Voluntary Carbon Standard Project Description

19 November 2007

September 25th, 20009

Contents

1 Description of Project:

1.1 Project title

Maracá Ceramic Fuel Switching Project

Version 02

PDD completed in: September 25th, 2009

1.2 Type/Category of the project

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

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

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

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

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

Table 1. Emission reductions estimate during the crediting period

Year	**Emission Reductions (tCO_2e)**
March – 2008	10,310
2009	12,372
2010	12,372
2011	12,372
2012	12,372
2013	12,372
2014	12,372
2015	12,372
2016	12,372
2017	12,372
February - 2018	2,062
Total Emission Reductions (tCO_2e)	**123,720**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO_2e)	12,372

1.4 A brief description of the project:

The project activity is the project of *Maracá* Ceramic, which is a red ceramic industry localized in *Ituiutaba* municipality, in the state of *Minas Gerais*, region known as *Triangulo Mineiro,* southeastern of Brazil. The ceramic industry produces bricks and roof tiles, destined mainly for the regional market in *Minas Gerais*, but also for *Mato Grosso* and *Goiás*, which are boundary states.

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

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

As renewable biomasses, the project activity consists in utilizing wood residues from industrial waste, (such as pallets, sawdust, and wood chips) energy supply, replacing the use of wood from areas with non sustainable forest management, which does not have any kind of contribution to the level of biodiversity enrichment.

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

The main goal of this project activity is to minimize the negative impacts of the deforestation of the *Cerrado* biome by discouraging the exploitation of the area through limiting the interested party in acquiring the proper legal documents for the commercialization of the native firewood. Furthermore, the project activity will grant a satisfactory destination to wood residues such as sawdust and wood chips. Moreover, in opposition to the identified baseline, the project activity will generate thermal energy without stimulating deforestation by using an abundant renewable biomass in the region.

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

The ceramic is located in the Municipality of *Ituiutaba* in the state of *Minas Gerais* which is indicated in Figure 2. The project site has the following postal address and geographical coordinates:

Avenida Geraldo Alves Tavares, 903, Ipiranga

Ituiutaba – Minas Gerais, Brasil

CEP: 38.302-134

Ceramic’s Boundaries Coordinates:

Table 2. Coordinates of a point from the enterprise area utilized at Operational license – GPS project boundaries

UTM Format (X,Y) Check the datum, zone and meridian	
Datum: [ ] SAD 69 [**X**] WGS 64 [ ] Córrego Alegre	Zone: [**X**]22 [ ]23 [ ]24 Central Meridian:[ ]39º [ ]45º [**X**]51º
X= 682598 – E	Y= 7.903722-N

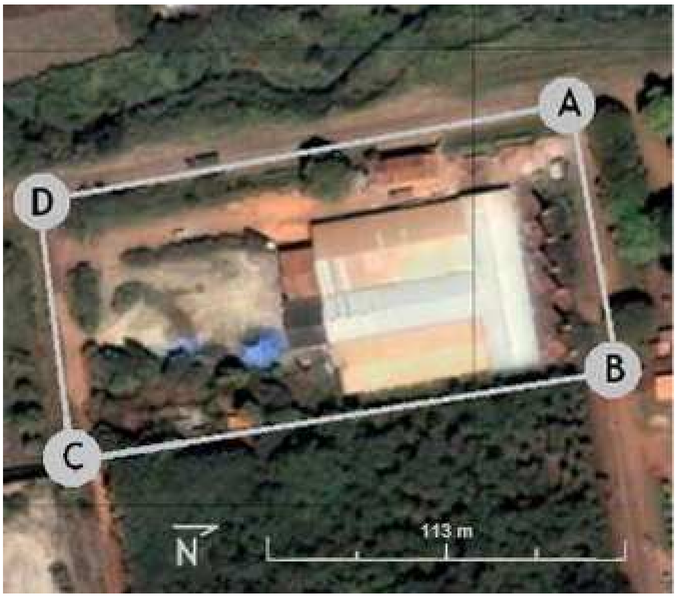

Figure 1 Spot A: 18º57'04.17''S 49º27'22.18''W, spot B: 18º57'03.76''S 49º27'19.27''W, spot C: 18º57'09.09''S 49º27'18.37''W and D: 18º57'09.48''S 49º27'21.12''W(Source Google Earth).

Figure 2. Geographic location of the city of the project activity that has the following coordinates in *Minas Gerais* State: *Ituiutaba*: *18°58'8"S, 49° 27' 54" W.*

1.6 Duration of the project activity/crediting period:

- Project start date:[1] December 1st, 2007;
- Project Crediting Period Start Date:[2] March 1st, 2008;
- Date of terminating the project activity:[3] February 28th, 2018;
- VCS project crediting period: 10 years renewable.

1.7 Conditions prior to project initiation:

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

Although firewood from deforested areas has been used for many decades as fuel in Brazil, it is impossible to define a start date on which this kind of non-renewable biomass began to be applied. Firewood used to be the most employed source of primary energy until de decade of 1970, when the petroleum started to supply the majority of Brazilian´s energy needs.[4] Moreover the Brazilian´s Energy and Mine Ministry has been monitoring all energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector[5].

According to Seye (2003),[6] in Brazil, the red ceramic units are produced through an inefficient and traditional process using wood without forest management to generate thermal energy. In this industry segment, the use of wood represents about 98% of the total fuel employed.

Therefore, the employment of this fuel stimulates the increase in Brazilian deforestation rates. The baseline identified for this project activity is the employing of an average of 1,397.27 m^3 of non-renewable native wood per month to provide thermal energy to the ceramic's kilns. The project activity focuses on the use of wood residues from industrial waste, (like pallet, sawdust, and wood chips) and other residues from *Pinus* manufacturing process as renewable biomasses for energy supply.

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

The emission reductions will be achieved by displacing the use of wood from areas with no sustainable forest management to provide thermal energy in the ceramic company. Therefore, the emissions launched during the combustion of native wood from deforestation activities were not offset by the replanting, which is a carbon absorbance method. An

[1] Date on which the project began reducing or removing GHG emissions, i.e. when the project proponent began employing renewable biomass. At this date, the ceramic acquired the first quantity of renewable biomass.

[2] Date on which the project proponent completed the fuel switch of Maracá ceramic, thus, when the ceramic stopped employing native wood.

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

[4] 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.*

[5] Energy Research Company. National Energy Balance - energy consumption per sector. Available at <http://www.mme.gov.br/mme/menu/todas_publicacoes.html>. Last visit on: April 15th, 2009.

[6] 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.*

opposite scenario occurs with the renewable biomasses utilized in this project activity, which have carbon neutral cycle.

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

Maracá Ceramic produces bricks and roof tiles. The production process at *Maracá* Ceramic encompasses six “Round kilns”[7] in order to burn the fuel and fire the ceramic units, which are mainly used in the construction sector.

Figure 3. Some of the ceramic units produced at Maraca Ceramic

The “Round kilns” at *Maracá* Ceramic has capacity for 10,000 ceramic units approximately, depending on the kind of the products that are fired, and approximately 46 burning cycles are done per month. *Maracá* Ceramic production is around 427,594 ceramic units per month.

