Voluntary Carbon Standard Project Description

19 November 2007

August 26th, 2009

Contents

1 Description of Project:

1.1 Project title

Bandeira and *Capelli* Ceramics Fuel Switching Project
Version 03
PDD completed in: August 26th, 2009

1.2 Type/Category of the project

This is a grouped project activity that encompasses two small ceramic industries: *Bandeira* and *Capelli* Ceramics. 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 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 tons of CO2 equivalent and less than 1,000,000 tons 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	Total Emission Reductions of the project activity (tons of CO2e)
April to December 2006	23,212
2007	30,950
2008	30,950
2009	30,950
2010	44,108
2011	44,108
2012	44,108
2013	44,108
2014	44,108
2015	44,108
January to March 2016	11,026
Total Emission Reductions (tons of CO2e)	**391,736**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tons of CO2e)	**39,174**

1.4 A brief description of the project:

The project activity is the grouping project of *Bandeira* and *Capelli* Ceramics, which are two small and prototypical red ceramic industries. *Capelli* Ceramic produces chiefly roof tiles while *Bandeira* Ceramic produces bricks, both destined mainly for the market in *Alagoas* and for other states of the Brazilian northeast region. The fuel utilized in the baseline scenario to cook the ceramic devices was native wood from the Atlantic Forest biome and *Caatinga* biome[1].

The Atlantic Forest biome is considered one of the global hotspots[2] due to the enormous biodiversity of fauna and flora and the great threat to its integrity. This biome is nowadays inserted in a region of approximately 95,000 km² (which originally has an extent of around 1.3 millions of km²). The forest is the second major forest of South America, being located in the Brazilian coast[3]. The uncontrolled deforestation broke up the firm land forest and led up to the loss of this biome, which nowadays has about 7% of the original area, which contains the last surviving vegetable and animal species of one of the richest ecosystems of the world[4].

The *Caatinga* is an exclusively Brazilian biome and occupies 844,453 Km², equivalent to around 10% of the territory of the country[5]. 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[6].

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 grouping utilizes coconut husk, sugar cane bagasse, sawdust and bamboo in order to generate thermal energy into their kilns to cook their ceramic pieces. Furthermore, wood from afforestation and elephant grass could also be utilized in the ceramic industries. This fuel exchange could only be feasible when considering the carbon credits incomes, since the adaptation of kilns to the new biomasses and the purchase of new equipments required considerable investments. Furthermore, the fuel-switch in *Capelli* Ceramic has not been completely done. With the approval of this project activity, the use of renewable biomasses can be feasible when comparing to the non-renewable fuel use.

The main goal of this project activity is to minimize the negative impacts of the deforestation of the Atlantic Forest biome by discouraging the

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[1] *In the State of Alagoas, the forest is called Palm-rich Open Tropical Rain Forest, which is a type of transition of the Dense Ombrófila Forest, characterized by perennial plant, with green plants, trees reaching from 15 to 40 meters and dense arbustive vegetation. The main cause of the deforestation of this biome in the state of Alagoas was the agroindustrial activities. Source: MENEZES, A. F. et al.* ***A Reserva da Biosfera da Mata Atlântica no estado de Alagoas.*** *Série Estados e Regiões da RBMA. Available at: <http://www.sectma.pb.gov.br/comites/rbma/pdf/cad29.pdf>. Last visit on: March 9th, 2009.*

[2] *Source: <http://www.biodiversityhotspots.org/xp/Hotspots/Pages/default.aspx>. Last visit on: March 9th, 2009.*

[3] *Source: <http://www.colegiosaofrancisco.com.br/alfa/meio-ambiente-mata-atlantica/mata-atlantica-1.php>. Last visit on: March 9th, 2009.*

[4] *Source: <http://www.rbma.org.br/anuario/mata_01_mataconhecemos.asp>. Last visit on: March 9th, 2009.*

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

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

exploitation of the area through limiting the interested parties in acquiring the proper legal documents for the commercialization of the native fire wood. Moreover, In opposition to the identified baseline, the project activity will generate thermal energy without stimulating deforestation by using an abundant renewable biomass.

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

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

Table 2. Localization of the ceramics

Ceramic	City	State
Bandeira	*Capela*	*Alagoas*
Capelli	*Capela*	*Alagoas*

The project sites have the postal addresses:

- *Bandeira* Ceramic

  Address: *Fazenda Flexeiras, s/nº - Zona Rural - Capela – AL – Postal Code: 57.780-000*.

- *Capelli* Ceramic:

  Address: *Fazenda Flexeiras, s/nº - Zona Rural - Capela – AL – Postal Code: 57.780-000*.

Ceramics’ Boundaries Coordinates (measured through GPS):

9°40'22" S, 36°09'62" W;

9°40'21" S, 36°09'60" W;

9°40'26" S, 36°09'65" W;

9°40'44" S, 36°09'67" W;

9°40'46" S, 36°09'50" W;

9°40'45" S, 36°09'39" W;

9°40'45" S, 36°09'38" W.

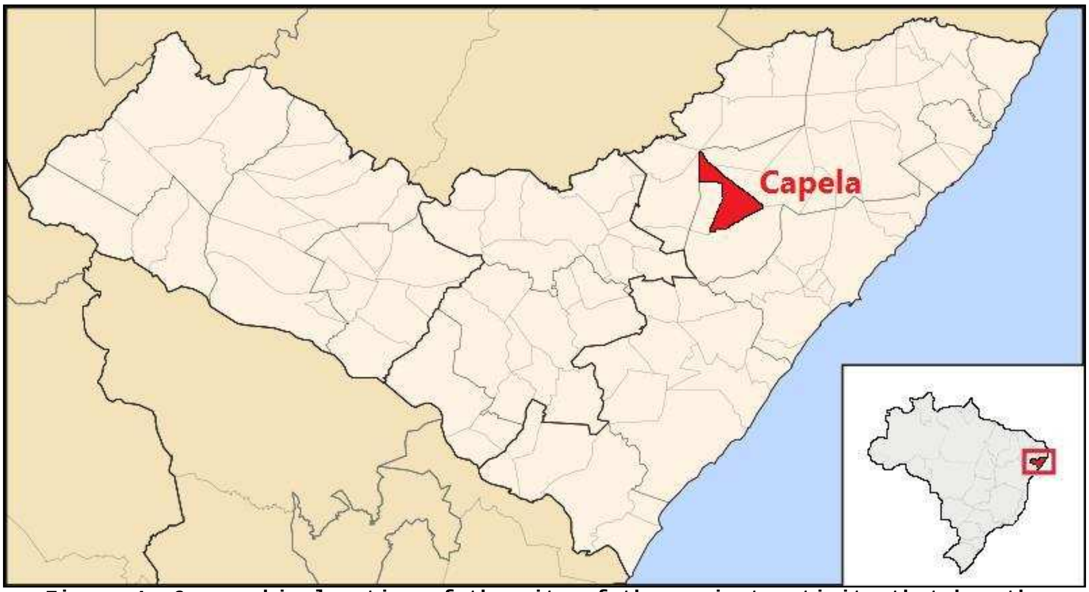

Figure 1. Geographic location of the city of the project activity that has the following coordinates in *Alagoas* State: *Capela*: 09º24'27" S and 36º04'25" W

1.6 Duration of the project activity/crediting period:

- Project start date[7]:

Table 3. Ceramics' project start date

Ceramic	Project Start Date
Bandeira	January 2004
Capelli	July 2004

- Crediting period start date[8]: 01/04/2006;
- Date of terminating the project activity[9]: 30/03/2016;
- VCS project crediting period: 10 years 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 facilities 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

[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 Bandeira ceramic, thus, when the ceramic stopped employing native wood. Capelli ceramic has not done the complete fuel-switch.*

[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.*

energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector[11].

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 employing of a total of 41,146 m^3 of non-renewable native wood per year for both ceramic companies to provide thermal energy to the ceramics' kilns. The project activity focuses on the use of coconut husk, sugar cane bagasse, sawdust and bamboo 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 companies. Therefore, the emissions launched during the combustion of native wood from deforestation activity are not compensated by the replanting, which is a carbon absorbance method. An opposite scenario occurs with the renewable biomasses employed in this project activity, which have carbon neutral cycle.

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

The production process of *Bandeira* Ceramic involves one "Hoffman"[13] kiln in order to cook ceramic bricks. The production process of *Capelli* Ceramic involves four "Round" kilns in order to cook roof tiles. Afterwards, some of these roof tiles produced in *Capelli* ceramic are coated with enamel and cooked again in the "Tunnel"[14] kiln in order to fix the enamel on the roof tiles. The following table shows the technical parameters of each kiln utilized in both ceramics:

Table 4. Technical parameters of the kilns utilized in this project activity

Technical Parameters	"Hoffman" Kiln	"Round" Kiln	"Tunnel" Kiln
Features	Continuous with rectangular shape and upper furnaces	Intermittent with round shape and lateral furnaces	Continuous with rectangular shape and upper furnaces
Maximum Temperature (°C)	850	900	950
Time of loading	15 minutes	9 hours	1 minute

[11] *Energy Research Company. National Energy Balance - energy consumption per sector. Available at <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" kiln have parallel chambers where the heat from one chamber is used in the next, therefore recycling the generated heat in the previous chambers. The most common fuels that are used in this type of kiln are native fire wood and sawdust.*

[14] *"Tunnel" kiln is a kind of a continuous kiln more efficient and modern, which has the transportation of the ceramics pieces through a conveyor belt or special carts inside the kiln, passing through three sections: heating, burning and cooling, with reuse of the heat in the sections.*

Burning Cycle[15]	1 hour[16]	90 hours	30 minutes[17]
Time of unloading	15 minutes	9 hours	1 minute
Average production per burning cycle (ceramic pieces)[18]	2,500	47,500	72

With the project activity, it is expected to use four types of biomasses, which can be utilized combined or isolated: sugar cane bagasse, sawdust, coconut husk and bamboo. The amount of each biomass and type of biomass employed in both ceramics may change according to its availability. However, others biomasses can also be used, since its renewable origin can be verified, as the afforestation wood. 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[19]. The ceramic companies could utilize elephant grass due to harvest reason or lack of the other renewable biomasses.

