Voluntary Carbon Standard Project Description

19 November 2007

November 11th, 2009

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1 Description of Project:

1.1 Project title

Maguary Ceramic Fuel Switching Project

Version 06

PDD completed in: November 11^{th}, 2009

1.2 Type/Category of the project

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

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

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

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

The amount of emission reductions are greater than 5,000 tonnes of CO2 equivalent and less than 1,000,000 tonnes of CO_2 equivalent, thus classifying as a *project* under the VCS 2007.1 size groups (micro project, project, mega project). The estimates of emission reduction are available at the Table 1.

Table 1. Emission reductions estimate during the crediting period

Year	Emission Reductions (tCO_2e)
November - December 2008	1,946
2009	11,677
2010	11,677
2011	11,677
2012	11,677
2013	11,677
2014	11,677
2015	11,677
2016	11,677
2017	11,677
January - October 2018	9,731
Total Emission Reductions (tCO_2e)	**116,770**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO_2e)	11,677

1.4 A brief description of the project:

The project activity is the project of *Maguary* Ceramic, which is a red ceramic industry localized in *Nazaré da Mata* municipality, in the state of

Pernambuco, northeast of Brazil. The ceramic industry produces ceramic bricks destined mainly for the regional market in *Pernambuco*.

The fuel utilized in the baseline scenario to fire the ceramic units was native wood obtained through deforestation of the *Caatinga* biome, which is the pioneer practice in the region. This type of wood is considered a non-renewable biomass, as it is obtained from areas without reforestation activities or sustainable management activities.

The *Caatinga* biome is an exclusively Brazilian biome and occupies around 850,000 Km^2, equivalent to 10% of the territory of the country. Although rich in natural resources, the *Caatinga* biome is one of the most threatened ecosystems on the planet. Its high calorific value is a major cause of its decline. This region has few rivers, resulting in less potential for the generation of electric energy. Thus, native firewood and charcoal account for thirty percent of the total energy utilized in the industries of the region; intensifying the rate of local deforestation.[1]

The *Caatinga* biome has a strong propensity for desertification and its deforestation consequently increases this possibility. With the loss of natural vegetation, the exposed soil becomes more susceptible to erosion and degradation of the soil. These events are responsible for altering the system of rivers, which reduces the water supply to local communities and family farming.

This fuel switching project activity will reduce greenhouse gases (GHG) emissions by substituting native wood obtained through deforestation with renewable biomasses for the creation of thermal energy.

As renewable biomasses, *Maguary* Ceramic utilizes *Algaroba* wood,[2] sugar cane briquette[3], native wood from areas with sustainable forest management,[4] sawdust, and wood residues from constructions and industries. Any other biomasses might be used, once its renewable origin is verified. In the future, *Maguary* Ceramic could also utilize *Eucalyptus* wood, cashew tree pruning, glycerin, coconut husk, and elephant grass.

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[5].

This project introduced the possibility of switching non-renewable biomass for renewable biomasses in the generation thermal energy. Previously, this switch was unattractive due to high investment costs in upgrading machinery for working with biomasses, in addition to other barriers. This project became financially possible after the ceramic owner incorporated the potential income from the commercialization of the carbon credits.

The main goal of this project activity is to minimize the negative impacts of the deforestation of the *Caatinga* biome by encouraging the interested party to acquire the proper legal documents for the commercialization of the native firewood. In addition, the project activity will generate thermal

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

[2] *The* wood *from afforestation in the northeast region of Brazil is mainly consisted of Algaroba (Prosopis juliflora).*

[3] *The sugar cane has been cultivated in the state of Pernambuco for almost five centuries. Each ton of sugar cane used for alcohol production generates around 140 Kg of sugar cane bagasse, which can be either compacted into briquettes or utilized in natura for thermal energy generation. www.herbario.com.br/atual2005_4/cana_energia.htm*

4 This type of wood proceeds from areas with sustainable management, where its renewable origin can be verified through documents from the government – IBAMA (Brazilian Institute of Environment and Renewable Natural Resources, which is the Brazilian Ministry of the Environment's enforcement agency).

[5] *According to EMBRAPA (*Brazilian *Agricultural Research Corporation's). Source: <http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Last visit on: June 3rd, 2009.*

energy without stimulating deforestation by using the abundant renewable biomasses in the region.

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

The ceramic is located in the Municipality of *Nazaré da Mata,* in the state of *Pernambuco* which is indicated in Figure 1. The project site has the following postal address:

Granja Maguary, s/n, Bairro Paraíso

Nazaré da Mata – Pernambuco - Brasil

Postal Code: 55.800-000

Coordinates: 07º45'18" S; 35º14'08" W.

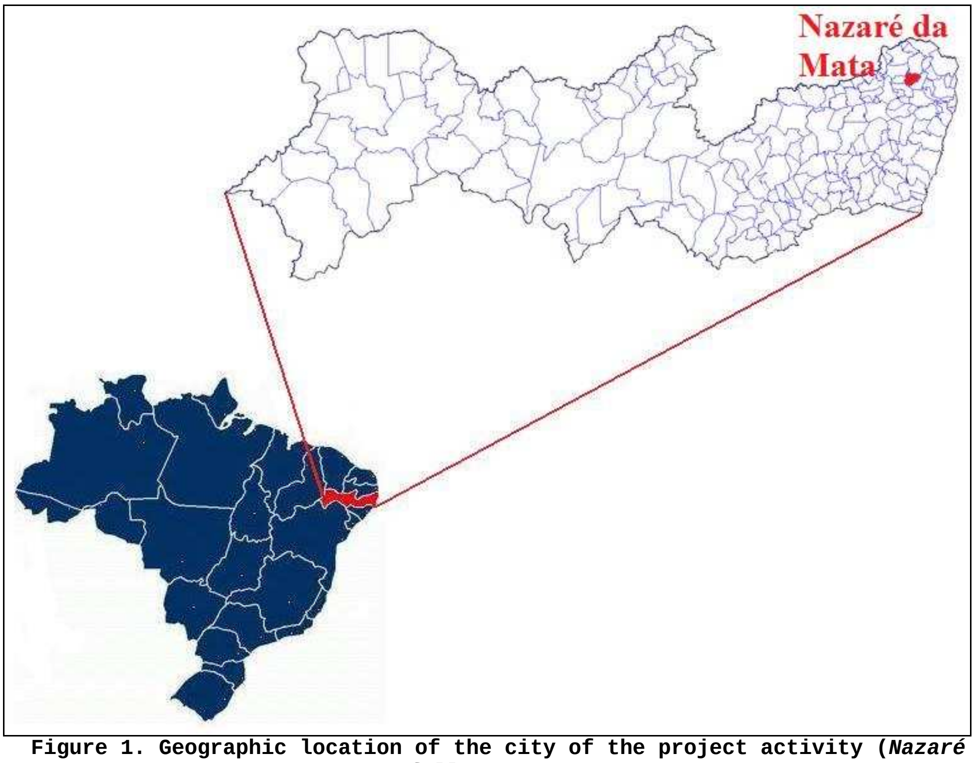

Figure 1. Geographic location of the city of the project activity (*Nazaré da Mata,* Pernambuco) that has the following coordinates: 07º44'31" S; 35º13'40" W.

1.6 Duration of the project activity/crediting period:

- Project start date[6]: October 14th, 2008;
- Project Crediting Period Start Date[7]: November 1st, 2008;

[6] *Date on which the ceramic acquired the mechanic burners, thus, evidencing alteration of the technology in order to support the fuel switch.*
The project activity started to utilize renewable biomasses together with non-renewable native wood before the project start date; however, before this date, the project was not in accordance with the methodology requirements, which require the alteration of technology in order to support the use of renewable biomasses.

[7] *Date on which the ceramic began to utilize constantly the mechanic burners, and only renewable biomasses, thus, when the ceramic ceased completely to utilize non-renewable wood. Therefore, this date defines when the emission reductions of this ceramic will start to be accounted.*

- Date of terminating the project activity[8]: October 31st, 2018;
- VCS project crediting period: 10 years, two times renewable.

1.7 Conditions prior to project initiation:

The use of native wood without sustainable management as fuel is a prevalent practice among ceramics industries in Brazil. Wood from deforestation is delivered and utilized in the ceramic facility, and this non-renewable biomass offered at 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 was used as a primary source of energy until the decade of 1970, when petroleum began to supply the majority of Brazilian´s energy needs.[9] Since the 1970s, Brazilian´s Energy and Mine Ministry has been monitoring all energetic sectors of Brazil, and their research indicates that firewood has been a significant source of thermal energy for ceramic sector.[10]

According to Seye (2003)[11], in Brazil, red ceramic goods are produced through inefficient and traditional processes, using wood without forest management to generate thermal energy. In this industry sector, the use of wood represents about 98% of the total fuel employed. Therefore, use of this fuel increases Brazilian deforestation rates.

The baseline identified for this project activity is the utilization of around 5,400 m³ of non-renewable native wood per year to provide thermal energy to ceramic kiln. The monthly production was around 1,560 tons of ceramic pieces. The production before the project activity was low because of market demand.

