Voluntary Carbon Standard
Lara Ceramic Project Description

19 November 2007

Date of the VCS PD: November 03rd, 2009

Contents

1 Description of Project:

1.1 Project title

Lara Ceramic fuel switching project
Version 05.1
PDD completed in: November 03rd, 2009

1.2 Type/Category of the project

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

- **Category AMS-I.C: Thermal energy for the user with or without electricity** – Version 13 from March 14th 2008.

This category comprises renewable energy technologies that supply individual households or users with thermal energy that displace fossil fuels such as *Lara* Ceramic.

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

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

Table 1. Emission reductions estimate during the crediting period

Year	Total Emission Reductions
April to December 2006	7,706
2007	10,275
2008	10,275
2009	10,275
2010	10,275
2011	10,275
2012	10,275
2013	10,275
2014	10,275
2015	10,275
January to March 2016	2,569
Total Emission Reductions (ton of CO_2e)	**102,750**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (ton of CO_2e)	**10,275**

1.4 A brief description of the project:

The project activity promotes a fuel switch at *Lara* Ceramic, which is a small and prototypical ceramic industry that produces structural ceramic units like bricks, destined for the local market of *Vale do Paraíba*. The project consists on switching the non-renewable fuel such as heavy oil, which was a common practice in the region, by a renewable biomass to feed the kiln.

Lara Ceramic utilized a fossil fuel (heavy oil) to feed their kiln, however it made adaptations to change the fuel, and become to use renewable biomass such as sawdust and rice husk to supply of the kiln. *Lara* Ceramic receives sawdust, wood residues, and wood chips, which are all turned into sawdust inside the ceramic and then mixed with rice husk to feed the kilns.

Usually the environmental aspects are not concerning issues in the ceramic sector; however this is not the case with this ceramic, which worked hard to create a well-working system, processing the biomass, and is perfectly within the boundaries of the regulations imposed by the Brazilian Government.

This fuel switching project will reduce the greenhouse gas (GHG) emissions through the substitution of heavy oil for renewable biomasses to generate thermal energy. It was concluded that this is feasible when considering the income derived from commercializing the resulting carbon credits. This move was originally unattractive due to the high investment costs of the adaptation of machineries to the new biomass and other barriers.

By diverging significantly from the identified baseline scenario, the ceramic will minimize the environmental damages caused by the use of fossil fuels.

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

The ceramic is located in *Cachoeira Paulista*, in the state of São Paulo, which is indicated in Figure 01.

The project site has the following postal address:
- *Lara* Ceramic:
Estrada Rio São Paulo, S/N Km 200
Bairro das Palmeiras - Zona Rural
Cachoeira Paulista, SP
Postal code: 12.630-000

Figure 1. Geographic location of the city of the project activity that has the following coordinates: *Cachoeira Paulista* 22º39'54" S, 45º00'34"W

Figure 2. *Lara* Ceramic's boundaries: A: 22°40'32" S, 45°01'37" W; B: 22°40'29" S, 45°01'31" W; C: 22°40'36" S, 45°01'30" W; D: 22°40'39" S, 45°01'32" W

1.6 Duration of the project activity/crediting period:

- Project start date[1]: 1st January 2004
- Date of initiating project activities[2]: 1st April 2006
- VCS project crediting period: 10 years, twice renewable
- Data of terminating the project activity: 31st March 2016

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

[2] *Date of initiating project activities: Earliest credit start date under the VCS 2007 is March 28th, 2006. To simplify the calculations it was adopted April 1st, 2006.*

1.7 Conditions prior to project initiation:

The oil supply was stable and the ceramics had a reliable logistic program which did not present high risks for the ceramics. Heavy oil was utilized as fuel in the ceramic's kiln for many years.

The use of heavy oil as fuel was a prevalent practice among the ceramics. The use of fossil fuels brings forward serious environmental problems such as global warming. There are also raising concerns about the security of oil transportation that can result in huge environmental impacts, chiefly when this transportation is overseas. The baseline identified for this project activity is the utilization of a total of 1,920,000 liters of heavy oil to maintain the actual production of 9,600,000 ceramic units per year, providing thermal energy to the ceramics' kilns, according to historical experience of the ceramics. The project activity aims at the use of renewable biomass for energy supply from sawdust, wood chips, non-fossil fraction of industrial or municipal waste, and rice husk.

However, elephant grass and afforestation wood, which are possible biomasses to be utilized in this project, are not considered a residue, since it would be cultivated in order to supply the ceramic fuel needs.

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

The emission reductions will be achieved by displacing the use of heavy oil, which is a fossil fuel, to provide thermal energy in the ceramic companies. Therefore, the emissions launched during the combustion of heavy oil are not compensated by carbon absorbance methods since fossil fuels had been stored for millions of years prior to their consumption. An opposite scenario occurs with the renewable biomasses employed in this project activity since they are wood residues and wood provided from areas with sustainable forest management.

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

Lara Ceramic industry produces structural ceramic devices like bricks, which are mainly used in the construction sector. *Lara* Ceramic uses a "Hoffman" kiln. These kilns are commonly utilized in Brazil to burn bricks and roof tiles. The following table shows the value of the dry mass per product, specified by *Lara* ceramic.

Table 2. Values of Dry mass per product.

Tijolo Baiano (9 X 19 X 19)	Unity
2.20	kg

The Hoffmann is a continuous kiln and a series of batch process kilns. Hoffmann Kilns are the most common kiln used in production of bricks and some other ceramic products. A Hoffmann kiln consists of a main fire passage surrounded on each side by several small rooms (chambers). Each room contains a pallet of bricks. In the main fire passage there is a "fire wagon", that holds a fire that burns continuously. Each room is fired for a specific time, until the bricks are vitrified properly, and thereafter the fire wagon is rolled to the next room to be fired.

Each room is connected to the next room by a passageway carrying hot gases from the fire. In this way, the hottest gases are directed into the room that is currently being fired. Then the gases pass into the adjacent room that is scheduled to be fired next. There the gases preheat the brick. As the gases pass through the kiln circuit, they gradually cool as they transfer heat to the brick as it is preheated and dried. This is essentially a counter-current heat exchanger, which makes for a very efficient use of heat and fuel.

In addition to the inner opening to the fire passage, each room also has an outside door, through which recently-fired brick is removed, and replaced with wet brick to be dried and then fired in the next firing cycle.

Lara Ceramic works with a Hoffman kiln with 109 lines, and in each line, 1,200 ceramic units are burned per line. Moreover, the biomass consumption per line is around 1.5 m^3

The burning cycle in a "Hoffman" kiln is considered the number of hours it takes to burn a single line inside the kiln. The average time spent with warming, burning and cooling are around 18 hours, 30 minutes, and 18 hours respectively, with a total of 36 hours and 30 minutes per burning cycle. It was only considered the burning stage in the burning cycle of this type of kiln because while one line is burning, 15 lines ahead and behind of it are warming and cooling respectively. Another 6 hours are spent to load the kiln, and 6 hours to unload it.

Table 3. Technical parameters of the Hoffman kiln employed.

Technical Parameters	"Hoffman" Kiln
Features	Continuous with two straights, 55 lines at one and 54 lines at the other, and rectangular shape (each line has three fuel entrances). The furnaces are in the upper part of the kiln
Maximum Temperature	850 to 880°
Quantity of burning cycles per month	11
Average production per line (thousand of ceramic units)	1200
Time of loading	6 hours
Hours of burning (per cycle)	36 hours and 30 minutes
Time of unloading[3]	6 hours

In the project activity, *Lara* Ceramic consumes around 1,400m^3 of biomass divided in 350m^3 of rice husk, 600m^3 of sawdust and wood chips, and 450m^3 of wood residues from industrial waste, to feed its kilns to obtain an approximate temperature of 850 to 880ºC, in order to sustain the production of 1,400,000 ceramic devices per month. The purpose is to employ 100% of sawdust, which can be replaced by other renewable biomass.