If any biomass were to be utilized in the future, it will be reported at the Monitoring Report.

The biomass providers are listed at the table below; nevertheless, it does not exclude the possibility of buying renewable biomass from others in the future.

Table 5. Main renewable biomasses providers

Biomass	Provider	City
Bamboo	*Anísio Leite da Silva*	*Rio Largo – AL*
	Fernando Alves de Morais	*Capela - AL*
	José da Silva Abreu	*Cajueiro - AL*
	José Edson Ferreira	*Cajueiro - AL*
	João Manoel dos Santos	*Satuba - AL*
	Renato Marques da Silva	*Capela - AL*
	Carlos Jorge de Melo	*Capela - AL*
Coconut husk	*Leonidas de Melo Silva*	*Atalaia – AL*
	José Vânio Barbosa da Silva	*Cajueiro - AL*
	Renato Marques da Silva	*Capela - AL*

[15] The burning cycle described above encompasses the warming, burning and cooling stages.

[16] The burning cycle in a "Hoffman" kiln is the number of hours it takes to burn a single line inside the kiln.

[17] The burning cycle in a "Tunnel" kiln is the number of hours it takes to a single wagon to pass through inside the whole kiln.

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

[19] According to EMBRAPA (Brazilian Agricultural Research Corporation's). Source: http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292. Visited on March 27th, 2009.

	Wellington Bezerra Brandão	*Cajueiro - AL*
	Cícero Albuquerque	*Cajueiro - AL*
Sawdust	*Jaja Indústria e Comércio de Madeira LTDA*	*Maceió – AL*
	Madeireira Linhares Indústria e Comércio	*Maceió - AL*
	Esquadros Indústria e Comércio Móveis e Esquadria	*Maceió - AL*
	Pimentel Lopes Engenharia e Arquitetura	*Maceió - AL*
	Portas e Janelas	*Maceió - AL*
	Giu Móveis e Decorações	*Maceió - AL*
Sugar cane bagasse	*Usina Sumaúma*	*Marechal Deodoro - AL*
	Usina João de Deus	*Capela - AL*

Due to the project activity, a set of adaptations were necessary, such as the purchase of new equipments, alterations into the kilns as well as the construction of sheds where the biomasses should be stored so the ceramics can operate with the renewable biomasses. It is very gainful for the ceramics the opportunity of using a variety of kinds of biomasses due to when there is a lack of one of them, the ceramic can use another one, depending on its availability. All of these changes were made counting on this project approval in order for the ceramics to become able to receive the biomasses to be used.

Before the project activity, the process was noticeably different; the non-renewable wood was inserted in the kilns by the employee and it was not necessary any logistic modification.

The ceramics' adaptation to the fuel-switch will be explained separately, and afterwards, a table will represent each scenario.

***Bandeira* Ceramic**

The main renewable biomasses utilized in this ceramic are sawdust and bamboo. *Bandeira* Ceramic acquired three moveable mechanic burners, which are manually fed by an operator, in order to automatically inject the sawdust with air inside the kiln. Nevertheless, the bamboo is inserted manually into the kiln.

Thus, the superior part of the "Hoffman" kiln had to be modified in order to adapt the burners. Each chamber presents three lined entries where the mechanic burners are installed, and thus, the biomass is injected. The proportion of the sawdust and bamboo utilized in the ceramic is around 11% and 89% respectively.

With the carbon credits, the project proponent intends to acquire more mechanic burners and all the necessary equipments.

***Capelli* Ceramic**

In *Capelli* Ceramic, the switching of fuel is being gradually performed as the project proponent has not acquired any machines yet. Besides the native wood, the main renewable biomasses utilized in this ceramic are sugar cane bagasse and coconut husk, in percentage of around 8% by 92% respectively. Furthermore, in order to get a better burning efficiency with the sugar cane bagasse, the ceramic constructed a sugar cane bagasse dryer.

The biomasses are being manually inserted with shovels in some “Round” kilns. It results in products with an inferior quality of what is expected in this period of fuel transition.

Currently, the ceramic has reduced the use of non-renewable wood by around 40% with the use of renewable biomasses. However, the burning in the “Tunnel” kiln is only performed with non-renewable wood.

With the carbon credits income, the project proponent intends to acquire all necessary equipments in order to accomplish the fuel-switch. Thus, it will be acquired twelve mechanic burners, as well as it will be constructed more sheds in order to protect the biomass from adverse weather situations. Moreover, some adjustments will be necessary in all the fuel entrances of the “Round” kilns, since the mechanic burners must be embedded in the kilns to insert the exactly quantity of biomass with no loss, guarantying a better burn with quality. Also, the fuel entrances in the superior part of the “Tunnel” kiln have been adapted to the use of mechanic burners due to the renewable biomasses use.

Table 6. Scenario of each ceramic (year of 2008)

	Bandeira	***Capelli***
Production (devices per month)	1,349,874	479,734
Biomass Consumption (tonnes/month)	1,213	508[20]
Kiln Efficiency with renewable biomass (tonnes/thousand of ceramic devices)	0.8986	--[21]

The project proponent had also constructed artificial greenhouses in order to dry the ceramic devices, avoiding the consumption of wood by dryers that would consume this fuel. This was planned with the aim of reducing the wood employment, since it displaces part of the non-renewable wood that was previously destined to the dryers. Thus, the ceramic devices can be dried naturally with the same result of the dryers. However, currently, the ceramics still need to use the *Bandera’s* furnace to provide thermal energy to the dryers. *Bandeira’s* furnace had all the non-renewable wood utilized substituted by renewable biomasses. The project proponent intends to displace the use of the furnace and only employ the artificial greenhouses in the future.

The implementation of the project activity will save energy due to the following modifications:

- Use of biomasses with less surface area than wood;
- Insertion of air with the new fuels, increasing the oxygenation;

[20] This consumption of biomass refers to an average of the period corresponding from april/2006 to march/2009, when the ceramic did not made the complete fuel-switch and is in a testing period with renewable biomasses.

[21] It was not calculated the kiln efficiency with renewable biomass because it is also utilized non-renewable wood in the kilns.

• Reduction of thermal energy loss since the entrances will be kept closed or connected to the equipments;

• Injection of biomasses controlled by equipments, avoiding surplus of fuel often occurred when using wood.

All of these changes were made counting on this project approval in order for the ceramics to become able to receive the biomass to be used. The following figures show some of the changes at the ceramic industries.

Figure 2. "Round" kiln at *Capelli* Ceramic

Figure 3. Roof tiles enameled produced at *Capelli* Ceramic

Figure 4. Coconut husks utilized as biomass

Figure 5. Bamboo and the mechanic burners of *Bandeira* Ceramic

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

This project is in accordance to the CONAMA[22] 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 the Environmental Secretary of *Alagoas* (SEMARH[23]), which must run under the valid time

[22] *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: April 01st, 2009.*

[23] *SEMARH is the Secretary of the environment and hydrous resources of the State of Alagoas responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: <http://www.semarh.al.gov.br>. Last visit on: April 01st, 2009.*

All the biomasses utilized in this project activity (such as bamboo, sawdust, coconut husk, and sugar cane bagasse) do not require legal documents specifically for residues, which do not fall under the by-product definition of *IBAMA* Normative Instruction N° 112 from August 21st, 2006[24]. Furthermore, the Operational License of the state of *Alagoas* does not require any documents for the use of these types of biomass.

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[25]).

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. 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.

- Difficulty related to the common practice

The ceramics utilized native wood from deforestation areas in its kilns for several years. The gradual change has been claiming a lot of effort from each ceramic to make the adaptation successfully. The fuel-switch represents a risk to the project proponent since the original practice has shown good results for many years. Furthermore, the employees' resistance to the new situation was another difficulty faced by the ceramics.

- Closing of the ceramic business

If the ceramic companies close, it may substantially affect the project's GHG emission reductions once other ceramic would probably supply the products consuming native wood, which is the common practice of the region. However, there are currently good perspectives in the ceramic market and in the organization of the administrations verified at *Bandeira* and *Capelli* Ceramics, avoiding this possibility.

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 fact that the two ceramics had historically operated using wood without sustainable management as fuel, clearly confirms the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

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[24] *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.*

[25] *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: April 01st, 2009.

The ceramics had used non-renewable wood to produce its pieces for several years. *Capelli* ceramic still use this kind of fuel in some parts of the ceramic production. This is evidence that guarantees the integrity of this project activity.

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

This grouped 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.

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

This grouped 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:

<u>Project Proponents</u>

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

Bandeira and *Capelli* Ceramics:

Mr. *Frederico Gondim C. de Albuquerque,* Director: Information and visit of the ceramics, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramic devices market challenges.

Mr. *Júlio César Lins Brites*, monitoring responsible: General data and information on inputs and outputs of the ceramics, 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:

Addresses: *Fazenda Flexeiras, s/nº - Zona Rural - Capela – AL – Postal Code: 57.780-000*.

Ceramic phone number: +55 (82) 3287-1188/ 3287-1339

<u>Project Developer</u>

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 assessors directly involved are:

Marcelo Hector Sabbagh Haddad, Technical Analyst: Project Design Document writers, elaboration of GHGs Emissions' Inventory, direct contact between *Carbono Social Serviços Ambientais LTDA* and the ceramics, and responsible for collecting the necessary information.

Coordinated by:

Flávia Yumi Takeuchi and *Rafael Ribeiro Borgheresi*, Technical Coordinators.

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

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

This project activity is a grouping of two ceramics industries.

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 Application by the User – Version 01 from February 1st of 2008, which is applicable for project activities that avoid greenhouse gases 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.

Furthermore, the project activity will annually generate less than 45 MWthermal, which is the limit for Type I small scale project activities.

There are no similar registered small-scale CDM project activities in the region of the project activity once *Carbono Social Serviços Ambientais LTDA.* 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 (UNFCC)[26] and Brazilian's Technology and Science Ministry[27]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted for by the other registered project activities.