Due to market demand, the “Hoffman” kiln at *Maguary* Ceramic was reformed. The kiln capacity increased to 86 lines, increasing the monthly production to 2,600 tons of ceramic pieces.

The project activity intends to use *Algaroba* wood, native wood from sustainable management plan, sugar cane briquette, sawdust, and wood residues from constructions and industries for the supply of energy.

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

Emission reductions will be achieved by a cessation of the use of wood obtained from areas without sustainable forest management plans in the generation of thermal energy. As the combustion of native wood using deforestation methods was not offset by replanting, the use of renewable biomasses with this project does absorb carbon - resulting in a carbon neutral cycle.

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

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[8] Date on which the project activity completes 10 years after the crediting period start date.

*[9] 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.*

[10] 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.

*[11] 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.*

Maguary Ceramic produces ceramic bricks (Figure 2). The production process at *Maguary* Ceramic encompasses one "Hoffman" kiln[12] (Figure 3) in order to burn the fuel and cook the ceramic devices at 850ºC.

Figure 2. Ceramic devices (bricks) at *Maguary* Ceramic.

[12] Kind of kiln that is normally divided in chambers (or "lines"), all linked by a central gas collector. This type of kiln has parallel columns where the heat from one line is used in the next, therefore recycling the generated heat in the previous lines. The kiln is fuel fed from its top.

Figure 3. Ceramic devices placed at "Hoffman" kiln at *Maguary* Ceramic.

Before being cooked at the kilns, the goods must be dried. At *Maguary* Ceramic, the ceramic devices are dried naturally under a sun roof, in a period that usually lasts for 3 to 5 hours (Figure 4).

Figure 4. Devices drying naturally at *Maguary* Ceramic.

As stated before, there is one "Hoffman" kiln [13] at *Maguary* Ceramic. The "Hoffman" kiln has 86 lines, producing around 1,000,000 ceramic units monthly. Each brick weights 2.6 kg, thus, the production of the ceramic is about 2,600 tons of ceramic pieces. The average time required to complete a burning cycle in a single line of this kiln is 1 hour (0.3h warming, 0.4h burning, and 0.3h cooling). Table 2 shows the technical parameters of the "Hoffman" kiln utilized at *Maguary* ceramic.

Table 2. Technical parameters of the "Hoffman" kiln

Technical Parameters	"Hoffman" Kiln
Features	Continuous with rectangular shape and upper furnaces. There are 86 lines on the kiln, with three fuel entrances each
Maximum Temperature (°C)	850
Time of loading	15 minutes
Burning Cycle[14]	1 hour[15]

[13] *"Hoffman" kiln is a continuous kiln. Thus, the heating is made while the previous lines are cooling.*

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

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

Time of unloading	15 minutes
Average production per burning cycle (tons of ceramic pieces)[16]	3.56
Quantity of burning cycles per month	730
Average supposed capacity of the kiln (tons of ceramic pieces)	306.16

Maguary Ceramic acquired three mechanic burners to automatically inject biomass into the kilns. With the use of the mechanic burners, the contact with the kiln entrances by the employees will be minimized, contributing to preserve their health and safety. Moreover, *Maguary* Ceramic constructed other three mechanic burners for the same purpose.

It was also acquired a wood shredder, with the purpose of transforming the *Algaroba* wood into small pieces in order to be possible the entrance of the wood into the kiln.

Moreover, a shed was constructed in order to store and dry biomasses and consequently, improve their burning efficiency.

Currently, using *Algaroba* wood, native wood with sustainable management plan, sugar cane briquette, sawdust, and wood residues from constructions and industries, *Maguary* Ceramic produces 2,600 tons of pieces monthly.

The intent is to utilize around 62% of *Algaroba* wood, 14% of native wood with sustainable management plan, 10% sugar cane briquette, 2% of sawdust, and 13% of wood residues from constructions and industries (proportion in mass unity), as can be observed in table 3.

However, in the future, the proportion of these renewable biomasses may change.

Moreover, other biomasses can also be used if presenting a verified renewable origin, such as *Eucalyptus* wood, coconut husk, cashew tree pruning, elephant grass, and glycerin. 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.[17]

Table 3. Scenario of *Maguary* Ceramic

***Maguary* Ceramic**	
Current production (tons of ceramic pieces)	2,600
Algaroba wood	250.5 (tons/month)
Native wood with sustainable management plan	58.4 (tons/month)

[16] *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.*

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

Sugar cane briquette	39.5 (tons/month)
Sawdust	6.1 (tons/month)
Wood residues from constructions and industries	50.9 (tons/month)

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

Table 4. Main biomasses providers.

Biomass	Provider	Location
Algaroba wood	*Perazzo e Filhos LTDA*	*Afogados da Ingazeira - PE*
Native wood with sustainable management plan	*Oriosvaldo Barros Mangueira*	*Floresta - PE*
Sugar cane briquette	*Comercial Santo Amaro*	*Goiana - PE*
Sawdust	*Estaleiro Atlântico Sul*	*Ipojuca - PE*
Wood residues from constructions and industries	*Estaleiro Atlântico Sul*	*Ipojuca - PE*

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

This project is in accordance to the CONAMA[18] 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 State Agency of Environment and Water Resources of *Pernambuco* (CPRH[19]), which must run under the valid time.

The project is also in accordance to Federal Constitution, Article 20, which establishes the payment of Financial Compensation by the Mineral Resources

[18] *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*>.

[19] *CPRH is the State Agency of Environment and Water Resources of the State of Pernambuco responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: <http://www.cprh.pe.gov.br/>.*

Exploitation. This financial compensation is annually performed to DNPM (National Department of Mineral Production[20]).

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 types of renewable biomasses. Hence, it follows that the project approval will make the continued use of renewable biomasses feasible.

- Availability of the renewable biomasses

The current abundant amount of the biomasses available locally was already described herein, however if an unforeseeable reason affects the availability of the biomasses, the ceramic owner will search for other type of renewable biomasses, such as elephant grass.

- Closing of the ceramic business

If the ceramic company closes, it may substantially affect the project's GHG emission reductions, as other ceramic facilities would probably produce utilizing native wood obtained through deforestation. However, there are currently good perspectives in the ceramic market, and the organized administration verified at *Maguary* Ceramic avoid this possibility in short term.

- Difficulty related to the abrupt change

As affirmed before, the ceramic used wood in its kilns for many years. The sudden change demanded a lot of effort from each employee in the ceramic; the main challenges are the reconfiguration of internal logistics and the employees' resistance to the new situation.

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

Maguary Ceramic used to feed the kilns with native wood from deforestation activities to generate thermal energy in order to cook ceramic devices since the beginning of its operation in 1981.

Thus, *Maguary Ceramic's* previous production methods used native wood; clearly confirming that the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

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[20] 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: June 3rd, 2009.

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

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

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

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

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

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

Project Proponent

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

Industrial establishment: *Rosemberg de Andrade Vasconcelos ME.*

Fantasy name: *Maguary* Ceramic.

Mr. Wilder Germano de Albuquerque, Monitoring data responsible: General data, information on inputs and outputs of the ceramic, detailed information and numbers on sales, how output data is handled, and how data is stored and kept by the *Maguary's* office.

Mr. Rosemberg de Andrade Lima Vasconcelos, Director and Owner: Information and visit of the ceramic, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramic devices market challenges.

Other information on the project's proponent:

Address:

Granja Maguary, s/n, Bairro Paraíso

Nazaré da Mata – Pernambuco – Brasil

Phone: +55 81-3633 1326

Postal Code: 55.800-000

Coordinates: 07º45'18" S; 35º14'08" W

Project Developer

Carbono Social Serviços Ambientais LTDA.: Project developer, Project participant and Project idealizer.

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

Gabriel Fernandes de Toledo Piza and *Marcelo Hector Sabbagh Haddad*, Technical Analysts: Project Design Document writers, elaboration of GHGs Emissions' Inventory, direct contact between *Carbono Social Serviços*

Ambientais LTDA and the ceramic, and responsible for collecting the necessary information.

Coordinated by:

Rafael Ribeiro Borgheresi, Technical Coordinator.

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

Address:
R. Borges Lagoa, 1065 – Conj. 144 – Vila Clementino
Postal Code: 55.845-000
São Paulo – SP, *Brazil*

Phone number:
+55 11 2649-0036

Web site:
http://www.socialcarbon.com

Email:
gabriel@socialcarbon.com
marcelo@socialcarbon.com
rafael@socialcarbon.com

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

The project is eligible according to:

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

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

1.17 List of commercially sensitive information (if applicable):

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

2 VCS Methodology:

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

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

The amount of non-renewable biomass (B_y) will be determined according to the option "b" of the applied methodology once option "a" is designed for really small appliances like household stoves and does not fit for the kind of projects in question.

