Voluntary Carbon Standard
Arrozal, GGP, Sul América Ceramics Project Description

19 November 2007
August 05th, 2009

Contents

1 Description of Project:

1.1 Project title

Arrozal, GGP and *Sul América* Ceramics Fuel Switching Project

Version 06

PDD completed in: August 05th, 2009

1.2 Type/Category of the project

This is a grouped project activity that encompasses three small ceramic industries: *Arrozal, GGP,* and *Sul América* Ceramics. The voluntary project activity, although being applied at the voluntary market, encloses the following category of the simplified modalities and procedures, which is described in appendix B, for small scale type I CDM project activities.

- **Category AMS-I.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.

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

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

Table 1. Emission reductions of the project activity estimate during the crediting period

Year	Total Emission Reductions
April to December 2006	20,826
2007	27,771
2008	27,771
2009	27,771
2010	27,771
2011	27,771
2012	27,771
2013	27,771
2014	27,771
2015	27,771
January to March 2016	6,942
Total Emission Reductions (tonnes of CO2e)	**277,707**
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tonnes of CO2e)	**27,771**

1.4 A brief description of the project:

The project activity is the grouping project of *Arrozal*, *GGP,* and *Sul América* Ceramics, which are three small and prototypical ceramic industries that produce structural ceramic devices like bricks destined for the regional market of the state of *Rio de Janeiro*. The project consists on utilizing renewable biomass to feed the kiln rather than using a non-renewable fuel such as heavy oil, which was a pioneer practice in the region.

As renewable biomasses, *Arrozal* ceramic utilizes afforestation wood, such as eucalyptus biomass material obtained from regulated forest areas, and non-fossil fraction of industrial waste, such as pallets and wooden packages. *GGP* ceramic utilizes afforestation wood and afforestation wood residues (such as wood chips and sawdust), and *Sul América* ceramic utilizes afforestation wood residues (such as sawdust) and industries residues wood.

Usually the environmental aspects are not concerning issues in the ceramic sector; however this is not the case with these three ceramics, which worked hard to create a good working system and are 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 ceramics will minimize the environmental damages caused by the use of fossil fuels. Thus, this project activity also contributes to reducing fossil fuel consumption and preserving its reserves.

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

The ceramics are located in *Brazil*, in the state of *Rio de Janeiro*, in the southeast region of the country. The geographic location is illustrated in Figure 1.

Table 2. Localization of the ceramics

Ceramic	City	State
Arrozal	*Piraí*	*Rio de Janeiro*
GGP	*Três Rios*	*Rio de Janeiro*
Sul América	*Itaboraí*	*Rio de Janeiro*

The project sites have the postal addresses:

- Arrozal Ceramic

  Address: *Estrada Arrozal Pinheiral, Km 10 - Piraí, Rio de Janeiro*

  Postal Code: 27.185-000;

- *GGP* Ceramic

  Address: *Avenida Zoelo Sola, 417 – Três Rios, Rio de Janeiro*

  Postal Code: 25.820-180;

- *Sul América* Ceramic:

  Address: *Rua Odir Barros, 99 - Rio Várzea – Itaboraí - Rio de Janeiro*

  Postal Code: 24.800-000.