The utilization of firewood from areas without any kind of management can not be considered a renewable source of biomass, since it interferes in the carbon pools and increases the carbon emissions to the atmosphere, turning greenhouse 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 the ceramic industries presented in this project activity, *Bandeira* Ceramic started its operation at 1980 utilizing non-renewable native wood from areas without any kind of management, which was the fuel utilized for several years. *Capelli* Ceramic operates at the same industrial park of *Bandeira* ceramic.

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 afforestation wood is considered renewable according to option I, as soon as it fits all the assumptions below:

[26] *CDM activities registered by CDM Executive board are Available at: <http://cdm.unfccc.int/Projects/registered.htm>.*

[27] 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: December 12th, 2008.*

"The biomass is originating from land areas that are forests[28] 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 afforestation wood that would be consumed by this project activity is consisted of *Eucalyptus* and *Pinus* genuses. 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[29]. The grand major of these cultivations were established in the middle of 1970 to 1980. The *Eucalyptus* and *Pinus* genuses correspond to 80% of the afforestation in *Brazil*. Furthermore, these genuses are mainly cultivated in the southeast region of the country, where the climate is more favorable for their growing[30]. Moreover, these genuses of trees are the only utilized by the ceramic companies due mainly to the local availability.

The afforestation wood fits all the three options above since just wood from land areas that are forests are utilized, i.e. the area remains a forest (this assertion is supported by reports sent in annex) with the use of the biomass. Moreover, the 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 bamboo is considered renewable according to option II, as soon as it fits all the assumptions below:

"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."

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[28] The forest definitions as established by the country in accordance with the decisions 11/CP.7 and 19/CP.9 should apply.

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

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

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

[32] *MCT/IPEF.* ***Silvicultura e Manejo.*** *Source: <http://www.ipef.br/mct/MCT_03.htm>.*

[33] Brazilian *Association of producers of cultivated forests. Source: <http://www.abraflor.org.br/estrutura.asp>.*

Bamboo fits all the three options above since just the stem of the bamboo is utilized and the rhizome remains in the ground. Therefore, the area remains a cropland with the use of the biomass. Moreover, the bamboo is the faster growth plant in the world, and efficiently performs the functions of soil protection and carbon sequestration, and provides food and raw material for many applications. The area where the bamboo is cultivated follows sustainable management practices, according to its cultivation and harvest techniques. Unlike trees, which once cut do not grow again, the bamboo can be harvested without the destruction of the crop. When it is properly harvested and managed, the plantation continues full of younger individuals and it is difficult to realize that a harvest was done[34].

Besides, Brazilian's production presents the tendency of increasing so far, carried by the new technologies utilized and the rampant importance of the bamboo for sustainable activities. In Brazil, scientific researches in several States have contributed to a better utilization of bamboo in the construction sector[35]. Moreover, Article 14 of Decree No. 113 of IBAMA[36] from December 29th, 1995, establishes that the bamboo species does not need a deforestation authorization in order to promote its cut[37].

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 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[38]. 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 sawdust, sugar cane bagasse and coconut husk are agro-industries residues; thus, they are considered renewable according to option V of UNFCCC definition of renewable biomass: "The biomass is the non-fossil fraction of an industrial or municipal waste". Sugar cane bagasse, coconut husk and sawdust are common residues in the region generated. Bagasse is generated by industries to produce sugar and alcohol. The sawdust is resulted from wood manufacturing. Eventually, the coconut husk is widely generated due to the utilization of the coconut fruit for diverse finalities.

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[34] According to "Projeto Bambu". Available at: <http://www.a-ponte.org.br/modulos/projetos/projeto_10/index.php?pgn=prj_bambu.php>. Last visit on: July 16th, 2009.

[35] According to "Projeto Bambu". Available at: <http://www.a-ponte.org.br/modulos/projetos/projeto_10/index.php?pgn=prj_bambu.php>. Last visit on: July 16th, 2009.

[36] Brazilian Institute of Environment and Renewable Natural Resources.

[37] Available at: <http://www.biodiversitas.org.br/floraBr/legislacao_da_flora.PDF>. Last visit on: April 6th, 2009.

[38] According to EMBRAPA (Brazilian Agricultural Research Corporation's). Source: <http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Visited on: December 12th, 2008

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

According to the applied methodology, the project boundaries for the grouped project are the physical, geographical areas of the use of biomass or the renewable energy, thus, the ceramics limits.

In the baseline scenario, there is use of non-renewable biomass to burn ceramic devices in the ceramics' 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 7. 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 8. 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>)

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 0.01598 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 0.00000414661 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 price per 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 this

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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>*

[40] *According to a receipt of firewood from 2003.*

[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>. Visited on: December, 12th 2008*

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 ceramics for a long time and has a consolidated delivery system and long term supply assurance. As affirmed before, *Capelli* ceramic still utilizes this kind of non-renewable fuel in its production. The overall characteristics of the ceramics production are used to obtain the real amount of non-renewable biomass used in the baseline scenario.

According to the characteristics of the kilns of *Capelli* Ceramic, the “Tunnel” kiln used to burn 20 m^3 of native wood per day in order to produce around 1,611 ceramic pieces per day. The “Round” kilns used to burn around 14.1 m^3 of native wood per day in order to produce around 36,000 ceramic pieces per day. Thus, the monthly consumption of *Capelli* ceramic would be around 1,023 m^3 of native wood, or around 58% consumed in the “Tunnel” kiln and 42% consumed in the “Round” kilns.

Before the project activity, *Bandeira* Ceramic consumed around 28,872 m^3 in order to produce 17,609,240 ceramic devices per year; *Capelli* Ceramic consumed an average of 12,274 m^3 to maintain the production of 3,500,569 ceramic devices per year, provided that 2,920,493 ceramic pieces were produced at the “Round” kilns, and 580,076 ceramic pieces were produced at the “Tunnel” kiln.

Therefore, of a total of around 12,274 m^3 of native wood utilized at *Capelli* ceramic at the baseline scenario, 58% or 7,119 m^3 would be utilized in the “Tunnel” kiln, and 42% or 5,155 m^3 would be utilized in the “Round” kilns.

The calculations regarding the quantity of non-renewable wood required in the burning process were done according to the efficiency of the kilns employed in the ceramics, which would require 1.6396 m^3 of non-renewable wood to produce 1,000 ceramic devices in *Bandeira* Ceramic; and at *Capelli* Ceramic, the efficiency of the kilns in order to produce a thousand of ceramic pieces would be 12.2732 m^3 and 1.7653 m^3, in the “Tunnel” and “Round” kilns, respectively. These values are higher than the reference[45] due to the lack of technologies in the region and the indiscriminate use of the deforestation wood, which represented the ceramics’ baseline scenario. Furthermore, besides *Capelli* ceramic produce roof tiles in the “Round” kilns, which requires more time to cook, some of these ceramic pieces are enameled and cooked again in the “Tunnel” kiln, which is a continuous kiln. As this kiln is constantly burning fuel in order to produce a small amount of ceramic pieces, this leads to a very low efficiency.

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

Table 9. General description of the ceramics

	Bandeira	***Capelli***		***Total***
Type of kiln	“Hoffman” Kiln	“Tunnel” Kiln	“Round” Kiln	
Production (devices per year)	17,609,240	580,076	2,920,493	21,109,809
Non-renewable wood consumption without the project activity (m^3 per year)	28,872	7,119	5,155	41,146

[44] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Visited on: December, 12th 2008*

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

BFy (m^3 of wood per thousand of devices)	1.6396	12.2732	1.7653	

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 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, which is the limit for Type I small scale project activities.

The native wood from deforestation consumption before this project activity for the group would be around 41,146 m^3 of non-renewable wood per year to feed their kilns in order to produce 21,109,80 ceramic devices.

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 it will be 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 [46] 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. Moreover, in accordance with Article 5 of the Constitution of the Federative Republic of Brazil, 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[47].

The consumption of non-renewable biomass by the ceramic industry was related by several authors (NERI, 2003[48]; ALBUQUERQUE *et al*, 2006[49]; BRASIL, 2001[50]; VIANA, 2006[51]; CARDOSO, 2008[52]).

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[46] 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.

[47] 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.

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

[49] 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.*

As the common practice at the ceramic sector is the use of non-renewable fuel, the fuel switch that would happen without this project activity probably would not be to renewable biomasses.

Step 2: Implementation Barriers

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

- **Technological Barrier**

In the grouped small project activity, the ceramics found some technological barriers. 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 ceramics was necessary.

Before the project activity, the process was noticeably different: native wood was delivered in the plants; it was inserted in the kilns by the employees and it was not necessary any logistic modification in order to attend the ceramics' production process.

The renewable biomasses require a specific attention once the humidity degree of the biomasses affects directly on the burning process. Thus, as soon as the biomass arrives at the ceramic, it passes through a logistic system until its insertion in the kiln. The project proponent constructed three sheds with the purpose of storing the biomasses in covered sites, thus keeping it dry.

The main technological barriers were the non-availability of human knowledge to operate and maintain the new technology, the internal logistic modification and the employee's resistance to the new technology.

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; cracks along the kilns; and damages in the new machinery due the inexperience in their use; therefore adding a significant amount of insecurity to the production process.

The operators did not have knowledge of the ideal amount of renewable biomasses that was necessary to achieve the ideal temperature for the ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using native wood from deforestation.

As a result of this difficulty, some training courses were required for the staffs of the two ceramics in order to clarify new measures linked to the use of renewable biomasses and to the new machinery, in order to sustain the quality of the final product and find a burning cycle standard.

***Bandeira* Ceramic**

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[50] *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.*

[51] *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.*

[52] *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.*

This ceramic has been operating for more than 30 year, and the laborers were very used with the native wood from deforestation. Presently, *Bandeira* ceramic uses mainly sawdust and bamboo as renewable biomasses in the “Hoffman” kiln; however, sugar cane bagasse and coconut husk are also used as fuel.

This ceramic had acquired three moveable mechanic burners, which burns one line of the kiln at a time. However, these machines were not projected to employ sawdust, therefore not appropriate to burn this biomass since it injects more sawdust in the kiln than the necessary. An ideal scenario would be to use a specific machine that burns sawdust in order to improve the burning of the ceramic pieces. Thus the project proponent is burning one line with sawdust and inserting the others biomasses manually in the other two lines, resulting in products with an inferior quality of what is expected.

