MENEGALLI CERAMIC FUEL SWITCHING PROJECT

Document Prepared By Sustainable Carbon – Projetos Ambientais Ltda

Project Title	Menegalli Ceramic Fuel Switching Project
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Prepared By	Sustainable Carbon – Projetos Ambientais Ltda.
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1 PROJECT DETAILS

1.1 Summary Description of the Project

Menegalli Ceramic is located in the city of São Miguel do Guamá, Pará State, north of Brazil. *Menegalli* Ceramic is a small industry that produces structural ceramic pieces such as bricks and roof tiles, mainly for the market in Belém and for the northeast of the State of Pará. In the years prior to the project initiation the fuel employed to fire the ceramic units was native wood obtained from the Amazon forest, which led to the deforestation of this biome.

The Amazonian Biome has sufficiently diversified fauna and flora, representing 60% of all Brazilian territory. Nowadays, uncontrolled deforestation is breaking up the firm land forest. Without necessary care, entire regions of fauna and old centers of species have the risk to completely disappear.

In opposition to the identified baseline, the project activity will generate thermal energy without stimulating deforestation and will use an abundant renewable biomass. Therefore, the project will reduce greenhouse gases emissions through the substitution of native wood (non-renewable woody biomass) for sawdust, açaí pits and eventually other types of renewable biomass, such as elephant grass and rice husk, for thermal energy generation. This fuel switching could only be feasible when considering the incomes from carbon credits, since the adaptation of kilns to the new biomasses and the purchase of new equipment required considerable investments.

The main goal of this project activity is to minimize the negative impacts of the deforestation of the Amazonian biome by discouraging the exploitation of the area. The switching of non-renewable fuel (non-renewable wood) to renewable biomasses is expected to reduce an average of 23,515 tCO_2e per year during the first crediting period of the Project. The first crediting period started on 01-July-2008 and will end on 30-June-2018.

The VCS PD is being updated to include changes to the Project design that took place during the 4^{th} and 5^{th} monitoring period of the Project (respectively from 01-March-2011 to 30-April-2012 and from 01-May-2012 to 31-December-2015). Changes to the Project include the construction of kilns that did not exist at the time of validation and modifications to the monitoring procedures to ensure consistency with the ceramic factory operations. These changes are further described on Section 1.8 of this VCS PD.

The inclusion of new kilns is considered not to impact the applicability of the methodology, the additionality of the Project activity or the appropriateness of the baseline scenario, as described below:

Applicability of the methodology: Project Proponents consider there is no impact on the applicability of the methodology, since the methodology applied on this project comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The new kilns are similar to the ones existing at the time of validation, which means they comply with such definition. Also, the applied methodology is applicable to projects that comply with the threshold for small scale CDM Project Activities, specifically projects involving renewable energy from biomass that have an output capacity lower than 45 MW thermal. The Project will remain within such threshold even with the introduction of the new kilns.

The use of non-renewable biomass can be considered a plausible baseline scenario for the new kilns, meaning the use of renewable biomass on the new kilns displaces the expected use of non-renewable biomass. Project Proponents are able to conclude that because the baseline scenario determined at the time of validation is still valid for the current scenario (the scenario existing on the Project region at the time of creation of the present version of the VCS PD).

The remaining applicability conditions of the methodology applied are also not affected by the introduction of new kilns. Those applicability conditions relate to the existence of small-scale CDM project activities in the region and to the demonstration that non-renewable biomass has been used in the past, which are not affected by the introduction of kilns on Menegalli Ceramic.

Additionality: the use of renewable biomass on the new kilns is considered additional. The improvements on energy efficiency on the new kilns (when compared to the kilns available at validation) do not impact additionality, since the new kilns would be more efficient even if fueled with non-renewable biomass. This means the improvements on energy efficiency would not impact the attractiveness of non-renewable biomass when compared to renewable biomass. Also, an assessment was made on the cost of delivered heat to demonstrate the use of renewable biomass is less financially attractive than the use of non-renewable wood. This is further described on Section 2.5 of this VCS PD.

Appropriateness of the baseline: non-renewable biomass is still a plausible baseline alternative. The appropriateness of the baseline is not affected by the introduction of new kilns on Menegalli Ceramic.

This version of the VCS PD provides updates to version 3 (dated 15-September-2009) to account for the design changes mentioned above and to include minor updates and corrections considering the Project status at the time of creation of version 4 of the VCS PD (August, 2016). However, most of the information on this document (including the identification of the baseline scenario, the assessment of additionality and the *ex-ante* calculation of expected emission reductions) still refers to conditions and assumptions that were valid at the time of Project validation, as previously described on version 3 of the VCS PD.

1.2 Sectoral Scope and Project Type

The project is associated to the following scope, as per UNFCCC definitions:
1 - Energy industries (renewable - / non-renewable sources);

This is not an AFOLU project. This is not a grouped project.

1.3 Project Proponent

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

Organization name	Cerâmica Menegalli Ltda
Contact person	Mr. Edison Menegalli and Mr. Juliano Queiroz

Title	Mr. Edson Menegalli, 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.Juliano Queiroz, Administrative Manager of the ceramic and Monitoring Responsible: information about the ceramic, detailed information on process and production line, environmental challenges, technological challenges, research and development history, ceramics units market challenges, general data and information on inputs and outputs of the ceramic, detailed information on the acquisition of renewable biomasses and how this data is kept by the controller's office.
Address	Rua João Barbosa, 340 – Vila França São Miguel do Guamá - Pará - Brazil Postal Code: 68660-000
Telephone	Ceramic phone number: +55 91 3446-1421
Email	ceramicamenegalli@hotmail.com

As the project authorized contact, Sustainable Carbon was given the responsibility of preparing the present project report and to accompany the proponents until the end of the crediting period.

Organization name	Sustainable Carbon – Projetos Ambientais Ltda
Contact person	Dênis dos Santos Fernanda Sayuri Suzuki Marcelo Haddad Thiago de Avila Othero
Title	Dênis dos Santos: Technical Analysit Fernanda Sayuri Suzuki: Technical Analyst Marcelo Hector Sabbagh Haddad: Technical coordinator Thiago de Avila Othero: Senior Technical coordinator
Address	R. Doutor Bacelar. 368 – Conj. 23 – Vila Clementino Postal Code: 04.026-001 São Paulo – SP. Brazil
Telephone	+55 11 2649 0036
Email	tecnica@sustainablecarbon.com

1.4 Other Entities Involved in the Project

No other entity is involved in this project activity.

1.5 Project Start Date

Project start date: 01/07/2007. Date on which the project began reducing or removing GHG emissions. On this date, the project began reducing or removing GHG emissions, i.e. the ceramic started using renewable biomass as fuel.

1.6 Project Crediting Period

Crediting Period start Date: 01-July-2008.

Date of terminating the project (date on which the project completes 10 years after the date on which the project proponent completed the fuel switch to renewable biomass): 30-June-2018

VCS project crediting period: 10 years, twice renewable

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)[1]
From July to December – 2008	11,758
2009	23,515
2010	23,515
2011	23,515
2012	23,515
2013	23,515
2014	23,515
2015	23,515
2016	23,515
2017	23,515
From January to June – 2018	11,758

[1] This Table provides the estimated GHG emission reduction at the time of Project validation, as available on version 3 of the VCS PD. The introduction of the new kilns increased the production capacity of Menegalli Ceramic from 2011 onwards and, hence, the emission reductions resulting from the Project implementation. However, the ex-ante estimation of emission reductions is presented here with the conditions and assumptions valid at the time of Project validation. Please view Appendix 1 for the amount of GHG emission reduction verified until the date of this document. Such information provides ex-post calculation of emission reductions (considering the new kilns). This information also allows concluding that even with the introduction of the new kilns this Project Activity does not qualify as a Large Project according to VCS definitions (emission reductions greater than 300,000 tonnes of CO2e per year).

Total estimated ERs	235,150
Total number of crediting years	10
Average annual ERs	23,515

1.8 Description of the Project Activity

This Project will promote a fuel switch from non-renewable biomass (native wood) to renewable biomasses at Menegalli Ceramic, which is a red ceramic factory. The productive process of Menegalli Ceramic includes many types of equipment to produce bricks and tiles by processing clay and other components to achieve specific properties and dimensions. After these devices are molded, they are sent to dry in an artificial dryer and then are loaded to the kilns for burning. Once the ceramic devices are burned they are unloaded from the kilns and are ready for sale.

This emission reduction project does not involve modifications to most of the processes and equipment and will be limited to allowing the ceramic factory to use renewable biomasses instead of non-renewable wood. All equipment and procedures that are not used for drying and burning ceramic devices (such as molding machinery) are considered to lie within of the Project boundary, as they are within the limits of the ceramic factory. However, no emissions sources relate to these processes and equipment, since no modifications will result from the project implementation.

The Project included adaptations to the kilns that existed before the Project initiation and the investment in equipment and facilities to allow the efficient use of biomass. Menegalli Ceramic is currently operating with 14 kilns, since new kilns were introduced to meet market demand. Eight of these kilns started to operate after the Project validation and were, therefore, not described on the VCS PD version 03. All new kilns are of the same type "Paulista" as the kilns that were available at validation. However, the kilns built after the Project validation are more efficient, as informed by an expert consulted by the Project Proponents. Information on the starting date of operation of each kiln is available below:

- Kilns 1 to 5 were available at the time of validation and had operated on Menegalli Ceramic during the years prior to the Project initiation[2].
- Kilns 6 to 12 started to operate during the 4th monitoring period of the Project and began producing ceramic devices on 10-March-2011 (Kiln 6) and between 17-January-2012 and 22-March-2012 (kilns 7 to 12).
- Kilns 13 and 14 started to operate during the 5th monitoring period of the Project and began producing ceramic devices between 24-September-2012 and 08-October-2012.