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

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

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

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

There are no similar registered small-scale CDM project activities in the region of *Nazaré da Mata,* once Social Carbon Company made a research and did not find any registered small–scale CDM Project activity in the region. The sources of registered small-scale CDM project activity consulted were the United Nations Framework Convention on Climate Change (UNFCCC) [21] and Brazilian's Technology and Science Ministry [22]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted 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 involves a decrease of carbon pools and increases the carbon emissions to the atmosphere. 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.

Furthermore, firewood has been used for many decades as fuel in Brazil[23]. Although it is impossible to define a start date on which this kind of non-renewable biomass began to be applied, there are many documents to prove that wood has been used for thermal energy generation before 1989 as requested in the applied methodology. Firewood used to be the most employed source of primary energy until de decade of 1970, when the petroleum started

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

[22] *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.Vitied on March 27th, 2009.*

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

to supply the majority of Brazilian's energy needs [24]. Moreover the Brazilian's Energy and Mine Ministry has been monitoring every energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector.[25] Especially in the ceramic sector, the use of firewood is visible non-renewable and unsustainable, involving negative environmental impacts associated.[26]

This way, it can be concluded that non-renewable biomass has been used since 31st December 1989.

The biomasses utilized in the project: *Algaroba* wood, native wood with sustainable management plan, sugar cane briquette, wood residues from constructions and industries, and sawdust are common in the region generated.

The possible biomasses that could be utilized in the project: *Eucalyptus* wood, cashew tree pruning, glycerin, elephant grass, and coconut husk are also common in the region generated.

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

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

The utilization of *Algaroba* (*Prosopis juliflora*) is in according with option IV since it is considered a biomass residue due its competitive characteristics. A research made by EMBRAPA[27], which encompass the States of *Pernambuco* and *Bahia*, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts[28]. This source stated that there were several centers of *Algaroba* operation highlighting the *San Francisco* Basin, which is comprised for many municipalities from the states of *Bahia* and *Pernambuco*, including this project region.

Furthermore, *Algaroba* is a very aggressive plant, and is able to invade natural habitats and to inhibit the regeneration of *Caatinga* species, thus reducing biodiversity of the biome. Although this tree has good properties to the *Caatinga* population, like production of fodder, flour, and human feed, *Algaroba* is very widespread through the region and its control is necessary to halt its dominance, and consequently, the pruning and cut of this tree is largely done throughout the *Caatinga*'s biome[29].

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[24] *BRITO, J. O.* ***Energetic use of Wood****. Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES>. Visited on March 27th, 2009.*

[25] *National Energy Balance- energy consuption per sector. Available at: http://www.mme.gov.br/download.do?attachmentId=16555&download. Visited on March 27th, 2009.*

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

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

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

[29] *According to: "Projeto vai definir manejo para evitar invasão da algaroba no ambiente semi-árido", from November 25th, 2004. This information was done by EMBRAPA.*

The native wood with sustainable forest management plan is considered renewable according to option I, as soon as it fits all the assumptions below:

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

(a) The land area remains a forest; and

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

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

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

The sustainable forest management plan can be organized into three stages: firstly, the division of the property in exploitable areas and areas of permanent preservation that are inaccessible to exploitation. The second stage is the planning of roads that connect the area with the primary roads. In the third stage, the allocated area is divided for exploration in blocks in order to sustain forest exploitation annually[30].

Furthermore, the minimum requirements of the management plan are defined by Article 19 of Brazilian Forest Code, and are regulated by Decree 5975/06[31].

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

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

Sugar cane bagasse is generated by industries to produce sugar and alcohol, and is compacted into briquettes in order to generate thermal energy. The wood residues from constructions and industries are resulted from construction and industries residues, which constitute a huge problem due to the deficiency of a correct destination for this wood. The sawdust is generated in the production of wood, which is utilized in several segments of industries and activities.

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

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

(a) The land area remains a forest; and

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

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

The *Eucalyptus* wood fits all the three options above since just wood from *Eucalyptus* plantation areas are utilized, i.e. the area remains a *Eucalyptus*

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

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

plantation with the use of the biomass. The area destined for afforestation in *Brazil* corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare [32]. Moreover, the afforestation supplies the society demands and avoids the pressure on the remnants of natural forests[33].

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[34].

The afforestation in Brazil is complied with the ABRAF[35], which represents, promotes and defends the collective interests of the forestry companies that engage in sustainable development based on planted forests.

Coconut husk and glycerin are industries residues coming from large scale reforestation or agro industrial projects, so it is considered renewable according to option V of methodology definition of renewable biomass:

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

The coconut husk is widely generated due to the utilization of the coconut fruit for several finalities. The glycerin is a waste generated during a stage production of biodiesel.

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

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

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

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

Residues from cashew trees also fits all the three options above since just residues from the croplands area would be utilized, i.e. the area remains a cropland with the use of the biomass. Moreover, the areas where the cashew trees fallows sustainable management practices, according to its cultivation and harvest techniques, where the pruning of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest period [36]. This way, in cashew cultivation must be cut undesirable branches of the cashew trees.

Besides, Brazilian’s production presents the tendency of increasing so far, carried by the new technologies utilized and the higher national and

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

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

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

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

[36] *According with “Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural” Available at: <http://www.cepel.br/~per/download/rer/rt-789-00.pdf>. Last visit on:May 4th, 2009.*

international demand of cashew nuts[37]. This way, the Brazilian sources of residues from cashew trees will increase following the Brazilian production, due the fact that cashew cultivation requests it.

The elephant grass is considered renewable according to option III, as soon as it fits 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.

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

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

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

In the baseline scenario, there is use of non-renewable biomass to burn ceramic devices in the ceramic's kilns. This practice is responsible to discharge in the atmosphere the carbon that was stored inside of the wood (commonly known as a carbon sink). Gases included in the project boundaries are described at Table 5.

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

	Gas	Source	Included?	Justification/ Explanation
Baseline	CO_2	Emission from the combustion of non-renewable fuel	Yes	The major source of emissions in the baseline
	CH_4	-	No	Renewable biomasses could be left to decay. Excluded for simplification.

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

[38] *According to EMBRAPA* (Brazilian *Agricultural Research Corporation's). Source: <http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Last visit on: June 3rd, 2009.*

				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. Fuel employed at the ceramic sector in Brazil and its proportion is shown at Table 6.

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

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

Piped gas	0%	0%	0%
Electricity	8%	8%	7%
Others non specified	0%	0%	0%

(Brazilian Energy Balance, Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download>)

The most probable 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 14 BRL/tonne[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 0.0000056 BRL/Kcal utilizing the Net Calorific Value and the specific gravity of both fuels. 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.

Another plausible baseline scenario would be the use of Natural Gas. Although there is distribution/gas pipe in the region,[41] the inconstant distribution of natural gas made the project proponents not to trust in this fuel, as 40% of the natural gas consumed in *Brazil* proceeds from *Bolivia,*[42] therefore excluding this possibility.

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

Before the project activity, the Ceramic's monthly production was about 1,560 tons of ceramic pieces per month, using about 450 m^3 (or 396 tons) of native firewood per month in the process of cooking and burning of the ceramic devices in order to sustain that production.

The efficiency of the kiln is around 0.2538 tons of wood per tons of blocks produced, which is more efficient than average for the "Hoffman" kiln.[43]

This value was not expected, because of the lack of technology in the region, and the indiscriminate use of the native wood without sustainable forest management.

If afterwards, the production in the ceramics rises, it will be reported in the monitoring report. *Maguary* Ceramic baseline scenario is shown at Table 7.

[39] *According to data values and facts from "Estudo Comparativo da Queima de Óleo BPF e de Lenha em Caldeiras". Available at: <http://www.abcm.org.br/xi_creem/resumos/TE/CRE04-TE01.pdf>. Last visit on: June 3rd, 2009.*

[40] *Average value of non-renewable wood at Maguary Ceramic.*

[41] *Source: <http://www.ctgas.com.br/template02.asp?parametro=2547>. Last visit on: June 3rd, 2009.*

[42] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Last visit on: June 3rd, 2009.*

[43] *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).*

Table 7. General description of the ceramic before the project activity

	Maguary
Production at baseline (tons of ceramic pieces per year)	18,720
Non-renewable wood consumption at baseline (m³ per year)	5,400

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.

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

According to ASPAN,[44] the major industries, mainly the steel, plasterer and ceramic industries are primarily responsible for the use of native firewood as fuel in their productions. Of a total of 850,000 km², currently it is remaining 50% of the local biome, even with 365,000 hectare of annual loss of all the biome.[45]

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

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

Step 2: Implementation Barriers

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

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[44] *Source: Association for the nature defense of Pernambuco. http://www.aspan.org.br/ Brazilian Institute of Environment and Renewable Natural Resources*

[45] *http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47*

- **Technological Barrier**

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

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

The operators did not have knowledge of the ideal amount of renewable biomass that was necessary to achieve the temperature of about 850ºC for its ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using native wood. As a consequence of this barrier, there were variations in the color of the final ceramic devices, affecting the quality of the products; cracks on the ceramic devices; the explosion of some of them and cracks along the kilns; adding a significant amount of insecurity in production process.