For the project activity was necessary for the ceramic industry the purchase of 16 mechanic burners for the introduction of the sawdust and wood chips in the kilns, the entrances needed to be reconstructed aiming to receive the new kind of biomass employed, and the employees needed to be trained reducing the losses in the firing process.

Figure 4. Mechanic Burners acquired in order to employ the renewable biomass.

[7] *The “Round Kilns” are intermittent kilns with round shape and lateral furnaces. Its internal diameter is about 9 meters. It is usually employed to burn roofs and bricks*

As renewable biomasses, *Maracá* Ceramic employ the use of wood residues from industrial waste, (like pallet, sawdust, and wood chips) and other residues from *Pinus* manufacturing process.

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

Table 3. Main biomasses providers

Biomass	Provider	Location
Wood Residues (sawdust/wood chips)	*CARROCERIAS LIDER - INDÚSTRIA E CARPINTARIA LIDER LTDA*	*ITUIUTABA - MG*
	A.W FABER-CASTEL S.A	*PRATA – MG*
	ALIANÇA AGRO FLORESTAL LTDA	*INDIANÓPOLIS – MG*
	SERRARIA NOSSA SENHORA DA GUIA LTDA	*NOVA PONTE – MG*
	MADEREIRA & MATERIAIS DE CONSTRUÇÃO SETTE LTDA - ME	*ITUIUTABA - MG*
	SEMACOL MADEIREIRA E MATERIAIS PARA CONSTRUÇÃO LTDA	*ITUIUTABA - MG*
	SERRARIA CUNHA & SILVA LTDA	*NOVA PONTE – MG*

The amount of each biomass and type of biomass employed in the ceramic industry may change according to its availability. However, in case of lack of these of biomasses, other biomasses, such as corn straw, sugar cane bagasse, bamboo, and elephant grass, can be employed due to seasonal harvest reasons, since its renewable origin can be verified.

Currently, bamboo and 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. The ceramic companies could utilize elephant grass due to harvest reason or lack of the other renewable biomasses.

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

The biomass arrives in the ceramic industry and it is stored under a shed, such procedure is essential to protect the biomass and keep it away from the rain and maintain it dried, keeping an acceptable efficiency. The wood chips and sawdust are carried in a handcart to the mechanic burners by an employee.

The mechanic burners disposed at a single “Round Kiln” are activated at the same time through a signal emitted by an electrical system to maintain the temperature defined by it. This way, the amount of biomass utilized to supply the Kilns is considered homogeneous.

Due to the project activity, a set of adaptations were necessary, such as alterations to the furnaces and other machineries as well as the acquisition of new equipments so the ceramics can operate with the new biomasses.

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

This project is in accordance to the CONAMA[8] 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, and environmental licenses, which must run under the valid time.

The project attends the constraints at the operation license determined by the environmental agency competent at the region.

The project is also in accordance to Federal Constitution, Article 20, which establishes the payment of a Financial Compensation by the Mineral Resources Exploitation. This financial compensation is annually performed to DNPM (National Department of Mineral Production).[9]

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

- Availability and price of the renewable biomasses

The thermal energy generation through the combustion of biomasses is an innovation in the ceramic industries. The future demand of this alternative fuel (e.g. by other consumers) is not easy to foresee. There is currently a great amount of these types of biomasses available regionally, however, a demand and price increase has already been reported. If non-foreseeable reasons affect the availability of the biomasses, the ceramic owner will search for other type of renewable biomasses. Hence, it follows that the project approval will make the continued use of renewable biomasses feasible.

- Closing of the ceramic business

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

- Difficulty related to the abrupt change

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

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.

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[8] *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>.*

[9] *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>.*

The historical of *Maracá's* activities using wood as fuel clearly confirms that the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

Maracá Ceramic used to feed the kilns with native wood from deforestation activities to generate thermal energy in order to fire ceramic units. According to historical data from *Maracá*, the ceramic facilities used to utilize non-renewable native wood from areas without any kind of management since 1984.

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

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

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

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

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

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

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

Project Proponent

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

Mr. *Mário Eugênio Rezende Jacob Iunes,* Director and owner: Information about the ceramics, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramics devices market challenges.

Mr. Ivan Abrão Filho, Director and owner: Information about the ceramics, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramics devices market challenges.

Mrs. Valciene Soares Santana, Quality Controller, monitoring data responsible: General data and information on inputs and outputs of the ceramic industry, detailed information on the acquisition of renewable biomasses and how this data is kept by the controller's office.

Other information on the project's proponent:
Address:

Avenida Manoel Afonso Cancella, 571

Setor Industrial Norte – Ituiutaba

CEP: 38301-196

Phone number: +55 (34) 3268-5400

Web site: http://www.ceramicamaraca.com.br

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:

Rafael Kupper Bonizio Oliva, Technical Analysts: Project Design Document writers, elaboration of GHGs Emissions' Inventory, direct contact between *Carbono Social Serviços Ambientais LTDA* and the ceramic industry, 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*
CEP: 04.038-032
São Paulo – SP, Brazil
Phone number: +55 11 2649-0036
Web site: http://www.socialcarbon.com
Email: kupper@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 proposed at the operational license;
- Technical: alterations/adaptations required are technically feasible;
- Economic: carbon credits will make the project feasible;
- Sectoral: incentive of good practices to the sector;
- Social: social carbon methodology will be applied which will improve long term sustainability. The culture of burning wood without sustainable management as fuel will be slowly mitigated;
- Environmental: the project attends all legal requirements proposed at the operational license and there is no significant environmental impacts predicted;
- Geographic /site specific: the plant can be uniquely geographically identified with no barriers regarding logistic;
- Temporal information: the project will not double count the GHG emissions during the ten years renewable of the crediting period.

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

1.17 List of commercially sensitive information (if applicable):

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

2 VCS Methodology:

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

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

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

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

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

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

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

There are no similar registered small-scale CDM project activities in the region of *Ituiutaba,* 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) [10] and Brazilian's Technology and Science Ministry [11]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted by the other registered project activities.

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

According to historical data from *Maracá*, the ceramic facilities used to employ non-renewable native wood from areas without any kind of management since 1984.

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

The biomasses utilized in the project: wood residues from industrial waste, (like pallets, sawdust, and wood chips), and other residues from

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

[11] 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.

Pinus manufacturing process, are commonly generated in the region. Furthermore, bamboo and elephant grass has a high potential of being a future fuel for the ceramic industry.

Sugar cane briquette, corn straw, and wood residues from industrial waste, (like pallets, sawdust, and wood chips), are industries residues coming from large scale reforestation or agro industrial projects, so they are considered renewable according to option V of methodology definition of renewable biomass:

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

The bamboo is considered renewable according to option II, as soon as it fits all the assumptions below:

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

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

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

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

Bamboo fits all the three options above since just the stem of the bamboo is utilized and the rhizome remains in the ground. Therefore, the area remains a cropland with the use of the biomass. Moreover, the bamboo is the faster growth plant in the world, and efficiently performs the functions of soil protection and carbon sequestration, and provides food and raw material for many applications. The area where the bamboo is cultivated follows sustainable management practices, according to its cultivation and harvest techniques. Unlike trees, which once cut do not grow again, the bamboo can be harvested without the destruction of the crop. When it is properly harvested and managed, the plantation continues full of younger individuals and it is difficult to realize that a harvest was done[12].

