of soil conditions because of the native vegetation conservation	Positive
Air	Production of ash	Negative
Climate	GHG emission reduction	Positive
Water/ hydric resources	Preservation of ground water quality	Positive
Water/ hydric resources	Preservation of the water cycle renewal	Positive
Energy	No more use of a polluting residues as fuel for energy production	Positive
Fauna	Biodiversity preservation	Positive
Flora	Biodiversity preservation	Positive

Environmental Laws related to the plant activities

The Environmental National Policy, *Política Nacional do Meio Ambiente* - PNMA, instituted by the Brazilian Law 6.938/81, establishes that the

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[135] *METZGER, B. Glycerol Combustion. A thesis submitted to the Graduate Faculty of North Carolina State University – Mechanical Engineering. Raleigh, 2007. Available at: <http://www.lib.ncsu.edu/theses/available/etd-07312007-153859/unrestricted/etd.pdf>. Last visit on: October 15th, 2009.*

construction, installation, amplification and operation of any enterprise or activity which may exploit natural resources, and are considered potentially pollutant, or capable of degrading the environment, will be possible only if they obtain a previous environmental permission; according to the Brazilian Constitution of 1988. One of the tools settled by the PNMA, in order to monitor and study the potential impacts generated by these kinds of enterprises, is the Environmental Impact Assessment (EIA).

An EIA was not required due to the project activity.

In addition, the project activity will contribute to the sustainable development of the host country, such as:

- The use of clean and efficient technologies through the use of biomass waste as fuel. By these means, the project is in accordance to *Agenda 21* and with Brazilian Sustainable Development Criteria;

- A pioneer initiative that encourages throughout the country the development of new technologies that substitutes the use of usual fuels for renewable biomass which presents an efficient thermal energy generation potential as shown in the project demonstration.

6 Stakeholders comments:

The main stakeholders considered in this project are the ceramic industry labour union (SINDICER)[136] and the ceramic company employees. A letter was sent to the stakeholders informing about the project. In the ceramic's facilities, the letter was posted on the employees' board which is a visible place with high circulation of employees. The letter was available during 7 days and the comments were expected for a period of 7 days after the letter has been posted.

SINDICER sent a letter stating their support to each ceramic of the present project activity[137].

In addition, having the ceramic sector association being aware of the project, other local stakeholders will be able to be informed about the proposed project activities, because the ceramic sector association has great visibility trough different parts of the community, public entities on different levels, like Municipality, State and Federal organizations.

The ceramic sector association keeps relationships to local developing agencies, like SEBRAE (Brazilian Service to support Micro and Small size companies), SENAI (Brazilian Service to support technically Manufacturing Companies), among others so it will help in the diffusion of project results and practices.

Till validation time, positive answers were received and the outcomes are available and arrived within the validation of the project.

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[136] *This institution is focused in the quality and sustainable management, offering opportunities for the ceramists, their business and employees as a result of its services, researches, events and associations.*

[137] *The letter from SINDICER was evidenced to the DOE.*

7 Schedule:

- Project start date: Date on which the project began reducing or removing GHG emissions, i.e. when the project proponents began employing renewable biomass: November, 2006;
- Crediting period start date: 01/01/2007;
- Validation Report predicted to: November, 2009;
- First Verification Report predicted to November, 2009;
- VCS project crediting period: 10 years, twice renewable;
- Monitoring and reporting frequency: preferentially from 6 to 12 months, since the beginning of the crediting period;
- Date of terminating the project: December 31st, 2016.

After the project start date, the ceramic owner made adaptations due to the use of new biomasses and its technology, encompassing for example, tests using the new biomasses, the ideal mix of renewable biomasses (different percentages of each biomass) and technological adaptations.

8 Ownership:

8.1 Proof of Title:

Ceramic’s article of incorporation and the contract between *Carbono Social Serviços Ambientais* LTDA. - project developer – and *Bom Jesus* Ceramic of this project activity will proof the title, demonstrating the rights to the GHG emissions reductions and the ownership of the project. These proofs of title will be checked by DOE and are in power of the Ceramic Company and available to consultation.

The responsible for the contract between *Bom Jesus* Ceramic and *Carbono Social Serviços Ambientais LTDA* is *Mrs. Elisângela Maria Carneiro*, represented by *ECJ* Ceramic.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not applicable.