It is important to notice that kilns used by red ceramic factories are generally produced by the ceramic factory, since they are basically a physical structure built of bricks with a specific design to allow for the burning of fuels and the efficient distribution of heat. Therefore, ceramic kilns do not have manufacturer's specifications or follow industry standards. Parameters such as the installed capacity, load factors and efficiencies depend on how the kilns are built and operated. Also,

[2] Menegalli Ceramic actually had eight kilns at the time of validation. However, three of such kilns were deactivated during the third monitoring period (from 01-February 2010 to 28-February-2011). Therefore, only five kilns are considered to be the ones existing at the time of validation.

ceramic kilns typically do not have a predetermined lifetime and can be used for many decades as long as preventive and corrective maintenance procedures are followed.

To account for the improvement on the energy efficiency of the kilns that started to operate after the project validation, different values for the parameter "Baseline consumption of non-renewable biomass per tonnes of ceramic units produced (BFy)" are considered for the original kilns (kilns 1 to 5) and for the new kilns (kilns 6 to 14). More details on the determination of BFy are available on Sections 3.4 and 4.1 of this document.

During the project validation, Menegalli Ceramic was operating with eight "Paulista" kilns which had two rooms each and an artificial greenhouse to fire and dry the products. The fuel's monhly consumption was based in the employment of approximately 150 tonnes of sawdust and 1,000 tonnes of açaí pits to supply approximately 40 burning cycles per month, each with 22,500 ceramic units, totalizing a production of 1,205 tonnes of ceramic units fired per month. Therefore, the burning efficiency with sawdust and açaí pits was approximately 0.954 tonne of biomass per tonne of ceramic units fired(13% of sawdust and 87% of açaí pits in mass).

The burning cycle with "Paulista" kiln comprises 6 hours to load the kiln with ceramic units, 20 hours of heating, 24 hours of burning, 36 hours of cooling, 6 hours to unload and approximately 30 minutes to clean the kiln. The kilns achieve the temperature of about 950ºC as described in Table 1. Kilns 6 to 14, which were built after Project validation operate under similar conditions, but with a reduced consumption of energy, as described on Sections 3.4 and 4.1 of this document.

Table 1 Technical parameters in which situation.

Situation	**Project Activity** (as available at validation)		**Baseline**
Kiln	*Paulista*		*Paulista*
Type of biomass	Renewable		Non-renewable
	sawdust	Açaí pits	Native firewood
Monthly Production (tonnes of ceramic units fired)	1,205		1,205
Consumption of biomass [3] (tonnes of biomass per tonnes of ceramic units)	0.954		1.251
Features of the kiln	*Intermittent with rectangular shape*		*Intermittent with rectangular shape*
Clay's consumption (tonnes per month)	1,574		1,574
Maximum Temperature of kiln (°C)	950		950
Average Production per burning cycle (tonnes of ceramic units fired)	30		30

[3] Measured by the project proponent.

Average supposed capacity of each kiln (MW)	3.59	3.59
Total hours of burning cycle	92.5	92.5

The sawdust employed in the project activity will be acquired from legal saw mills, as determined by information made available on the Environmental Information System of the State of Pará[4]. The enterprises listed in this system have all the necessary licenses which ensures that the saw mills utilize wood from areas with sustainable forest management.

The emission reductions will be achieved by displacing the use of non-renewable wood (wood from areas with no sustainable forest management) to provide thermal energy in the ceramic company. Therefore, the emissions from the combustion of wood were not compensated by the replanting. An opposite scenario occurs with the biomass employed in this project activity, which has carbon neutral cycle. In the absence of the Project, the thermal energy required to fire the ceramic devices would probably be obtained by the use of non-renewable biomass.

Due to the project activity, a set of adaptations were necessary, such as alterations of the kilns as well as the construction of sheds where the biomass must be stored so the ceramic company can operate with the açaí pits and sawdust. It is very gainful for the ceramic the opportunity of using two kinds of biomasses because when there is a lack of one of them, the ceramic can use the other one as rice husk and elephant grass, depending on its availability.

The ceramic owner showed also interest in elephant grass. At the time of validation, elephant grass was acquiring national importance as biomass to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions[5].

All of these changes were made counting on this project approval in order for the ceramic to become able to receive the biomass to be used.

[4] Environmental Information System of the State of Pará. According to Environmental Legislation of the State of Pará, the industries which use forested material raw have to ensure the sustainable management of their forested resources to be able to get their licenses. The System is currently available at: <http://monitoramento.sema.pa.gov.br/simlam/index.htm>.

[5] EMBRAPA, Instrução Técnica para o Produtor de Leite- Formação e utilização de pastagem e capim elefante. Available from: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Visited on April 23rd, 2009.

Figure 1.**"Paulista" kiln with the mechanic burners at *Menegalli* Ceramic.**

Figure 2. Shed constructed to store the biomasses at Menegalli Ceramic.

1.9 Project Location

The ceramic company is located in Brazil, in the state of Pará, in the north region of the country. The geographic location is illustrated in Figure 3.

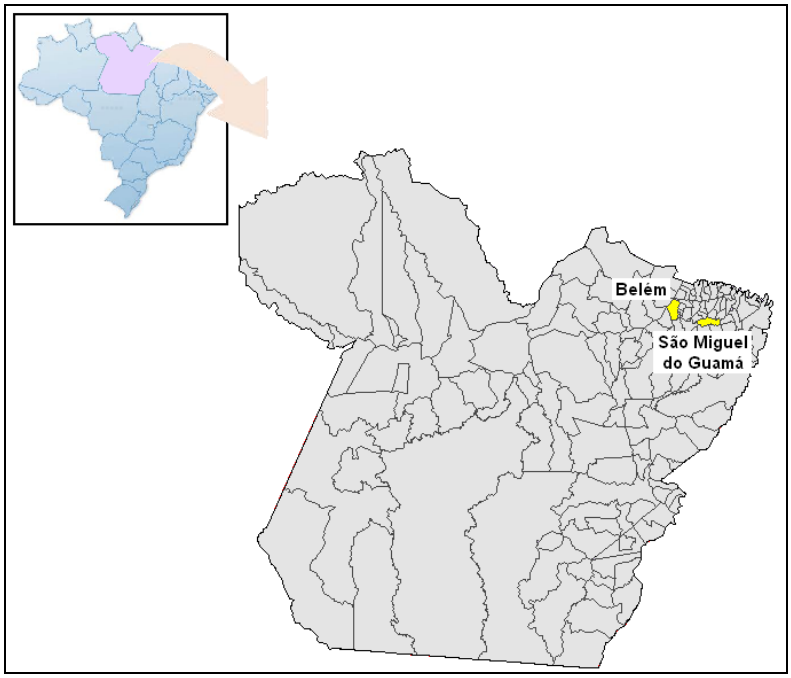

Figure 3**. Geographic location of São Miguel do Guamá which has the following coordinates: 01º 37' 09.22'' S, 47º 28' 33.68'' W.**

The project site has the following geographic locations and postal addresses:

- Company name: Cerâmica Menegalli Ltda

Rua João Barbosa, 340 -Vila França, São Miguel do Guamá – Pará

CEP: 68660-000

Ceramic Coordinates: 1°37'39.60"S, 47°28'54.67"W

1.10 Conditions Prior to Project Initiation

The conditions prior to project activity are the production through inefficient and traditional processes, using wood without forest management to generate thermal energy. The use of native wood from areas without reforestation activities is a common practice in the ceramic industries. Although firewood 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 the decade of 1970, when the petroleum started to supply the majority of Brazilian´s energy needs . Moreover the Brazilian´s Energy and Mine Ministry has been monitoring every energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for the ceramic sector.

According to Seye (2003), 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 represent about 98% of the total fuel employed at the time of validation, stimulating the increase in Brazilian deforestation and desertification rates. It happens because wood without forest management is widely offered at low prices.

The baseline identified for this project activity is the utilization of a total of 18,089 tonnes of native wood per year to provide thermal energy to the ceramic's kilns. On the other hand, the project activity focuses on the use of sawdust and açaí pits as renewable biomasses for thermal energy supply.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

This project is in accordance to the CONAMA[6] Resolution, no. 237/97 which establishes that clay extraction activities and ceramic production must be supported by specific licenses, such as operational license, clay extraction license, environmental licenses and the permission of the Environmental Secretary of Pará (SEMA[7]) which must run under the valid time.

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[8]) due to the clay exploitation.

1.12 Ownership and Other Programs

1.12.1 Right of Use

Ceramic's article of incorporation and the contract between Sustainable Carbon – Projetos Ambientais – project developer – and *Menegalli* Ceramic will proof the title, demonstrating the rights to the GHG emissions reductions and the ownership of the project. These proofs of title were checked by Validation and Verification Body at the time of validation and are in power of *Menegalli* Ceramic and available for consultation.

[6] 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. Visited on April 22nd, 2009.

[7] SEMA is the Environment Secretary in the State of Pará, responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: www.sema.pa.gov.br. Visited on April 23rd, 2009

[8] 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. Available at: http://www.dnpm.gov.br/enportal/conteudo.asp?IDSecao=168&IDPagina=222. Visited on April 23rd, 2009.

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable.

1.12.3 Other Forms of Environmental Credit

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

Q27 Standard[9] was applied to perform validation and verification of the Project, however it was switched to the Verfied Carbon Standard, which is currently being applied. The crediting period of the verified carbon credits Q27 Standard is from January 1st, 2008 to June 15th, 2008 and this period was not considered in this VCS PD.

SOCIALCARBON Methodology[10] is being applied only as a Sustainability tool in association with VCS.

1.12.4 Participation under Other GHG Programs

The project activity is not registered under any other GHG program.

1.12.5 Projects Rejected by Other GHG Programs

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.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

Not applicable. This is not a grouped Project.

Leakage Management

Not applicable.