Besides, Brazilian's production presents the tendency of increasing so far, carried by the new technologies utilized and the rampant importance of the bamboo for sustainable activities. In Brazil, scientific researches in several States have contributed to a better utilization of bamboo in the construction sector[13]. Moreover, Article 14 of Decree No. 113 of IBAMA[14] from December 29th, 1995, establishes that the bamboo species does not need a deforestation authorization in order to promote its cut[15].

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

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

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

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

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

[14] *Brazilian Institute of Environment and Renewable Natural Resources.*

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

(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[16]. 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 boundary is the physical, geographical area of the use of biomass or the renewable energy.

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

Table 4. Gases included in the project boundary and brief explanation

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

[16] *According to EMBRAPA* (Brazilian *Agricultural Research Corporations). Source: http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292*

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

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

Table 5. 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%
Liquefied Petroleum Gas	4%	4%	4%
Others from Petroleum	2%	2%	4%
Piped gas	0%	0%	0%
Electricity	8%	8%	7%
Others non specified	0%	0%	0%

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

The most probably scenario in the absence of native wood from deforestation areas would be the use of fuel oil, which is not viable considering its higher prices when compared with other non-renewable biomass. Even though, fuel oil presents a higher Net Calorific Value when compared with non-renewable firewood; the costs with fuel oil are higher because of its expensive prices. Fuel oil presents an average price of 0.895 BRL/kg [17] and the firewood without sustainable forest management used to present an average price of 0.02346 BRL/kg[18] in the baseline scenario. These values lead us to conclude that the price of fuel oil is around 0.000090587 BRL/Kcal as long as the price of this kind of wood is around 0.00000608757 BRL/Kcal, according to CAETANO[19] *et al* (2004) that utilized the Net Calorific Value and the specific gravity of both fuels. The value of price per kcal is acquired through dividing the price per weight (BRL/kg) by the price per NCV (kcal/kg)[20].

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

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[17] 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>

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

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

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

Another plausible baseline scenario would be the use of Natural Gas. Although there is distribution/gas pipe in the region[21], 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*[22]*,* 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.

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.

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

Test 1 – The project test

Step 1: Regulatory Surplus

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

Legal requirements, as stated by the Constitution of the Federal Republic of Brazil[23] as well as Federal and State Regulations, do not require entrepreneurs, which use raw forest materials as an energy source, to switch from non-renewable biomasses to renewable biomasses. Therefore, the project activity is not a legal obligation, and in accordance with Article 5 of the Constitution of the Federative Republic of Brazil; moreover, nobody can be forced to follow a course of action if it is not addressed by law.

There are legal requirements constraints regarding the use of non-renewable biomass as exposed in Decree N.5,975 of November 30th,2006. However, it is not enforced namely due to the lack of control[24].

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[21] Source: http://www.ctgas.com.br/template02.asp?parametro=2547

[22] Source: http://ecen.com/eee51/eee51p/gn_bolivia.htm

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

[24] 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.

The consumption of non-renewable biomass by the ceramic industry was related by several authors (NERI, 2003[25]; ALBUQUERQUE *et al*, 2006[26]; BRASIL, 2001[27]; VIANA, 2006[28]; CARDOSO, 2008[29]).

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

Step 2: Implementation Barriers

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

- **Technological Barrier**

As affirmed before, the use of wood from areas without sustainable forest management is a traditional and well-known process, and as a result of the sudden change, a lot of effort from each employee in the ceramic industry 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: 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, which required more high-skilled labor.

The operators did not have knowledge of the ideal amount of renewable biomass that was necessary to achieve the ideal temperature for its ceramic units firing, 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 units, complicating the maintenance of the quality of the products; cracks on the ceramic devices; the explosion of some of them and cracks along the kilns; adding a significant amount of insecurity in production process. A pyrometric system (thermocouples) was installed in order to control the burning due to the lack of experience with the new fuel.

Diverging from the baseline scenario, in the project activity, the sawdust and wood chips are fed to the kilns by automatic machineries, the mechanic burners, which are fed manually by an operator, had to be

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

[26] *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.*

[27] *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.*

[28] *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.*

[29] *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.*

installed. Also, the machineries needed some adjustments in order to use the new biomasses, fuels that are uncommonly employed for the initial propose of the machines.

The employees must be careful not to fill the devices with large amounts of biomass, which can clog the mechanic burner and consequently, cause disorder in the burning process and that was one of the causes of the production losses throughout the adaptation period. So, the mechanic burner's feeding has to be done gradually, demanding even more time and labor from the employees.

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

Furthermore, there was a lack of infrastructure to utilize the new technology. The region of *Ituiutaba* is commonly 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 sheds to store and to dry biomasses and consequently improve their burning efficiency.

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 *Maracá* Ceramic had to find the best procedure to handle with the new technology, i.e. the new biomass, logistic and machines. An adaptation period was necessary to learn how to utilize the new fuel and employ it in the process.

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

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

- **Financial barrier**

With the project implementation, the ceramic company had to withstand higher costs rather than if it had continued employing native wood as fuel as shown on the table below. The most important additional costs are related to biomass acquisition.

Table 6. Main Costs before and after the project activity, including investment costs.

Maraca Ceramic				
Scenario	**Non renewable biomass**		**Renewable biomass**	
Monthly consumption of the fuel	1,397	m3 of wood per month	750	m3 sawdust/wood chips per month
Price of biomass	18	BRL per m3	35	BRL per m3

Total cost	25,150.86	BRL per month	26,250	BRL per month
Investment Costs				
Costs with mechanic burners	58,898	BRL		
Loss of revenues - period for adaptation of the kiln for biomass	12,000	BRL		
Waste of products in the testing period (3 months)	13,922	BRL		
Waste of Biomass in the testing period (BRL)	19,688	BRL		
New biomass storage shed	18,480	BRL		
Total Costs	122,988	BRL		

Due to the implementation of the project activity, the ceramic company had high investments. Mechanic burners, to automatically inject the biomass with air inside the kilns, were acquired once when using wood, the fuel was manually inserted by operators in the kilns. The project proponent also constructed a shed to store its renewable biomasses.

Furthermore, when the new production techniques have been introduced in the ceramic plant, there was an adaptation period and a testing period. For the adaptation of the kilns, a period of at least one burning cycle for each kiln had to be considered. Besides, a testing period of approximately three months, required in order to identify the correct burning curve, lead to waste of considerable amount of biomass (average 25%) in each burning cycle. All this resulted in prejudice for the company financial profit and loss balance.

Due to all the above mentioned reasons, the ceramic industry thought about stopping the fuel switching project.

Besides, as shown on Table 6, the baseline is the scenario in which there are lower costs than other scenarios. The most probable scenario as a project activity would be the use of 100% of firewood sawdust and wood chips. This scenario is more viable due to the efficiency of the kilns using this proportion of biomasses.