In case of lack of these kinds of biomasses, the project proponents can use elephant grass and afforestation wood.

[3] The cleaning of the "Hoffman" Kiln is performed while the kiln is loaded again with other pieces to be burnt. It is not necessary to clean the "Tunnel" Kiln due to the high efficiency of this kiln, which almost does not generate ashes.

The area destined for afforestation in *Brazil* corresponds to 5.6 millions of hectares, where the *Eucalyptus* corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare[4].

Sawdust and wood chips are resulted from wood manufacturing, considering that around 22% of the wood produced will generate sawdust/wood chips[5].

The construction residues wood corresponds around 85% of the total construction residues. The deficiency of a correct destination for this wood constitutes a huge problem[6]. Furthermore, pallets that are either broken or worn-out could be consumed by the ceramics, measure that would attenuate the landfills final disposal problem.

The ceramics owners also showed interest in elephant grass. Currently, elephant grass has been acquiring national importance as biomass to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions.

The ceramics production has been increasing in order to attend the market demand. The Brazilian building construction sector is also increasing mainly due to the Brazilian Government program called Growth Acceleration Program (PAC)[7]. This way, it has been required more and more ceramic devices to attend the developing building construction sector. The biomass providers listed at the table below are only a few of those that work for each ceramic; nevertheless, it does not exclude the possibility of buying biomass from others.

Table 4. Main biomass providers

Ceramic	Biomass	Provider	State
Lara	Sawdust and wood chips	*Matec Ind. e Com. de Móv. e Acessórios de Madeira LTDA.*	*São Paulo*
		Madeireira Bananal LTDA	*São Paulo*
	Wood residues from industrial waste	*Saint-Gobain Abrasivos LTDA.*	*São Paulo*
		Yakult S.A.	*São Paulo*
		BASF S.A.	*São Paulo*
	Rice Husk	*Ind. e Com. Cereais Irmãos Gadiole LTDA*	*São Paulo*

[4] *Avaiable at: ABRAF Statistical Yearbook: base year 2007 (Anuário Estatístico da ABRAF: ano base 2007); and* Brazilian *Society of Forestry. Source: Available at: <http://www.abraflor.org.br/estatisticas/ABRAF08-BR.pdf>. Last visit on July 6th, 2009.*

[5] *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.Cited in: CLASSIFICAÇÃO DAS ESPECÍES MAIS ESPLORADAS E CONSEQUENTE PRODUÇAO DE RESÍDUOS DE MADEIRA EM TRÊS MADEIREIRAS NO MUNICÍPIO DE BENJAMIM CONSTANT – AM. Avaiable at: http://www2.uea.edu.br/data/categoria/pesquisa/download/648-1.doc. Last visited on: July 6th, 2009.*

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

[7] *More information available at: http://www.brasil.gov.br/pac/. Last visit on January 26th, 2009.*

		Beneficiadora Arroz Irmãos Ligabo LTDA	*São Paulo*

Figure 3 - Wood residues used in Lara Ceramic

In order to implement the project activity, the ceramic made a series of adaptations that were required, and new equipments had to be purchased due to the employment of the new fuel. The ceramics passed through reforms to adapt the kiln to the new fuel use with the adaptation of the interior and superior parts of the kiln, which demanded to work with low production during some months. Thus the entire pipeline and the injectors of oil became useless, although this system is still installed in the ceramics.

For the purpose of burning the biomass with energetic efficiency, it was also necessary to install new machineries. The acquiring of these new machineries resulted in the reconstruction of the kiln's entrances.

Differently from heavy oil, the new fuel must be stored in covered sites. For this purpose, the project proponent had to construct a shed to stock the biomass and keep it dry.

Beyond these alterations, the ceramic, due to the fuel switch, had to make some changes in its whole system and develop its own particular system, as can be seen below.

The wood residues from industrial waste accepted in Lara Ceramic are processed through a semi-automated equipment to improve their energy efficiency. First, the residues are directed to the wood shredder, which are converted into wood chips. After this stage, part of the wood chips are carried through a conveyor belt to silos, or directly to the metal doser, where through an injector, the wood chips are sent to two specific furnaces to generate heat for the drying chambers.

The other part of the residues (wood chips) follows for the final preparation of biomass for use as fuel in the kiln. The wood chips are mixed with rice husk and sawdust and are directed to the mill with hammers exhaustion forced. In this process there is the use of a cyclone air separator[8] and baghouse[9] to atmospheric control. After that,

[8] *A dust separator of cylindrical or conical form which utilizes the centrifugal force produced by the gas flow for the removal of particles from gas.*

[9] *An air pollution control device used to filter particulates from waste combustion gases; a chamber containing a bag filter – Avaiabl at: <http://www.atmosambiental.com.br/industrial/filtro_manga.htm> Last visit on July 6th, 2009.*

the processed renewable biomass are conditioned in silos and stored in a shed. Later this renewable biomass is taken to special injectors for combustion of the kiln.

This way the ceramic had to install these pollution controller equipments aiming the protection of the employee’s health, since the fuel employed is a fine wood residue. The use and monitoring of this new equipment called for new employees, whose were contracted for this purpose. The following figures show some of the changes at the ceramic industries.

Figure 4 - Mechanic burners used in Lara Ceramic

Figura 5 - Cyclone filter and baghouse used in Lara Ceramic

Moreover, studies of drying elephant grass[10] in order to employ it as fuel are being done and there are possibilities of start using this as renewable biomass in the project. Elephant grass has an excellent net calorific value when it is dried, although its drying process is still a problem for the project proponent.

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[10] *An African grass mostly used to feed cattle which its fast growing can promote four harvests per year. It was verified, after many studies, that the Elephant Grass when dried is a great source of biomass that can be used to energy generation purposes. According to EMBRAPA (Brazilian Agricultural Research Corporation's). Source: http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292. Visited on March 27th, 2009.*

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

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

This project is in accordance to the CONAMA[11] 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 CETESB[12] 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[13]).

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

- Availability and price of the renewable biomasses

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

- Difficulty related to the abrupt change

As affirmed before, the ceramic used heavy oil in its kilns since their beginning, the sudden change claimed a lot of effort from each one in the ceramic; the main challenges are the reconfiguration of the internal logistic, the employees' resistance to the new situation and the lack of knowledge.

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

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[11] *CONAMA (National Environmental Council), created in 1981 by Law 6.938/81, is the Brazilians' department responsible for deliberation and consultation of the whole national environmental policy and it is chaired by the Minister of Environment. It is responsible for the establishment of standards and criteria relating to licensing of potentially polluting companies. More information is available at <http://www.mma.gov.br/port/conama/estr.cfm>. Last visited on January 17th, 2009.*

[12] *CETESB (Technology Environmental Sanitation Company) is the São Paulo State government agency responsible for the control, surveillance, monitoring and license of potentially polluting companies. More information is available at : <http://www.cetesb.sp.gov.br/>. Last visited on January 17th, 2009.*

[13] *The objectives of the National Department of Mineral Production are: to foster the planning and promotion of exploration and mining of mineral resources, to supervise geological and mineral exploration and the development of mineral technology, as well as to ensure, control and monitor the exercise of mining activities throughout the national territory, in accordance with the Mining Code, the Mineral Water Code and respective legislation and regulations that complement them. Source: <http://www.dnpm.gov.br/enportal/conteudo.asp?IDSecao=168&IDPagina=222>. Last visited on January 17th, 2009.*

The fact that *Lara* Ceramic have historically operated using oil as fuel, clearly confirms the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

The ceramic had used non-renewable fuels to produce its pieces since the beginning of its operation, which means for more than twenty years. This is evidence that guarantees the integrity of this project activity.