Commercially Sensitive Information

[9] Standard developed by BRTUV – Avaliações da Qualidade, Brazilian Subsidiary of TÜV NORD CERT GmbH.

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

None of the information exposed to the Validation and Verification Body was withheld from the public version of the report.

Further Information

The project is eligible according to:

- Legislative: the project attends all legal requirements;
- Technical: alterations/adaptations required are technically feasible;
- Economic: fuel switching project requires high investments;
- Sectoral: incentive of good practices to the sector;
- Social: SOCIALCARBON methodology will be applied which will improve long term sustainability. The culture of burning wood as fuel will be slowly mitigated;
- Environmental: the project attends all legal requirements and no environmental impacts are predicted;
- Geographic /site specific: the plant can be uniquely geographically identified with no barriers regarding logistic;
- Temporal information: the project will not double count the GHG emissions during the ten years renewable of the crediting period.

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

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Category AMS-I.E: Switch from Non–Renewable Biomass for Thermal Applications by the User – Version 01, valid from 01/02/2008 to 08/04/2010[11].

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

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

2.2 Applicability of Methodology

The methodology applied is Category AMS-I.E: Switch from Non–Renewable Biomass for Thermal Applications by the User – Version 01 valid from 01/02/2008 to 08/04/2010, which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

[11] Available at: < http://web.archive.org/web/20090304141849/http://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSP4VBBO5G54RXDE9KQ6FJWMGHZLHFA5 >. Last visit on: 17/03/2015.

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 São Miguel do Guamá once Sustainable Carbon 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)[12] and Brazilian´s Technology and Science Ministry[13]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted for by the other registered project activities.

The utilization of firewood from 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 greenhouse effect even worse. Moreover, the native wood provided from areas without a reforestation management plan does not fit any of the options of UNFCCC definition of renewable biomass in Annex 18, EB 23.

Furthermore, firewood has been used for many decades as fuel in Brazil[14]. Although, it is impossible to define a start date on which this kind of non-renewable biomass began to be applied, there are many documents to prove that wood has been used for thermal energy generation before 1989 as requested in the applied methodology. Firewood used to be the most employed source of primary energy until the decade of 1970, when the petroleum started to supply the majority of Brazilian's energy needs[15]. Moreover the Brazilian's Energy and Mine Ministry has been monitoring every energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for the ceramic sector[16]. Especially in the ceramic sector, the use of firewood is notably non-renewable and unsustainable, involving negative environmental impacts associated[17].

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

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[12] CDM activities registered by CDM Executive board are Available at:< http://cdm.unfccc.int/Projects/registered.html>. Visited on April 23rd, 2009.

[13] Brazilian´s Technology and Science Ministry is responsible for registry and approval of all CDM activities within Brazilian boundaries. CDM activities submitted to the Brazilian Inter-Ministerial Commission of CDM Activities are available at: http://www.mct.gov.br/index.php/content/view/47952.html. Visited on May 15th, 2009.

[14] 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 April 23rd, 2009.

[15] Brito, J.O."Energetic use of Wood". Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES>. Visited on April 23rd, 2009.

[16] National Energy Balance- energy consuption per sector. Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download>. Visited in March 24th, 2009.

[17] 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 24th, 2009.

Sawdust/wood chips are forest residues while açaí pits and rice husk are agro-industries residues, 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". Besides, sawdust, açaí pits and rice husk are common residues in the region generated.

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

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

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

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

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

Moreover, the project activity will have an output energy capacity lower than 45 MW thermal.

2.3 Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Emissions from the combustion of non-renewable biomass	CO_2	Yes	The major source of emissions in the baseline
		CH_4	No	Deforestation rates will probably decay. Excluded for simplification. This is conservative.
		N_2O	No	Possibly emissions from wood burning will be excluded for simplification. This is conservative.
		Other	No	Not appicable
Project	-	CO_2	No	Excluded for simplification. This emission source is assumed to be very small
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
		Other	No	Excluded for simplification. This emission source is assumed to be very small

The following figure provides a diagram of the Project boundary.

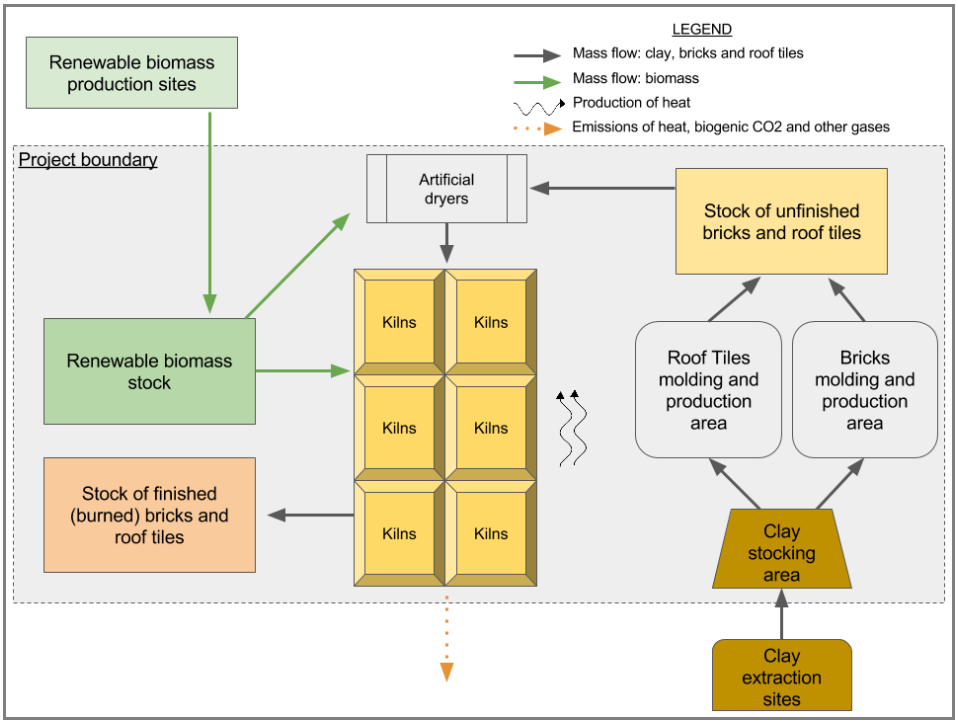


Figure 1. Diagram representing of the Project boundary.

2.4 Baseline Scenario

Observing Table 2, 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 none specified.

A probable baseline scenario would be the use of Natural Gas. However, there was no distribution/gas pipe in the region at the time of validation[18], excluding this possibility.

The most probable scenario in the absence of native wood would be the use of fuel oil, which is not viable considering its higher prices when compared with non-renewable biomass. Even tough, fuel oil presents a higher Net Calorific Value when compared with non-renewable firewood; the costs with Fuel Oil are higher because of their expensive prices. Fuel Oil presents an average price of 0,895R$/Kg and the firewood used to present an average price of 17.91 R$/tonne in the baseline scenario. These values lead us to conclude that the price of fuel oil around 0.000090587R$/Kcal[19] as long as the price of this kind of wood is around 0.0000041R$/Kcal[20] utilizing the Net Calorific Value of both fuels. Therefore, the cost with the employment of fuel oil is higher than the utilization of firewood. Besides, the fuel oil requires more technology to be inserted. The conclusion is that use of fuel oil is not attractive at all.

[18] GISMAPS. Gás Natural. Available at: http://www.gismaps.com.br/gasnatural/gasnatural.htm. Visited on April 24th, 2009.
[19] CAETANO L.; DUARTE JR. A. 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>. Visited on April 24th, 2009.
[20] According to the values of native wood paid at Menegalli Caramic before the project activity (17.91 BRL per tonne) . The values of NCV and density utilized are the same utilized in monitoring parameters (NCV=0.0182 TJ/t and specific gravity=0,67 tonne/m^3).

Table 2 Distribution of fuel employed on the ceramic sector in Brazil.

BRAZILIAN ENERGY BALANCE 2008[21] - CERAMIC SECTOR EVALUATION **Unit: 10^3 Tone of oil equivalent**			
FUEL	***2005***	***2006***	***2007***
Natural Gas	831	901	**960**
Charcoal	70	42	**33**
Wood	1,710	1,762	**1,885**
Other recuperations	36	32	**35**
Diesel Oil	9	8	**7**
Fuel Oil	268	285	**313**
Liquified Petroleum Gas	148	151	**153**
Others from Petroleum	71	76	**170**
Piped gas	0	0	**0**
Electricity	270	276	**284**
Others non specified	0	0	**0**
TOTAL	**3,412**	**3,533**	**3,841**

The baseline is identified as the amount of non-renewable wood displaced with the fuel switch. The overall characteristics of the ceramic production are used to obtain the real amount of non-renewable biomass used in the baseline scenario.

The identified baseline for this project activity would employ 1,507.50 tonnes of native wood per month, the fuel most commonly employed in Brazilian ceramic industries, to provide thermal energy to the ceramics' kilns and obtain an approximate temperature of 950ºC, in order to produce 1,205 tonnes of ceramic units fired per month. The wood consumption of the kiln in the baseline scenario is around 1.251 tonnes of wood per tonne of pieces fired for kilns 1 to 5 (that existed at the time of validation) and around 0.934 tonnes of wood per tonne of pieces fired for kilns 6 to 14. Such efficiencies are consistent with the expected efficiency for a "Paulista" kiln, which consumes about 1.34 m^3 per thousand of pieces[22].

[21] Brazilian Energy Balance, Available at: http://www.mme.gov.br/download.do?attachmentId=16555&download. Visited on May 15th, 2009.

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

2.5 Additionality

The methodology applied is Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Applications by the User – Version 01 valid from February 01/02/2008 to 08/04/2010 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 have an output capacity lower than 45 MW thermal.