The upper part of the “Hoffman” kiln was modified in order to accomplish the machines adjustment.

The operators did not have knowledge of the ideal amount of renewable biomasses that was necessary to achieve the correct temperature for the ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using native wood without sustainable management plan.

Bandeira Ceramic, with this project activity, intends to acquire proper mechanic burners and to acquire all the necessary equipments.

Capelli Ceramic

This ceramic produces roof tiles in the four “Round” kilns and afterwards, some of these roof tiles produced are enameled and cooked in a “Tunnel” kiln. The switching of fuel is being gradually performed in *Capelli* Ceramic and as the project proponent still did not acquire proper machines, the sugar cane bagasse and the coconut husk, which are the main renewable biomasses utilized, are being inserted manually with shovels in some “Round” kilns. This is not a proper method to burn with these biomasses, since they accumulate in the kilns’ entrances; therefore the heat generated is not being well distributed inside the kilns to cook the devices uniformly, resulting in products with an inferior quality of what is expected in this period of fuel transition. In addition, this ceramic is facing serious difficulties related to finding out the correct burning process with the new biomasses utilized.

In the “Tunnel” kiln, it will be preferentially utilized sawdust due to the high content of sulfur contained in the coconut husk and the existing silica content in the sugar cane bagasse and bamboo biomasses; both these substances harm the burn of the enameled roof tile, since this process is about to fix the enamel in the roof tiles and not to burn these devices.

Furthermore, a shed with sun roof was constructed in order to naturally dry the roof tiles. Moreover, a sugar cane bagasse dryer was also constructed due to the high humidity level of this biomass when it arrives in the ceramic company.

Capelli Ceramic, with this project activity approval, intends to acquire twelve mechanic burners, to adapt all the kilns’ entrances to the use of these machines, and to acquire all necessary equipments.

Due to the adaptation to the new fuel, the ceramics worked with reduced production during the reforms and constructions in the companies. Furthermore, there is a lack of knowledge and technology in the region.

Thus, the project proponent had to find the best procedure to handle with the new biomasses, which is far different when compared with the use of wood without sustainable forest management.

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**

The owner of the company, Mr. *Frederico Gondim,* is implementing the fuel switch very carefully in the ceramics facilities, since there are high costs involved to adapt the kilns and other equipments to work with the new renewable biomasses. For this reason, the project activity will be gradually implemented. Initially, the substitution of firewood for renewable biomasses was undertaken in *Bandeira* Ceramic. *Capelli* Ceramic already started the substitution; however, it will be completely executed when the ceramic receives the benefits from the commercialization of the carbon credits related to the first monitoring period of *Bandeira* ceramic. This income will be essential to make the fuel switch feasible.

With the project implementation, the ceramics had to withstand more costs than if they had continued utilizing native wood as fuel, namely in the form of payment for the biomass transportation. The non-renewable biomass is delivered by lumberjacks, which is the common practice in the region.

New equipments were acquired, such as mechanic burners, as well as three sheds were constructed in order to store the biomasses. These investments added an additional cost for the ceramics.

Table 10. Fuel consumption and costs related in *Bandeira* ceramic

Bandeira Ceramic					
Scenario	**Non-renewable wood**		**Renewable Biomass**		
Production	1,467,437	pieces/ month	1,467,437		pieces/month
Monthly consumption of the fuel	23,479	ton/ month	Bamboo	Sawdust	Biomass
			1,581	12,981	ton/ month
Cost per m³	16.19	BRL/ton	33.50	64.69	BRL/ton
Total Fuel Costs	380,160.15	BRL/ month	52,948.69	839,776.40	BRL/ month
			892,725.08		
Cost per ceramic device	0.25906	BRL/ ceramic device	0.60836		BRL/ ceramic device

Table 11. Fuel consumption and costs related in *Capelli* ceramic

Capelli Ceramic						
Scenario	**Non-renewable wood**		**Renewable Biomass**			
Production	291,714	pieces/ month	291,714			pieces/ month
Monthly consumption of the fuel	20,598	m³/month	Non-renewable native wood	Coconut husk	Sugar cane bagasse	Biomass
			12,275	4,040	991	ton/ month
Cost per m³	20.40	BRL/m³	20.40	18.90	166.67	BRL/ton
Total Fuel	420,136.93	BRL/month	250,371.37	76,364.97	165,166.67	BRL/

Costs			491,903.00	month
Cost per ceramic device	1.44024	BRL/ ceramic device	1.68625	BRL/ ceramic device

Table 12. Sensitivity Analysis of *Bandeira* Ceramic

	Biomasses	Biomass Costs (BRL/ tons)	Estimated Amount to be employed (tonnes/year)	Energy Generated (TJ)	-25%	-15%	-5%	0%	5%	15%	25%
Project Activity Scenario	Eucalyptus wood	78.43	25,737		R$ 1,513,949	R$ 1,715,808	R$ 1,917,668	R$ 2,018,598	R$ 2,119,528	R$ 2,321,388	R$ 2,523,248
	Elephant grass	67.45	16,732		R$ 846,420	R$ 959,275	R$ 1,072,131	R$ 1,128,559	R$ 1,184,987	R$ 1,297,843	R$ 1,410,699
	Bamboo	33.50	25,923		R$ 651,299	R$ 738,139	R$ 824,979	R$ 868,399	R$ 911,819	R$ 998,659	R$ 1,085,499
	Sawdust	64.69	15,303		R$ 742,514	R$ 841,515	R$ 940,517	R$ 990,018	R$ 1,039,519	R$ 1,138,521	R$ 1,237,523
	Bamboo	33.50	12,981	201.0	R$ 326,135	R$ 369,620	R$ 413,104	R$ 434,847	R$ 456,589	R$ 500,074	R$ 543,558
	Sawdust	64.69	1,581	23.2	R$ 76,691	R$ 86,916	R$ 97,142	R$ 102,255	R$ 107,367	R$ 117,593	R$ 127,818
	Most probable scenario	**-**	**-**	**224.2**	**R$ 402,826**	**R$ 456,536**	**R$ 510,246**	**R$ 537,101**	**R$ 563,956**	**R$ 617,666**	**R$ 671,376**
Baseline Scenario	Non-renewable wood	16.19	23,479.48	401	R$ 380,160	R$ 380,160	R$ 380,160	R$ 380,160	R$ 380,160	R$ 380,160	R$ 380,160

Table 13. Sensitivity Analysis of *Capelli* Ceramic

	Biomasses	**Biomass Costs (BRL/ tons)**	**Estimated Amount to be employed (tonnes/year)**	**Energy Generated (TJ)**	**-25%**	**-15%**	**-5%**	**0%**	**5%**	**15%**	**25%**
Project Activity Scenario	Eucalyptus wood	78.43	22,578		R$ 1,328,142	R$ 1,505,228	R$ 1,682,314	R$ 1,770,856	R$ 1,859,399	R$ 2,036,485	R$ 2,213,571
	Elephant grass	67.45	26,285		R$ 1,329,709	R$ 1,507,003	R$ 1,684,298	R$ 1,772,945	R$ 1,861,592	R$ 2,038,887	R$ 2,216,181
	Coconut Husk	18.90	21,036		R$ 298,182	R$ 337,940	R$ 377,698	R$ 397,576	R$ 417,455	R$ 457,213	R$ 496,971
	Sugar cane bagasse	166.67	4,675		R$ 584,328	R$ 662,238	R$ 740,148	R$ 779,104	R$ 818,059	R$ 895,969	R$ 973,879
Baseline Scenario (year of 2005)	Non-renewable native wood	20.40	12,275	209.9	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371
	Coconut Husk	18.90	4,040	67.7	R$ 76,365	R$ 76,365	R$ 76,365	R$ 76,365	R$ 76,365	R$ 76,365	R$ 76,365
	Sugar cane bagasse	166.67	991	74.7	R$ 165,167	R$ 165,167	R$ 165,167	R$ 165,167	R$ 165,167	R$ 165,167	R$ 165,167
	Total (Baseline Scenario)			**352.2**	**R$ 491,903.00**	**R$ 491,903.00**	**R$ 491,903**	**R$ 491,903**	**R$ 491,903**	**R$ 491,903**	**R$ 491,903**
	Non-renewable native wood	20.40	20,598		R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371	R$ 250,371