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

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

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

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

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

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

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

Project Proponents

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

Carlos Edson Vieira Camargo, Director and monitoring data responsible: Information and visit of the ceramic, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramic devices market challenges, detailed information and numbers on sales and how output data is handled and how data is stored and kept by the *Lara*’s office.

Other information on the project’s proponent:

Address:
- *Lara Indústria e Comércio de Materiais LTDA*:
Estrada Rio São Paulo, S/N Km 200
Bairro das Palmeiras - Zona Rural
Cachoeira Paulista, SP
Postal code: 12.630-000

Phone number: +55 12 3101-1993

Project Developer

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

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

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

Coordinated by:

Rafael Ribeiro Borgheresi, Technical Coordinator.

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

Address:
R. Borges Lagoa, 1065 – Conj. 146 – Vila Clementino
Postal Code: 04038 032
São Paulo – SP, *Brazil*
Phone number: +55 11 2649 0036
Web site: http://www.socialcarbon.com
Email: marcelo@socialcarbon.com
kupper@socialcarbon.com
rafael@socialcarbon.com

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

The project is eligible according to:

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

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

1.17 List of commercially sensitive information (if applicable):

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

2 VCS Methodology:

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

Category AMS-I.C.: Thermal energy for the user with or without electricity – Version 13 from March 14th 2008, which is applicable for project activities that avoid greenhouse gases emissions by using renewable biomass instead of fossil fuels, in order to generate thermal energy.

This project activity is not a grouping project.

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

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

The methodology applied is Category AMS-I.C.: Thermal energy for the user with or without electricity – Version 13 from March 14th 2008, which is applicable for project activities that avoid greenhouse gases emissions by using renewable biomass instead of fossil fuels, in order to generate thermal energy.

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

There are no similar registered small-scale CDM project activities in the region of the project activity once *Carbono Social Serviços Ambientais LTDA.* made a research and did not find any registered small–scale CDM Project activity in the region. The sources of registered small-scale CDM project activity consulted were the United Nations Framework Convention on Climate Change (UNFCC) [14] and Brazilian's Technology and Science Ministry [15]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted for by the other registered project activities.

The utilization of fossil fuel interferes in the carbon pools, and emits to the atmosphere the carbon that was once stored, turning greenhouse effect even worse. Moreover, the renewable biomasses utilized in this project activity fit the options of UNFCCC definition of renewable biomass in Annex 18, EB 23:

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

"The biomass is originating from land areas that are forests[16] where:

(a) The land area remains a forest; and

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[14] *CDM activities registered by CDM Executive board are Available at:<http://cdm.unfccc.int/Projects/registered.htm>. Last visited on January 17th, 2009.*

[15] 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>. Last visited on February 10th, 2009.*

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

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

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

In case of consuming the afforestation wood by this project activity, it would be consisted of *Eucalyptus* and *Pinus* genuses. The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare[17]. The grand major of these cultivations were established in the middle of 1970 to 1980. The *Eucalyptus* and *Pinus* genuses correspond to 80% of the afforestation in Brazil. Furthermore, these genuses are mainly cultivated in the southeast region of the country, where the climate is more favorable for their growing[18]. Moreover, these genuses of trees are the only utilized by the ceramic companies due mainly to the local availability.

The afforestation wood fits all the three options above since just wood from land areas that are forests are utilized, i.e. the area remains a forest (this assertion is supported by reports sent in annex) with the use of the biomass. Moreover, the afforestation supplies the society demands and avoids the pressure on the remnants of natural forests[19].

In addition, sustainable management practices of the afforestation in Brazil (as the techniques of preparation, fertilization, control of weeds, improved seeds, cloning and reform) were introduced and constantly improved in order to increase its productivity[20].

The afforestation in Brazil is complied with the ABRAF[21], which represents, promotes and defends the collective interests of the forestry companies that engage in sustainable development based on planted forests.

The elephant grass is considered renewable according to option 3, as soon as it fit all the assumptions below:

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

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

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

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

Currently, elephant grass has been acquiring national importance as biomass to generate thermal energy due to its high productiveness and

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

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

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

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

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

easy adaptation in almost all climate and soil Brazilian conditions[22]. The elephant grass is cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area.

The wood chips, sawdust, wood industries residues, and the rice husk, are agro-industries residues, so they are considered renewable according to option V of UNFCCC definition of renewable biomass: "The biomass is the non-fossil fraction of an industrial or municipal waste", as the woody and agro-industries residues are resulted from its manufacturing or municipal waste.

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

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

In the baseline scenario, the emissions launched during the combustion of heavy oil were not compensated by carbon absorbance methods, because the fossil fuel had been stored for millions of years prior to its consumption. An opposite scenario occurs with the renewable biomasses employed in this project activity, once they are provided from areas with sustainable forest management.

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

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

[22] *According to EMBRAPA (Brazilian Agricultural Research Corporation's). Source: <http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292> Last visited on February 10th, 2009.*

	CH_4	-	No	Excluded for simplification. This emission source is assumed to be very small.
	N_2O	-	No	Excluded for simplification. This emission source is assumed to be very small.

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

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

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

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

(Brazilian Energy Balance, Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download>.Accessed on September 10th, 2008.)

Analyzing the Table 6, the most probably scenario would be the use of wood as the Brazilian ceramic sector's common practice states, which would be the wood from the Atlantic forest without sustainable management. This biome is extremely reduced into few fragments[23] due to the historical of high deforestation, which made the majority of the

[23]< *http://mapas.sosma.org.br/site_media/download/mapas_a3/uf_sao_paulo_A3.pdf* > <*http://mapas.sosma.org.br/site_media/download/mapas_a3/uf_rio_de_janeiro_A3.pdf*> *. Last visited on February 10th, 2009.*

remaining areas to become preserved. The UNESCO delimited 350,000 km^2 of the Atlantic Forest as Biosphere Reserve, which is the biggest of the world. From the primitive Atlantic forest, nowadays remains only 7.6% (99,466 km^2) of its original area, where is currently dwelled by 120 million people (70% of the Brazilian population)[24]. Therefore, this wood can be considered non-renewable; nevertheless, this baseline is not viable considering the inaccessibility of this Biome and its unavailability in the region.

Another plausible baseline scenario would be the use of Natural Gas. Although there is distribution/gas pipe in the region[25], the inconstant distribution of natural gas made the project proponent not to trust in this fuel, as 40% of the natural gas consumed in *Brazil* proceeds from *Bolivia*[26], therefore excluding this possibility.

This way, the identified baseline for this project activity is the use of heavy oil which was used by the ceramics for a long time and has a consolidated delivery system and long term supply assurance. The overall characteristics of the ceramics production are used to obtain the real amount of fossil fuel used in the baseline scenario.

According to historical experience of the ceramics, the oil consumption before this project activity in *Lara* Ceramic was 1,920,000 liters of heavy oil to produce 9,600,000 ceramic units per year, as the production before the project activity was around 800,000 ceramic units per month.

The calculations regarding the quantity of oil required in the burning process were done according to the efficiency of the kilns employed in the ceramic, which would require 200 liters to produce 1,000 ceramic devices. These values are higher than the reference [27] because it considers advanced equipments of oil insertion, which did not represented the ceramics' baseline scenario.