To demonstrate that the project is additional it will be used the test 1 of section 5.8 of the Voluntary Carbon Standard (version 2007.1) - Specification for the project-level quantification, monitoring and reporting as well as validation and verification of greenhouse gas emission reductions or removals.

Test 1 – The project test

Step 1: Regulatory Surplus

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

Step 2: Implementation Barriers

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

Before the project activity, the process was noticeably different; native wood was inserted in the kilns by the employees and it was not necessary any machine experience or logistic modification. Due to the project activity, the new biomass began to be inject with the use of a semi-automatic system with mechanic burners. This new biomass also has to be stored in cover sites and needs to be dried in order to achieve a better burning efficiency.

The operators did not have knowledge of the ideal amount of renewable biomass that was necessary to achieve the temperature of about 950ºC for the ceramic pieces firing, to acquire the final product with the same quality and to maintain the optimal process as they did when using native wood, adding a significant amount of insecurity to the production process.

The employees must be careful not to fill the devices with large amounts of biomass, which can clog the new entrance of the kiln, designed especially for the project activity, 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 kiln's feeding has to be done gradually, demanding even more time and labor from the employees.

As a result of the fuel switch, training was 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 at the time of validation. The region of São Miguel do Guamá was well known for not being updated with new technologies in the Ceramic sector and very resistant to changes or improvements to its work process and general practices. This way, a set of adaptations were necessary, such as adjustments in the kiln entrances and the construction of sheds to keep the biomass away from the rain and to maintain it dry in order to increase its efficiency in the burning process.

Moreover, the use of new biomasses represented a high risk to the project proponent 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 biomasses is an innovation in the ceramic industry and their future demand (e.g. by other consumers) is not easy to foresee.

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

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

Due to the implementation of the project activity, the ceramic had to purchase machines to automatically inject the biomass with air inside the kilns, once when using wood, the fuel was manually inserted by operators in the kilns, a procedure which was deemed unfeasible when employing sawdust and açaí pits. The project proponent also acquired thermocouples and constructed sheds.

When the new production techniques were introduced at the ceramic plant, there was an adaptation period and a testing period. For the adaptation of the kilns a still period of a burning cycle for each kiln had to be considered. Also the testing period of approximately six 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 losses for the company financial profit and loss balance.

Due to all mentioned reasons the ceramic industry had to deal with a high investment that made the ceramic owner think about stopping the fuel switching project.

The demonstration of the main costs after and before the project activity can be checked in the Table 3.

Table 3. Main Costs before and after the project activity at Menegalli Ceramic

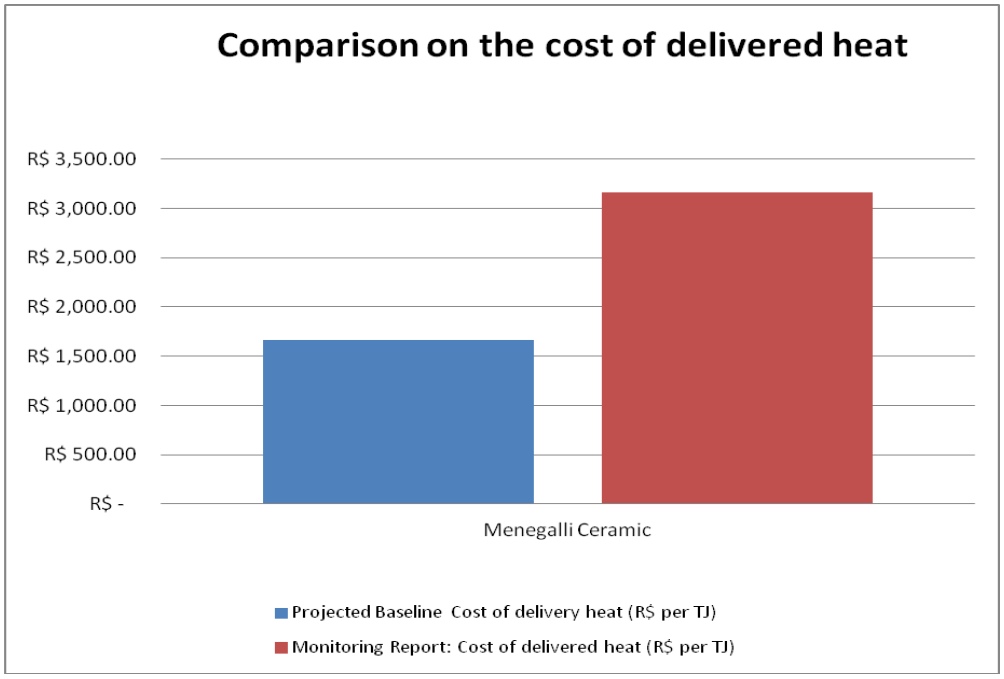
Scenario	Non renewable biomass	Renewable biomass	
		Açaí Pits	Sawdust
Variable costs			
Monthly consumption of the fuel (tonnes/month) (production of 1,205 tonnes of ceramic units monthly)	1,507.5	1,000	150
Price of biomass (BRL per tonne)	17.91	0.27	2.86
Total acquisition biomass cost (BRL per month)	27,000.00	270.41	
Energy Costs	12,853.11	14,842.00	
Costs of fuel transportation (BRL per month)	-	5,650.00	
Costs of transportation maintenance and ferryboat (BRL per month)	-	9,054.50	
Costs of mechanic burner maintenance (BRL per month)	-	12,839.33	
Truck Drivers (BRL per month)	-	1,446.74	
New Labors (BRL per month)	-	930.00	
Total variable cost per month (BRL per month)	**39,853.11**	**45,032.98**	
Investment			
Costs with truck acquisition (BRL)		273,756.70	
Costs with equipment acquisition (including freight) (BRL)		400,000.00	
Costs with kiln reconstruction (BRL)		8,100.00	
Loss of revenues - period for adaptation of the kiln for biomass (BRL)		36,000.00	
Waste of products in the testing period (6 months) (BRL)		54,000.00	

Waste of Biomass in the testing period (BRL)	3,786.17
New biomass storage shed (BRL)	110,526.53
Total Invested	**886,169.40**

To account for the inclusion of two new kilns during the 5th monitoring period (from 01-May-2012 to 31-December-2015), a reassessment of additionality was made. As the ceramic company has used exclusively renewable biomass in these two new kilns, it was performed an additionality assessment based on the renewable biomass used in the ceramic kilns, in order to include the two new "Paulista" kilns, in the project boundary.

Regarding the Financial Barrier, a comparison was made between the cost of energy generated on the baseline scenario of Menegalli Ceramic and at the 5th monitoring period. The cost of non-renewable wood was updated according to local surveys available on the VSC PD of Menegalli Ceramic. These surveys indicate that the costs for non-renewable biomass for the period (2005) was 17.91 BRL/tonne. A conservative correction factor was applied to the cost of the non-renewable biomass, in order to account for general price increases due to inflation. The annual rate of increase applied on the current monitoring period was based on the national inflation for each year[23].

Chart 1. Comparison between the cost of delivered heat at the projected baseline and the 5th monitored period.



[23] Instituto Brasileiro de Geografia e Estatística, "Índices de preços ao consumidor – IPCA e INPC" http://www.ibge.gov.br/home/estatistica/indicadores/precos/inpc_ipca/ipca-inpc_201604_1.shtm Last visited on 17/06/2016.

The Chart above displays the comparison of cost of delivered heat at the projected baseline scenario (year 2015) and at the 5th monitoring period. It can be observed that the non-renewable biomass is more financially attractive than using the renewable biomass: sawdust (which was the only type of renewable biomass used during that monitoring period). Detailed information on such assessment was made available to the Validation and Verification Body responsible for the verification of the 5th monitoring period.

Institutional barrier

Since the kilns had to be constructed to burn the new biomasses, and there was a lack of qualified work force to manage these new logistic, it was necessary to submit some workers to training and capacitating.

The new biomass presented a larger volume changing the established logistic system of the ceramics.

These arrangements require the ceramics' 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

The project activity implementation presented a risk to the project proponent, once the use of a new type of fuel and its machines added a significant amount of insecurity to the production process, while the use of native firewood is a traditional and well-known process. Furthermore, the ceramics can overgrow a period in which there is possibility that there is lack of biomass, representing another risk period.

It must be re-emphasized that there is no direct subsidy or support from the government for this project, and without the income from the commercialization of the carbon credits, the fuel switch at Menegalli Ceramic would not be feasible or attractive to the project proponent.

Barrier due to the price of the biomass

The thermal energy generation through the combustion of renewable biomasses such as sawdust is 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 this type of biomass 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 ceramics cannot re-pass it, once the ceramics would not have competitive prices in relation to others which did not make 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 products of the project activity are ceramic bricks and roof tiles.

2. Identify possible types of baseline candidates.

Observing Table 4, the common fuels employed in the ceramic sector at the time of validation 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. Other possible baseline candidate would be the use of renewable biomass without the carbon credits support.

Table 4. Distribution of fuel employed on the ceramic sector in Brazil in percentage.

BRAZILIAN ENERGY BALANCE 2008[24] - 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%

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[25]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 Pará at the time of validation.

[24] *Brazilian Energy Balance, Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download>). Visited on May 15th, 2009.*

[25] 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.

Therefore, data from table above were provided by a reliable source and it was considered 3 years of its historical data, including the most recent available data at the time of validation and the period when Menegalli Ceramic started its fuel switch.

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

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

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

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

There are legal requirements constraints regarding the use of non-renewable biomass as exposed in Decree N.5,975 of November 30, 2006. However, it is not enforced namely due to the lack of control[26]. The consumption of non-renewable biomass by ceramic industry was related by several authors (NERI, 2003[27]; ALBUQUERQUE et al, 2006[28]; BRASIL, 2001[29]; VIANA, 2006[30]; CARDOSO, 2008[31]). This is also observed in other industries as in the production of steel (BRASIL, 2005[32]), 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.