Furthermore, it was acquired three mechanic burners in order to automatically inject biomasses and air into the kilns. The employees must be careful not to fill the burners with large amounts of biomass, which can clog the mechanic burners and consequently, cause disorder in the burning process. That was one of the causes of the production losses throughout the adaptation period. So, the mechanic burner's feeding has to be gradually done, demanding even more time and labor from the employees.

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

Furthermore, a lack of infrastructure to utilize the new technology was verified. The northeast region of Brazil is well known for not being updated with new technologies in the Ceramic sector and very resistant to changes or improvements to its work process and general practices. This way, a set of adaptations were necessary, such as adjustments in the kiln entrances to embed mechanic burners and the construction of a shed to store and dry biomasses and consequently, improve their burning efficiency.

These fuels generate a great amount of energy, but are rarely employed by the ceramic industries. Its use means a revolutionary adaptation by *Maguary* Ceramic*,* indicating a huge technological barrier.

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

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

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

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

- **Financial barrier**

With the project implementation, the ceramic company had to withstand higher costs than if it had continued utilizing native wood as fuel. The most important additional costs are related to biomass transportation.

Furthermore, there are spending with the equipment maintenance, so the mechanic burners can operate. Besides, due to the implementation of the project activity, the ceramic had to purchase three mechanic burners to automatically inject the biomass in the kilns, once when using wood, the fuel was manually inserted by operators in the kilns, a procedure which is unfeasible when using sawdust.

When the new production techniques have been introduced in the ceramic plant, an adaptation period and a testing period were necessary. For the adaptation of the kiln, a still period of a burning cycle for kiln had to be considered. Also, a testing period of approximately three months was required in order to identify the correct burning curve; thus, it led to a waste of a considerable amount of biomass (average 25%) in each burning cycle. All these adaptations resulted in losses at the financial profit and economical balance of the company.

Due to all the above mentioned, the ceramic industry had to deal with higher production costs. That made the ceramic responsible to think about stopping the fuel switching project. The costs related to the baseline and project activity are described at Table 8.

Table 8. Main Costs before and after the project activity

<table>
<tr><th>Scenario</th><th colspan="2">Non-renewable wood</th><th colspan="6">Renewable Biomass</th></tr>
<tr><td>Production</td><td>2,600</td><td>tons of pieces/month</td><td colspan="5">2,600</td><td>tons of pieces/month</td></tr>
<tr><td rowspan="2">Monthly consumption of the fuel</td><td rowspan="2">750</td><td rowspan="2">m^3/month</td><td>*Algaroba* wood</td><td>Native wood with sustainable management plan</td><td>Sugar cane briquette</td><td>Sawdust</td><td>Wood residues</td><td>Biomass</td></tr>
<tr><td>329.6</td><td>66.4</td><td>39.5</td><td>6.1</td><td>50.9</td><td>m^3 or tons/month</td></tr>
<tr><td>Cost per m^3</td><td>22.00</td><td>BRL/m^3</td><td>35.00</td><td>35.00</td><td>230.00</td><td>170.00</td><td>25.00</td><td>BRL/m^3 or tons</td></tr>
<tr><td rowspan="2">Total Fuel Costs</td><td rowspan="2">16,500.00</td><td rowspan="2">BRL/month</td><td>11,536.18</td><td>2,322.73</td><td>9,085.00</td><td>1,037.00</td><td>1,272.50</td><td rowspan="2">BRL/month</td></tr>
<tr><td colspan="5">25,253.41</td></tr>
<tr><td>Energy consumption</td><td>1,776.00</td><td>kWh</td><td colspan="5">11,089.00</td><td>kWh</td></tr>
<tr><td>Energy cost</td><td>726.77</td><td>BRL</td><td colspan="5">4,537.84</td><td>BRL</td></tr>
<tr><td>**Total Costs**</td><td>**17,226.77**</td><td>**BRL**</td><td colspan="5">**29,791.25**</td><td>**BRL**</td></tr>
<tr><td>**Cost per ton of ceramic pieces**</td><td>**6.62568**</td><td>**BRL/ton of ceramic pieces**</td><td colspan="5">**11.45817**</td><td>**BRL/ton of ceramic pieces**</td></tr>
</table>

With the project activity's implementation, the total spending has increased, as can be verified at the table above. The income from the commercialization of the carbon credits is essential to maintain the fuel switch, as this change needs more resources than previously to maintain operations. This disparity obviously puts the ceramic in a less competitive situation, which would make the fuel switching and the continued use of the needed machinery unfeasible without the existence of the carbon markets.

- **Institutional barriers**

Since the kilns were adapted to burn the new biomass, and there was a lack of qualified labor to manage these new equipments, it was necessary to submit some workers to training and capacitating courses.

These arrangements require the ceramic employees to have or get specific expertise and knowledge where such experience is lacking. Because of this, promoting the new arrangement involves a significant institutional barrier.

- **Risks of the project**

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

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

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

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

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

Step 3: Common Practice

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

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

The product of the project activity is ceramic bricks.

2. Identify possible types of baseline candidates.

Observing Table 9, 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 9. 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[46] from Mines and Energy Ministry of Brazil is the most representative and reliable source of information about the ceramic sector and its fuel employed. Furthermore, there was no local data regarding to the ceramic sector and its energy source in the State of *Pernambuco*. Therefore, data from table above were provided by a reliable source and it was considered 3 years of its historical data, including the most recent available data and the period when *Maguary* Ceramic did its fuel switch.

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

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

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

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

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

There are legal requirements constraints regarding the use of non-renewable biomass as exposed in Decree N. 5,975 of November 30th, 2006.

[46] *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.*

However, it is not enforced namely due to the lack of control[47]. The consumption of non-renewable biomass by ceramic industry was related by several authors (NERI, 2003[48]; ALBUQUERQUE *et al*, 2006[49]; BRASIL, 2001[50]; VIANA, 2006[51]; CARDOSO, 2008[52]). This is also observed in other industries as in the production of steel (BRASIL, 2005[53]), which has a much better structure and internal organization when compared with ceramic industries that are generally small and familiar enterprises. BRASIL (2001) suggests that it is important to stimulate the miner sector, especially who are respecting the environment. The incomes from carbon credits can be this incentive which would contribute to avoid the consumption of non-renewable biomass illegally. Therefore laws and regulations will not be considered as criteria to excluded baseline candidates and to constraint the geographical area and temporal range of the final list of the baseline candidates.

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

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

Table 9 provides the percentage of the level of penetration of each fuel employed in the ceramic sector during the average of the three last years available (2005, 2006 and 2007). Baseline candidates are the use of:

a) **Wood:** The fuel most employed, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006.[54]

b) **Natural gas:** The Brazilian Energy Balance results showed significant percentage of natural gas consumption especially due to the production of ceramic tiles (used to finish floor or wall). Furthermore, in the case of structural ceramic, the use of natural gas is restricted by the absence of pipes, and its high costs.[55] The risk of lack of offering and higher

[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.*

[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.*

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

[54] *Source: IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Visited on March 27th, 2009.*

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

costs when compared with other fuels 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 can be a more probable of substitute of wood than natural gas. The risks involving natural gas distribution are so considerable that PETROBRÁS[56] was offering subsidy to the consumption of fuel oil in spite of natural gas in the State of *São Paulo*. However, in the baseline scenario, the use of fuel oil is not feasible due to the high costs associated to atomization system required to its burn, which demands frequent maintenance.[57]

d) **Renewable biomass:** despite the high biomass availability, the main problems concerning the use of renewable biomass are related to the high investments, technological and institutional barrier, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries.[58]

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

In Brazil, the red ceramic devices are produced through an inefficient and traditional process using wood without forest management to generate thermal energy technologies.[59] 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.[60] 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 in the ceramic sector,[61] which seemed inexhaustible, due to the amount generated in the expansion of the agriculture frontier bringing forward environmental impacts, with regard to the degradation of soil, change in the regime of rainfall and consequent desertification.

The ceramic industry sector has practically not evolved compared to the past, mainly due to the simplified techniques of manufacture. Moreover, the major equipments (chiefly kilns) of the production process were not improved significantly. Most of these companies still use non-renewable wood in their kilns and the drying process occurs naturally, without the utilization of energy. On the other hand, the influence of the market by improvements in this sector is very insignificant.[62]

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[56] *PETROBRÁS performs oil and oil byproduct 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>. Visited on March 27th, 2009.*

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

[58] *The use of renewable biomass was not included in table 8 which shows the fuel most employed in the ceramic sector according to Brazilian Energy Balance.*

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

[60] *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.*

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

[62] *PAULETTI, M. C.* ***Procedimento para Introdução de Nova Tecnologia em Agrupamentos de Micro e Pequenas Empresas: Estudo de Caso das indústrias de Cerâmica Vermelha no Vale do Rio Tijucas.*** *2001. Available at:*

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 ceramic owner since the baseline practice was already established and well-known by the laborers. The operators did not have the knowledge of the ideal amount of renewable biomass that is necessary to use in order to achieve the temperature of about 700ºC to cook its ceramic pieces, to acquire the final product with the same quality and to maintain the optimal process as they did when using the wood. As a result of the fuel switch, an extensive training course was required for the staff in order to clarify new measures linked to the machinery in order to sustain the quality of the final product.