As the project activity was implemented, the production of the ceramic increased regarding to the market demand. In the absence of this project activity, the identified baseline scenario would be: *Lara* Ceramic would consume 3,360,000 liters per year of heavy oil to feed their kilns to sustain an annual production of 16,800,000 ceramic devices.

Table 7. General description of the ceramic.

Production before the project activity (devices per year)	9,600,000
Oil consumption before the project activity (liters per year)	1,920,000
Actual production (devices per year)	16,800,000
Oil consumption without the project activity (liters per year)	3,360,000
BFy (liters of oil per thousand of devices)	200

[24] *<Source: http://www.rbma.org.br/anuario/mata_01_mataconhecemos.asp>. Last visited on February 10th, 2009.*

[25] *<Source: http://www.ctgas.com.br/template02.asp?parametro=2547>. Last visited on February 17th, 2009.*

[26] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Last visited on February 10th, 2009.*

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

As stated before, in order to attend the market demand made the production increase in the ceramics, as the developing building construction sector is the main cause for this increase. If afterwards, the production in the ceramics rises, it will be reported in the monitoring report.

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

The methodology applied is Category AMS-I.C.: Thermal energy for the user with or without electricity – Version 13 from March 14th 2008 onwards, which is applicable for project activities that avoid greenhouse gases emissions by using renewable biomass instead of fossil fuels, in order to generate thermal energy.

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

The oil consumption before this project activity would be around 1,920,000 liters of heavy oil per year to feed it kiln in order to produce 9,600,000 ceramic devices. Without the project activity, as the ceramic increased it production to 16,800,000 ceramic devices per year to attend the market demand, which means that the consumption of heavy oil would be around 3,360,000 liters.

Brazil has a great availability of heavy oil, which in 2006 was an excess of 6.5 billions of liters [28]. Therefore, assuming that this availability maintains constant, this fossil fuel would be enough to ensure the increase in Ceramics production for at least the next 15 years, which is over the project activity life-time.

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

Test 1 – The project test

Step 1: Regulatory Surplus

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

Step 2: Implementation Barriers

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

- **Technological Barrier**

As affirmed before, the use of heavy oil is a traditional and well-known process, and as a result of the sudden change, a lot of effort from each employee in the ceramics was necessary. The main technological barriers were the non-availability of human knowledge to operate and maintain the new technology, the internal logistic modification and the employees' resistance to the new technology.

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[28] *Source: Brasil Energia. Available at: <http://www.energiahoje.com/index.php?ver=mat&mid=29380>. Last visit on January 22nd, 2009.*

Before the project activity, the process was entirely different: the heavy oil was delivered in the plant, and through the pipeline the injectors of oil inserted the fuel in the kilns, and it was not necessary any logistic modification or labor in order to attend the project's needs. Currently, with the implementation of the project, the new biomass has to be stored in cover sites and needs to be dried in order to achieve a better burn efficiency.

At the beginning of the project implementation the operators did not have knowledge of the ideal amount of renewable biomass that was necessary to achieve the temperature of about 900ºC for its ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using fossil fuel, adding a significant amount of insecurity to the production process, once it was not a common practice in the region and there was not similar process.

Nowadays, the employees must be careful not to fill the mechanic burners with large amounts of biomass (sawdust, rice husk, and large wood pieces), 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, some training courses were required for the staffs in order to clarify new measures linked to the use of renewable biomass, such as the equipment acquired demanded new qualified employees to control and do the maintance of it, sustaining the quality of the final product. Besides there have been some new openings once the biomass requires more labor, like to clean the kilns and transport by shed to the kilns.

Furthermore, there was a lack of infrastructure to utilize the new technology. 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.

This means that *Lara* Ceramic had to find the best procedure to handle with the new technology, i.e. the new biomass process, logistic and kiln's adaptations.

All these changes were made counting on this project approval in order to the ceramic become able to receive the biomass to be used. *Lara* Ceramic, with this project activity, intends to develop their burning process and their kilns in order to reduce losses, thus increasing both the system efficiency as the production.

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

- ***Financial barrier***

With the project implementation, the ceramic made heavy investments regarded to the acquisition of the equipments used in the processing of the biomass, adaptation of the kiln, electronic burn monitoring system, the construction of the storage sheds for the biomass, consultancy, wastes and loss of revenue during the adaptation.

Table 8. Investments due the project implementation

Investment Costs		
Costs with equipment acquisition)	166,200	BRL
Costs with Kiln adaptation	233,600	BRL
Electronic Burn Monitoring system	36,058	BRL
Loss of revenues - period for adaptation of the kiln for biomass	26,400	BRL
Waste of products in the testing period (3 months)	42000	BRL
Consultancy from *Processos & Sistemas*	30,000	BRL
Waste of Biomass in the testing period (BRL)	26,480	BRL
New biomass storage shed	499,247	BRL
Total Costs	1,059,985	BRL

As the production rose right after the fuel switch and the cost's comparison of transportation and fuel price have the need of identical scenarios, it was considered the same production of 1,400,000 devices in order to have the right assessment.

Table 9.Comparison between costs due to the fuel switch in the baseline scenario and the project activity scenario

OIL			Renewable Biomass		
Production	1,400,000	devices per month	Production	1,400,000	devices per month
Monthly consumption of the fuel	280,000	L/month	Monthly consumption of the fuel	1400	m^3/month
Cost with transportation	0.17	BRL/L of oil	Costs - Kiln	310,907	BRL/year
	10,000	L de oil/truck	Costs - Furnace 1	46,028	BRL/year
	28	Truck / month	Costs - Furnace 2	66,752	BRL/year
Total Costs	47,600	BRL/month	Total Costs per month	35,307	BRL/month
Employees costs - considering the fuel switching		BRL/month	Employees costs - considering the fuel switching	6,341	BRL/month
Electricity costs	8,924.59	BRL/month	Electricity costs	16,697.54	BRL/month
Total	**56,524.59**	**BRL/month**	**Total**	**58,346.17**	BRL/month

Therefore, the income from the commercialization of the carbon credits is essential to control and minimize the damages made from the investment and to maintain the fuel switch and to, as this change needs more resources than previously to maintain operations. This disparity obviously puts the ceramics in a less competitive situation, which would make the fuel switching and the continued use of the needed adaptations unfeasible without the existence of the carbon markets.

- **Institutional barriers**

- **Risks of the project**

Since the use of heavy oil is an established and well-known process, the project activity implementation represents a risk to the project proponent because the use of a new biomass and its new logistic adds a significant amount of insecurity to the production process. This change an extensive period of fiscal vulnerability for the ceramic, since during the reconstruction of the kilns, the ceramic production was low. In addition, there is the transition period, where the ceramic lost production due to the adaptation to the use of biomasses and to the new logistic.

Furthermore, the ceramics can go through a period in which there is lack of biomasses, representing another period of risk.

Since it must be emphasized that there is no direct subsidy or support from the government for this project, without the income from the commercialization of the carbon credits, the fuel switch at *Lara C*eramic would not be feasible or attractive to the project proponent.

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

The combustion of sawdust and rice husk to generate thermal energy is an innovation in the ceramic industry. The future demand of this alternative fuel (e.g. by other consumers) is not predictable. Although there is currently a great amount of these biomasses available, there is a possibility that the prices will increase when the biomasses disposal problem is attenuated. If the price of the biomass increases, in the other hand, the price of products cannot increase, once it would not have competitive prices in relation to other ceramics which did not made the fuel switch.