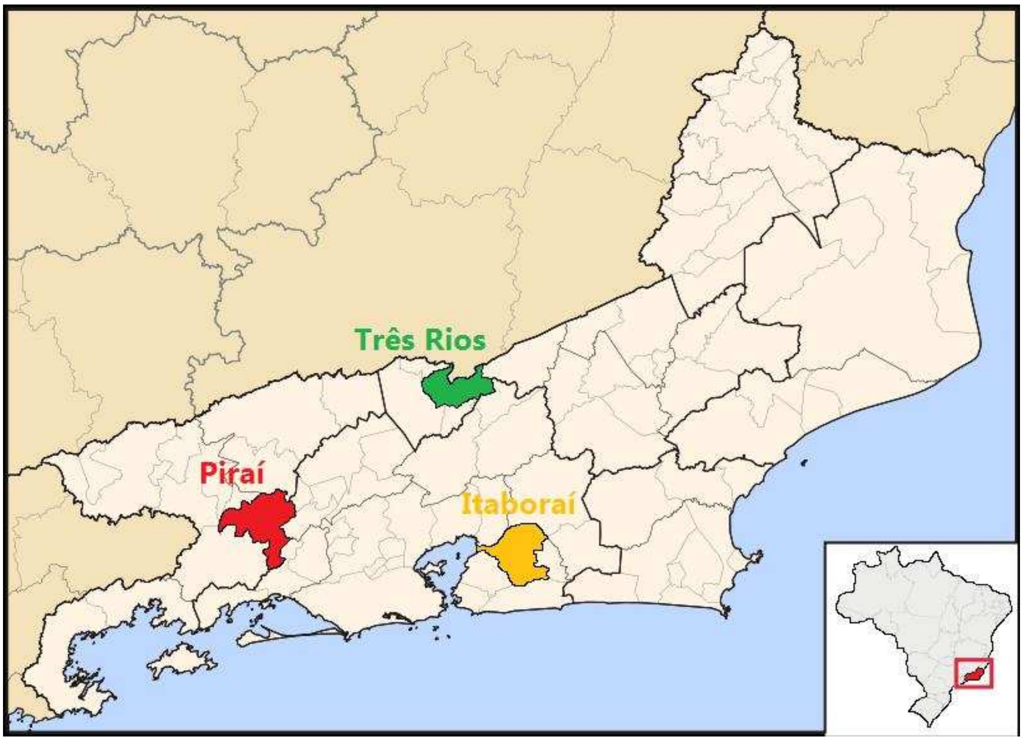

Figure 1. Geographic location of the cities of the project activity that has the following coordinates *Rio de Janeiro* State: *Três Rios:* 22º07’00” S, 43º12’13” W; *Itaboraí*: 22º44’51” S, 42º51’21” W; and Piraí: 22° 37' 44" S, 43° 53' 52" W

Figure 2. *Arrozal* Ceramic’s coordinates: 22°34'16" S; 44°01'13" W

Figure 3. *GGP* Ceramic's coordinates: 22° 08' 13" S; 43°14'59" W

Figure 4. *Sul América* Ceramic's coordinates: 22°44'52" S; 42°52'19" W

1.6 Duration of the project activity/crediting period:

- Project start date[1]:

Table 3. Ceramics' project start date

Ceramic	Project Start Date
Arrozal	Estimated to January 2004
GGP	Estimated to January 2003

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

Sul América	Estimated to July 2004

- Date of initiating project activities[2]: 01/04/2006;
- VCS project crediting period: 10 years, two times renewable.

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 kilns for many years, at *Arrozal* ceramic the fossil fuel was employed since the beginning of the 1980, *GGP* employed fossil fuel since 1919, and *Sul América* ceramic used fossil fuel since 1972.

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 6,152,000 liters of heavy oil per year to provide 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 afforestation wood residues and non-fossil fraction of industrial waste.

However, elephant grass, which is one possible biomass utilized in this project, is 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 provided from areas with sustainable forest management.

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

The three ceramic industries produce structural ceramic devices like bricks, which are mainly used in the construction sector. *Arrozal* utilize a "Hoffman" kiln, *GGP* Ceramic utilizes four "Vagão[3]" kilns and *Sul América* ceramic utilizes ten "Paulistinha[4]" kilns. These kilns are commonly utilized in *Brazil* to burn bricks and roof tiles.

Nowadays, with the project activity implemented in the ceramics, the average production in *Arrozal* Ceramic is 1,100,000 ceramic devices per month with an average consumption of 459 tons per month of wood from afforestation such as eucalyptus biomass material obtained from regulated forest areas for the kiln and another 157.5 tons per month of wood residues used for the ceramic devices dryer. At *GGP* Ceramic the regular production is 1,800,000 ceramic devices per month with an average biomass consumption of 1026.75 tons//month of biomass. *Sul América* Ceramic utilizes 1338,75 tons of biomass per month in order to produce 880,000 ceramic devices.

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[2] *Earliest credit start date under the VCS 2007.1*

[3] *"Vagão" kiln is the previous version of "Tunnel" kiln. There isn't a heating section in the kiln, because the heating section and the burning section are the same. Due to this fact, the burning in this kiln is a slow process.*

[4] *"Paulistinha" is a kind of intermittent kiln with rectangular shape and lateral furnaces. It is usually employed to burn tiles.*

The following table shows the scenario of each of the ceramics.