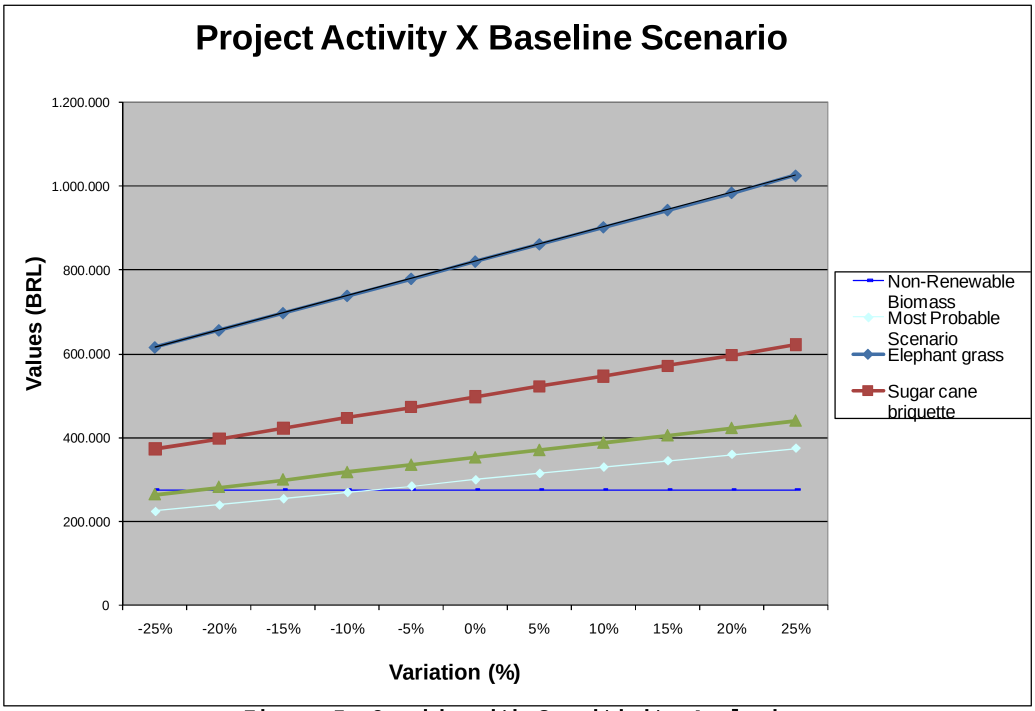

Figure 5. Graphic with Sensitivity Analysis

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

Table 7. Sensitivity Analysis

	Biomasses	Biomass Costs (BRL/ton)	Estimated Amount to be Employed (tons per year)	Energy Generated (TJ)	**-25%**	**-20%**	**-10%**	**-5%**	**0%**	**5%**	**10%**	**20%**	**25%**
Project Activity Scenario	Sugar cane briquette	230,00	2.164	173,17	373.212	398.093	447.855	472.735	497.616	522.497	547.378	597.139	622.020
	Elephant grass	67,45	12.165	173,17	615.395	656.421	738.474	779.500	820.526	861.553	902.579	984.631	1.025.658
	Bamboo	33,50	10.525	173,17	264.429	282.057	317.314	334.943	352.571	370.200	387.829	423.086	440.714
	Wood Residues-Sawdust and Wood chips	100,00	3.000	43,68	225.000	240.000	270.000	285.000	300.000	315.000	330.000	360.000	375.000
	Current scenario	**100,00**	**3.000**	**43,68**	**225.000**	**240.000**	**270.000**	**285.000**	**300.000**	**315.000**	**330.000**	**360.000**	**375.000**
Baseline Scenario	Non-renewable wood	31,57	8.764	173,17	293.904	293.904	293.904	293.904	293.904	293.904	293.904	293.904	293.904

- **Institutional barriers**

Since the kilns were adapted to burn the new biomass, and there was a lack of qualified work force 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, since during the reconstruction of the kilns, the production of the ceramic was low. In addition, there was the transition period where the ceramic had lost production due to the adaptation to the use of biomass and to the new machineries.

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

Since there is no direct subsidy or support from the government for this project, without the income from the commercialization of the carbon credits, the fuel switch at the *Maracá C*eramic 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 renewable biomass like sawdust, wood chips, and other residues from *Pinus* manufacturing process 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 roof tiles and bricks.

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

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

Table 8. 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[30] 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 *Minas Gerais*. Therefore, data from table above were provided by a reliable source and it was considered 3 years of its historical data.

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

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

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

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

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[30] 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.

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.

The consumption of non-renewable biomass by ceramic industry was related by several authors (NERI, 2003[31]; ALBUQUERQUE et al, 2006[32]; BRASIL, 2001[33]; VIANA, 2006[34]; CARDOSO, 2008[35]). This is also observed in other industries as in the production of steel (BRASIL, 2005[36]), 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 8 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.[37]

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

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

[32] *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.*

[33] *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.*

[34] *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.*

[35] *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.*

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

[37] *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.*

gas is restricted by the absence of pipes, and its high costs.[38] The risk of lack of offering and higher 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[39] 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.[40]

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.[41]

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

In Brazil, the red ceramic units are produced through an inefficient and traditional process using wood without forest management to generate thermal energy technologies.[42] 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.[43] 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,[44] 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.

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

[39] PETROBRÁS performs in oil and oil byproduct exploration, production, refining, marketing, and transportation, both in Brazil and abroad. More information available in: <http://www2.petrobras.com.br/ingles/ads/ads_Petrobras.html>. Visited on March 27th, 2009.

[40] Source: <http://www.ctgas.com.br/template04.asp?parametro=155>. Visited on March 27th, 2009.

[41] 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.

[42] 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.

[43] 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.

[44] 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

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.[45]

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 ideal temperature to fire its ceramic units, 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 *Minas Gerais* is comprised mostly by small industrial units that still use varying technological models. The majority of ceramic industries in the region of this project activity use native wood without sustainable forest management as fuel, mainly from *Cerrado* biome. These industries have some technological restrictions such as the energy exploitation and the efficiency of the machinery.

Brazil is the third major contributor[46] 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[47] – 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 *Cerrado* Biome deforestation was intensified due to the grazing practice and site preparation which involves extraction and burning of firewood and firewood commercialization.

Another relevant issue is how fast deforestation occurs in the *Cerrado* biome, representing 1,5% or 3 million ha/ year. It is equivalent to 2, 6 soccer fields /minute[48].

A study performed by the non-governmental institution, Conservation International of Brazil, indicates that by 2030 the *Cerrado* biome will disappear maybe even sooner since the areas that are earmarked for

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

[46] *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.*

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

[48] *Conservation Intenational of Brazil.* ***Estimativas de perda da área do Cerrado brasileiro.*** *Available at: <http://www.conservacao.org/noticias/noticia.php?id=31>. Visited in: September, 10 2008*

official protection are also being destroyed. From a total of 204 million acres of the original biome, 57% has been completely destroyed, as shown in Figure 6. The main areas that are being most affected by the alarming *Cerrado* deforestation are the states of *Mato Gross do Sul, Goiás, Tocantins, Mato Grosso, Triângulo Mineiro* and the western portion of *Bahia*. These concerning deforestation rates are due to the expansion of the agricultural frontier, unregulated burnings and due to the disorderly growth of the urban zones.[49]

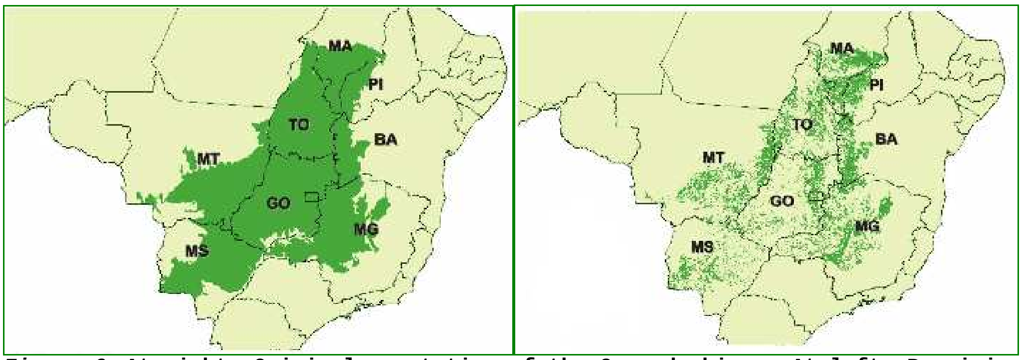

***Figure 6.* At right: Original vegetation of the Cerrado biome. At left: Remaining vegetation of the Cerrado biome in the year 2002** (Source: *Conservação Internacional Brasil*[50]).