These circumstances make the commercialization of the carbon credits essential to the maintenance of the fuel switch.

Step 3: Common practice

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

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

The product of the project activity is ceramic blocks.

2. Identify possible types of baseline candidates.

Observing Table 10, 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. Other possible baseline candidate would be the use of renewable biomass without the carbon credits support.

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

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

(Brazilian Energy Balance, Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download> Visited in September 10th, 2008.)

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[29] from Mines and Energy Ministry of Brazil is the most representative and reliable source of information about the ceramic sector and its fuel employed.

Therefore, data from Table 10 were provided by a reliable source and it was considered 3 years of its historical data, including the most recent available data and the period when *Lara* Ceramic did their fuel switch.

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

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

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

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

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

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

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

However, it is not enforced namely due to the lack of police. The consumption of non renewable biomass by the ceramic industry was related by several authors (NERI, 2003[30]; ALBUQUERQUE et al, 2006[31]; BRASIL, 2001[32]; VIANA, 2006[33]; CARDOSO, 2008[34]). This have also been observed in other industries as in the production of steel (BRASIL, 2005[35]), which has a much better structure and internal organization when compared with the ceramic industry, that is usually a small and familiar enterprise. BRASIL (2001) suggests that it is important to stimulate the miner sector, especially who are respecting the environment. The incomes from carbon credits can be this incentive which would contribute to avoid the consumption of non renewable biomass illegally. Therefore laws and regulations will not be considered to constraint the geographical area and temporal range of the final list of the baseline candidates.

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

5. Identify a final list of baseline candidates.

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

a) Wood: The fuel most used, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006[36].

b) Natural gas: it is restricted by the absence of pipes, its high costs[37] and lack of availability[38]. The risk of lack of offering and higher costs when compared with other fuels discourages the scenario of investing in this type of fuel even in local with piped gas. The distribution of gas is preferentially performed to thermal power plants, increasing the risk of blackout of natural gas.

c) Fuel oil: This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas. The risks

[30] *NERI, J.T. Energia Limpa, Sustentável ou de Subsistência? Cerâmica Industrial, Rio Grande do Norte;V,8, n.1,35 -6,2003.*
[31] *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.*
[32] *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>. Access at: September 10th, 2008.*
[33] *VIANNA, F.M.A. Participação Pública em Programas Ambientais: Um Estudo em Área Suscetível a Desertificação no Estado do Rio Grande do Norte. 2006, 109f. Dissertação (Mestrado em Engenharia de Produção) – Universidade Federal do Rio Grande do Norte, Natal, 2006. Available at: <http://www.pep.ufrn.br/publicacoes.php?enviou=1>. Accessed in September 10th, 2008.*
[34] *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.*
[35] *BRASIL. Diagnóstico do Setor Siderúrgico nos Estados do Pará e do Maranhão. Brasília: Ministério do Meio Ambiente, 2005. 76 p.*
[36] *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. Table 2.3. >. Accessed on September 10th, 2008.*
[37] *Source: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>.>. Accessed on September 10th, 2008.*
[38] *Source: <http://www.gasnet.com.br/novo_entrevistas.asp?cod=145>.>. Accessed on September 10th, 2008.*

involving natural gas distribution are so considerable that PETROBRÁS[39] was offering subsidy to the consumption of fuel oil in spite of natural gas in the State of São Paulo.

d) Renewable biomass: despite the high biomass availability, the main problems concerning the use of renewable biomass are related to the high investments, technological and institutional barrier, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries[40].

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

Lara ceramic is a small ceramic industry that had used heavy oil successfully since the beginning of their activities, which means more than twenty years. To acquire new equipments and switch the fuel represents a risk to the project proponent since the original practice was showing good results for many years.

Besides, the burning of oil in the Ceramic sector is well known by the laborers, since it had been done for a long period. The operators had the knowledge of the ideal amount of oil required in order to achieve the temperature of 900ºC in the kilns to fire the ceramic and then, optimize this process. In order to clarify new procedures related to the machineries implemented to maintain the final product quality, the fuel switching required capacitating courses for the staff. Furthermore, the ceramic faced arduous resistance from the employees who were very used to the standard situation of managing the oil insertion.

Therefore, the common practice is the use of oil; the fuel most employed, with low price, fewer risks associated and high availability. Using heavy oil as fuel to provide thermal energy is efficient and had shown good results. The Brazilian technology for ceramic industry is not much modernized with the existing global technologies and using oil is a procedure well known by the kiln operators in the Northeast of State of São Paulo and the State of Rio de Janeiro, which is a border state.

In order to maintain correct operation, Lara Ceramic hired a new employee at each new stage of the process. Six employees were hired with the aim of managing the new equipments.

The acquiring of new equipment and the overall costs of the fuel switch represented a risk to the project proponent since the baseline practice was already established and well-known by the laborers. The operators did not have the knowledge of the ideal amount of renewable biomass that is necessary to use in order to achieve the temperature of about 900ºC to cook its ceramic pieces, to acquire the final product with the same quality and to maintain the optimal process as they did when using the native wood without sustainable management. As a result of the fuel switch, an extensive training course was required for the staff in order to clarify new measures linked to the new technology in order to sustain the quality of the final product.

Thus, the project activity is not a common practice.

Impact of projects approval

Presently, the ceramic industrial segment of state of *São Paulo* is comprised mostly of small industrial units that still use varying technological models. The grand majority of ceramic industries in the

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[39] 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>. >. Accessed on September 10th, 2008.

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

region of *Cachoeira Paulista* use heavy oil as fuel. These industries have some technological restrictions such as the energy exploitation and the efficiency of the machinery, the project approval can improve the development of this sector.

Brazil is the third major contributor[41] to the carbon dioxide emissions in the year of 2003, due mainly to deforestation. Contemporary studies generally place *Brazil* fourth in the ranking of the countries that emit the most GHGs.

Renewable sources are relatively less prejudicial to the environment, in terms of local emissions (particle material, sulphur and lead) and greenhouse gases.

The use of fossil fuels brings forward serious environmental problems such as global warming. There are also raising concerns about the security of the oil transportation that can result in huge environmental impacts, chiefly when this transportation is overseas.

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

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

[41] *Source: Goldemberg & Moreira.* ***Política Energética no Brasil****. Estudos Avançados 19 (55), 2005. Available at <http://www.scielo.br/pdf/ea/v19n55/14.pdf>. Last visit on March 30th, 2008.*

3 Monitoring:

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

The methodology applied is Category AMS-I.C.: Thermal energy for the user with or without electricity – Version 13 from March 14th 2008, which is applicable for project activities that avoid greenhouse gases emissions by using renewable biomass instead of fossil fuels, in order to generate thermal energy.

The project activity will annually generate less than 45 MWthermal as described for Type I small scale project activities.

Source data used in this report is based on real outputs from the ceramic. This section will focus on information management related to production.

The biomasses receipts will be monitored to represent the amount of each biomass in fact consumed, which means the amount of biomasses consumed through the ceramic devices production.

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

The monitoring will be done with the aim of determining the most approximate quantity of heavy oil that, in the absence of the project, would be used in the ceramics' kilns and consequently the amount of GHG that would be emitted in tons of CO_2e. The following table shows the frequency of the monitoring of each parameter.