Table 4. Scenario of each ceramic

	Arrozal	***GGP***	***Sul América***
Actual production (devices per month)	1,100,000	1,800,000	880,000
Biomass Consumption (ton/month)[5]	616.5	1026.75	1338.75
Kiln Efficiency with renewable biomass (ton of biomass/thousand of ceramic units)	0.56	0.57	1.52

Arrozal Ceramic works with a Hoffman kiln with 16 chambers and in each chamber, around 92,000 ceramic units are burned per burning cycle[6]. Moreover, the biomass consumption is around 15 ton per day for the kiln, and other 5 ton per day approximately for the 2 ceramic units dryer. 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, 70 minutes, and 18 hours respectively, with a total of 37 hours 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.

GGP Ceramic utilizes four *Vagão* kiln and burns approximately 64 kilns per month with 28,000 ceramic devices each, consuming approximately 16 tons of biomass per burning cycle. The burning cycle comprises 6 hours to load the kiln with ceramic units, approximately 25 hours to warming and burning together, 13 hours to cooling, another 6 hours to download, and approximately 30 minutes to clean when it is done. These values may change since the ceramic will seek a more efficient process.

Sul América Ceramic utilizes ten *Paulistinha* kilns and burns approximately 50 kilns per month with 18,000 ceramic devices each, consuming approximately 26.775 ton of biomass per burning cycle. The burning cycle comprises 6 hours to load the kiln with ceramic units, approximately 72 hours to warming and burning together, 16 hours to cooling, another 6 hours to download, and approximately 30 minutes to clean when it is done. These values may change since the ceramic will seek a more efficient process.

Table 5. Technical parameters of the ceramics kiln.

Technical Parameter	**Vagão**	**Paulistinha**	**Hoffman**
BFy (liters of oil per thousand of devices)	175.98	250	200
Features	Semi-continuous with rectangular shape and lateral furnaces.	Intermittent with rectangular shape and lateral	Continuous with two lines, rectangular shape and 16 chambers (each chamber has 5 lines

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[5] *It was considered the total biomasses used at each Ceramic, so the dryers were included undirected in the calculation.*

6 The burning cycle of a continuous kiln encompasses the warming, burning and cooling stages, as the kiln is always burning.

	Ceramic units are inserted in a rail cart	furnaces	with three fuel entrances). The furnaces are in the upper part of the kiln
Maximum Temperature	900°C	900°C	900ºC
Quantity of burning cycles per month	64	50	960
Average production per burning cycle (thousand of ceramic units)	28	18	1.15[7]
Average supposed capacity of each kiln (MW)	3.11	1.59	3.73
Time of loading	6 hours	6 hours	6 hours
Hours of burning (per cycle)	25	72	37 hours
Time of unloading	6 hours	6 hours	6 hours

The project activity aims at the use of renewable biomass for energy supply from afforestation wood and woody residues, such as wood chips, sawdust and industries residues wood. In case of lack of these kinds of biomasses, the project proponents can use elephant grass.

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 ton of biomass per hectare[8].

The afforestation residues (sawdust and wood chips) are resulted from wood manufacturing, considering that around 22% of the wood produced will generate sawdust/wood chips[9].

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[10]. Furthermore, pallets that are either broken or worn-out could be consumed by the ceramics, measure that would attenuate the landfills final disposal problem. These pallets could be acquired from large industries in the region of the state of *Rio de Janeiro*.

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.[11]

In order to implement the project activity, the ceramics 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

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[7] It was considered a single line in order to calculate the average production per burning cycle.

[8] *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.sbs.org.br/atualidades.php>. Last visit on: January 19th, 2009.*

[9] *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.*

[10] *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.*

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

the kiln to the firewood use, 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 high energy efficiency, new machineries were necessary to be installed.

Differently from heavy oil, the new fuel that is utilized to burn and maintain the ideal temperature for the ceramic firing process shall be dry in order to increase the burning efficiency of the kiln. For this purpose, the project proponents of the ceramics had to reserve a determinate sheltered space in the ceramic company in order to store the biomass in covered sites, thus keeping it dry.

Beyond these alterations, all the ceramics, due to the fuel switch, had to make some changes in the whole system, and each ceramic developed their particular system.