The *Cerrado* biome is the second largest Brazilian biome. It is located in the central portion of Brazil and can be observed in **Table 9**. The flora and fauna of this biome is rich once it shares frontiers with the Brazilian biomes: to its west with Amazonian; to the north with *Caatinga*; and to the east and south with *Mata Atlântica*. In spite of the size and importance of this biome, the *Caatinga* is an endangered habitat.

Table 9. 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[51])

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.

[49] *AmbienteBrasil. Study performed by a partnership between Conservation International of Brazil and the Oréades NGO situated in Mineiros (GO). Available at : <http://www.cenargen.embrapa.br/cenargenda/noticias2006/atrativos130606.pdf>*

[50] *Available at: <http://www.conservation.org.br/arquivos/Mapa%20desmat%20Cerrado.jpg>*

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

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.

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 ceramics’ kilns and consequently, the amount of GHG that would be emitted in tons of CO2e. The following table shows the frequency of the monitoring of each parameter.

Table 10. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass	Tons	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 units	Units	Controlled by the ceramic owner	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tons or m³	Monitored by articles and database. Described at Section 3.3.	Annually
Leakage of Non-Renewable Biomass	Leakage resulted from the non-renewable biomasses	tCO2e	Monitored by articles and database. Described at Section 3.3.	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/ton of Wood	Bibliography. Described at Section 3.3.	Not monitored
ρbiomass	Specific gravity of non-renewable biomass	Ton/m3	Bibliography. Described at Section 3.3.	Not monitored
***ƒ*NRB,y**	Fraction of biomass (wood) used in the absence of the project activity in year y can be	Percentage	Bibliography. Described at Section 3.3.	Annually

	established as non-renewable biomass using survey methods			
BFy	Consumption of non-renewable biomass per thousand of ceramic devices produced	tons/ thousand of ceramic units	Data from ceramic owner	Function of PRy

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

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

Where:

PRy = Number of ceramic pieces produced per month;

BFy = Tons of wood per thousand of pieces produced.

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

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

The responsible to monitor data provided in Table 10 will be Mrs. Valciene Soares Santana. Internal audit will guarantee the quality of data monitored. It will be realized by Mr. *Mário Eugênio Rezende Jacob Iunes,* Director of *Maracá* ceramic.

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

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 applied for the purpose of calculating expected emission reductions:	Sawdust/Wood chips – 250 tons
Description of measurement methods and procedures to be applied:	The amount of renewable biomass will be monitored in accordance to the internal controls of the ceramic industry. It will be utilized the Specific Gravity in order to convert from m³ to ton. The data to be applied are: Sawdust/Wood chips – 0,35 ton/m³ Source: <u>Sawdust and wood chips</u> - SIMIONE F. J. **Análise Diagnóstica E Prospectiva Da Cadeia Produtiva De Energia De Biomassa De Origem Florestal No Planalto Sul De SantaCatarina** – Available at: <http://hdl.handle.net/1884/10294>. Visited on June 22th, 2009.

QA/QC procedures to be applied:	The ceramic has spreadsheets of the quantity of biomass acquired. It will be rechecked according to the receipts of purchase.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**PRy**
Data unit:	Ceramic units per month
Description:	Production of ceramic units
Source of data to be used:	Controlled by the ceramic owner
Value of Data applied for the purpose of calculating expected emission reductions:	Approximately 427,594
Description of measurement methods and procedures to be applied:	The amount was acquired by counting the total production of the last eleventh months. The measurement will be done by an internal control sheet monitored by the ceramic owner, which will be fed according to the production.
QA/QC procedures to be applied:	The ceramics have an internal control of the quantity of units produced. It will be rechecked according to the biomass employed and the kiln consumption of renewable biomass.
Any comment:	The ceramic owner will preferentially employ wood residues, such as sawdust and wood chips. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Origin of Renewable Biomass**
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data to be used:	Controlled by the ceramic owner
Value of Data applied for the purpose of calculating expected emission reductions:	Renewable biomass
Description of measurement methods and procedures to be applied:	This information will be given by the biomasses providers. The guarantee of acquiring renewable biomass will be achieved by invoices from the providers. As stated in the section 2.2, the biomasses (wood residues) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied :	The biomass will be considered as renewable if it is according to the definition given by the methodology applied.
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 applied for the purpose of calculating expected emission reductions:	0

Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in methodology applied will be monitored. Scientific articles, official statistical data, regional and national surveys will be provided in order to ensure that there is no leakage from non-renewable biomass (or to estimate the leakage).
QA/QC procedures to be applied :	Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Renewable biomass surplus**
Data unit:	ton or m³
Description:	Amount of renewable biomass available
Source of data to be used:	Monitored
Value of Data applied for the purpose of calculating expected emission reductions:	see table below Detailed information in section 4.1 – LEAKAGE
Description of measurement methods and procedures to be applied:	It will be used to calculate the leakage of renewable biomass. The sources of leakages predicted in methodology applied will be monitored. The measurement of the leakage will be based in national and internal articles and databases every monitoring period. These sources will provide information about the biomass availability in the project activity's region.
QA/QC procedures to be applied :	Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Biomass	**Surplus**	**Year**
Wood Residues(sawdust/wood chips) in m³	5,737,174.08	2007
Industrial wood residues in tons	749,839	2006
Sugar Cane Bagasse (in thousands of tons)	36,941	2006/07
Corn Straw – Residues from corn production	19,975,556	2007
Elephant Grass	Not measured	
Bamboo	Not measured	

Data / Parameter:	**ƒNRB,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 to be used:	Survey methods
Value of Data applied for the purpose of calculating expected emission reductions:	0,9806 or 98.06%

Description of measurement methods and procedures to be 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)[52], Cerrado Biome has only 1.9% of its total area with sustainable use. Furthermore, considering that 0.058% of this biome has been saved by other project activities, thus, 98.04% is considered as a fraction of non-renewable biomass. It was made two sheets to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the *Cerrado* biome. The other sheet calculates de amount of wood consumed regarding only *Maracá* Ceramic. Dividing these values by the total of wood available, it was achieved the amount of renewable biomass that has been saved by all the project activities or only by *Maracá* project, respectively.[53] Afterwards, summing each value with the Sustainable use areas defined by Klink (2005), it was acquired two fraction of renewable biomass. Finally, each value was subtracted from 100% to achieve the ƒNRB,y. Therefore, it was taken the smaller value in order to be more conservative. These sheets are available at the VCU Estimative spreadsheet.
QA/QC procedures to be applied:	The monitoring of this parameter will be based in national and internal articles and database. The source provided information about the sustainable use of *Cerrado* biome. Wood saved from projects with same biome and applied methodology developed by Carbono Social Serviços Ambientais LTDA was considered in this fraction. CDM or VCS registered projects will also be included in this fraction if placed in the same region and methodology.
Any comment:	It will be employed in order to estimate the amount of non-renewable biomass. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Fixed Parameters

Data / Parameter:	$EF_{projected\ fossil\ fuel}$
Data unit:	tCO_2/TJ
Description:	CO2 Emission factor of residual fuel oil
Source of data to be used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf. Page 2.18. Table 2.3. Visited on March 27th, 2009.
Value of Data applied for the purpose of calculating expected emission reductions:	77.4
Description of measurement methods and procedures to be applied:	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood,

[52] 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>. Visited on May 11th, 2009.