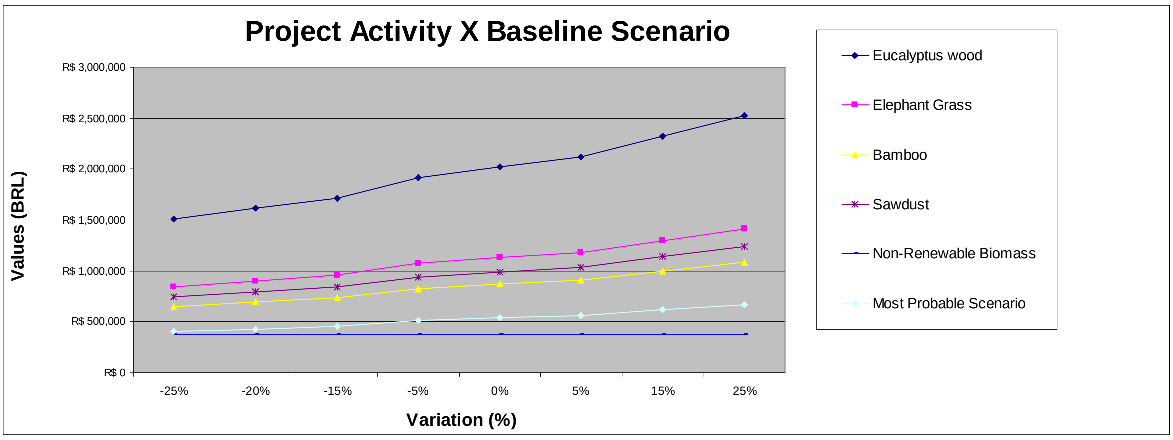

Figure 6. Sensitivity Analysis Graphic of *Bandeira* Ceramic

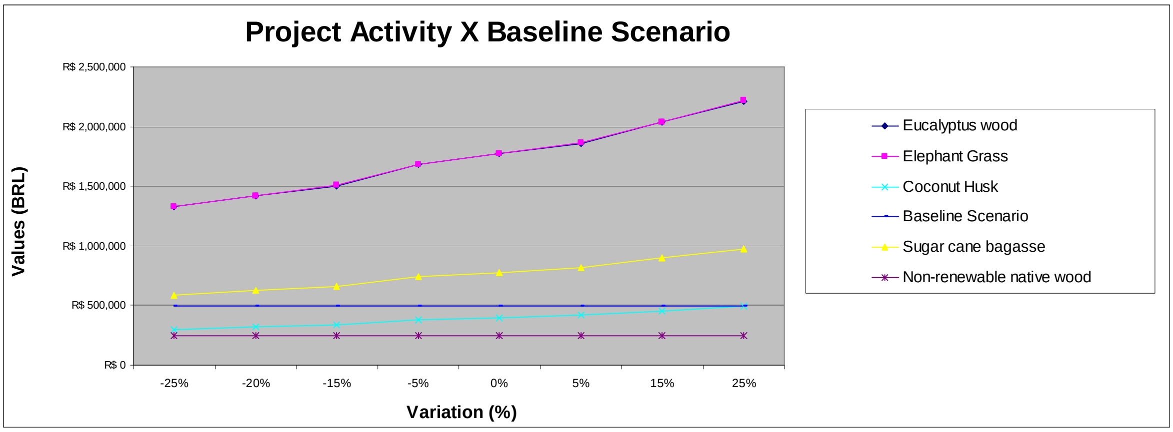

Figure 7. Sensitivity Analysis Graphic of *Capelli* Ceramic

With the project activity's implementation, the total spending has increased, as can be verified in the tables 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 ceramics 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 ceramics, since during the reconstruction of the kilns, the production of the ceramics will be low. In addition, there is the transition period where the ceramics have lost production due to the adaptation to the use of biomass and to the new machineries.

Furthermore, the ceramics 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 ceramics would not be feasible or attractive to the project proponent. *Capelli* ceramic will make the complete fuel-switch when *Bandeira* ceramic receives the carbon credits regarding the first monitoring period.

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

The combustion of sawdust, bamboo, sugar cane bagasse and coconut husk to generate thermal energy is an innovation in the ceramic industry. The future demand of this alternative fuel (e.g. by other consumers) is not predictable. Moreover, there is a possibility that the prices can increase, especially between harvest periods, when the biomasses disposal problem is mitigated.

Even if the price of the biomasses increases, the ceramic can not repass it, once the ceramic would not have competitive prices in relation to others which did not made the fuel switch. These circumstances make the commercialization of the carbon credits essential to the maintenance of 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 product of the grouped project activity is ceramic blocks and roof tiles.

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 and others non-specified.

Table 14. 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%
Others non specified	0%	0%	0%

(Brazilian Energy Balance, source: http://www.mme.gov.br)

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*[53] 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 *Alagoas*.

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 the ceramics have done their 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 criteria 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 criteria 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 fuel was criteria as the lack of fuel in the region excludes it as baseline candidates. An example may be the lack of natural gas distribution in some regions.

The consumption of non-renewable biomass by ceramic industry was related by several authors (NERI, 2003[54]; ALBUQUERQUE et al, 2006[55]; BRASIL, 2001[56]; VIANA, 2006[57]; CARDOSO, 2008[58]). This is also observed in other

[53] *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.*

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

[55] *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. Available at: <http://www.ararajuba.org.br/sbo/ararajuba/artigos/Volume144/ara144not3.pdf>. Accessed on: 10 May 2008.*

[56] *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>. Accessed on 01 June 2008.*

[57] *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>. Accessed on 01 June 2008.*

industries as in the production of steel (BRASIL, 2005[59]), which has a much better structure and internal organization when compared with ceramic industry which is generally a small and familiar enterprise. 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 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 criteria once there was biomass availability.

5. Identify a final list of baseline candidates.

Table 14 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 used in the ceramic sector, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006[60].

b) Natural gas: it is restricted by the inconstant distribution of natural gas which made the project proponent not to trust in this fuel, therefore excluding this possibility. The risk of lack of offering[61] and high costs depending on the region of the country[62] discourages the scenario of investing in this type of fuel even in local 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 is more plausible to use it than natural gas or wood. The risks involving natural gas distribution are so considerable that PETROBRÁS[63] was offering subsidy to the consumption of fuel oil in spite of natural gas in the state of *São Paulo*.

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, and chiefly the risks of changing for a biomass not consolidated as fuel for ceramic industries[64].

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

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[58] *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.*

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

[60] *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: December, 12th 2008*

[61] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Visited on: December, 12th 2008*

[62] *Source: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>. Visited on: December, 12th 2008*

[63] *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*

[64] *The use of renewable biomass was not included in table 12 which shows the fuel most employed in the ceramic sector according to Brazilian Energy Balance.*

In Brazil, the red ceramic devices are generally produced through an inefficient and traditional process using wood without forest management to generate thermal energy technologies[65]. In this industry segment the use of wood represents about 98% of the total fuel employed 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[66].Furthermore, using non-renewable wood is a simple procedure and well known by the kiln operators.

The native forest without any kind of sustainable management has always been a source of firewood, 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[67].

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[68].

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

The acquiring of new equipment and the overall costs of the fuel switch represented a risk to the project proponent 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 ideal temperature to cook its ceramic pieces, and eventually, to acquire the final product with the same quality and to maintain the optimal process as they did when using the native wood without sustainable management.

In order to clarify new procedures related to the implantation of machineries that maintain the final product quality, the fuel switch required capacitating courses for the staff in the two ceramics. Furthermore, the ceramics faced arduous resistance from the employees who were very used to the standard situation of managing the native wood from deforestation insertion, without any technical restriction.

Thus, the project activity is not a common practice.

Impact of projects approval

Presently, the ceramic industrial segment of the state of *Alagoas* 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 Atlantic Forest and *Caatinga* biomes. These industries have some technological restrictions such as the energy exploitation and the efficiency of the machinery.

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[65] *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>. Last visit on: March 17th, 2009.*

[66] *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.*

[67] *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/>. Last visit on: March 17th, 2009.*

[68] *PAULETTI, M. C.* ***Modelo 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://www.spg.sc.gov.br/menu/desenv_economico/camara_apls/estudos/Trabalhos_sobre_economia_catarinense/Ceramica_estrutural/2001_Tecnologia_ceram_verm_vale_tijucas_dissertacao.pdf>. Last visit on: March 17th, 2009.*

Brazil is the third major contributor[69] 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[70] – 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%).

The *Caatinga* is an exclusively Brazilian biome and occupies 844,453 Km², equivalent to around 10% of the territory of the country.[71]. 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[72]. 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[73].

According to ASPAN[74], the major industries, mainly the steel, plasterer and ceramic industries are primarily responsible for the use of native firewood as fuel in their productions.

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.

The Atlantic Forest biome deforestation started with the exploration of the *Pau-Brasil* tree, which persisted and was intensified by the sugar cane cycles, the exploration of gold, grazing practice and the cultivation of coffee, the site preparation which involves extraction and burning of firewood and firewood commercialization, paper production, construction of highways and of dams, and urbanization.

The Atlantic Forest had originally 1,290,692.46 km² of area, about 15% of the national territory, and nowadays this biome comprises an area of 95,000 km², equivalent of 7.3% of the original area. There are possibilities of losing known and unknown species of this sublime biome. About 31,000 and 32,000 km² per year are deforested in Brazil, especially of the Amazonian, *Cerrado* and *Caatinga* biomes. Currently, every sector of the society should be involved in this, and all efforts are necessary to revert this degradation scenario observed in the Atlantic Forest biome in order to prevent its extinction, once the Atlantic Forest has a great variety of animal and vegetable species and is the second major tropical forest of the country (only behind of the Amazonian forest). The Atlantic Forest biome encompasses different ecosystems, which represents a large structural composition, indicating a high level of characteristics, due to the

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[69] *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.*

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

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

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

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

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

variations of soil, climate and relief that occur in the great area of this biome in Brazil[75].

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

Below, the figure 8 shows the total deforestation occurred in Atlantic Forest and its original area.

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.

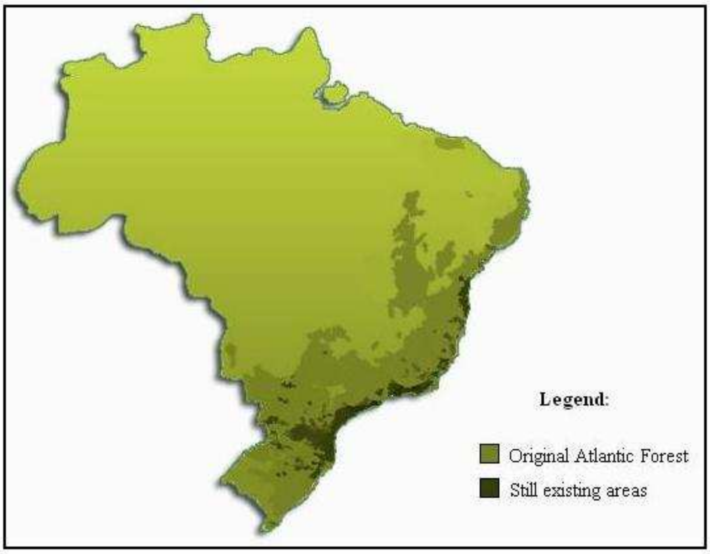

Figure 8. Map of the Atlantic Forest Biome (Source: Rede de ONGs da Mata Atlântica. Available in: http://www.rma.org.br)

[75] *Available at: <http://www.ibama.gov.br/ecossistemas/mata_atlantica.htm>. Last visit on: March 17th, 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:

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. 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 annually generate less than 45 MWthermal as described 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 ceramics' kilns and consequently, the amount of GHG that would be emitted in tonnes of CO2e. The following table shows the frequency of the monitoring of each parameter.