The ceramics production has been increasing in order to attend the market demand. The Brazilian building construction sector is also increasing [12] mainly due to the Brazilian Government program called Growth Acceleration Program (PAC)[13]. 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 6. Main biomass providers

Ceramic	Biomass	Provider	State
Arrozal	Wood Residues	Pernod Ricard Brasil	*Resende - RJ*
	Wood Residues	Clariant do Brasil	*Resende – RJ*
	Afforestation Wood	Rural Mirtalves Reflorestamento Ltda.	*Engeheiros Passos - RJ*
GGP	Wood Residues	Icomasa	*Bananal – SP*
	Afforestation wood	3 J.I. Indústria e Comércio de Madeiras	*Bananal – SP*
Sul América	Wood Residues	Petrobrás	*Macaé* - RJ

***Arrozal* Ceramic**

Arrozal Ceramic uses to operate a "Hoffman" kiln using oil as fuel. For the development of the project, the entrepreneur invested in the reconstruction of the upper part of the kiln, which demanded to work with low production during some months.

Arrozal Ceramic acquired new equipments necessary to the project activity, included a mechanic ax, (used to cut bigger pieces of wood), a pyrometric system to burning control (thermocouple), and a circular saw. The use and monitoring of those new equipments required new employees, which demanded some training, once it was not a common practice in the region the use of those equipments.

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[12] *Source: Infomoney. Available at: <http://web.infomoney.com.br/templates/news/view.asp?codigo=1145289&path=/suasfinancas/imoveis/compra>. Last visit on: January 26th, 2009.*

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

Furthermore, a chimney exhauster was necessary to be installed in order to control the expelling out of the combustion gases from the kiln. In addition, when using oil, the fire was easily passed from a burning line to the next one in the “Hoffman” kiln. With the renewable biomasses, it is needed a chimney exhauster in order to draw the fire from a burning line to the next one.

Arrozal Ceramic uses afforestation wood and non-fossil fraction of industrial waste (i.e. woody residues such as pallets and packages), with proportion of 67% and 33% respectively, while the afforestation wood is utilized only in the "Hoffman" kiln and the industrial waste is utilized in the 2 ceramic devices dryers. The feeding process in the kiln is manually realized, so there was a need of new employees for this job.

With the purpose of maintain the quality of its ceramics products, the project proponent constructed two ceramic devices dryers, aiming to improve the efficiency and effectiveness of the burn process.

Figure 5. The renewable biomass deposited in the “Hoffman” kiln.

GGP Ceramic

Firstly, *GGP* Ceramic had to reconstruct the kilns’ entrances in order to install twenty-six mechanic burners to insert both biomass and air into the kilns. Operators must feed biomass into these mechanic burners manually. The mechanic burners insert sawdust and wood chips together into the kilns.

GGP ceramic utilizes wood chips, sawdust, and afforestation wood in the average proportion of about 60%, 30%, and 10% respectively. The ceramic industry also had to acquire a wood shredder, with the purpose to cut the afforestation wood into wood chips, once the kilns are supplied only by wood chips and sawdust by mechanic burners.

Furthermore, to control the temperature and burning in the kilns, the ceramic had to install thermo couples, due to the lack of experience with the biomass.

The project proponent wants to install a biomass dryer to improve the efficiency of the burning process.

Figure 6. Ceramic devices ready to enter in a “*Vagão*” Kiln at *GGP* Ceramic

Sul América **Ceramic**

Sul América Ceramic utilizes about 551.25 ton of sawdust and other 787.5 ton of wood residues from industries. This amount is widely superior comparing to the other ceramics once the kind of devices produced in *Sul América* Ceramic (primarily ceramic devices, used mainly for final touch and appearance, or ceramic devices that need special treatment, such as those used for protection purposes) takes almost the double time to burn in the kilns. Therefore, the quantity of biomass required is also superior. This amount is used in the ten “Paulistinha” kilns as well as in the two ceramic devices’ driers. The first biomass utilized was *Eucalyptus* firewood; nevertheless, one year later, the project proponent started burning wood residues with higher surface area, such as sawdust. Moreover, the machines and mechanization necessary had to be acquired and adopted.

The Ceramic’s kilns needed to have its entrances reconstructed in order to accomplish the thirty six mechanic burners acquired and also, to improve the air circulation inside the kilns. Furthermore, it was installed doors with better thermal isolation in the kilns entrances in order to improve the burning efficiency. In addition, other air channels were constructed with the intention of capturing the heat generated in the kilns, so it can be reutilized in the ceramic devices dryers.

In order to transform the industries residues wood into wood chips and sawdust (with a higher surface area), the ceramic acquired two mechanic axes. Thus, it is possible the injection of this kind of biomass into the kiln by the mechanic burners.