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

	however it can be a more plausible of substitute of wood than natural gas due to risks involving natural gas distribution.
QA/QC procedures to be applied :	The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction.

Data / Parameter:	**$NCV_{biomass}$**
Data unit:	TJ/Ton of wood
Description:	Net Calorific Value
Source of data to be used:	Brazilian study carried out with Cerrado wood: Vale, A.T; Brasil, M.A.M; Leão, A.L. Quantificação e caracterização energética da madeira e casca de espécies de Cerrado. Ciência Florestal, Santa Maria; v.12,n.1, p. 71-80; 2002. Available at: http://www.ufsm.br/cienciaflorestal/artigos/v12n1/A8V12N1.pdf. Visited on August 21th, 2009.
Value of Data applied for the purpose of calculating expected emission reductions:	0.0186
Description of measurement methods and procedures to be applied:	This value will provide the energy generated by the amount of wood that would be used in the absence of the project. The species used to calculate the average value are typical trees of *Cerrado* Biome that are usually employed as fuel in the ceramic industries of the region. In order to guarantee the confidentiality of the data, three studies were used to calculate the NCV. The study that demonstrates to be the most conservative was used at the calculations of the VCS PD. The other studies used are: VALE, Ailton Teixeira do, BRASIL, Maria Aparecida Mourão and LEAO, Alcides Lopes. Caracterização da madeira e da casca de Sclerolobium paniculatum, Dalbergia miscolobium e Pterodon pubescens para uso energético.. In: ENCONTRO DE ENERGIA NO MEIO RURAL, 3., 2000, Campinas. Proceedings online... Available from: <http://www.proceedings.scielo.br/scielo.php?script=sci_arttext&pid=MSC0000000022000000100002&lng=en&nrm=abn>. Acess on: 10 Sep. 2009. And VALE, Ailton Teixeira do, RESENDE, Raquel. Estimativa do consumo residencial de lenha em uma pequena comunidade rural do municipio de Sao Joao D'Aliança – GO. In: UNICAMP, 2004, Campinas. Proceedings online... Available from: <http://www.nipeunicamp.org.br/agrener/anais/2002/0040.pdf?3bc2dbeb0a7bf779fe39c865b70b3b3f=874f4d94a1a6d02689ed38812b475d50>. Acess on: 10 Sep. 2009. Some sources of data used provide the Gross Calorific Values (GCV) of the *Cerrado* species. In order to transform the GCV to NCV, it was utilized the equation which is available at the VCU Estimative spreadsheet. IPCC default values shall be used only when country or project specific data are not available or difficult to obtain, according to "Guidance on IPCC default values" (Extract of the report of the twenty-fifth meeting of the Executive Board, paragraph 59).

QA/QC procedures to be applied :	It was included species that are usually employed as fuel from *Cerrado* Biome in the ceramic sector according to "Vale, A.T; Brasil, M.A.M; Leão, A.L.". These species present such good characteristics in order to be applied as fuel in the ceramic kilns.
Any comment:	

Data / Parameter:	$\rho_{biomass}$
Data unit:	ton/ m3
Description:	Specific gravity
Source of data to be used:	Brazilian study carried out with Cerrado wood: Vale, A.T; Brasil, M.A.M; Leão, A.L. Quantificação e caracterização energética da madeira e casca de espécies de Cerrado. Ciência Florestal, Santa Maria; v.12, n.1, p. 71-80; 2002. Available at: http://www.ufsm.br/cienciaflorestal/artigos/v12n1/A8V12N1.pdf. Visited on August 21th, 2009.
Value of Data applied for the purpose of calculating expected emission reductions:	0.5702
Description of measurement methods and procedures to be applied:	The amount of wood used in the baseline was measured by volume units, so this data is used to the unity conversion. The species used to calculate the average value are typical trees of *Cerrado* Biome that are usually employed as fuel in the ceramic industries of the region. In order to guarantee the confidentiality of the data, three studies were used to calculate the Specific gravity of the biomass. The study that demonstrates to be the most conservative was used at the calculations of the VCS PD. The other studies used are: VALE, Ailton Teixeira do, BRASIL, Maria Aparecida Mourão and LEAO, Alcides Lopes. Caracterização da madeira e da casca de Sclerolobium paniculatum, Dalbergia miscolobium e Pterodon pubescens para uso energético.. In: ENCONTRO DE ENERGIA NO MEIO RURAL, 3., 2000, Campinas. Proceedings online... Available from: <http://www.proceedings.scielo.br/scielo.php?script=sci_arttext&pid=MSC0000000022000000100002&lng=en&nrm=abn>. Acess on: 10 Sep. 2009. And VALE, Ailton Teixeira do, RESENDE, Raquel. Estimativa do consumo residencial de lenha em uma pequena comunidade rural do municipio de Sao Joao D'Aliança – GO. In: UNICAMP, 2004, Campinas. Proceedings online... Available from: <http://www.nipeunicamp.org.br/agrener/anais/2002/0040.pdf?3bc2dbeb0a7bf779fe39c865b70b3b3f=874f4d94a1a6d02689ed38812b475d50>. Acess on: 10 Sep. 2009.
QA/QC procedures to be applied :	It was included species that are usually employed as fuel from *Cerrado* Biome in the ceramic sector according to "Vale, A.T; Brasil, M.A.M; Leão, A.L.". These species present such good characteristics in order to be applied as fuel in the ceramic kilns.
Any comment:	

Data / Parameter:	**BFy**
Data unit:	Tons of wood per thousand of ceramic units
Description:	Consumption of non renewable biomass per thousand of ceramic units produced in the baseline

Source of data to be used:	Historical data from ceramic owner
Value of Data applied for the purpose of calculating expected emission reductions:	1,863
Description of measurement methods and procedures to be applied:	The value was acquired through the average consumption and production of ceramic units during the last year 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 in the region. If nowadays the plant still used native firewood, its consumption would be around 797 tons of native firewood per month to produce 427,594 ceramic units. The value is employed to calculate the real amount of wood displaced to maintain the ceramic production at each kiln in the baseline scenario.
QA/QC procedures to be applied :	The total of 797 tons of native wood utilized to produce 427,594 ceramic units. Eventually, these values lead to an efficiency of 1,863 tons of native wood to produce a thousand of ceramic units at the “Round kilns”. *Maracá* Ceramic’s kilns are less efficient than average for a “Round Kiln”. [54] These values are discrepant because of the lack of technology in the region, the indiscriminate use of the wood causing it surplus.
Any comment:	

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan will be the owner of *Maracá* Ceramic. The ceramic owner will also be responsible for developing the forms and registration formats for data collection and further classification. Data monitored will be kept during the crediting period and 2 years after. For this purpose, the authority for the registration, monitoring, measurement and reporting will be Mrs. *Valciene Soares Santana* by *Maracá* 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 units, equipments from *Flyever* will monitor each burning cycle of the kilns 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/>.