Table 15. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass	Tonnes	Measured by the ceramic owner	Monthly
Origin of Renewable Biomass	Renewable origin of the biomass	Not applicable	Controlled by the ceramic owner	Annually
PRy	Production of ceramic pieces	Units	Controlled by the ceramic owner	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tonnes or m³	Monitored by articles and database.	Annually
Leakage of Non-Renewable Biomass	Leakage resulted from the non-renewable biomasses	tCO2e	Monitored by articles and database.	Annually
EFprojected fossil fuel	CO_2 Emission factor of residual fuel oil	tCO2/TJ	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.	Not monitored
NCVbiomass	Net Calorific Value of non-renewable biomass	TJ/tonne of Wood	Bibliography	Not monitored
ρbiomass	Specific gravity of non-renewable biomass	Tonne/m³	Bibliography	Not monitored
***f*NRB,y**	Fraction of biomass (wood) used in the	Percentage	Bibliography	Annually

	absence of the project activity in year y can be established as non-renewable biomass using survey methods			
BFy	Consumption of non-renewable biomass per thousand of ceramic devices produced	tonnes/ 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).

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

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 each ceramic. It was calculated by dividing the monthly consumption at the baseline from the monthly production at the baseline, in thousands.

The quantity of native wood that would be used in the ceramics will be calculated through the multiplication of each ceramic's monthly production by the efficiency of its kiln, as the following example:

By = (Monthly production/1000) x Kiln efficiency (BFy)

Bandeira ceramic

By = 1,467.437 x 1.6396 m^3 of wood/thousand pieces

By = 2,406 m^3 of native wood/month;

Capelli ceramic

"Round" kiln

By = 243.374 x 1.7653 m^3 of wood/thousand pieces

By = 429.6 m^3 of native wood/month;

"Tunnel" kiln

By = 48.34 x 12.2732 m^3 of wood/thousand pieces

By = 593.2 m^3 of native wood/month.

The responsible to monitor data provided in table 15 will be: Mr. *Júlio César Lins Brites* from *Bandeira* and *Capelli* Ceramics. Internal audit will guarantee the quality of data monitored. It will be realized by Mr. *Frederico Gondim C. de Albuquerque,* Director of *Bandeira* and *Capelli* Ceramics.

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><th>Data / Parameter:</th><th>Q renbiomass</th></tr>
<tr><td>Data unit:</td><td>Tons per month</td></tr>
<tr><td>Description:</td><td>Amount of renewable biomasses utilized per month</td></tr>
<tr><td>Source of data to be used:</td><td>Measured by the project proponent</td></tr>
<tr><td>Value of Data applied for the purpose of calculating expected emission reductions:</td><td>
<table>
<tr><th></th><th>Bandeira Ceramic</th><th>Capelli Ceramic</th></tr>
<tr><td>Biomasses</td><td>1,213</td><td>508</td></tr>
</table>
Bandeira ceramic will preferentially use sawdust and bamboo, while Capelli ceramic will preferentially use sugar cane bagasse and coconut husk as biomasses in their burning process. Capelli ceramic has not done the complete fuel-switch, therefore the Qrenbiomass value of this ceramic will be higher than this stated above when it does not use non-renewable wood anymore.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The amount of biomasses will be monitored in accordance to the weight described in the receipts or invoices from the providers. The values in the receipts are described in m^3, therefore it is necessary the conversion to tonnes through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project are:
<table>
<tr><th>Biomass</th><th>Bamboo</th><th>Coconut husk</th><th>Sawdust</th><th>Sugar Cane bagasse</th></tr>
<tr><td>Specific gravity (tonnes/m^3)</td><td>0.703</td><td>0.5</td><td>0.245</td><td>0.15</td></tr>
</table>
The sources of these data are:
- Bamboo
TOMAZELLO FILHO, J. O. B. M; SALGADO, A. L. B. Produção e caracterização do carvão vegetal de espécies e variedades de bambu. IPEF, n.36, p.13-17, ago.1987. Available at: <http://www.ipef.br/publicacoes/scientia/nr36/cap02.pdf>. Last visit on: April 8th, 2009.</td></tr>
</table>

	It was utilized the average value of specific gravity of 5 species of bamboo: *Bambusa vulgaris vittata, B. vulgaris, B. tuldoides, Dendrocalamus giganteus* and *Guadua angustifolia.* - Coconut husk -PINHEIRO, G. F.; RENDEIRO, G.; PINHO J. T. **Densidade Energética de Resíduos Vegetais.** 2006. Available at: <www.ufpa.br/gedae/BIOMASSAEENERGIA2006.pdf>. Last visit on: April 8th, 2009. - Sawdust Masses and Dead Loads of Concrete and Other Materials. Available at: <http://www.cca.org.nz/pdf/Masses.pdf>. Last visit on: April 8th, 2009. - Sugar Cane Bagasse ALVES, E. M. **Utilização do Bagaço de Cana-de-Açúcar Hidrolisado na Alimentação de Ovinos em Confinamento.** December/2006, Janaúba – MG, Brasil. Available at: <http://www.pubvet.com.br/material/Alves357.pdf>. Last visit on: April 8th, 2009.
QA/QC procedures to be applied:	The ceramic has spreadsheets of the quantity of biomass acquired. 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 project proponent.
Value of data applied for the purpose of calculating expected emission reductions:	<table><tr><td>Production (approximated)</td><td>*Bandeira*</td><td>*Capelli*</td></tr><tr><td>Ceramic Devices per month</td><td>1,467,437</td><td>291,714</td></tr></table>
Description of measurement methods and procedures to be applied:	The measurement will be done by an internal control sheet monitored by the project proponents, which will be fed daily.

QA/QC procedures to be applied:	As the ceramics must have an internal control of the production and sale at the end of every month, the PRy value cannot be manipulated. The exactly production will be monitored according to the financial transactions of the ceramic.
Any comment:	The production above is an average of the monthly production regarding the year of 2003 for *Bandeira* ceramic and the year of 2005 for *Capelli* ceramic. 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 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.

Data / Parameter:	**Renewable biomass surplus**
Data unit:	Ton or m^3
Description:	Amount of renewable biomass available
Source of data to be used:	Monitored
Value of Data applied for the purpose of calculating	Biomass surplus / Surplus / Year Bamboo in tons / 640,000 / 2005

Biomass surplus	Surplus	Year
Bamboo in tons	640,000	2005

expected emission reductions:	<table><tr><td>Woody residues (Sawdust/wood chips) in m^3</td><td>319,891.88</td><td>2007</td></tr><tr><td>Coconut husk in tons per year</td><td>6,700,000</td><td>2006</td></tr><tr><td>Sugar cane bagasse in tons</td><td>4,122,217</td><td>2007</td></tr><tr><td>Wood from afforestation in m^3</td><td>13,259,341</td><td>2007</td></tr><tr><td>Elephant Grass</td><td>Not measured</td><td>-</td></tr></table> Detailed information in section 4.1 – LEAKAGE.
Description of measurement methods and procedures to be applied:	It will be used to calculate the leakage of renewable biomass. The sources of leakages predicted in "General guidance on leakage in biomass project activities" of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, will be monitored. The measurement of the leakage will be based in national and international articles and database every monitoring period. The sources will provide information about the biomass availability in the project activity's region.
QA/QC procedures to be applied :	Data available regarding the ceramic industries 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.

Data / Parameter:	**Origin of renewable biomass**
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data to be used:	Controlled by the project proponent
Value of Data 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 sawdust from renewable wood will be achieved by invoices from the providers. As stated in the section 2.2, the biomasses (wood from afforestation, elephant grass, sawdust, bamboo, coconut husk

	and sugar cane bagasse) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied:	The biomass will be considered renewable if it is according to the definition given by the methodology applied. Furthermore, documents proving the origin of renewable biomass 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:	$f_{NRB,y}$
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%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramics owner. Thus, the totality of fuel employed in the baseline scenario was from non-renewable origin. However, according to Klink (2005), the *Caatinga* Biome has only 0.11% of its total area with sustainable use[76]. According to a research made by Brazilian Environmental Ministry, there are around 20m³ of wood per hectare in *Caatinga* biome[77]. 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 all the project activities located at the *Caatinga* biome. The other sheet calculates the amount of wood consumed regarding only *Bandeira* and *Capelli* Ceramics. 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 *Bandeira* and *Capelli* project activity, respectively. Afterwards, summing each value with the sustainable use areas defined by Klink (2005), it was acquired two fraction of renewable

[76] *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.*

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

	biomass. Finally, each value was subtracted from 100% to achieve the fNRB,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. It was only considered the $f_{NRB,y}$ value of *Caatinga* biome in order to be more conservative, once the *Atlantic Forest* biome has only 0.11% of its total area with sustainable use [78], and there are less project activities in this biome. 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.