Table 11. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass	tons	Measured by the project proponent	Monthly
Origin of renewable biomass	Renewable origin of the biomass	Not applicable	Controlled by the project proponent	Each crediting period
PRy	Production of ceramic units	Unity of ceramic units	Controlled by the project proponent	Monthly
Renewable Biomass Surplus	Amount of the biomasses available	tons or m^3	Monitored by articles and database	Annually
Leakage	Leakage resulted from the fossil fuel	tCO_2e	Monitored by articles and database	Annually
EF_{CO2}	CO_2 Emission factor of residual fuel oil	tCO2/TJ	Bibliography	Not monitored
NCVoil	Net Calorific Value of fossil fuel	TJ/ton of oil	Bibliography	Not monitored
ρ oil	Specific gravity of fossil fuel	ton/l	Bibliography	Not monitored
BFy	Consumption of fossil fuel per thousand of ceramic units produced per year	l/thousand of ceramic units	Data from project proponent	Function of PRy
ηth	The efficiency of the ceramics using fossil fuel in the absence of the project activity	Percentage	Data from project proponent	Not monitored

As stated before, the calculations regarding the quantity of oil required in the burning process were done according to the efficiency of the kilns utilized in the ceramics, which would require around 200 liters of oil to produce 1,000 ceramic devices in *Lara* Ceramic.
Nowadays, *Lara* ceramic sustains a production of around 1,400,000 ceramic devices per month.
The quantity of heavy oil that would be used in the ceramic will be calculated through the multiplication of the ceramic' monthly production by the consumption of fossil fuel per thousand of ceramic devices, as the following example:

Qoil = (Monthly production / 1000) x Consumption of fossil fuel per thousand of ceramic devices (BFy)
Lara ceramic
Qoil = 1,400 x 200 = 280,000 L oil / month

The responsible to monitor data provided in Table 11 will be: *Mr. Eduardo Lara from Lara Ceramic*. Internal audit will guarantee data quality.

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

Monitored Parameters

<table>
<tr><td>Data / Parameter:</td><td>Q renbiomass</td></tr>
<tr><td>Data unit:</td><td>tons</td></tr>
<tr><td>Description:</td><td>Amount of renewable biomasses</td></tr>
<tr><td>Source of data to be used:</td><td>Measured by the project proponent</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions</td><td>
<table>
<tr><td>Biomass</td><td>Rice Husk</td><td>Sawdust</td><td>Woody residues</td></tr>
<tr><td>Quantity in tons per month</td><td>42</td><td>147</td><td>214.65</td></tr>
</table>
</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The amount of biomasses will be monitored in accordance to the weight described in the receipts from the providers and the number of trucks which arrives in the ceramic companies. The values in the receipts are described in m^3, therefore it is necessary the conversion to tons through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project are:
<table>
<tr><td>Biomass</td><td>Rice Husk</td><td>Sawdust</td><td>Woody residues</td></tr>
<tr><td>Quantity in m^3 per month</td><td>350</td><td>600</td><td>450</td></tr>
<tr><td>Specific gravity (tons/m^3)</td><td>0.12</td><td>0.245</td><td>0.477</td></tr>
</table>
The sources of these data are:
Rice Husk:
<http://www.irga.rs.gov.br/arquivos/20050815133443.</td></tr>
</table>

	pdf Visited on 11/03/2008> Sawdust: Masses and Dead Loads of Concrete and Other Materials - <http://www.cca.org.nz/pdf/Masses.pdf>. Accessed on September 10th, 2008. Woody Residues (wood chips and non-fossil fraction of industrial or municipal waste) -Variação da densidade a granel de cavacos de *Eucalyptus saligna* em função das suas dimensões e da umidade- Source: <http://www.celso-foelkel.com.br/artigos/ABTCP/abtcp.%20para%20site%202002c.pdf>. Last visit on February 12th, 2009. It was utilized the normal type value for wood chips.
QA/QC procedures to be applied:	Amount of biomass will be checked according to receipts of purchase. The energy balance will be verified according to the amount of biomass applied.
Any comment:	The wood residues pass through a beneficiation process and are al turned into sawdust, and then mixed with rice husk to feed the kilns. Others biomasses can be used since it can be proved it renewable origin.

Data / Parameter:	**PRy**
Data unit:	Tons
Description:	Production of ceramic units per month
Source of data to be used:	Controlled by the project proponent
Value of data applied for the purpose of calculating expected emission reductions	3,080
Description of measurement methods and procedures to be applied:	The measurement of the quantity ceramic pieces will be done by an internal control sheet monitored by the project proponent, which will be fed daily. Then, the value will be multiplied by the ceramic piece weight.
QA/QC procedures to be applied:	As the ceramic must have an internal control of the production and sale at the end of every month, the PRy value cannot be manipulated. A double check will be done with the value of the biomass utilized.
Any comment:	The production stated above is referent to the year of 2008.

Data / Parameter:	**Leakage**
Data unit:	tCO_2e

Description:	Leakage resulted from fossil fuel
Source of data to be used:	Monitored
Value of data	0
Description of measurement methods and procedures to be applied:	The source of leakage predicted in the methodology will be monitored.
QA/QC procedures to be applied :	Receipts and invoices will be used to prove that the equipments were acquired. The old equipments of oil are still in the ceramics, proving that no equipments were transferred.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

<table>
<tr><td>Data / Parameter:</td><td>Renewable biomass surplus</td></tr>
<tr><td>Data unit:</td><td>ton or m^3</td></tr>
<tr><td>Description:</td><td>Amount of renewable biomass available</td></tr>
<tr><td>Source of data to be used:</td><td>Monitored</td></tr>
<tr><td>Value of data</td><td>
<table>
<tr><th>Biomass surplus</th><th>Surplus</th><th>Year</th></tr>
<tr><td>Wood from afforestation in m^3</td><td>7,776,095</td><td>2007</td></tr>
<tr><td>Sawdust and wood chips in m^3</td><td>5,737,174.08</td><td>2007</td></tr>
<tr><td>Industrial woody residues in tons</td><td>749,839</td><td>2006</td></tr>
<tr><td>Rice Husk in m^3</td><td>131.38 thousands</td><td>2007/08</td></tr>
<tr><td>Elephant Grass</td><td>Not measured</td><td>-</td></tr>
</table>
Detailed information in section 4.1 – LEAKAGE.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>It will be used to calculate the leakage of renewable biomass.
The sources of leakages predicted in “General guidance on leakage in biomass project activities” of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, will be monitored. The</td></tr>
</table>

	measurement of the leakage will be based in national and internal articles and database every monitoring period. The sources will provide information about the biomass availability in the project activity’s region.
QA/QC procedures to be applied :	Data available regarding the ceramic industries fuel consumption will be employed to monitor the leakage.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Origin of renewable biomass**
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data to be used:	Controlled by the project proponent
Value of data	Renewable biomass
Description of measurement methods and procedures to be applied:	This information will be given by the biomasses providers. The guarantee of acquiring sawdust, wood chips, rice husk, and non-fossil fraction of industrial waste from renewable sources will be achieved by invoices from the providers, as well as their tracking until their afforestation origin. As stated in the section 2.2, the biomasses are considered renewable as fulfilling the options described in the Annex 18, EB 23.
QA/QC procedures to be applied:	The biomass will be considered as renewable if it is according to the definition given by the Annex 18, EB 23.
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.