[54] *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).*

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

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

Baseline

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

Where:

ER_y: Emission reductions during the year y in tCO_2e

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

$f_{NRB,y}$: Fraction of non-renewable biomass (wood) used in the absence of the project activity in year y

$NCV_{biomass}$: Net calorific value of non-renewable biomass in TJ/ton

$EF_{projected\ fossil\ fuel}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO_2e/TJ[55].

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

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

Where:

PRy = Number of ceramic pieces produced per month;

BFy = Tons of wood per thousand of pieces produced.

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

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

Leakage (LE)

The methodology AMS-I.E.-Switch from Non–Renewable Biomass for Thermal Applications by the User – version 01 from February 01 of 2008 onwards predicts the following possible three sources of leakage:

***A)** If the project activity includes substitution of non-renewable biomass by renewable biomass, leakage in the production of renewable biomass must be considered*

The leakage from biomass projects, like the project activity, shall also be estimated according to the "General guidance on leakage in

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

biomass project activities" (attachment C of appendix B) of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on the type of biomass considered (described in the table below).

Table 11. 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:

<u>Wood residues (sawdust/wood chips)</u>

Wood Residues are a probable fuel to be used for the ceramic units burning. The production of wood generates a large amount of residues, which can be reused to generate thermal energy. As can be observed in the Figure 7, the potential of energy generation in the state of *São Paulo* is extremely high, and *Minas Gerais* has a great potential too, which means that there is an enormous availability of this kind of fuel to be employed in the project activity. This way, this biomass does not have potential to generate leakage emissions due to its high availability.

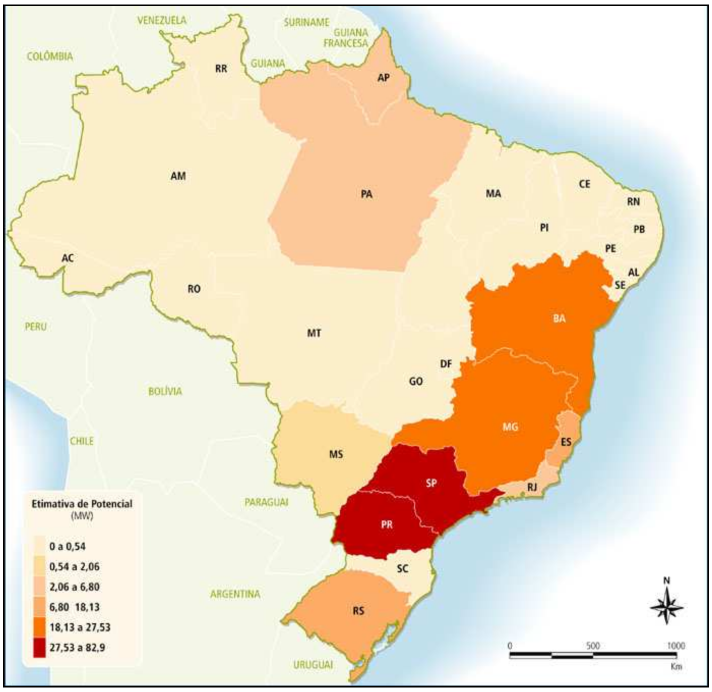

Figure 7. Forest Residues Potential for Energy Generation[56]

According to IBGE 2007, the production of log of wood and firewood in the State of *São Paulo,*[57] *Mato* Grosso do Sul,[58] and *Minas Gerais*[59] totalizes 38.5 millions of wood which will generate more than 8.4 millions of residues, considering that around 22% of this total will generate sawdust[60].

Table 12. Production of log of wood and firewood

Production / **State**	*São Paulo*	*Mato Grosso do Sul*	*Minas Gerais*	**Residues Generated**
Log of wood (m^3)	25,966,464	1,042,639	374,389	6,024,368
Firewood (m^3)	7,407,385	468,143	3,326,732	2,464,497
Total (m^3)	38,585,752			8,488,865

The project activity will employ approximately 6,300 tons or 18,000 m^3 of woodchips/sawdust per year which represent 0.21% of the total of residues generated, considering only this two States.

<u>Sugar Cane Bagasse</u>

[56] Source: CENTRO NACIONAL DE REFERÊNCIA EM BIOMASSA - CENBIO. Panorama do potencial de biomassa no Brasil. Brasília; Dupligráfica, 2003. 80 p. Avaiable at: <www.aneel.gov.br/aplicacoes/atlas/pdf/05-Biomassa(2).pdf>. Last Visited on: June 30th 2009

[57] IBGE. Extração vegetal e silvicultura 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=extracaovegetal2007>. Visited on May 11th, 2009.

[58] IBGE. Extração vegetal e silvicultura 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=mg&tema=extracaovegetal2007>. Visited on May 11th, 2009.

[59] IBGE. Extração vegetal e silvicultura 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ms&tema=extracaovegetal2007>. Visited on May 11th, 2009.

[60] 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.

Sugar Cane Bagasse is another probable biomass to be utilized in the project activity. 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. Only in the state of São Paulo, there are located more than 40% of this total. Each plant produces around 1.5 million tons of cane yearly[61]. One ton of sugar cane produces about 140 kilograms of sugar cane bagasse and finally 90% of this amount can be used to energy production.[62]

Table 13. Production of Sugar Cane in the center-south region of Brazil.

Harvest	04/05	05/06	06/07	07/08
Production of Sugar Cane (tons)	328,697,362	337,714,418	372,285,061	431,184,748
Sugar Cane Bagasse (tons)	41,415,868	42,552,017	46,907,918	54,329,278

Text adapted from : http://www.unica.com.br/downloads/estatisticas/processcanabrasil.xls. Visited on May 21th, 2009.

Sugar cane bagasse is also employed for cogeneration systems. However Figure 8 presents the excess of energy in Brazil from sugar cane bagasse. The region of the project activity and its boundaries states has a great surplus of this biomass.