Therefore, the project activity is not a common practice.

Impact of projects approval

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

Brazil is the third major contributor[63] 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[64] – 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 around 850,000 Km^2, equivalent to 10% of the territory of the country. 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.[65] 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.[66]

According to ASPAN,[67] 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.

<http://biblioteca.universia.net/html_bura/ficha/params/id/597230.html>. Visited on March 27th, 2009.

[63] *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.*

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

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

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

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

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 *Caatinga* biome is the fourth largest Brazilian biome. It is located in the northeast portion of Brazil and can be observed in table 10. The flora and fauna of this biome is rich once it shares frontiers with the main Brazilian biomes to its west with *Amazonian*, to the southwest with *Cerrado*, and to the southeast with *Mata Atlântica*. In spite of the size and importance of this biome, the *Caatinga* is an endangered habitat.

Table 10. Brazilian biomes in decreasing order of importance.

Brazilian Biomes	Approximate Area (km²)	Area of the biome / Total Brazilian Area (%)
Amazonian biome	4,196,943	49.29
Cerrado biome	2,036,448	23.92
Mata Atlântica biome	1,110,182	13.04
Caatinga biome	844,453	9.92
Pampa biome	176,496	2.07
Pantanal biome	150,355	1.76
Total Brazilian Area	**8,514,877**	**100**

(Source: IBGE – Brazilian Institute of Geography and Statistic[68])

Another relevant issue is how fast deforestation occurs in the *Caatinga* biome, representing 365,000 ha/year.[69]

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.

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.

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

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

3 Monitoring:

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

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

This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The project's emissions from the combustion of native wood are accounted in the same way as fossil fuel combustion, once it is not renewable and emits CO_2.

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

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

The monitoring will be done with the aim of determining the most approximate quantity of non-renewable wood that, in the absence of the project, would be used in the ceramic' kilns and consequently, the amount of GHG that would be emitted in tonnes of CO_2e. Table 11 shows the frequency of the monitoring of each parameter.

Table 11. 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	Tonnes	Controlled by the ceramic owner	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tonnes or m^3	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	CO2 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/m^3	Bibliography	Not monitored
***f*NRB,y**	Fraction of biomass (wood)	Percentage	Bibliography	Annually

	used in the 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 'b' of the applied methodology, i.e. it will be calculated from the thermal energy generated in the project activity as:

$$B_y = \frac{HG_{p,y}}{\eta_{old} \times NCV_{biomass}}$$

The responsible to monitor data provided in table 11 will be Mr. *Wilder Germano de Albuquerque.* Internal audit will guarantee data quality.

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

Monitored Parameters

Data / Parameter:	$Q_{renbiomass}$
Data unit:	tons per month
Description:	Amount of renewable biomass employed
Source of data to be used:	Measured by the ceramic owner
Value of data	The ceramic owner will preferentially employ *Algaroba* wood, native wood with sustainable management plan, sugar cane briquette, sawdust, and wood residues from constructions and industries on its burning process, as can be verified in the table below.
Description of measurement methods and procedures to be applied:	The amount of renewable biomass will be monitored in accordance to the weight described in the receipts or invoices from the providers. It will be utilized the Specific Gravity in order to convert from m³ to ton. The data to be applied are:

Biomass	***Algaroba* wood**	**Native wood with sustainable management plan**	**Sugar cane briquette**	**Sawdust**	**Wood residues from constructions and industries**
$Q_{renbiomass}$	250.5	58.4	39.5	6.1	50.9

<table>
<tr><td></td><td>

Biomass	*Algaroba* wood	Native wood with sustainable management plan	Sugar cane briquette	Sawdust	Wood residues from constructions and industries
Specific Gravity (ton/m³)	0.76	0.88	-	-	-

Source:

Algaroba Wood

According to:
PEREIRA J. C. D., LIMA P. C. F. "Comparação da Qualidade da Madeira de Seis Espécies de Algarobeira para a Produção de Energia." Bol. Pesq. Fl., Colombo, n. 45, jul/dez. 2002 p. 99-108.
Available at:
http://www.cnpf.embrapa.br/publica/boletim/boletarqv/bolet45/pag-99_106.pdf. Last visit on August 5th, 2009.

Native wood with sustainable management plan

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.

PODER CALORÍFICO DA MADEIRA E DE RESÍDUOS LIGNOCELULÓSICOS. Available in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf. Available at: Augut 10th, 2009.

http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139. Available at: August 10th, 2009.

Orientácion del IPCC sobre las buenas prácticas par UTCUTS - chapter3 - Table 3A.1.9-2

Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir . Available in:http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf

Sugar cane briquette, sawdust, and wood residues from constructions and industries

The amount of these biomasses that arrive at the ceramic industries is described in tons.
</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The ceramic has spreadsheets of the quantity of biomass acquired. It will be rechecked according to the receipts of purchase.</td></tr>
<tr><td>Any comment:</td><td>Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.</td></tr>
</table>

Data / Parameter:	**PRy**

Data unit:	Tons of ceramic devices produced per month
Description:	Production of ceramic devices
Source of data to be used:	Controlled by the ceramic owner
Value of data	Approximately 2,600
Description of measurement methods and procedures to be applied:	The amount was acquired by counting the total production of one year. The measurement will be done by an internal control sheet monitored by the ceramic owner, which will be fed daily. As stated by the ceramic, each device weights 2.6 kg. The production is a representative sample to ensure that all appliances are still in operation.
QA/QC procedures to be applied:	The ceramic has an internal control of the quantity of pieces produced. It will be rechecked according to the biomass utilized and the kiln consumption of renewable biomass.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Origin of Renewable Biomass**
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data to be used:	Controlled by the ceramic owner
Value of data	Renewable biomass
Description of measurement methods and procedures to be applied:	This information will be given by the biomasses providers. The guarantee of acquiring renewable biomass will be achieved by invoices from the providers. As stated in the section 2.2, the biomasses (*Algaroba* wood, native wood with sustainable management plan, sugar cane briquette, sawdust, and wood residues from constructions and industries) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied :	The biomasses will be considered as renewable if they are according to the definition given by the methodology applied. Furthermore, documents proving the origin of renewable biomasses from forested resources will be provided.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Leakage of non-renewable biomass**
Data unit:	tCO_2e
Description:	Leakage resulted from the non-renewable biomass
Source of data to be used:	Monitored
Value of data	0
Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in methodology applied will be monitored. Scientific articles, official statistical data, regional and national surveys will be provided in order to ensure that there is no leakage from non-renewable biomass (or to estimate the leakage).
QA/QC procedures to be applied :	Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.

Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

<table>
<tr><td>Data / Parameter:</td><td>Renewable biomass surplus</td></tr>
<tr><td>Data unit:</td><td>ton or m^3</td></tr>
<tr><td>Description:</td><td>Amount of renewable biomass available</td></tr>
<tr><td>Source of data to be used:</td><td>Monitored</td></tr>
<tr><td>Value of data</td><td>
<table>
<tr><th>Biomass</th><th>Surplus</th><th>Year</th></tr>
<tr><td>Algaroba wood (m^3)</td><td>2,500,000</td><td>2007</td></tr>
<tr><td>Native wood with sustainable management plan (m^3)</td><td>519,558</td><td>2007</td></tr>
<tr><td>Sugar cane briquette (tons)</td><td>2,209,479</td><td>2007</td></tr>
<tr><td>Sawdust/woodchips (m^3)</td><td>319,890</td><td>2007</td></tr>
<tr><td>Wood residues from constructions and industries (m^3)</td><td>749,839</td><td>2006</td></tr>
<tr><td>Cashew tree pruning (tons)</td><td>82,875</td><td>2007</td></tr>
<tr><td>Coconut husk (tons)</td><td>6,700,000</td><td>2006</td></tr>
<tr><td>Eucalyptus wood in m^3</td><td>13,259,341</td><td>2007</td></tr>
<tr><td>Glycerin in m^3</td><td>129,370</td><td>2008</td></tr>
<tr><td>Elephant Grass</td><td>Not measured</td><td>-</td></tr>
</table>
Detailed information in section 4.1 – LEAKAGE</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>It will be used to calculate the leakage of renewable biomass.
The sources of leakages predicted in methodology applied will be monitored. The measurement of the leakage will be based in national and international articles and databases every monitoring period. These sources will provide information about the biomass availability in the project activity’s region.</td></tr>
<tr><td>QA/QC procedures to be applied :</td><td>Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.</td></tr>
<tr><td>Any comment:</td><td>Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.</td></tr>
</table>