Figure 7. Mechanic burners and the biomass utilized in Sul América ceramic

Moreover, studies of drying elephant grass[14] in order to employ it as fuel are being done and there are possibilities of start using this as renewable biomass in the project. Elephant grass has an excellent net calorific value when it is dried, although its drying process is still a problem for the project proponents.

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

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

This project is in accordance to the CONAMA[15] Resolution, no. 237/97 that establishes that clay extraction activities and ceramic production must be supported by specific licenses, such as operational license, clay extraction license, environmental licenses and the permission of the Environmental Secretary of *Rio de Janeiro (FEEMA)*[16]*,* 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[17]).

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[14] *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.*

[15] *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.*

[16] *State Foundation of Environmental Engineering is responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: <http://www.feema.rj.gov.br/>. Last visit on: January 19th, 2009.*

[17] *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.*

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 common practice

The ceramics utilized heavy oil in its kilns for several years, at *Arrozal* ceramic the fossil fuel was employed since 1980, *GGP* ceramic used fossil fuel since 1919, and *Sul América* ceramic employed the fossil fuel since 1972. The sudden change claimed a lot of effort from each ceramic to make the adaptation successfully. Hiring new employees, acquiring new equipments and switching the fuel represented a risk to the project proponents since the original practice had shown good results for many years. Furthermore, the employees' resistance to the new situation was another difficulty faced by the ceramics.

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

The fact that the three ceramics 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.

Arrozal ceramic used fossil fuel since 1980, *GGP* ceramic employed fossil fuel since 1919, and *Sul América* ceramic used the fossil fuel since 1972.

The ceramics had used non-renewable fuels to produce its pieces for several 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.

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

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

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.

Source: http://www.dnpm.gov.br/enportal/conteudo.asp?IDSecao=168&IDPagina=222>. Last visit on: January 19th, 2009.

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

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

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

Project Proponents

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

Arrozal Ceramic:

Industrial Establishment: *Cerâmica Arrozal LTDA*

Mr. Marcus Vinicius Cunha Filho, 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 *Arrozal*’s office.

Other information on the project’s proponent:

Address: *Estrada Arrozal Pinheiral, km 10 – Piraí, Rio de Janeiro - CEP: 27.185-000.*

Ceramic phone number: +55 (24) 3333-1108

***GGP* Ceramic:**

Industrial Establishment: *Indústria José Vicente Sesto LTDA*

Mr. *André Luiz de Aguiar Vicente*, 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 *GGP*’s office.

Other information on the project’s proponent:

Address: *Av. Zoelo Sola, 417 – Três Rios, Rio de Janeiro – CEP: 25.820-180.*

Ceramic phone number: +55 (24) 2263-1267

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

***Sul América* Ceramic:**

Industrial Establishment: *Cerâmica RJ Nunes LTDA*

Mr. *Ricardo Nunes*, Director: 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.

Mr. *Rodrigo Lima*, monitoring responsible: General data and information on inputs and outputs of the ceramic, detailed information on the acquisition of renewable biomasses and how this data is kept by the controller’s office.

Other information on the project’s proponent:

Address: *Rua Odir Barros, 99 - Rio Várzea – Itaboraí, Rio de Janeiro - CEP: 24.800-000.*

Ceramic phone number: +55 (21) 2635-1531/ 2635-2581

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:

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

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

Address:
R. Borges Lagoa, 1065 – Conj. 146 – Vila Clementino
Postal Code: 04.038-032
São Paulo – SP, Brazil
Phone number: +55 11 2649 0036
Web site: http://www.socialcarbon.com
Email: marcelo@socialcarbon.com
kupper@socialcarbon.com
flavia@socialcarbon.com
rafael@socialcarbon.com

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

The project is eligible according to:

- Legislative: the project attends all legal requirements;
- Technical: alterations/adaptations required are technically feasible;
- Economic: carbon credits will compensate the high investments that were necessary to achieve the fuel-switch;
- Sectoral: incentive of good practices to the sector;
- Social: social carbon methodology will be applied which will improve long term sustainability. The culture of burning 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.

This project activity is a grouping of three ceramic industries.