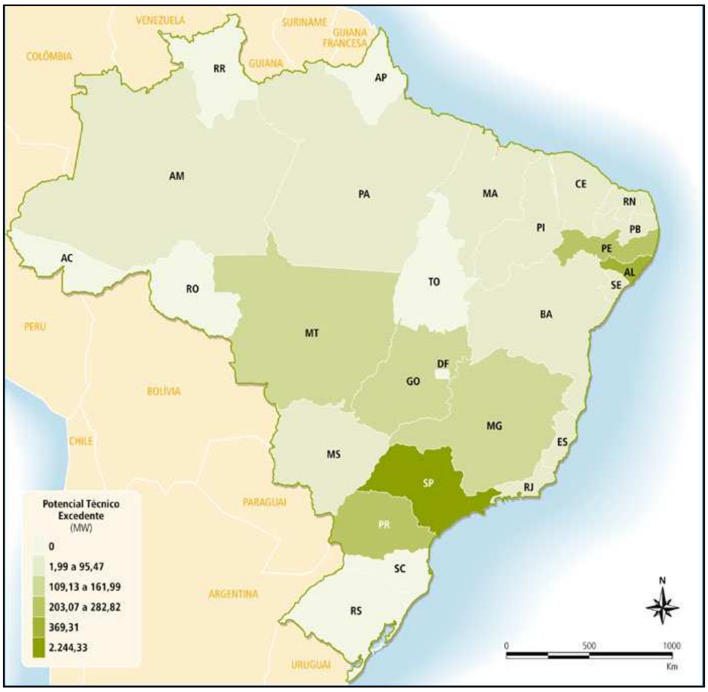

Figure 8. Sugar Cane Residue Potential for Energy Generation[63]

<u>Bamboo</u>

In case of using Bamboo it will be cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, therefore the leakage that would be

[61] *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> . Visited on May 11th,2009.*

[62] *CGEE. Geração de energia elétrica a partir de biomassa no Brasil: situação atual, oportunidades e desenvolvimento. Available at: <www.cgee.org.br/arquivos/estudo003_02.pdf>. Visited on May 11th, 2009.*

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

applicable is the emissions from biomass generation/cultivation. In case of using this kind of biomass, the ceramic company will cultivate, by itself, elephant grass in abandoned areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, i.e. only the leakage from biomass cultivation will be monitored in case of its use.

Furthermore, since the cultivation of bamboo would be in abandoned land areas, the emissions from the cleared land would be omitted as suggested by the "General guidance on leakage in biomass project activities."

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

Corn Straw

Corn Straw is another probable biomass to be utilized in the project activity. A study made by *Universidade Federal do Rio Grande do Sul* (one the most respected universities in Brazil) showed that the residues of corn plantation are 2 times the quantity of corn extracted from it respective plantation.[64]

Only in the state of *Minas Gerais*, the production of corn in tons was 6,066,077 in 2007, according to IBGE (*Geographic and Statistic Brazilian Institute)* and *São Paulo*, which is a bordering state, had a production of 3,921,701 tons in 2007.

Table 14. Production of corn

Harvest – 2007	*Minas Gerais*[65]	*São Paulo*[66]	Total
Production of Corn (tons)	6,066,077	3,921,701	9,987,778
Residues from corn (tons)	12,132,154	7,843,402	19,975,556

Elephant grass

In case of using elephant grass[67] it will be cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, therefore the leakage that would be applicable is the emissions from biomass generation/cultivation. Currently, elephant grass has been acquiring national importance as biomass[68] to generate thermal energy due to its high productiveness and

[64] *Sabalsagaray, B. S.* ***Levantamento de produção de resíduos agro-industriais e seu potencial de utilização na indústria da construção.*** *Dissertação (Mestrado em Engenharia Civil)* – Universidade Federal do Rio Grande do Sul*, 1998. Available at: <http://www.lume.ufrgs.br/bitstream/handle/10183/3121/000332554.pdf?sequence=1>. Visited on August 21th, 2009.*

[65] *According to IBGE(Geographic and Statistic Brazilian Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=mg&tema=pamclo2007>. Visited on: August 21th, 2009*

[66] *According to IBGE(Geographic and Statistic Brazilian Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=pamclo2007>. Visited on: August 21th, 2009*

[67] *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.*

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

easy adaptation in almost all climate and soil Brazilian conditions; it also dismisses the use of fertilizers (NPK).[69] In case of using this kind of biomass, the ceramic company will cultivate, by itself, elephant grass in abandoned areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, i.e. only the leakage from biomass cultivation will be monitored in case of its use.

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

Furthermore, since the cultivation of elephant grass would be in abandoned land areas, the emissions from the cleared land would be omitted as suggested by the "General guidance on leakage in biomass project activities."

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.

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

With the implementation of the project activity, the ceramics will avoid the consumption of about 16,328 m³ per year of non-renewable wood helping the conservation of forests at *Cerrado* biome, besides the ecological and social benefits to the region.

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

This leakage will be monitored in order to guarantee the project conservativeness.

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

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

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

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

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

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

Maracá Ceramic – Year of 2007

ERy, total = 8,764 tons of wood x 0.9806 x 0.0186 TJ/ton x 77.4 tCO2/TJ

ERy, total = 12,372 tons of CO_2e

Table 15. Emission reductions without considering the leakage

Year	**Emission Reductions (tCO2e)**
March -2008	10,310
2009	12,372
2010	12,372
2011	12,372
2012	12,372
2013	12,372
2014	12,372
2015	12,372
2016	12,372
2017	12,372
February - 2018	2,062
Total Emission Reductions (tCO2e)	**123,720**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO2e)	**12,372**

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

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

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

Table 16. Estimation of overall emission reductions

Year	Baseline Emissions (tons of CO2e)	Leakage (tons of CO2e)	Emission Reductions (tons of CO2e)
March -2008	10,310	0	10,310
2009	12,372	0	12,372
2010	12,372	0	12,372
2011	12,372	0	12,372
2012	12,372	0	12,372
2013	12,372	0	12,372
2014	12,372	0	12,372
2015	12,372	0	12,372
2016	12,372	0	12,372
2017	12,372	0	12,372
February - 2018	2,062	0	2,062
Total			**123,720**
Average			**12,372**

5 Environmental Impact:

As can be observed in Table 17, the 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 CO_2, as well as when using wood. However, the emission reductions of GHG will improve since they are renewable biomasses.

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

Table 17. Summary of the environmental impacts

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

Environmental Laws related to the plant activities

The Environmental National Policy, *Política Nacional do Meio Ambiente* - PNMA, instituted by the Brazilian Law 6.938/81, establishes that the construction, installation, amplification and operation of any enterprise or activity which may exploit natural resources, and are considered potentially pollutant, or capable of degrading the environment, will be possible only if they obtain a previous environmental permission; according to the Brazilian Constitution of 1988. One of the tools settled by the PNMA, in order to monitor and study the potential impacts generated by these kinds of enterprises, is the Environmental Impact Assessment (EIA).

An EIA was not required due to the project activity.

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

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

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

6 Stakeholders comments:

Maracá Ceramic sent a letter for about 20 stakeholders, considering clients, suppliers, public organizations, and academic organizations. 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 a minimum of 7 days and the comments are expected for a period of a minimum of 7 days after the letter has been posted.

CCB,[70] one of the considered stakeholders, answered the letter stating their support to the present project activity.[71]

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.

[70] *Disponsable at: <http://www.ccb.org.br/servicos/index.php>*

[71] *The letter from CCB was evidenced to the DOE.*

7 Schedule:

- Project start date: Date on which the project began reducing or removing GHG emissions, i.e. when the project proponents began employing renewable biomass. At this date, the ceramic acquired the first burners: December 1st, 2007;
- Crediting period start date: March 1st, 2008;
- Validation Report predicted to: September, 2009;
- First Verification Report predicted to September, 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:[72] February 28th, 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.

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

8 Ownership:

8.1 Proof of Title:

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

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

Not applicable.