Data / Parameter:	***f*NRB,y**
Data unit:	Fraction of biomass or (percentage).
Description:	Fraction of biomass (wood) used in the absence of the

	project activity in year y established as non-renewable biomass using survey methods. It was also discounted the amount of wood saved by similar projects in the same biome.
Source of data used:	Survey methods
Value of applied:	0.9940 or 99.40%
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 is from non-renewable origin. However, according to Klink (2005)[70], the *Caatinga* Biome has only 0.11% of its total area with sustainable use. Furthermore, considering that 0.425% of this biome has been saved by other project activities, thus, 99.4% is considered as a fraction of non-renewable biomass.
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. The wood that was 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 utilized in order to estimate the amount of non-renewable biomass. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Fixed Parameters

Data / Parameter:	$\mathbf{EF}_{\mathbf{projected\ fossil\ fuel}}$
Data unit:	tCO_2/TJ
Description:	CO2 Emission factor of residual fuel oil
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. Last visit on June 3rd, 2009.
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas due to risks involving natural gas distribution.
Any comment:	Applicable for stationary combustion in the manufacturing

[70] *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.*

	industries and construction. The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/Ton of wood
Description:	Net Calorific Value
Source of data used:	Brazilian study carried out with *Caatinga* wood: 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. EMBRAPA, Comunicado Técnico: Características Físico-Mecânicas e Energéticas de Madeira do Trópico Semi-Árido do Nordeste do Brasil. Nº63, mar/96, p.1-12.
Value applied:	0.01917
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value will provide the energy generated by the amount of wood that would be used in the absence of the project. Available at: PODER CALORÍFICO DA MADEIRA E DE RESÍDUOS LIGNOCELULÓSICOS. Available in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf. Available at: Augut 10th, 2009. Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir . Available at: http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf. Last visit on August 10th, 2009.
Any comment:	The species used to calculate the average value are typical trees of *Caatinga* Biome that are usually employed as fuel in the ceramic industries of the region. IPCC default values shall be used only when country or project specific data are not available or difficult to obtain, according to "Guidance on IPCC default values" (Extract of the report of the twenty-fifth meeting of the Executive Board, paragraph 59). Data 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:	$\rho_{biomass}$
Data unit:	ton/ m^3
Description:	Specific gravity
Source of data used:	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. PODER CALORÍFICO DA MADEIRA E DE RESÍDUOS LIGNOCELULÓSICOS. Available in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf. Available at: Augut 10th, 2009. http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139. Available at: August 10th, 2009. Orientácion del IPCC sobre las buenas prácticas par

	UTCUTS - chapter3 - Table 3A.1.9-2 Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir . Available in:http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf
Value applied:	0.8800
Justification of the choice of data or description of measurement methods and procedures actually applied :	The amount of wood used in the baseline was measured by volume units, so this data is used to the unity conversion.
Any comment:	The species used to calculate the average value are typical trees of *Caatinga* Biome that are usually employed as fuel in the ceramic industries of the region. 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 tons of devices produced.
Description:	Consumption of non renewable biomass per tons of ceramic devices produced in year y
Source of data used:	Historical data from ceramic owner
Value of data	0.2538
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramic used to consume non-sustainable wood. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns. It was considered that each device weights 2.6 kg. If nowadays the plant still used native firewood, its consumption would be around 660 tons of native firewood (or 750 m^3) per month to produce 2,600 tons of ceramic blocks. The value is utilized to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

3.4 Description of the monitoring plan

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

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

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

Social Carbon Company will also implement the sustainability report following the Social Carbon methodology, which was developed by *Instituto Ecológica* and focus in implementing the environmental and social activities within the fuel switching project. Social Carbon follows the Social Carbon Guidelines available at: <http://www.socialcarbon.org/Guidelines/>.

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

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The project's emissions from the combustion of native wood are accounted in the same way as fossil fuel combustion, once it is not renewable and emits CO_2.

<u>Baseline</u>

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

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.[71]

B_y is determined using the following option:

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

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

Where:

$HG_{p,y}$: Quantity of thermal energy generated by the renewable energy in the project in year y in TJ.

η_{old}: Efficiency of the system being replaced

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

Where:

SGE: Specific energy which has to be generated in the process to produce a certain amount of ceramic devices in TJ/thousand of ceramic device.

PR_y: Amount of product produced in year y in thousand of ceramic devices

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

Where:

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

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

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

Where:

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

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

$$B_y = PR_y \times BF_y$$ (Equation 06)

As shown in the calculations above, the η_{old} is not required to calculate the Emission Reductions, thus it was excluded.

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 Categories, which identifies different emission sources based on the type of biomass considered (described in the table 12).

Table 12. Sources of leakage according to the type of the biomass

Biomass Type	Activity/Source	Shift of pre project activities	Emissions from biomass generation / cultivation	Competing use of biomass
Biomass from forests	Existing forests	-	-	X
	New forests	X	X	-
Biomass from croplands or grasslands (woody or non-woody)	In the absence of the project the land would be used as a cropland/wetland	X	X	-
	In the absence of the project the land will be abandoned	-	X	-

Biomass residues or waste	Biomass residues or wastes are collected and use.	-	-	X

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

Native wood with sustainable forest management plan

The sustainable forest management plan can be organized into three stages: firstly, the division of the property in exploitable areas and areas of permanent preservation that are inaccessible to exploitation. The second stage is the planning of roads that connect the area with the primary roads. In the third stage, the allocated area is divided for exploration in blocks in order to sustain forest exploitation annually.[72]

Afterwards, a technical responsible elaborates the next stages: forest inventory, estimation of growth, the best intervention techniques, fixes the arrangement of exploration and the silvicultural treatment. An annual technical report of the sustainable forest management area is elaborated and it is necessary a yearly authorization of the environmental agency of the state to keep the activities. Furthermore, the minimum requirements of the management plan are defined by Articles 19, 20 and 21 of Brazilian Forest Code, and are regulated by Decree 5975/06.[73]

The total area properly regularized with sustainable forest management plan in the *Caatinga* biome corresponds to 94,287 hectares. There are around 189 sustainable forest management plans operating in this biome[74].

Considering that around 5.7% of a sustainable forest management plan can be explored per year (exploration in blocks in order to sustain forest exploitation annually)[75], the area available for exploration is around 5,374 ha per year in *Caatinga* biome. In addition, it was considered the productivity of wood in *Caatinga* biome as 96.68 m^3/ha[76].

Therefore, the production of wood with sustainable forest management plan in *Caatinga* biome was around 519,558 m^3 in 2007.

Maguary Ceramic utilizes around 796 m^3 of native wood with sustainable management plan per year, i.e. its consumption corresponds to less than 1% of the biomass availability. This way, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

The sustainable forest management promotes the conservation of biodiversity, conservation of soil and water regime, which are essential practices to

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

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

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

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

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

combat the desertification. Moreover, there is an increment at the opportunity of employment for the rural population due to the sustainable exploration of plants destined for fruits, apiculture, medicinal, oil, ornamental and fiber production purposes.[77]

Sugar Cane Briquette

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.[78] One ton of sugar cane produces about 140 kilograms of cane bagasse and finally 90% of this amount can be used to energy production, either in its natural state or compacted into briquettes.[79]

According to the table 13, the state of Pernambuco presents a great amount of sugar cane bagasse, i.e. the ceramics have enough availability of this kind of biomass, what avoid the possibility of leakage generation in case of the sugar cane utilization as fuel source.

Table 13. Production of Sugar Cane in the State of Pernambuco

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

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

Sugar cane bagasse is also employed for cogeneration systems. However, figure 5 presents the excess of energy in Brazil from sugar cane bagasse. Please observe that the State of Pernambuco (PE) presents a large surplus of this biomass.

Pernambuco state is marked by the monoculture of sugar cane, using much of the labor-place. The ceramics may be supplied easily with sugar cane bagasse, due to its availability at the local market.