Fixed Parameters

Data / Parameter:	**ρ oil**
Data unit:	ton/l
Description:	Specific gravity of fossil fuel
Source of data used:	Value average checked at: -Faculdade de Engenharia Mecânica UNICAMP - <http://www.fem.unicamp.br/~em672/GERVAP2.pdf>. Accessed on September 10th, 2008.
Value applied:	0.000978

Justification of the choice of data or description of measurement methods and procedures actually applied :	The amount of oil used in the baseline was measured by volume units.
Any comment:	

Data / Parameter:	**NCVoil**
Data unit:	TJ/ton of oil
Description:	Net Calorific Value
Source of data used:	Value average checked at: - IPCC : Intergovernmental Pannel on Climate Change: Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf>, table 1.2. Accessed on September 10th, 2008.
Value applied:	0.0404
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value will provide the energy generated by the amount of heavy oil that would be used in the absence of the project.
Any comment:	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 / Parameter:	**BFy**
Data unit:	l of oil/tons of product
Description:	Consumption of fossil fuel per tons of product
Source of data used:	Historical data from project proponent
Value of applied:	90.909
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramics used to consume heavy oil. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns. The value is employed to calculate the real amount of heavy oil displaced to maintain the ceramic production in the baseline scenario.

Any comment:	

Data / Parameter:	**EF_{CO2}**
Data unit:	tCO_2/TJ
Description:	CO_2 Emission factor of residual fuel oil
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The fuel that would have been used in the baseline scenario for this project activity would be heavy oil. The non-renewable wood would be provided from the *Atlantic Forest* biome. However, this fuel is not viable considering the inaccessibility of this Biome and its unavailability in the region. The natural gas has an inconstant distribution, bringing forward a lot of risks associated.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits income for this project activity, whichever occurs later.

Data / Parameter:	**ηth**
Data unit:	Percentage
Description:	The efficiency of the ceramics using fossil fuel that would have been used in the absence of the project activity
Source of data used:	Historical data from project proponent
Value applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied :	Efficiency should be calculated as total energy produced (electricity and steam/heat extracted) divided by thermal energy of the fuel used. As the ceramics did no use to monitor the energy produced due to the heavy oil burning, the ηth could not be calculated. Despite the fact that is impossible to any industry achieve the maximum efficiency to generate thermal energy, the efficiencies of the ceramics using heavy oil in the absence of the project activity were adopted as 100%, as this value is the most conservative one. Furthermore, the ηth is in accordance with the methodology applied, which states that the efficiency of the baseline units shall be determined by adopting one of the criteria. The criterion adopted was the maximum efficiency of 100%, which is the most conservative of the options showed in the methodology.
Any comment:	

3.4 Description of the monitoring plan

The responsible for implementing the monitoring plan shall be the owners of the companies. The project proponent will also be responsible for developing the forms and registration formats for data collection and further classification. Data monitored will be kept during the crediting period and 2 years after.

For this purpose, the authority for the registration, monitoring, measurements and reporting is: Mr. Eduardo *Lara* from *Lara* Ceramic.

The management structure will rely on the local technicians with a periodical operation schedule during the project. The technical team will manage the monitoring, the quality control and quality assessment procedures and the different auditory will be responsible to carry the project premises.

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

Carbono Social Serviços Ambientais LTDA. will also implement a report following the Social Carbon methodology, which was developed by *Instituto Ecológica* and focus on sustainable development and better social conditions for the communities where it is implemented. This Social Carbon Reports will be available at TZ1 registry (http://www.tz1market.com/socialpublic.php) once the project is registered.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

Category AMS-I.C.: Thermal energy for the user with or without electricity – Version 13 from March 14th 2008. This category comprises renewable energy technologies that supply individual households or users with thermal energy that displace fossil fuels such as the three grouped ceramics.

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

Baseline

$$BEy = HGy * EF\ CO_2 / \eta th \qquad \text{(Equation 01)}$$

Where:

BEy: The baseline emissions from steam/heat displaced by the project activity during the year y in tCO_2e.

HGy: The net quantity of heat supplied by the project activity during the year y in TJ.

$EFCO_2$: The CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO_2/TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used.

ηth: The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity.

The ceramic facilities did not use to monitor the energy generated by the fossil fuel consumed. However, it is well known the amount of fossil fuel consumed as well as the amount of fuel required to burn a thousand of pieces. Therefore, this project will estimate the baseline emissions through the energy generated by the real consumption of fuel oil and assuming that ηth is 100%.

The thermal energy generated by the fossil fuel is estimated as follows:

$$HGy = Qoil \times NCV \times \rho \qquad \text{(Equation 02)}$$

Where:

Qoil: Amount of oil (L)

NCV: Net calorific value of oil (TJ/Tonne)

ρ: Specific gravity of oil (ton/L)

Leakage (LE)

The leakage predicted in the methodology employed is not applicable for this project activity as there is no transference of equipment in spite of new equipments had to be acquired. Furthermore, the old oil equipments are still in the ceramics, proving that these equipments were not transferred.

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

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

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

Observing the table above, the source of leakage of the present project is the competing use of wood from afforestation and its residues. The ceramics utilize wood residues and the providers are mainly industries and wood industries. There are plenty of industries of this category in the state of *São Paulo*, and also in the bordering states: *Rio de Janiero, Mato Grosso do Sul, Paraná* and *Minas Gerais*, which means that the project activity will not disturb in any aspects the wood market once there is plenty of this kind of biomass available. The source of leakage of the present project is showed below according to each type of biomass:

Rice Husk

The project activity will switch native wood to rice husk, an abundant biomass in the region. The state of São Paulo and its border states has a production of 597.2[42] thousand tonnes registered in the last year, and consequently a great supplier of rice husk.

[42] *Brazilian Rice Annuary of 2008. Available at <http://www.anuarios.com.br/port/versao_pdf.php?idEdicao=39&idAnuario=3>. Accessed on September 10th, 2008.*

The Table 13 shows production of rice and rice husk in the region of Southeast in the years of 2006, 2007 and 2008. Each ton of produced rice leads to the supply of 0.22 ton of rice husk[43].

Table 13. Rice and rice husk production.

Harvest	Area(ha)	Rice(ton)	Rice husk (ton)
2006/07	211.6 thousand	657 thousand	144.54 thousand
2007/08	179 thousand	597.2 thousand	131.38 thousand

As stated before, the region of São Paulo and its border states has a harvest of 2007/08 produced 597.2 thousand tons, generating around 131.38 thousand tons of rice husk. The project activity will employ approximately 504 tons of biomass per year which lead de fraction of 0.38% of the total availability of this kind of biomass in the region. Thus, It can be concluded that the biomass available is widely superior then the amount required for this project i.e. leakage from rice husk can be neglected.

Wood from Afforestation

The area destined for afforestation in *Brazil* corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of biomass per hectare[44]. The grand major of these cultivations were established in the middle of 1970 to 1980. The *Eucalyptus* and *Pinus* genuses correspond to 80% of the afforestation in *Brazil*. Furthermore, these genuses are mainly cultivated in the southeast region of the country, where the climate is more favorable for their growing[45].

In addition, sustainable management practices of the afforestation in *Brazil* (as the techniques of preparation, fertilization, control of weeds, improved seeds, cloning and reform) were introduced and constantly improved in order to increase its productivity[46]. As a consequence, *Brazil* withholds the best productivity taxes (in m^3/ha/year) over the world due to the adaptation of these species to the Brazilian territory and the success of the experiments of genetic improvement[47].

The production of wood from afforestation in the state of *Rio de Janeiro* was of 368,710 m^3 [48] and in *São Paulo*, which is a bordering

[43] *Source: EMBRAPA. Available at <http://sistemasdeproducao.cnptia.embrapa.br/>. Visited on September 06th, 2008*

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

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

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

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

[48] *According to IBGE(Geographic and Statistic* Brazilian *Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=rj&tema=extracaovegetal2007>. Last visited on January 22nd, 2009.*

state, was of 7,407,385 m³[49] in 2007. As the consumption of this kind of fuel is around 30,720 m³ per year for this project activity, it represents around 0.4% of the total of wood from afforestation produced in the region.