Fixed Parameters

Data / Parameter:	$\rho_{biomass}$
Data unit:	tonne/m³
Description:	Specific gravity of non-renewable wood
Source of data to be used:	Brazilian study carried out with *Caatinga* and *Atlantic Forest* 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. LIMA, M. S. C. **Potencial de Uso das Espécies que Compõem Cercas Vivas na Comunidade Rural de Pitanga, Município de Abreu e Lima, Pernambuco.** Universidade Federal de Pernambuco. Recife, 2008. Available at: <http://www.bdtd.ufpe.br/tedeSimplificado//tde_busca/arquivo.php?codArquivo=5482>. Last visit

[78] *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.*

	on: July, 16th, 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:	0.8132 ton/m³
Description of measurement methods and procedures to be 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* and *Atlantic Forest* Biome that are usually employed as fuel in the ceramic industries of the region. The $\rho_{biomass}$ value here presented is the average values for the two biomes.
QA/QC procedures to be applied :	It was included species that are usually employed as fuel from *Caatinga* and *Atlantic Forest* Biome in the ceramic sector according to “NASCIMENTO, W. S. A.” and “LIMA, M. S. C.”, respectively. These species present such good characteristics in order to be applied as fuel in the ceramics kilns.
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:	$\mathbf{NCV_{biomass}}$
Data unit:	TJ/tonne of wood
Description:	Net Calorific Value
Source of data to be used:	Brazilian study carried out with *Caatinga* and *Atlantic Forest* 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. LIMA, M. S. C. **Potencial de Uso das Espécies que Compõem Cercas Vivas na Comunidade Rural de Pitanga, Município de Abreu e Lima, Pernambuco.** Universidade Federal de Pernambuco. Recife, 2008. Available at: <http://www.bdtd.ufpe.br/tedeSimplificado//tde_busca/arquivo.php?codArquivo=5482>. Last visit on: July, 16th, 2009. Quirino W. F., Vale A. T.; Andrade A. P. A., Abreu,V. L. S.; Azevedo A. C. S. Calorific Value of Wood and Wood Residues . **Biomassa & Energia**, v. 1, n. 2, p. 173-182, 2004. Available at: <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf>. Last visit on: April 9th, 2009.
Value of Data applied for the purpose of calculating expected emission reductions:	0.0171 TJ/Tonne
Description of measurement methods and procedures to be applied:	This value will provide the energy generated by the amount of wood that would be used in the absence of the project. The species used to calculate the average value are typical trees of *Caatinga* and *Atlantic Forest* Biomes that are usually employed as fuel in the ceramic industries of the region. The $NCV_{biomass}$ value here presented is the average values for the two biomes.
QA/QC procedures to be applied :	The sources of data used in this project activity provide the Gross Calorific Values (GCV) of the *Atlantic Forest* and *Caatinga* species. In order to transform the GCV to NCV, it was utilized the equation that 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).
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:	**BFy**
Data unit:	Tons of wood per thousand of devices
Description:	Consumption of non-renewable biomass per thousand of ceramic devices produced in year y
Source of data to be used:	Historical data from ceramic owner

Value of Data applied for the purpose of calculating expected emission reductions:	**Ceramic** / *Bandeira* / *Capelli* **Type of kiln**: "Hoffman" (*Bandeira*); "Tunnel" (*Capelli*); "Round" (*Capelli*) **BFy**: 1.3333 ("Hoffman"); 9.9805 ("Tunnel"); 1.4355 ("Round")
Description of measurement methods and procedures to be applied:	The value was acquired through the average consumption and production of ceramic pieces during the years when the ceramics used to consume non-sustainable wood. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns to produce similar ceramic pieces. If nowadays the ceramics still used native firewood, their consumption would be: *Bandeira* Ceramic: around 1,956.62 tons of native firewood (or 2,406.08 m^3) per month to produce 1,467,437 ceramic blocks. *Capelli* Ceramic: around 831.82 tons of native firewood (or 1,022.90 m^3) per month to produce 291,714 ceramic roof tiles. The value is employed to calculate the real amount of non-renewable wood displaced to maintain the ceramics production in the baseline scenario.
QA/QC procedures to be applied :	As the average consumption of native wood at baseline scenario in *Bandeira* Ceramic was about 1,956.62 tons per month, and the average production at the baseline scenario was 1,467,437 pieces per month, the BFy value was achieved by dividing the consumption for the production (in thousands), obtaining a value of 1.3333 tons/thousand of pieces produced. The average consumption of native wood at baseline scenario at *Capelli* Ceramic was about 831.82 tons per month, and the "Tunnel" kiln was responsible for the consumption of about 58% of the non-renewable wood, or 482.46 tons per month. The average production at the baseline scenario of this kiln was about 48,340 pieces per month. Therefore, the BFy value of this kiln was achieved by dividing the consumption for the production (in thousands), obtaining a value of 9.9805 tons/thousand of pieces produced. The "Round" kiln was responsible for the consumption of about 42% of the non-renewable wood consumed at *Capelli* Ceramic, or 349.36 tons per month. The average production at the baseline scenario of this kiln was about 243,374 pieces per month. Therefore, the BFy value of this kiln was achieved by dividing the consumption for the production (in thousands), obtaining a value of 1.4355 tons/thousand of pieces produced. *Bandeira* and *Capelli* Ceramics' kilns are less

	efficient than average for a "Hoffman", "Round", and "Tunnel" kiln.[79]. These values are discrepant because of the lack of technology in the region, the indiscriminate use of the wood causing it surplus. Moreover, as the "Tunnel" kiln is constantly burning fuel in order to produce a small amount of ceramic pieces, this leads to a very low efficiency.
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:	**EF_{CO2}**
Data unit:	tCO2/TJ
Description:	CO2 Emission factor of residual fuel oil
Source of data to be used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. Last visit on: April 9th, 2009.
Value of Data applied for the purpose of calculating expected emission reductions:	77.4 tCO2/TJ
Description of measurement methods and procedures to be applied:	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas due to risks involving natural gas distribution.
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 will be kept for two years after the end of the crediting period or the last issuance of carbon credits income for this project activity, whichever occurs later.

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan shall be the owner of the companies. The project proponent 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.

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[79] *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).*

For this purpose, the authority for the registration, monitoring, measurements and reporting of both ceramics is: *Mr. Júlio César Lins Brites*.

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 and the different auditory will be responsible to carry the project premises.

With the carbon credits income, in order to complement the monitoring of the production of ceramic devices, equipments that will monitor each burning cycle of the ceramics' kilns through graphics of the temperature reached in the kilns versus time.

Carbono Social Serviços Ambientais LTDA. will also implement a report following the Social Carbon methodology, which was developed by *Instituto Ecológica* and focus on sustainable development and better social conditions for the communities where it is implemented. This Social Carbon Reports will be available at TZ1 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

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

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[80].

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.

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

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 Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity

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

Categories, which identifies different emission sources based on the type of biomass considered (described in the table 16).

Table 16. 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:

Elephant grass

In case of using elephant grass[81] 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 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[82] 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)[83]. 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

[81] *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.*

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

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

when it is dried, although its drying process is still a problem for the project proponents.

Wood from Afforestation

The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tonnes of biomass per hectare[84]. 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[85]. As a consequence, Brazil withholds the best productivity taxes (in m^3/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[86].

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 m^3[87] in 2007. It was considered that the specific gravity of the wood from afforestation is 0.51 tonnes/m^3 [88]. If utilized by the ceramics, the consumption of this kind of fuel would be around 68,000 m^3 per year[89], representing around 0.5% of the total of wood from afforestation produced in the region.

Sugar Cane Bagasse

A study made by *Universidade Estadual de Campinas* and *Universidade de São Paulo* (two of the most respected universities in Brazil) showed that in Brazil there are around three hundred sugar cane plants. Each plant produces around 1.5 million tons of cane yearly[90]. One ton of sugar cane produces about 140 kilograms of cane bagasse and finally 90% of this amount can be used to energy production.[91]

According to the table 17, the state of *Alagoas* presents a great amount of cane bagasse, i.e. the ceramics have enough availability of this kind of

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

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

[86] *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.*

[87] *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.*

[88] *-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-*

[89] *Considering that the ceramics would consume an average value of 41,760 m^3, or 34,577 tonnes per year of non-renewable native wood. Utilizing the specific gravity of the wood from afforestation, the consumption of this kind of fuel would be around 68,000 m^3 per year.*

[90] *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.*

[91] *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.*

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 by this project activity is around 516 tonnes per year, representing 0.01% of the total production of sugar cane bagasse.

Table 17. Production of Sugar Cane in the State of *Alagoas*[92].

Harvest	04/05	05/06	06/07	07/08
Production of Sugar Cane (in tonnes)	26,029,770	22,532,291	23,635,100	29,444,408
Sugar Cane Bagasse (in tonnes)	3,644,168	3,154,520	3,308,914	4,122,217

Sugar cane bagasse is also employed for cogeneration systems. However figure 9 presents the excess of energy in Brazil from sugar cane bagasse. Please observe that the State of *Alagoas* presents a large surplus of this biomass.

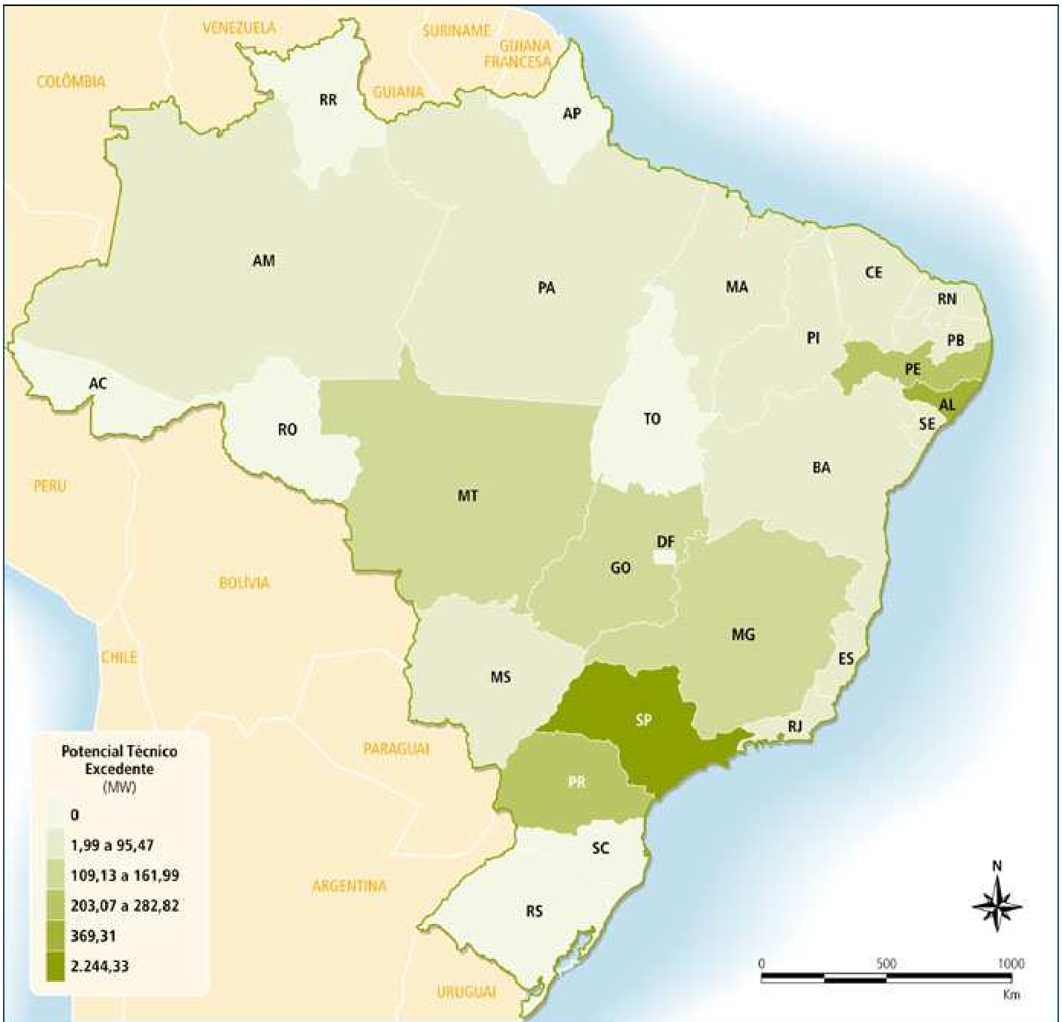

Figure 9. Sugar Cane Residue Potential for Energy Generation[93]