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

[78] *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.*

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

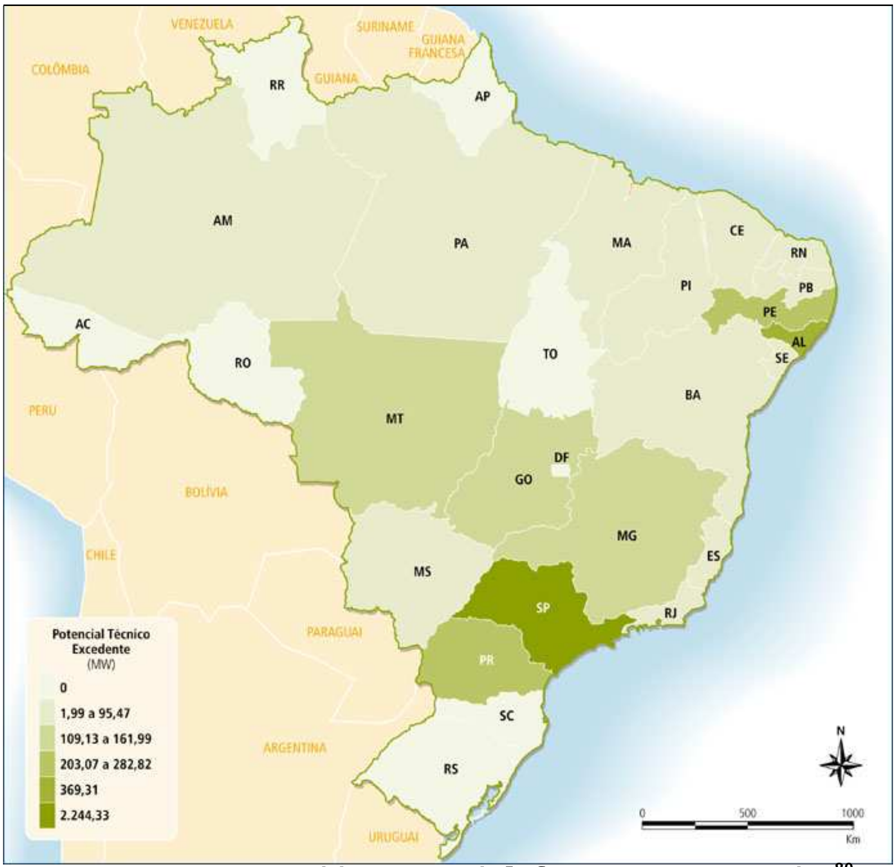

Figure 5. Sugar Cane Residue Potential for Energy Generation[80]

This project activity is responsible for the consumption of around 474 tons of sugar cane briquette per year, or less than 1% of the total production of sugar cane briquette. Thus, the amount of residues from sugar cane necessary to provide thermal energy in the ceramics' kilns would not be significant, which avoids the possibility of leakage.

Sawdust/wood chips

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.[81] The production of wood in the state of Pernambuco was 1,454,054 m^3[82] in 2007. Thus, the production of sawdust was 319,890 m^3 per year.

As *Maguary* Ceramic utilizes around 300 m^3 per year, i.e. the ceramic utilizes less than 1% of the biomass availability at the state. This way, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

As can be observed at the Figure 6, the potential of energy generation in the region is considered high, which means that there is an enormous availability of this kind of fuel to be employed in the project activity.

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

[81] *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.*

[82] *Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=pe&tema=extracaovegetal2007>. Last visit on May 5th, 2009.*

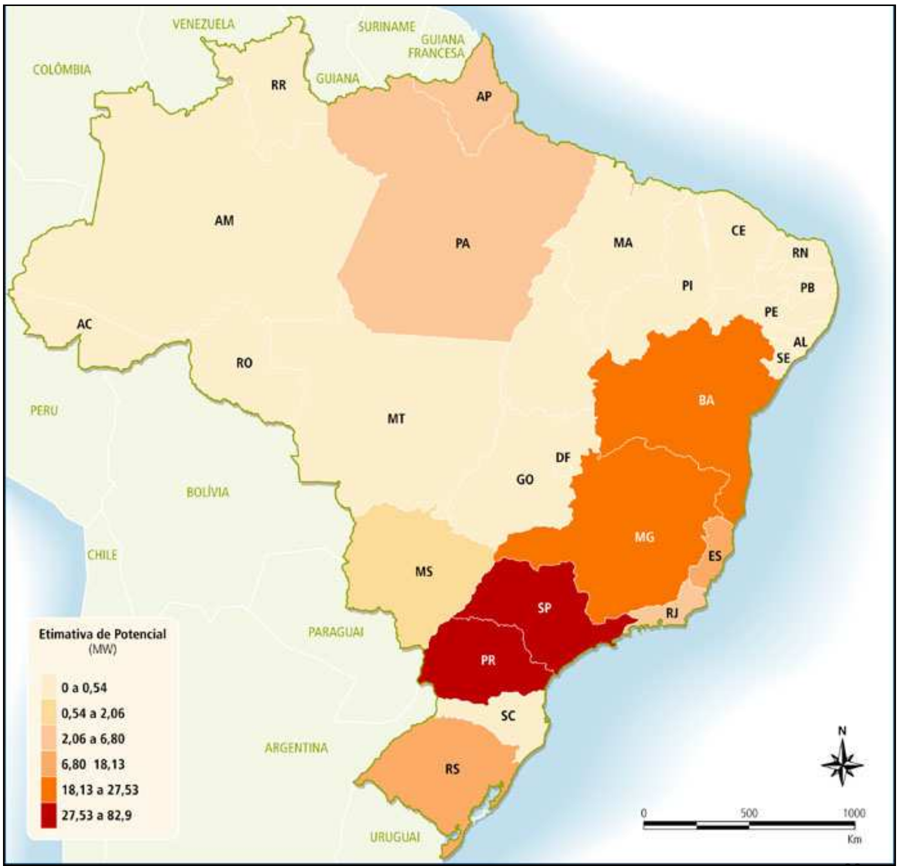

Figure 6. Woody Residues Potential for Energy Generation[83]

<u>Wood residues from constructions and industries</u>

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

The construction residues wood corresponds around 85% of the total construction residues in *Sorocaba*, city of the state of *São Paulo*. The deficiency of a correct destination for this wood constitutes a huge problem[84].

The percentage of the wood residues (such as pallets) contained within the industrial solid residues in the region of *Curitiba*, which is the capital of the state of *Paraná*, is around of 5%. Furthermore, the city garden residues correspond around 3.2% of the total of industrial solid residues[85].

It was utilized this estimative to calculate the percentage of consumption of these residues in the project activity. Moreover, it was only considered the availability of industrial wood residues, which is 749,839 tons per year (around 5% of the total of industrial solid residues). The consumption of these kinds of biomasses by this project activity is around 610 tons per year, corresponding to less than 1% of the total. Initiatives like these

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

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

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

should be stimulated in order to attenuate the solid residues final disposal in cities.

Algaroba wood

According to Silva (2007),[86] *Algaroba*[87] (Prosopis juliflora) is a tropical legume tree fairly common in the semi-arid region of Brazil, which thrives in dry environments where other plants would hardly survive.

At the beginning of 40's, this specie was introduced in the Northeast region of Brazil with the aim of providing food to animals and to be utilized for reforestation actions. However, currently, due to its competitive skills, *Algaroba* has spread through several regions of Brazilian semi-arid areas.[88]

A research made by EMBRAPA,[89] which encompass the States of Pernambuco and Bahia, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts.[90] This source stated that there were several centers of *Algaroba* operation highlighting the San Francisco Basin, which is comprised for many municipalities from the states of *Bahia* and *Pernambuco*, including this project region. Besides, *Algaroba* presents a considerable capacity of regeneration and dispersal,[91] which means that the plant does not die, it sprouts again stead.

The research's author reported that wood from *Algaroba* exploration on San Francisco Basin is mainly commercialized as fuel for industries of vegetable oil, leather, ceramic and bakeries. On the other hand, *Algaroba* wood is not sold for stake,[92] pegs and poles uses.

The factors which contribute most to the expansion of *Algaroba* uses, as firewood in these industries sectors, were its wide availability in the region and its legal release extraction from IBAMA.[93]

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

The same research estimated that in the Northeast semi-arid region there were about 500 thousands hectares spread through every type of its region

[86] *SILVA, C. G. M, MELO FILHO, A. B., PIRES, E. F., STAMFORD M. Physicochemical and microbiological characterization of mesquite flour (Prosopis juliflora (Sw.) DC).* ***Ciênc. Tecnol. Aliment.****, Campinas, 27(4): 733-736, out.-dez. 2007.*

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

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

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

[90] *ARAUJO, J. L. P., CORREIA, R. C., ARAUJO, E. P., LIMA, P. C. F.* ***Cadeia Produtiva da Algaroba no Pólo de Produção da Bacia do Submédio São Francisco.*** *EMBRAPA. Petrolina - PE – Brazil.*

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

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

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

land. Moreover, according to EMBRAPA (1992)[94], wood's production by *Algaroba* is at least 5 m^3/ha/year, i.e. the production in the project's region is about 2,500 thousands of m^3 per year.

As the consumption of *Algaroba* wood at *Maguary* Ceramic reaches approximately 3,955 m^3 per year, it represents less than 1% of the total of *Algaroba* wood availability at the region.

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

Cashew tree pruning

Cashew cultivation is extremely important to Brazilian economy; it is responsible for generate 150 million dollars per year. The cashew production is important especially in the northeast region, representing about 95% of Brazilian´s cashew production. Besides, cashew production is responsible for generating job opportunities for 35,000 fieldworkers, 15,000 in the manufacturing process and 200,000 indirect job opportunities.[95] The Brazilian production achieved 143,000 tons of cashew-nuts in 2005 spread in an area of 650,000 Hectares. Besides, Brazilian´s production presents the tendency of increasing so far, carried by the new technologies utilized and the higher national and international demand of cashew nuts.[96] This way, the Brazilian sources of residues from cashew trees will increase following the Brazilian production, due the fact that cashew cultivation request continuous cut of cashew trees. The cut of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest time. This way, in cashew cultivation must be cut undesirable branches of the cashew trees.[97] Moreover, dry branches on the ground compound a considerable amount of residues from cashew trees cultivation.