[26] Jornal Grande CPA. Corte e poda de árvores pelo Dnit na BR-158 é considerado crime ambiental, , Available at: http://www.grandecpa.com.br/?p=noticia&id_noticia=129. Visited on April, 24th 2009.
Desmatamento avança sobre reservas de Cerrado, Eco & Ação: Ecologia e Responsabilidade. Jornal da Ciência, Amazônia e cerrado - interrogações, artigo de Washington Novaes. Available at: http://www.ecoeacao.com.br/index2.php?option=com_content&do_pdf=1&id=5617. Visited on April 25th, 2009.

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

[28] 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.

[29] 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 April, 24th 2009.

[30] 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://bdtd.bczm.ufrn.br/tedesimplificado//tde_busca/arquivo.php?codArquivo=571>. Visited on April, 24th 2009.

[31] 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.

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

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 also a criteria once there was biomass availability.

5. Identify a final list of baseline candidates.

- Table 4 provides the percentage of the level of penetration of each fuel employed in the ceramic sector during the average of the three years prior to the validation (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[33].

b) **Natural gas:** The Brazilian Energy Balance results showed significant percentage of natural gas consumption especially due to the production of ceramic tiles (used to finish floor or wall). Furthermore, in the case of structural ceramic, the use of natural gas is restricted by the absence of pipes, its high costs[34] and the lack of availability[35]. 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[36] 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[37].

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

[33] 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 April 24th, 2009.

[34] Revista Brasil Energia Percalços do gás natural na indústria. Available at: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>. Visited on April 24th, 2009.

[35] GISMAPS. Gás Natural. Available at: http://www.gismaps.com.br/gasnatural/gasnatural.htm. Visited on April 24th, 2009.

[36] PETROBRÁS performs in oil and oil byproduct exploration, production, refining, marketing, and transportation, both in Brazil and abroad. More information available at: <http://www2.petrobras.com.br/ingles/ads/ads_Petrobras.html>. Visited on April 24th, 2009

[37] CTGAS. PROJETO CERÂMICAS: SUBSTITUIÇÃO DOS ATUAIS FORNOS INTERMITENTES À LENHA, COM EFICIÊNCIA DE FORNO CONTÍNUO A GÁS NATURAL. Available at: <http://www.ctgas.com.br/template04.asp?parametro=155>. Visited on April 24th, 2009.

institutional barrier, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries[38].

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[39]. In this industry segment the use of wood represented about 98% of the total fuel employed at the time of validartion, thus 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[40].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[41], which seemed inexhaustible, due to the amount generated in the expansion of the agriculture frontier bringing forward environmental impacts, with regard to the degradation of soil, change in the regime of rainfall and consequent desertification.

The ceramic industry sector has practically not evolved compared to the past, mainly due to the simplified techniques of manufacture. Moreover, the major equipments (chiefly kilns) of the production process were not improved significantly. Most of these companies still use non-renewable wood in their kilns and the drying process occurs naturally, without the utilization of energy. On the other hand, the influence of the market by improvements in this sector is very insignificant[42].

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.

Therefore, the project activity is not a common practice.

Impact of project approval

At the time of validation, the ceramic industrial segment of the State of Pará was constituted by small industrial units that were using the most diverse technological models. The productive chain

[38] The use of renewable biomass was not included in Table 4 which shows the fuel most employed in the ceramic sector according to Brazilian Energy Balance.
[39] 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 April 24th, 2009
[40] 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.Available at: <http://libdigi.unicamp.br/document/?code=vtls000411276>. Visited on April 24th, 2009.
[41] 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 April 24th, 2009.
[42] PAULETTI, M. C. Modelo para Introdução de Nova Tecnologia em Agrupamentos de Micro e Pequenas Empresas: Estudo de Caso das indústrias de Cerâmica Vermelha no Vale do Rio Tijucas. 2001. Available at: <http://biblioteca.universia.net/html_bura/ficha/params/id/597230.html>. Visited on April 24th, 2009.

of ceramics in the city was composed of 31 companies, the main economy to the city. The fuel used in almost all companies is the native firewood from Amazonian Biome, and it has some technological restrictions such as the energy exploitation and the efficiency of the machinery.

Brazil was the third major contributor[43] 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 Amazonian Biome deforestation, which can be observed in table 5 and graph 1, aggravates because of the grazing practice, agriculture and site preparation which involves extraction and burning of wood and firewood commercialization[44].

The First Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions [45] – 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%). Another relevant issue is the rise in deforestation rates in the Amazonian biome, which achieves more than 14,206,000 hectare per year of the Brazilian Legal Amazonian[46]. Currently, every part of the society sector should be involved in this, and all efforts are necessary to minimize the Amazonian biome scenario of degradation and prevent its extinction. The Amazonian Rainforest is the major tropical forest of the world. Furthermore, this biome is a supply of biodiversity, holding the bigger variety of species in the world; there are still many unknown vegetal and animal species in this magnificent biome[47].

The Project Proponents will also apply the SOCIALCARBON methodology, which was developed by Instituto Ecológica, and focuses on a sustainable development and better social conditions for the communities where it is implemented.

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

Table 5. Area and total deforestation proportion observed in the states of Amazonian

Years	2001		2002		2003	
States	km²	%	km²	%	km²	%
MT	7.703	42	7.578	33	10.416	44

[43] Goldemberg & Moreira. Política Energética no Brasil. Estudos Avançados 19 (55), 2005. Available at: <http://www.scielo.br/pdf/ea/v19n55/14.pdf>. Visited on April 24th, 2009.

[44] FERREIRA, Leandro Valle; VENTICINQUE, Eduardo and ALMEIDA, Samuel. O desmatamento na Amazônia e a importância das áreas protegidas. Estud. av. [online]. 2005, vol.19, n.53, pp. 157-166. ISSN 0103-4014. Available at: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-40142005000100010&lng=en&nrm=iso>.Visited on April 24th, 2009.

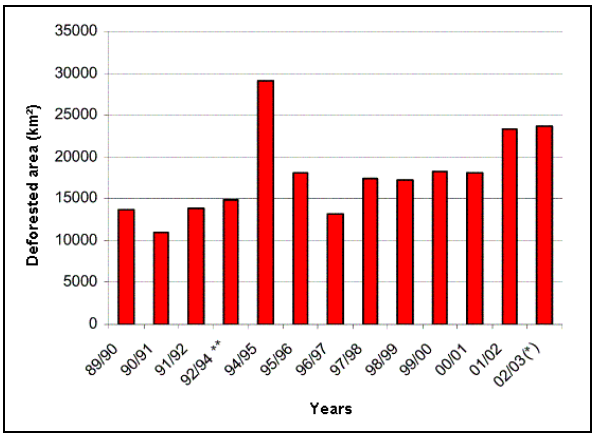
[45] MCT. Primeiro Inventário Brasileiro de Emissões Antrópicas de Gases de Efeito Estufa - Relatórios de Referência. Available at: <http://www.mct.gov.br/index.php/content/view/17341.html>. Visited on April 24th, 2009.

[46] PRODES – Program for Deforestation Assessment in the Brazilian Legal Amazonian. Available at: <http://www.obt.inpe.br/prodes/>. Visited on April 24th, 2009.

[47] PERES, C. A. Porque precisamos de megareservas na Amazônia. Megadiversidade, Vol. 1, Número 1, julho 2005. Available at: <http://www.unifap.br/ppgbio/doc/23_Peres.pdf>. Visited on September 1st, 2009.

PA	5.237	29	8.697	37	7.293	31
RO	2.673	15	3.605	15	3.463	15
MA	958	5	1.33	6	766	3
Total	**16.571**	**91**	**21.21**	**91**	**21.938**	**92**
Other States	1.594	9	2.056	9	1.812	8
Brazilian Legal Amazonian	**18.165**		**23.266**		**23.750**	

(Available at: http://www.scielo.br/scielo.php?pid=S0103-40142005000100010&script=sci_arttext&tlng=en. Visited on May 15th, 2009.)



Graph 1. Total area deforested in Brazilian Legal Amazonian between 1989 and 2003 (Available from: <http://www.scielo.br/scielo.php?pid=S0103-40142005000100010&script=sci_arttext&tlng=en>. Visited on May 15th, 2009.

2.6 Methodology Deviations

Not applicable. No methodology deviations were applied at the time of Project validation.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

The applied methodology does not predict project emissions; therefore, the baseline emissions are equivalent to emission reductions. The calculation of emission reductions are described on Section 3.4 of this VCS PD.

3.2 Project Emissions

The applied methodology does not predict project emissions

3.3 Leakage

The methodology AMS-I.E.-Switch from Non–Renewable Biomass for Thermal Applications by the User – version 01 valid from 01/02/2008 to 08/04/2010 predicts the following possible three sources of leakage:

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

The leakage from biomass projects, like the project activity, shall also be estimated according to the "General guidance on leakage in biomass project activities" (attachment C of appendix B) of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on the type of biomass considered (described in the

Table 6).

Table 6. Sources of leakage according to the type of the biomass.

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

Observing

Table 6, 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.

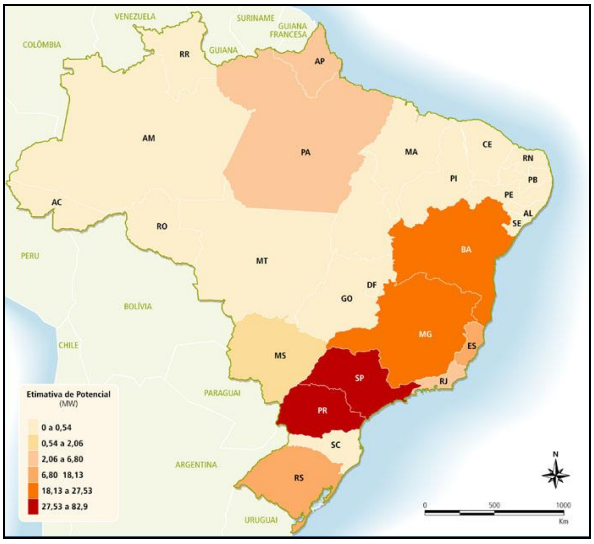
Elephant grass

In case of using elephant grass 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. At the time of validation, , elephant grass was acquiring national importance as biomass [48] to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions; it also dismisses the use of fertilizers (NPK)[49]. 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.