Sawdust and Wood Chips

The production of wood generates a large amount of residues, which can be reused to generate thermal energy, considering that around 22% of the wood produced will generate sawdust/wood chips[50]. The production of wood log in the state of *São Paulo* was of 25,966,464 m³[51] and in *Rio de Janeiro*, which is a bordering state, was of 111,600 m³[52] in 2007. Thus, the production of sawdust/wood chips in the region was around 5,737,174.08 m³ per year. Considering that these biomasses would be the only consumed by the ceramics, and that the specific gravity of the woody residues is 0.477 ton/m³[53] and the sawdust is 0.245 ton/m³[54], the consumption of this project activity would be around 7,200 m³ of sawdust and 5,400 m³ of wood residues per year, value that represents around 0.22% of the total of woody residues produced in the region.

Industrial and construction woody residues

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

The construction residues wood corresponds around 85% of the total construction residues in *Sorocaba*, city of the state of *São Paulo*. The deficiency of a correct destination for this wood constitutes a huge problem[55].

The percentage of the wood residues (such as pallets) contained within the industrial solid residues in the region of *Curitiba*, which is the capital of the state of *Paraná*, is around of 5%. Furthermore, the city garden residues correspond around 3.2% of the total of industrial solid residues[56].

It was utilized this estimative to calculate the percentage of consumption of these residues in the project activity. Moreover, it was

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[49] *According to IBGE(Geographic and Statistic* Brazilian *Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=extracaovegetal2007>. Accessed on February 18th, 2009.*

[50] *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.*

[51] *According to IBGE(Geographic and Statistic Brazilian Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=extracaovegetal2007>. Accessed on February 18th, 2009.*

[52] *According to IBGE(Geographic and Statistic Brazilian Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=rj&tema=extracaovegetal2007>. Accessed on February 18th, 2009.*

[53] *Variação da densidade a granel de cavacos de Eucalyptus saligna em função das suas dimensões e da umidade. Source: <http://www.celso-foelkel.com.br/artigos/ABTCP/abtcp.%20para%20site%202002c.pdf>. Last visited on February 12th, 2009. It was utilized the normal type value for wood chips.*

[54] *Masses and Dead Loads of Concrete and Other Materials- <http://www.cca.org.nz/pdf/Masses.pdf>. Accessed on February 18th, 2009.*

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

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

only considered the availability of industrial wood residues, which is 749,839 tonnes per year (around 5% of the total of industrial solid residues). The consumption of these kinds of biomasses in this project activity was around 2,575.8 tonnes per year, corresponding around 0.34% of the total. Initiatives like these could attenuate the problem with solid residues final disposal in cities.

Elephant grass

This biomass is from grassland in abandoned areas, therefore the leakage that would be applicable is the shift of pre project activity and emissions from biomass generation/cultivation. Currently, elephant grass has been acquiring national importance as biomass[57] 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)[58]. In case of employing this kind of biomass, the project proponent will cultivate, by himself, elephant grass 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, i.e. this leakage will not exist.

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

The implementation of this project in the ceramics is breaking the culture of fossil fuel burning in the state of *São Paulo and its border states* and consequently, several ceramics are becoming interested in implementing this project, given the possibility of income derived from the sale of carbon credits. The opportunity of spreading the use of renewable biomass to other ceramics presents huge possibilities for sustainable development in the region.

With the implementation of the project activity, the project participants will avoid the consumption of about 3,360,000 liters per year.

Emissions Reductions

$$\mathbf{ERy = BEy - Leakagey} \qquad \text{(Equation 03)}$$

Where:

ERy: Emission reduction in the year "y" (tonnes of CO_2 eq.)

BEy: Baseline emissions of CO_2 that would be generated through heavy oil burning (tonnes of CO_2 eq.)

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

Emission Reductions

Lara Ceramic – Year of 2008

The baseline emissions can be obtained by Equation 01 and 02, as follows:

HGy = 3,360,000 L of oil x 0.000978 ton/L x 0.04040 TJ/ton = 132.757 TJ

BEy = (77.4 tCO_2/TJ x 132.757 TJ) / 1 = 10,275 tCO_2

[57] *Source: <www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Visited on February 16th, 2009.*
[58] *Source: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Visited on February 13th, 2009.*

Table 14. Emission reductions without considering the leakage

Year	*Lara* Total Baseline Emissions(tonnes of CO_2e)
April to December - 2006	7,706
2007	10,275
2008	10,275
2009	10,275
2010	10,275
2011	10,275
2012	10,275
2013	10,275
2014	10,275
2015	10,275
January to March - 2016	2,569
Total Baseline Emissions (tonnes of CO_2e)	**102,750**
Number of years of the crediting period	10
Annual average of estimated baseline emissions for the 10 years of crediting period (tonnes of CO_2e)	**10,275**

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

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

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

Table 15. Estimation of overall emission reductions

Year	Baseline Emissions (tonnes of CO_2e)	Leakage (tonnes of CO2e)	Emission Reductions (tonnes of CO_2e)
April to December - 2006	7,706	0	7,706
2007	10,275	0	10,275
2008	10,275	0	10,275
2009	10,275	0	10,275
2010	10,275	0	10,275
2011	10,275	0	10,275
2012	10,275	0	10,275
2013	10,275	0	10,275
2014	10,275	0	10,275
2015	10,275	0	10,275
January to March - 2016	2,569	0	2,569
Total			102,750
Average			10,275

5 Environmental Impact:

As can be observed in Table 16, the only negative impact identified is that the project activity will generate ashes due to the burning of the biomass, but this impact will be mitigated by incorporating the ashes into the clay used as thermal insulator in the kilns entrance.

The burning of the new biomasses also emits particulate material and CO_2, as well as when using wood. However, the emission reductions of GHG will improve since they are renewable biomasses.

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

Table 16. Summary of the environmental impacts.

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

Environmental Laws related to the plant activities

The National Environmental Policy (PNMA), instituted by the Brazilian Law 6.938/81, has the purpose of preservation, improvement and recovery of the environmental quality, with the intention to assure conditions for the social-economic development and the protection of human dignity in the country. The PNMA 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 Stakeholders comments:

The main stakeholders considered in this project are the ceramic sector national association (ANICER)[59] and the ceramic company employees. A letter was sent to the stakeholders informing about the project. In the ceramic's facilities, the letter was posted on the employees' board which is a visible place with high circulation of employees. The letter was available during 7 days and the comments were expected for a period of 7 days after the letter has been posted.

ANICER sent one letter stating their support to the present project activity[60].

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

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

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

[59] *This institution is focused in the quality and sustainable management, offering opportunities for the ceramists, their business and employees as a result of its services, researches, events and associations. More information is available at:<http://www.anicer.com.br>. Accessed on December 10th, 2008.*

[60] *The letter from ANICER was evidenced to the DOE.*

7 Schedule:

- Project start date: 1st January 2004
- Date of initiating project activities: 1st April 2006
- Validation Report predicted to: 1st November 2009
- First Verification Report predicted to 15th November 2009
- VCS project crediting period: 10 years renewable
- Date of terminating the project: 31st March 2016
- Monitoring and reporting frequency: preferentially from 6 to 12 months, since the beginning of the crediting period.

After the project start date, the ceramic owner made adaptation due to the use of new biomass and its technology encompassing, for example, tests using the new biomasses, the ideal mix of renewable biomasses (different percentages of each biomass) and technological adaptations such as the installation of mechanic burner and its sub sequential removal due to its high maintenance costs.

8 Ownership:

8.1 Proof of Title:

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

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

Not applicable.