Woody residues (sawdust/wood chips)

[92] *Text adapted from: <http://www.unica.com.br/downloads/estatisticas/processcanabrasil.xls>. Last visit on: April 9th, 2009.*

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

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[94]. The production of wood in the state of *Bahia,* which is a bordering state in the northeast region of Brazil, was of 13,259,341 m^3[95] in 2007. Thus, the production of sawdust was around 2,917,055 m^3 per year. The consumption of this kind of fuel of this project activity is around 6,450 m^3 per year, i.e. the ceramic would utilize less than 0.25 % of the biomass availability in the region.

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.

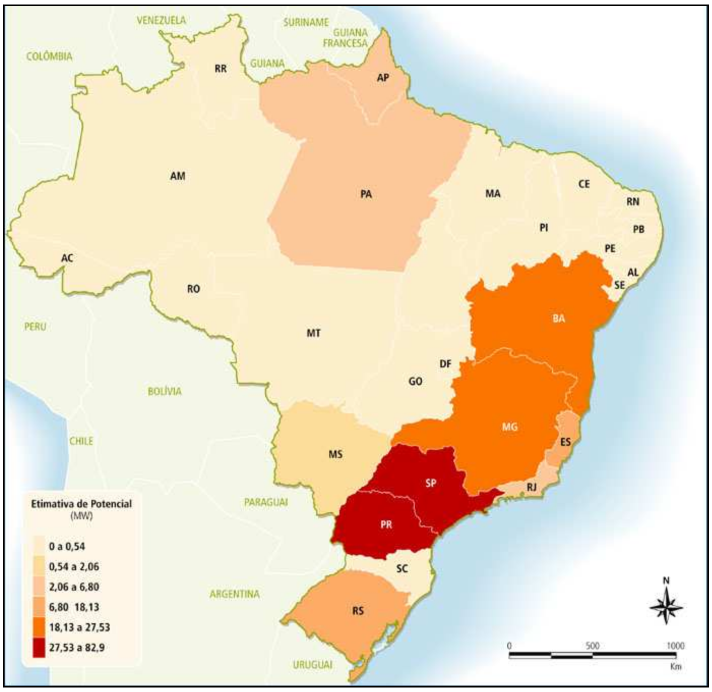

Figure 10. Forest Residues Potential for Energy Generation[96]

<u>Coconut Husk</u>

The coconut has diverse uses, which briefly is used 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[97]. The consumption of coconut husk by this project activity is about 5,581.2 tonnes of coconut husk per year, thus, it is responsible for the consumption of just 0.08% of 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.

<u>Bamboo</u>

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[94] *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.*

[95] *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.*

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

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

The bamboo is the faster growth plant in the world, and efficiently performs the functions of soil protection and carbon sequestration, and provides food and raw material for many applications. Furthermore, this plant is commonly utilized as quickset in rural properties, and its pruning is normally done in order to avoid the undesirable dispersion due to its invader characteristics. Unlike trees, which once cut do not grow again, the bamboo can be harvested without the destruction of the crop due to just the stem of the bamboo is utilized and the rhizome remains in the ground. When it is properly harvested and managed, the plantation continues full of younger individuals and it is difficult to realize that a harvest was done[98].

In the state of *Pernambuco*, which is a bordering state in the northeast region of the country, there is a bamboo crop of the specie *Bambusa vulgaris* with a total area of 16,000 ha[99]. The productivity of bamboo reaches 40 tonnes/ha/year[100]. Therefore, it is available 640,000 tonnes/year from this crop. This project activity utilizes around 12,980.4 tonnes/year of bamboo, representing around 2 % of the bamboo availability in the region.

This way, these renewable biomasses do not have potential to generate leakage emissions due to its 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 in *Bandeira* and *Capelli* Ceramics 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 *Alagoas*, and the result was that there are around 30 ceramic facilities in the state, nevertheless around 90% use native wood without sustainable management. Therefore, it can be concluded that the wood which was avoided by the present project activity is not being used by other ceramists.

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

[98] According to "Projeto Bambu". Available at: <http://a-ponte.org.br/index.php?pgn=prj_bambu.php>. Last visit on: March 16th, 2009.

*[99] MANHÃES, A. P. **Caracterização da Cadeia Produtiva do Bambu no Brasil: Abordagem Preliminar.** Instituto De Florestas Departamento De Silvicultura – UFRJ. Serópédica (RJ), 2008. Available at: <http://www.if.ufrrj.br/inst/monografia/2007II/Adriana%20Pellegrini%20Manhaes.pdf>. Last visit on: April 9th, 2009.*

*[100] KLINE, H. Uma fibra excepcional. **Revista O Papel**, 2005. Available at: <http://www.sitiovagalume.com/bambu/bambu-uma-fibra-excepcional/>. Last visit on: April 9th, 2009.*

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 current 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 ceramics will avoid the consumption of about 41,146 m³ per year of non-renewable wood helping the conservation of forests in *Caatinga* and *Atlantic Forest* 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 there is no transference of equipment, in spite of new equipments had to be acquired.

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

4.2 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.

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

Bandeira Ceramic

ERy, total = 23,478.4 tons of wood x 0.996 x 0.0171 TJ/ton x 77.4 tCO2/TJ

ERy, total = 30,950 tons of CO2e

Table 18. Emission reductions without considering the leakage

Year	***Bandeira* Total Baseline Emissions(tons of CO2e)**	***Capelli* Total Baseline Emissions (tons of CO2e)**
April to December - 2006	23,212	0
2007	30,950	0
2008	30,950	0
2009	30,950	0
2010	30,950	13,158
2011	30,950	13,158
2012	30,950	13,158
2013	30,950	13,158

2014	30,950	13,158
2015	30,950	13,158
January to March - 2016	7,737	3,289
Total Baseline Emissions (tons of CO2e)	**309,499**	**82,237**
Number of years of the crediting period	10	10
Annual average of estimated baseline emissions for the 10 years of crediting period (tons of CO2e)	**30,950**	**8,224**
Total Baseline Emissions (tons of CO2e)	**391,736**	

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 19. Estimation of overall emission reductions

Year	Baseline Emissions (tons of CO2e)	Leakage (tons of CO2e)	Emission Reductions (tons of CO2e)
April to December - 2006	23,212	0	23,212
2007	30,950	0	30,950
2008	30,950	0	30,950
2009	30,950	0	30,950
2010	44,108	0	44,108
2011	44,108	0	44,108
2012	44,108	0	44,108
2013	44,108	0	44,108
2014	44,108	0	44,108
2015	44,108	0	44,108
January to March - 2016	11,026	0	11,026

Total	**391,736**
Average	39,174

Table 20. Estimation of overall emission reductions

Year	***Bandeira* Total Emission Reduction (tons of CO2e)**	***Capelli* Total Emission Reduction (tons of CO2e)**	**Total Emission Reductions (tons of CO2e)**
April to December - 2006	23,212	0	23,212
2007	30,950	0	30,950
2008	30,950	0	30,950
2009	30,950	0	30,950
2010	30,950	13,158	44,108
2011	30,950	13,158	44,108
2012	30,950	13,158	44,108
2013	30,950	13,158	44,108
2014	30,950	13,158	44,108
2015	30,950	13,158	44,108
January to March - 2016	7,737	3,289	11,026
Total Emission Reductions (tons of CO2e)	**309,499**	**82,237**	**391,736**
Number of years of the crediting period	10	10	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tons of CO2e)	30,950	8,224	39,174
Total Emission Reductions (tons of CO2e)	**391,736**		

5 Environmental Impact:

As can be observed in table 21, 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 *Eucalyptus* reforestation next to the Ceramics.

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.

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 21. 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 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 sector national association (ANICER)[101] 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.

ANICER sent a letter stating their support to the present project activity[102].

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.

It was also received a letter from *Instituto Eco-Engenho* stating that *Bandeira* ceramic has consideration about the global warming and has been demonstrating environmental conscience since 2002, when it first established a partnership between the two companies. *Instituto Eco-Engenho* elaborated a study of technical and economical viability for implantation of a energetic woods for renewable biomass supply, studies and researches for utilization of biomasses residues (such as coconut husk, sawdust, sugar cane bagasse among others), and the recuperation of the old clay extraction areas.

[101] *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. More information is available at:< http://www.anicer.com.br>.*

[102] *The letter from ANICER 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.

Table 22. Ceramics' project start date

Ceramic	***Project Start Date***
Bandeira	January 2004
Capelli	July 2004

- Crediting period start date: 01/04/2006;
- Validation Report predicted to: July, 2009;
- First Verification Report predicted to July, 2009;
- VCS project crediting period: 10 years renewable;
- Monitoring and reporting frequency: preferentially from 6 to 12 months, since the beginning of the crediting period;
- Date of terminating the project: 31/03/2016.

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 each Ceramic of the 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 each Ceramic and available to consultation.

The responsible for the contract between both ceramics and *Carbono Social Serviços Ambientais* LTDA is the director of both ceramics: Mr. *Frederico Gondim C. de Albuquerque.*

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

Not applicable.