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

According to "Plantio do Caju", cashew trees cultivation presents a density of 51 units of trees per hectare[98], and the production of firewood residues from each tree is 2.5 kg per year[99]. The cultivation of cashew is located in an area of 650,000 hectares. This way, the Brazilian production of residues from cashew trees is around 82,875 tons per year.

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

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

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

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

[98] According with "Resposta Técnica" from CETEC (Technologic Center of Minas Gerais) considering a space of 10 meters from each tree. Available at: <http://sbrtv1.ibict.br/upload/sbrt4555.pdf?PHPSESSID=76a9111889defa6787039ca56b380c58>. Last visit on: April 28th, 2009.

[99] According with "Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural" Available at: <http://www.cepel.br/~per/download/rer/rt-789-00.pdf>.

Comparing with other ceramic that has similar production capacity[100], this project activity would be responsible for the consumption of around 6,000 tonnes per year, or around 7% of the total production of residues from cashew trees. Thus, the amount of residues from cashew trees necessary to provide thermal energy in the ceramics' kilns would not be significant, which avoids the possibility of leakage.

Eucalyptus wood

The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tonnes of biomass per hectare[101]. 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[102]. 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[103].

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[104] in 2007.

Comparing with other industry[105], *Maguary* Ceramic would utilize 240 tons of *Eucalyptus* wood per year. Thus, the consumption of this kind of fuel by *Maguary* Ceramic would be around 470 m^3 per year, representing less than 1% of the total of *Eucalyptus* wood produced in the region.

Coconut husk

Coconut husk has several uses; alimentation, water, and fiber among others. It is a common residue at northeast region of Brazil, reaching 6.7 million tons of coconut husk annually.[106]

Comparing with other ceramic[107], this project activity would be responsible for the consumption of around 176 tonnes per year, or less than 1% of the coconut husk availability. Therefore, this biomass is widely available in

[100] *According to Kitambar ceramic – Caruaru – PE, which utilizes cashew tree pruning as fuel to maintain a similar production.*

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

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

[103] *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.*

[104] *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.*

[105] *According to Bom Jesus Ceramic, which utilizes 480 tons of Eucalyptus wood to maintain a 2 times greater production.*

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

[107] *According to J L Silva Ceramic – Lajedo, PE, which utilizes coconut fiber to maintain a 3 times bigger production.*

the region, once its use for generate thermal energy may be a solution for the solid waste disposal in these cities.

Glycerin

The glycerin is a residue generated at the biodiesel process, which is named transesterification.[108] As the production of biodiesel is growing in Brazil, the offering of glycerin is also growing.[109] The combustion of the glycerin could be a solution to the biodiesel production, however the high investments necessaries and difficulties related with the burning process prevented this from becoming a chosen solution among industries.[110]

A study carried out by *Universidade Federal do Rio de Janeiro* states that for 90 m³ of biodiesel, it is generated 10 m³ of glycerin.[111] As the Brazilian production of biodiesel in 2008 was 1,164,332 m³,[112] the amount of glycerin generated was 129,370 m³.

According to other ceramic industry[113], *Maguary* Ceramic would utilize around 1,040 tons of glycerin per year, which corresponds to 825 m³ of glycerin. Thus, the project activity would utilize less than 1% of glycerin availability. It can be concluded that the biomass available is widely superior than the amount required for this project i.e. leakage from glycerin can be neglected.

Elephant grass

Elephant grass is another renewable biomass option for the generation of thermal energy.[114] It can be cultivated in pasture lands or in 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[115] 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).[116] 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

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

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

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

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

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

[113] *According to Trevo Ceramic, that utilizes 520 tons of glycerin to maintain a two times smaller production.*

[114] *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.*

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

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

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 is a possibility that it could be used as renewable biomass in the project. Elephant grass has an excellent net calorific value when it is dried, although its drying process is still a problem for the project entrepreneurs.

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

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

The following potential sources of this type of leakage were identified:

- Use/diversion of non-renewable biomass saved under the project activity by non-project households/users who previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable biomass used by the non-project households/users attributable to the project activity then baseline is adjusted to account for the quantified leakage.

- Use of non-renewable biomass saved under the project activity to justify the baseline of other project activities can also be potential source of leakage. If this leakage assessment quantifies a portion of non-renewable biomass saved under the project activity that is used as the baseline of other project activity then baseline is adjusted to account for the quantified leakage.

- Increase in the use of non-renewable biomass outside the project boundary to create non-renewable biomass baselines can also be potential source of leakage. If this leakage assessment quantifies an increase in use of non-renewable biomass outside the project boundary then baseline is adjusted to account for the quantified leakage.

To ensure that the project activity at *Maguary* Ceramic will not cause the type of leakage described in item B, *Carbono Social Serviços Ambientais LTDA* conducted research on the ceramics industries in the state of *Pernambuco*, and the result was that there are around 150 ceramic facilities in the state. Around 90% of the ceramic facilities use native wood without sustainable management.[117] Therefore, it can be concluded that the wood which was avoided by the present project activity is not being used by other ceramic facilities.

It is expected that carbon credits income will stimulate the use of renewable biomass in other ceramic facilities, presenting a huge possibility for sustainable development in the region. Therefore, the sources of leakages mentioned above will probably not be applicable as it is predicted the project activity will not displace the use of renewable biomasses. As it is likely there will be a decrease in the use of non-renewable biomasses in the region, ceramic facilities not involved in the project will have the incentive to incorporate renewable biomasses into their production processes, as there is current great amount of renewable biomasses available locally. The non-renewable biomass that would be utilized in this project activity would 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 9,000 m³ per year of non-renewable wood. This will help the conservation of forests in *Caatinga* biome, in addition to the ecological and social benefits to the region.

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

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. Table 14 describes the estimates of Emissions Reductions during the project activity.

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

Maguary Ceramic

ERy, total = 7,918 tonnes of wood x 0.994 x 0.01917 TJ/tonne x 77.4 tCO2/TJ

ERy, total = 11,677 tonnes of CO2e

Table 14. Emission reductions without considering the leakage

Year	Emission Reductions (tCO2e)
November - December 2008	1,946
2009	11,677
2010	11,677
2011	11,677
2012	11,677
2013	11,677
2014	11,677
2015	11,677
2016	11,677
2017	11,677
January - October 2018	9,731
Total Emission Reductions (tCO2e)	**116,770**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO2e)	11,677

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 15 shows the estimates of Emissions Reductions during the project activity, considering leakage.

Table 15. Estimation of overall emission reductions

Year	Baseline Emissions (tonnes of CO2e)	Leakage (tonnes of CO2e)	Emission Reductions (tonnes of CO2e)
November – December 2008	1,946	-	1,946
2009	11,677	-	11,677
2010	11,677	-	11,677
2011	11,677	-	11,677
2012	11,677	-	11,677
2013	11,677	-	11,677
2014	11,677	-	11,677
2015	11,677	-	11,677
2016	11,677		11,677
2017	11,677		11,677
January – October 2018	9,731	-	9,731
Total			**116,770**
Number of years of the crediting period			10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO2e)			11,677

5 Environmental Impact:

As can be observed in table 16, 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.

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

If utilized by the ceramic industry, the combustion of glycerin would need to have special precautions. Beyond the storage tank and pipelines must be correctly built in order to prevent leakages, the glycerin would be only injected into the kilns once the temperature would reach 280ºC. It happens because when glycerine is burned, the reaction has a product named acrolein, which is toxic. However, acrolein is unstable and flammable at higher temperatures. Thus, burning glycerine at temperatures higher than 280°C avoids the emission of acrolein[118].

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 16. 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 potential

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

pollutants, or capable of degrading the environment. Enterprises will only be possible if they obtain 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 Union of Ceramic Industries for Construction in the State of Pernambuco (SINDICER)[119] and the ceramic company employees. A letter was sent to the stakeholders informing about the project. In the ceramic's facilities, the letter was posted on the employees' board which is a visible place with high circulation of employees. The letter was available during 7 days and the comments were expected for a period of 7 days after the letter has been posted.

SINDICER sent a letter stating their support to the present project activity.[120]

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.

[119] *The objectives of the SINDICER are: to work with authorities in the development of social solidarity; to promote events relating to the subject; to mediate a dialogue between the ceramic factories in order to make the market fair and accessible to all.*

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

7 Schedule:

- Project start date: Date on which the ceramic has acquired the mechanic burners, thus, evidencing alteration of the technology in order to support the fuel switch: October 14th, 2008;
- Crediting period start date: November 1st, 2008;
- Validation Report predicted to: November, 2009;
- First Verification Report predicted to November, 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: October 31st, 2018.

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:

The ceramic facility's contract with *Carbono Social Serviços Ambientais* LTDA, the project developer, demonstrates GHG emissions reductions and the ownership of the project. These proofs of title will be checked by DOE and are in power of the Ceramic Company and available for consultation.

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

Not applicable.