Forest Residues

Forest Residues are also a 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 5, the potential of energy generation in the state of *Pará* is high, 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.



[48] Osava M. Energia: Capim elefante, novo campeão em biomassa no Brasil. Available at:<www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Visited on April 27th, 2009.

[49] Embrapa. Formação e Utilização de Pastagem de Capim-Elefante. Instrução Técninca para o produtor de Leite. Available at:< www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Visited on April 27th, 2009.

Figure 5. Forest Residues Potential for Energy Generation50

Considering that around 22% of the wood produced will generate sawdust[51], the production of wood in the state of *Pará* was of 9,090,150 m^3[52] in 2007, thus, 1,999,833 m^3 will generate sawdust.

The project activity will employ approximately 1,800 tonnes, thus 5,143 m^3 of woodchips/sawdust per year which represents 0.06% of the total of these residues generated in the State of *Pará*.

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

Rice Husk

In the case of rice husk, the state of *Pará* produced 368,410 tonnes of rice husk in the year of 2007[53]. The husk corresponds to 23% of the weight of rice in husk[54]. Therefore, the production of rice husk in the state of Para was 84,734.3 tonnes.

Menegalli *C*eramic would consume around 7,200 tonnes of rice husk, considering that the ceramics production would only depend on this type of renewable biomass. Thus, the rice husk consumption would represent around 8.5% of the total of the amount produced. Therefore, the project activity would not disturb in any aspects this renewable fuel market once there is plenty of this kind of biomass available.

Açaí Pits

In terms of açaí pits, the state of *Pará* is the biggest producer of açaí (*Euterpe oleraceae*) in *Brazil*. The pits are easily found, especially in *Belém*, which is the major consumer of açaí in the Sate of *Pará*. The açaí is the basis of the daily alimentation of the population in this state, where is widely cultivated. Nevertheless, its residues are still without adequate economic destination[55].

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

[51] 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.

[52] IBGE. Extração Vegetal e Silvicultura 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=pa&tema=extracaovegetal2007>. Visited on April 27th, 2009

[53] IBGE. Produção Agrícola Municipal - Cereais, Leguminosas e Oleaginosas 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=pa&tema=pamclo2007>. Visited on April 27th, 2009.

[54] GAIDZINSKI, R. Utilização da casca de arroz como sorvente alternativo para o tratamento de efluentes da Região Carbonífera Sul Catarinense. 2007. Available at: <http://www.cetem.gov.br/publicacao/serie_anais_I_jpci_2007/Roberta_Gaidzinski.pdf>. Visited on April 27th, 2009.

[55] SILVA, I. T. et al. Uso do caroço de açaí como possibilidade de desenvolvimento sustentável do meio rural, da agricultura familiar e de eletrificação rural no estado do Pará. 2004. Available at: <http://www.feagri.unicamp.br/energia/agre2004/Fscommand/PDF/Agrener/Trabalho%2059.pdf>. Visited on April 27th, 2009.

The production of açaí in the state of *Pará* in the year of 2007 was 93,783 tonnes[56]. The pit corresponds to 85% of the weight of açaí[57]; therefore the açaí pit production was around 79,715.5 tonnes in the year of 2007.

The project activity will employ approximately 12,000 tonnes of açaí pits per year, representing around 12.8% of the total of the amount produced. Therefore, the project activity will not disturb in any aspects this renewable fuel market once there is plenty of this kind of biomass available.

Demand of Biomasses

There are no data regarding the demand for the biomasses in the State of *Pará*. However, according to *Barbosa* (2009)[58], it is a common practice in sawmills the generation of methane due to the decay of sawdust in their onsite places. However, there was a very low demand for sawdust in the State of Pará at the time of validation. Furthermore, according to *Townsend* (2001)[59], at the place where the açaí is processed, there is a lot of açaí pits left to decay once they have very low utility. Therefore, the demand for the renewable biomasses used by the ceramic companies is very low.

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.

[56] IBGE. Extração vegetal e silvicultura 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=pa&tema=extracaovegetal2007>. Visited on April 27th, 2009.
[57] Frutas Brasil. Importância Economica do Açaí. Available at: <http://minhasfrutas.blogspot.com/2008/12/importancia-economica-do-aai.html>. Visited on April 27th, 2009.

[58] Barbosa D. - Do Globo Amazônia, em São Paulo. Available at: <http://portalamazonia.globo.com/noticias.php?idN=77689&idLingua=1%20-%2044k>. Visited on April 27th, 2009.
[59] Townsend C. R., Costa N. L., Pereira R. G. A., Senger C. C. D. Características químico-bromatológica do caroço de açaí. Nº 193, ago./01, p.1-5 Available at: http://www.cpafro.embrapa.br/Pesquisa/public/2001/outros/Cot_193.PDF. Visited on May 15th, 2009.

It is expected that the carbon credits income will stimulate the use of renewable biomass to other ceramic companies presenting a huge possibility for sustainable development in the region. Therefore, the sources of leakages mentioned above 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 employed which would be employed in this project activity will not be saved for other project activity, since other ceramics were already consuming wood from non-sustainable forest management (common practice).

The project will likely favor the decrease in the use of non-renewable biomass, especially due to the incentive of carbon credits. Therefore, it can be concluded that this source of leakage, is not relevant to this project activity.

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 at *Menegalli* Ceramic as there is no transference of equipment, in spite of new equipments had to be acquired. All new kilns introduced after the date of validation were built by Menegalli Ceramic staff and were not transferred from another activity.

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

3.4 Net GHG Emission Reductions and Removals

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.

Emission Reductions

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

Where:

ER_y:	Emission reductions during the year y in tCO_2e
B_y:	Quantity of biomass that is substituted or displaced in tonnes
$f_{NRB,y}$:	Fraction of non-renewable biomass (wood) used in the absence of the project activity in year y
$NCV_{biomass}$:	Net calorific value of non-renewable biomass in TJ/tonne
$EF_{projected\ fossil\ fuel}$:	Emission factor for the projected fossil fuel consumption in the baseline in tCO_2e/TJ[60].

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

B_y is determined using the following option:

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

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

Where:

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

η_{old} : Efficiency of the system being replaced

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

Where:

SGE: Specific energy which has to be generated in the process to produce a certain amount of ceramic units in TJ/tonnes of ceramic units fired.

PR_y: Amount of product produced in year y in tonnes of ceramic units

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

Where:

SFE: Specific fuel energy needed for the process to produce a certain amount of ceramic units in TJ/ tonnes of ceramic units

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

Where:

BF_y: Consumption of non-renewable biomass per tonne of ceramic units fired in year y

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

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

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

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

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

By,total = 14,460 tonnes of ceramic units per year x 1.251 tonnes of wood/tonnes of ceramic units = 18,089 **tonnes of wood per year**[61]

ERy, total = 18,089 tonnes of wood x 0.9228 x 0.0182 TJ/tonnes x 77.4 tCO2/TJ = **23,515 tCO_2e**

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
From July to December – 2008	11,758	0	0	11,758
2009	23,515	0	0	23,515
2010	23,515	0	0	23,515
2011	23,515	0	0	23,515
2012	23,515	0	0	23,515
2013	23,515	0	0	23,515
2014	23,515	0	0	23,515
2015	23,515	0	0	23,515
2016	23,515	0	0	23,515
2017	23,515	0	0	23,515
From January tp December – 2018	11,758	0	0	11,758
Total	235,150	0	0	235,150

4 MONITORING

4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$EF_{projected\ fossil\ fuel}$
Data unit:	tCO_2/TJ

[61] This estimate was not updated on this version of the VCS PD to account for the revised BFy for the kilns built after the Project validation. However, the calculation of actual emission reductions will take the revised BFy in consideration for all kilns that were built after Project validation. Such procedure will be performed to ensure calculations are conservative.

Description:	CO_2 Emission factor of residual fuel oil
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. IPCC. Last visit on: 13/03/2015.
Value applied:	77.4 tCO_2/TJ
Justification of choice of data or description of measurement methods and procedures applied	In the baseline scenario, the fossil fuel that would probably be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible substitute of wood than natural gas due to the risks involving natural gas distribution.
Purpose of the data:	The fossil fuel likely to be used by similar consumers is taken from the IPCC default value of residual fossil fuel. This parameter was used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario, in the absence of non-renewable wood.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction.

Data Unit / Parameter:	**$NCV_{biomass}$**
Data unit:	TJ/tonne of wood
Description:	Net Calorific Value (of non-renewable wood)
Source of data:	QUIRINO, W. F. et al. **Poder Calorífico da Madeira e de Resíduos Lignocelulósicos**. Biomassa & Energia, v.1, n.2, p. 173-182, 2004. Available at: <http://www.renabio.org.br/06-B&E-v1-n2-2004-173-182.pdf >. Last visit on: 12/04/2016.
Value applied:	0.0182
Justification of choice of data or description of measurement methods and procedures applied	This value provided the energy generated by the amount of wood that would be used in the absence of the project.
Purpose of the data:	Calculation of baseline emissions. This value provides the energy generated by the amount of wood that would be used in the absence of the project. It differs from the IPCC value because represents the net calorific value of the local biome
Any comment:	The species used to calculate the average value are typical trees of Amazonian Biome that are usually utilized as fuel in the ceramic industries of the region. Some sources of data used provide the Gross Calorific Values (GCV) of the Amazonian species. In order to transform the GCV to NCV. it was utilized the equation which is available at the VCS MR Calculation 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).