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)[18] and Brazilian's Technology and Science Ministry[19]. Therefore, the proposed project activity is not saving the fossil fuel 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[20] where:

(a) The land area remains a forest; and

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

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

The afforestation wood consumed by this project activity is consisted of *Eucalyptus* and *Pinus* genuses. The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tons of

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[18] *CDM activities registered by CDM Executive board are Available at:<http://cdm.unfccc.int/Projects/registered.htm>. Last visit on: January 19th, 2009.*

[19] 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 visit on: January 19th, 2009.*

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

biomass per hectare[21]. 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[22]. 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 with the use of the biomass. Moreover, the afforestation supplies the society demands and avoids the pressure on the remnants of natural forests[23].

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[24].

The afforestation in Brazil is complied with the ABRAF[25], which represents, promotes and defends the collective interests of the forestry companies that engage in sustainable development based on planted forests.

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[26].

The afforestation in *Brazil* is complied with the ABRAF[27], 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 III, as soon as it fit all the assumptions below:

> "The biomass is non-woody biomass and originates from croplands and/or grasslands where:
>
> (a) The land area remains cropland and/or grasslands or is reverted to forest; and
>
> (b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
>
> (c) Any national or regional forestry, agriculture and nature conservation regulations are complied with."

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

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

[22] *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.*

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

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

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

[26] *MCT/IPEF.* ***Silvicultura e Manejo.*** *Source: <http://www.ipef.br/mct/MCT_03.htm>. Last visit on: February 19th, 2009.*

[27] Brazilian *Association of producers of cultivated forests. Source: <http://www.abraflor.org.br/estrutura.asp>. Last visit on: January 19th, 2009.*

adaptation in almost all climate and soil Brazilian conditions[28]. In case of the utilization of the elephant grass, it will be cultivated in pasture or degraded areas, in which there is no vegetation to be deforested by the project proponent. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area.

The woody residues from industrial waste, like pallets and packages, wood chips, and sawdust, among others, are 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 residues are resulted from wood 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 7. Gases included in the project boundary and brief explanation

	Gas	Source	Included?	Justification/ Explanation
Baseline	CO_2	Emission from the combustion of non- renewable fuel	Yes	The major source of emissions in the baseline
	CH_4	-	No	Renewable biomasses could be left to decay. Excluded for simplification. This is conservative.
	N_20	-	No	Possibly emissions from wood burning will be excluded for simplification. This is conservative.
Project Activity	CO_2	-	No	Excluded for simplification. This emission source is assumed to be very small.
	CH_4	-	No	Excluded for simplification. This emission source is assumed to be very small.

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[28] *According to EMBRAPA* (Brazilian *Agricultural Research Corporation's). Source: http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Last visit on: January 19th, 2009.*

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

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

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

Table 8. Distribution of fuel employed 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%**
Liquefied Petroleum Gas	4%	4%	4%
Others from Petroleum	2%	2%	4%
Piped gas	0%	0%	0%
Electricity	8%	8%	7%
Others non specified	0%	0%	0%

(Brazilian Energy Balance, Available at: http://www.mme.gov.br/download.do?attachmentId=16555&download – Last visited on: 15th, 2009)

Another plausible baseline scenario would be the use of Natural Gas. Although there is distribution/gas pipe in the region[29], the inconstant distribution of natural gas made the project proponents not to trust in this fuel, as 40% of the natural gas consumed in *Brazil* proceeds from *Bolivia*[30], therefore excluding this possibility.

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

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[29] *Source: <http://www.ctgas.com.br/template02.asp?parametro=2547>. Last visit on: January 19th, 2009.*

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

few fragments[31] due to the historical of high deforestation, which made the majority of the remaining areas to become preserved. The UNESCO delimited 350,000 km² 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 km²) of its original area, where this is currently dwelled by 120 million people (70% of the Brazilian population)[32]. 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.

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 Arrozal Ceramic was 1,920,000 liters of heavy oil to produce 9,600,000 ceramics devices per year, while in *GGP* Ceramic was 2,492,000 liters of heavy oil to produce 14,160,000 ceramic devices per year; *Sul América* Ceramic consumed an average of 1,740,000 liters to maintain the production of 6,960,000 ceramic devices per year.

The calculations regarding the quantity of oil required in the burning process were done according to the efficiency of the kilns employed in the ceramics, which would require 200 liters of oil to produce 1,000 ceramics devices in Arrozal Ceramic, 175.989 liters of oil in *GGP* Ceramic, and 250 liters of oil in *Sul América* Ceramic. These values are higher than the reference[33] because it considers advanced equipments of oil insertion, which did not represented the ceramics' baseline scenario.