Data Unit / Parameter:	ρ_{wood}
Data unit:	tonne/m³
Description:	Specific gravity (of non-renewable wood)
Source of data:	QUIRINO, W. F. et al. **Poder Calorífico da Madeira e de Resíduos Lignocelulósicos**. Biomassa & Energia, v.1, n.2, p. 173-182, 2004. Available at: <http://www.renabio.org.br/06-B&E-v1-n2-2004-173-182.pdf >. Last visit on: 12/04/2016.
Value applied:	0.67
Purpose of the data:	Calculation of baseline emissions. The amount of wood used in the baseline was measured by volume units, so this data was used to the unity conversion.
Any comment:	The species used to calculate the average value are typical trees of *Amazonian* Biome that are usually utilized as fuel in the ceramic industries of the region.

Data Unit / Parameter:	BF_y
Data unit:	Tonnes of wood per tonnes of ceramic unit fired
Description:	Baseline consumption of non-renewable biomass per tonnes of ceramic units produced in year y.
Source of data:	Historical data from ceramic owner
Value applied:	Kilns 1 to 5 - 1.251 Kilns 6 to 14 – 0.934
Justification of choice of data or description of measurement methods and procedures applied	Two different values of BFy are applied due to the construction of 9 new kilns. The value used to kilns 1 to 5 was acquired through the average consumption and production of ceramic devices during the years when the ceramic used to consume non-renewable wood. The result, 1.251, was used to estimate the emission reduction of kilns 1 to 5 and also formed the basis for the calculation of the BFy applied to the kilns 6 to 14. More details about the considerations made to calculate the two BFy, are provided on Section 4.1.
Purpose of the data:	Calculation of baseline emissions. The value is utilized to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns.
Any comment:	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramic used to consume non-renewable wood.

4.2 Data and Parameters Monitored

Data / Parameter	**PRy**
Data unit	tonnes of ceramic units fired per month
Description	Production of ceramic units
Source of data	Controlled by the project proponent.
Description of measurement methods and procedures to be applied	The amount was acquired by counting the total production of one year. The measurement will be done by an internal control sheet monitored by the project proponent, which will be fed daily. The production is a representative sample to ensure that all appliances are still in operation It will be utilized the weight of the ceramic unit in order to convert from units to tonnes. Data to be applied are:
Frequency of monitoring/recording	Monthly
Value applied:	1,205
Monitoring equipment	No monitoring equipment is used to determine this parameter. Production is counted by trained personnel on Menegalli ceramic.
QA/QC procedures to be applied	The ceramic has an internal control of the quantity of pieces produced. It will be rechecked according to the biomass employed and the kiln consumption of renewable biomass.
Purpose of data	This parameter is used to calculate baseline emissions and the total energy produced in the current monitoring period in order to compare to the thermal energy necessary in the VCS PD (QA/QC table).
Calculation method	The ceramic industry has an internal control of the quantity of ceramic units produced. It was rechecked according to the biomass employed in the ceramic kilns.
Comments	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	**Brick 6 holes**	**Roof tile**
weight (tonnes/thousand of ceramic units fire)	1.339	1.219

Data / Parameter	$Q_{renbiomass}$

<table>
<tr><td>Data unit</td><td>tonnes per month</td></tr>
<tr><td>Description</td><td>Amount of renewable biomass used</td></tr>
<tr><td>Source of data</td><td>Measured by the project proponent</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>The amount of biomass will be monitored in accordance to the volume measured from the truck dimensions or, in case such information is not available, from the quantities described in receipts or invoices from biomass providers.
In case the values in the receipts are described in m³, the conversion to tonnes will be made by applying the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project is:
<table><tr><td>Biomass</td><td>Sawdust</td><td>Açaí pits</td></tr><tr><td>Specific gravity (tonne/m³)</td><td>0.35</td><td>0.723</td></tr></table>Source of data:
<u>Sawdust</u>:
SIMIONI. F. J. Análise diagnóstica e Prospectiva da cadeia produtiva de energia de biomassa de origem florestal no planalto sul de Santa Catarina. Curitiba. 2007. Available at: <http://docplayer.com.br/1564697-Analise-diagnostica-e-prospectiva-da-cadeia-produtiva-de-energia-de-biomassa-de-origem-florestal-no-planalto-sul-de-santa-catarina.html>. Last visit on 12/04/2016.
<u>Açaí Pits:</u>
PADILHA et al. Avaliação do Potencial dos Caroços de Açaí para a geração de energia. Biomassa & Energia. v. 2. n. 3. p. 231-239. 2005. Available at: <http://www.renabio.org.br/07-B&E-029-JLPadilha-2005-p231-239.pdf>. Last visit on: 04/04/2016.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Monthly</td></tr>
<tr><td>Value applied:</td><td>The project proponent will preferentially employ sawdust and açaí pits in its burning process.
<table><tr><th>Biomass</th><th>Sawdust</th><th>Açaí Pits</th></tr><tr><td>$Q_{renbiomass}$</td><td>150</td><td>1,000</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>No monitoring equipment is used to determine this parameter</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The ceramic has spreadsheets of the quantity of biomass acquired. It will be rechecked according to the receipts of purchase.</td></tr>
</table>

Purpose of data	This parameter will be used to : a. Compare the total energy produced in the current monitoring period to the thermal energy that would be necessary according to the VCS PD estimates (QA/QC table); *b.* Demonstrate that the Project fits in small scale category for biomass renewable energy projects (capacity <45MWth); *c.* Calculation of leakage emissions due to competing use of biomass.
Calculation method	The energy generated by the amount of renewable biomass will be calculated based on the Net Calorific Value of each biomass, as can be seen on the VCS MR Calculation spreadsheet. Values in the receipts from biomass providers may be described in m^3, therefore it is necessary the conversion to tonnes through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project under the item "Description of measurement methods and procedures to be applied".
Comments	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	Controlled by the project proponent
Description of measurement methods and procedures to be applied	Information on the origin of sawdust will be obtained from Sistema Integrado de Monitoramento e Licenciamento Ambiental (Integrated Environmental Monitoring and Licensing System) from the Environmental Agency of Pará. This system is currently available at: http://monitoramento.sema.pa.gov.br/simlam/index.htm (last visited on 15-August-2016). For all other types of biomass and for the sawdust where data is not available on such system, information will be obtained to allow tracking the origin of the biomass. Information will include official documents on the production or commercialization of biomass and the documented opinion of local experts on the origin of biomass used by the Project activity. All types of biomass shall be considered renewable if complying with the definition of renewable biomass described in the

	methodology applied. In addition, biomass from forests (such as sawdust and firewood) will be considered renewable if their producers operate in accordance with local regulations and/or if it is reasonable to assume the production of biomass does not involve deforestation or a permanent decrease in carbon stocks that can be attributed to the Project Activity.
Frequency of monitoring/recording	Annually
Value applied:	Not directly applied for the calculation.
Monitoring equipment	No monitoring equipment was used to determine this parameter.
QA/QC procedures to be applied	The biomass will be considered as renewable if it is according to the definition given by the applied methodology. Furthermore, documents proving the origin of renewable biomass from forested resources will be provided.
Purpose of data	This parameter is used to guarantee that the amount of biomass acquired by the project proponent has a renewable origin. It is also necessary to comply with procedures required by the methodology AMS-I.E, Version 01.
Calculation method	Not applicable
Comments	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 Unit / Parameter:	**Leakage of non-renewable biomass**
Data unit:	tCO_2e
Description:	Leakage resulted from the non-renewable biomass
Source of data:	Monitored
Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in the applied methodology will be monitored. Scientific articles, official statistical data, regional and national surveys will be assessed in order to ensure that there was no leakage from non-renewable biomass (or to estimate the leakage). Please see Section 3.3: “Leakage”.
Frequency of monitoring/recording:	Annually
Value monitored:	0
Monitoring equipment:	No monitoring equipment is used to determine this parameter.
QA/QC procedures to be applied:	Data available regarding the ceramic industries fuel consumption will be used to monitor the leakage.

Purpose of the data	Calculation of leakage emissions. This parameter is used to evaluate if there is any source of indirect emission related to non-renewable biomass. If applicable, leakage emissions are used to adjust emission reductions resulting from the project.
Calculation method:	Not applicable.
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 Unit / Parameter:	$f_{NRB,y}$
Data unit:	Percentage
Description:	Fraction of biomass (wood) used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods
Source of data:	Survey methods
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 ceramic facilities owners. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, according to Brazilian environmental agency (MMA) (2016)[62], Amazonian Biome has only 17.14% of its total area with sustainable use. According to a research made by Brazilian Environmental Ministry, there are around 60m³ of wood per hectare in Amazonia biome[63]. Thus, the amount of non-renewable woody biomass (NRB) available at Amazonia biome is around 20,873,070,000m³. The amount of demonstrably renewable woody biomass (DRB) is around 4,318,236,000 m³. So, according to the equation presented in the methodology applied, the fraction of non-renewable biomass is around 0.8284.
Frequency of monitoring/recording:	Annually
Value monitored:	92.28
Monitoring equipment:	No monitoring equipment is used to determine this parameter.
QA/QC procedures to be applied:	The monitoring of this parameter will be based in national and international articles and database every monitoring period. The sources provided information about the sustainable use of Amazonian biome.

[62] Source: Brazilian Environment Ministry, 2016 Unidades de Conservação por Bioma Available at: <http://www.mma.gov.br/images/arquivo/80112/CNUC_PorBiomaFev16.pdf>. Last visit on: 12/04/2016

[63] Source: Brazilian Environment Ministry, Normative Instruction nº 6 of 2006. Available at: <http://www.carvaomineral.com.br/abcm/meioambiente/legislacoes/bd_carboniferas/geral/in_06-2006_mma_n.pdf>. Last visit on: 12/04/2016

	Wood saved from projects developed by Sustainable Carbon in the same biome and that have applied the same methodology will be considered in this fraction[65]. CDM or VCS registered projects shall also be included in this fraction if placed in the same region and using the same methodology. Moreover the amount of non-renewable biomass applied in the project activity will be monitored monthly and shall be considered in the value of $f_{NRB,y}$ parameter.
Purpose of the data	This parameter is used to calculate Baseline emissions. The $f_{NRB.y}$ determines the fraction of biomass (wood) used in the absence of the project activity that can be established as non-renewable biomass.
Calculation method:	Two sheets were made in order to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the *Amazonia* biome. The other sheet calculates the amount of wood consumed regarding only *Menegalli* 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 Menegalli Ceramic project, respectively.[66] Finally, each value was subtracted from the fraction of non-renewable biomass to achieve the $f_{NRB,y}$, in order to be ensured that the proposed project activity is not saving the non-renewable biomass accounted for by the already registered project activities. Therefore, the smaller value was selected in order to be more conservative. These sheets are available at the VCU Estimates spreadsheet.
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 Unit / Parameter:	**Renewable biomass surplus**
Data unit:	tonnes or m³
Description:	Amount of renewable biomass available
Source of data:	Monitored
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 international articles and databases every monitoring period. These sources will provide information about the biomass availability in the project activity's region.
Frequency of	Annually

[65] Document available at: < http://mer.markit.com/br-reg/public/index.jsp?entity=project&sort=project_name&dir=ASC&start=0&acronym=&limit=15&name=sustainable+carbon&standardId> Last visit on: 16/03/2015.
[66] According to data from project activities at Sustainable Carbon Company.

<table>
<tr><td>monitoring/recording:</td><td></td></tr>
<tr><td>Value monitored:</td><td>
<table>
<tr><th>Harvest</th><th>07/08</th></tr>
<tr><td>Forest Residues (m³)</td><td>9,090,150</td></tr>
<tr><td>Rice Husk (tonnes)</td><td>84,734.3</td></tr>
<tr><td>Açaí Pits (tonsne)</td><td>79,715.5</td></tr>
<tr><td>Elephant Grass</td><td>Not measured</td></tr>
</table>
Detailed information in section 3.3 – LEAKAGE.
</td></tr>
<tr><td>Monitoring equipment:</td><td>No monitoring equipment is used to determine this parameter.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of leakage emissions due to competing use of biomass.</td></tr>
<tr><td>Calculation method:</td><td>The amount of biomass used by the project activity in each year of the crediting period will be compared to total biomass available, as estimated on this VCS PD.</td></tr>
<tr><td>Any comment:</td><td>Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.</td></tr>
</table>

4.3 Monitoring Plan

The monitoring is done with the aim of determining the most approximate quantity of non-renewable wood that, in the absence of the project, would be used in the ceramics' kilns and consequently the amount of GHG that would be emitted in tonnes of CO2e. Section 4.2 describes data and parameters monitored, as well as the procedures involved on the monitoring plan.

Ceramic personnel are responsible to monitor the operating conditions on the factory, including the amount of renewable biomass consumed and the monthly production of ceramic devices (parameters Qrenbiomass and PRy). Ceramic personnel are also responsible to store invoices, receipts of sales and other documents related to purchase or acquisition of biomass.

Ceramic personnel register monitoring data regarding parameters Qrenbiomas and PRy on electronic spreadsheets, which are shared with Sustainable Carbon team using an internet cloud service (dropbox). This gives Sustainable Carbon real time access to monitoring data.

Sustainable Carbon is responsible to assess if the biomasses are from renewable origin, to evaluate if there is a surplus of renewable biomass and to calculate emission reductions, including an assessment of leakage emissions and the determination of parameter fNRB.y.

Periodically, Sustainable Carbon will perform an analysis to verify if biomass and production data are being correctly filled in the monitoring spreadsheets. Analysis on production data will be

performed by a series of comparisons between different measurement points of production (molding machine, kiln loading and kiln unloading) to detect inconsistencies or suspicious data.

Analysis on biomass data will be performed by a series of comparisons between the amount of biomass and the cost over months to identify inconsistencies or unexpected variations in these parameters.

Sustainable Carbon is responsible for providing the required guidance to the ceramic factory, to evaluate biomass and production data, in order to minimize errors, including assisting the ceramic in case the person in charge of the project monitoring is replaced.

The three sources of leakages predicted in the applied methodology will be monitored. Scientific articles official statistical data regional and national surveys are provided in order to ensure that there is no leakage from non-renewable biomass (or to estimate the leakage). Based on this information, Sustainable Carbon is responsible to assess if the biomasses are from renewable origin, to evaluate if there is a surplus of renewable biomass and to calculate emission reductions, including an assessment of leakage emissions and the determination of parameter $f_{NRB,y}$. Sustainable Carbon shall also assists the Ceramic personnel to double check the monitored data on biomass consumption and ceramic devices production.

Non-conformities identified in the double check procedures will be clarified between Sustainable Carbon technical team and the monitoring responsible on the ceramic during site visits for data collection, by reassessing existing documents and sources of information.

The responsible for the monitoring plan are Mr. Edson Menegalli and Mr.Juliano Queiroz from Menegalli Ceramic. Sustainable Carbon technical team (including those members described on Section 1.3) was also involved in the project monitoring.

5 ENVIRONMENTAL IMPACT

Table 8. Summary of the environmental impacts

Environmental Factor	Environmental Impact	Classification
Soil	Improvement of soil conditions because of the vegetation conservation	Positive
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

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 contrary, 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.

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.

6 STAKEHOLDER COMMENTS

The main stakeholders considered in this project are the ceramic sector syndicate and the ceramic company employees. A letter was sent to the stakeholders informing about the project and in the ceramic´s facilities the letter was posted on the employee´s board, which is a visible place with high circulation of employees. The letter was available during 7 days and the comments were expected for a period of 7 days after the letter has been posted.

Moreover, having the ceramic sector syndicate being aware of the project, other local stakeholders were 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 syndicate 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 helped in the diffusion of project results and practices.

Till validation time, answers were not received.

However, São Miguel do Guamá Industries Syndicate (SICOM) sent a letter on December 19, 2008, certifying that they are aware of the activities related to the project. The syndicate demonstrated to recognize the importance of this practice, supporting and encouraging the divulgation of these projects.

In relation to the contact procedures and the involvement of the Stakeholders, an informal public consultation was realized (Figure6 and Figure 7), inviting environmental agencies, non

governmental organizations, the syndicate of the ceramic sector in the region, some ceramics from São Miguel do Guamá and Brazilian Service for Support of Micro and Small Companies.

The consultation explained the activities of the projects developed in the ceramics of São Miguel do Guamá, and also the SOCIALCARBON Methodology. In the end of the lectures, the participants could give their comments and resolved their doubts concerning the issue. The doubts were mainly about the Social Carbon methodology and its applicability. Furthermore, positive comments concerning the project were received.

Figure 6. Stakeholders Consultation

Figure 7. Stakeholders Consultation

APPENDIX 1: VERIFIED EMISSION REDUCTIONS

Table 9. Emission reductions verified until 12/08/2016.

	Emission Reduction (tCO_2e)	
1st Monitoring Period	01/07/2008 to 31/12/2008	11,791
	01/01/2009 to 31/07/2009	11,601
Total in the 1st Monitoring Period		**23,392**
2nd Monitoring Period	01/08/2009 to 31/12/2009	10,807
	01/01/2010 to 31/01/2010	2,000
Total in the 2nd Monitoring Period		**12,807**
3rd Monitoring Period	01/02/2010 to 31/12/2010	21,176
	01/01/2011 to 28/02/2011	3,006
Total in the monitoring 3rd Monitoring Period		**24,182**
4th Monitoring Period	01/03/2011 to 31/12/2011	25,536
	01/01/2012 to 30/04/2012	12,445
Total in the monitoring 4th Monitoring Period		**37,981**
Total		**98,362**

APPENDIX 2: POST-REGISTRATION CHANGES

The following Table provides a summary of changes that occurred on the Project design after the registration under the VCS.

Table 10. Summary of post-registration changes.

Date	Description of the change	Reason for the change
30-August-2016	Parameter BFy (Tonnes of wood per tonnes of ceramic unit fired) was revised. Two different values of are now applied due to the construction of 9 kilns after the Project validation. The new values for BFy will be applied to calculate emission reductions for the 5th monitoring period (starting on 01-May-2012) onwards.	To ensure emission reduction calculations are conservative given the improvement in energy efficiency of the kilns introduced after the Project was validated.
08-October-2012	Kiln 14 starts producing ceramic devices	Menegalli Ceramic built new kilns to meet market demand
24-September-2012	Kiln 13 starts producing ceramic devices	
01-May-2012	Ceramic personnel start using an indirect method of measurement of the amount of renewable biomass used. Such method involves measuring the dimensions of the vehicles trucks that delivery the biomass.	This procedure was adopted by Menegalli Ceramic as an internal monitoring procedure.
From January, 2012 to March, 2012	Kilns 7 to 12 start producing ceramic devices	Menegalli Ceramic built new kilns to meet market demand
10-March-2011	Kiln 6 starts producing ceramic devices	Menegalli Ceramic built a new kiln to meet market demand
01-July-2008	The amount of renewable biomass used by the ceramic factory starts being monitored through data available on the receipts and invoices of biomass received by the ceramic industry. This means the amount of renewable biomass was measured by each provider and controlled by the ceramic manager by storing receipts and invoices.	This approach was chosen considering that it is the responsibility of the provider to measure the amount of biomass since this information needs to be available in the sale invoice or receipt.