In the absence of this project activity, the identified baseline scenario would be: *Arrozal* Ceramic would consume 2,640,000 liters per year of heavy oil to produce 13,200,000 ceramic devices. *GGP* Ceramic would consume 3,801,356 liters per year of heavy oil to feed their kilns to sustain an annual production of 21,600,000 ceramic devices. *Sul América* Ceramic would consume 2,640,000 liters per year to maintain the actual production on the level of 10,560,000 ceramic pieces.

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.

Table 9. General description of the ceramics

	Arrozal	***GGP***	***Sul América***	***Total***
Production at baseline (devices per year)	9,600,000	14,160,000	6,960,000	30,720,000
Oil consumption at baseline (liters per year)	1,920,000	2,492,000	1,740,000	6,152,000
Actual production (devices per year)	13,200,000	21,600,000	10,560,000	45,360,000

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

[32] *Source: <http://www.rbma.org.br/anuario/mata_01_mataconhecemos.asp>. Last visit on: February 25th, 2009.*

[33] *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).*

Oil consumption without the project activity (liters per year)	2,640,000	3,801,360	2,640,000	9,081,360
BFy (liters of oil per thousand of devices)	200	175.9888	250	

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 for the group would be around 6,152,000 liters of heavy oil per year to feed their kilns in order to produce 30,720,000 ceramic devices. Without the project activity, as the group of ceramics increased their production to 45,360,000 ceramic devices per year to attend the market demand, which means that the consumption of heavy oil would be around 9,081,360 liters.

Brasil has a great availability of heavy oil, which in 2007 was an excess of 6.5 billions of liters [34] . 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 30 years, which is over the project activity life-time.

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

Test 1 – The project test

Step 1: Regulatory Surplus

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

Step 2: Implementation Barriers

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

- **Technological Barrier**

In the grouped small project activity, the ceramics found some technological barriers. In the baseline scenario, using the oil, the kilns were fed with

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

the use of pipes fixed on the side of the kilns, and a machine was used to pump the oil into the pipes. Those machines had to be deactivated when applied to the new biomasses.

The renewable biomasses require a specific attention once the humidity degree of the biomasses affects directly on the burning process. Thus, as soon as the biomass arrives at the ceramic, it passes through a logistic system until its insertion in the kiln. The project proponents of the ceramics had to reserve a determinate sheltered space in the ceramic company in order to store the biomass in covered sites, thus keeping it dry.

Beyond these alterations, all the ceramics, had to make some changes in the whole system, and each ceramic developed their particular system.

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

As a consequence of this barrier, there were variations in the color of the final ceramic devices, affecting the quality of the products; cracks on the ceramic devices; the explosion of some of them; cracks along the kilns; and damages in the new machinery due the inexperience in their use; therefore adding a significant amount of insecurity to the production process.

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

As a result of this difficulty, some training courses were required for the staffs of the three ceramics in order to clarify new measures linked to the machinery, sustaining the quality of the final product and find a burn cycle standard.

Arrozal Ceramic

Arrozal Ceramic use to operate a “Hoffman” kiln using heavy oil as fuel. Aiming at a cleaner mechanism, the proponent invested in the reconstruction of the upper part of the kiln, seeking the use of renewable biomasses. The reconstruction demanded specific consultancy and labor, since it is not a common practice the use of the new fuel in the region. Moreover, during the reconstruction of the kiln, the Ceramic worked with reduced production.

As the lack of experience to achieve the ideal temperature of the kiln with the biomass was an intricacy, a pyrometric system to burning control (thermocouples) was installed to monitor the burning in the kiln, and the use and monitoring of the system demanded training of the employees.

Furthermore, a chimney exhauster was necessary to be installed in order to control the expelling out of the combustion gases from the kiln. In addition, when using oil, the fire was easily passed from a burning line to the next one in the “Hoffman” kiln. With the renewable biomasses, it is needed a chimney exhauster in order to draw the fire from a burning line to the next one.

The use of renewable biomass required different and new equipments, which made the project even harder because of the difficulty of equipments management, since it is not a common practice the use of the same. A mechanic ax, to cut bigger pieces of wood, and a circular saw were purchased. The management of this equipments required new employees together with its specific training. The feeding process in the kiln is realized manually, so there is a need of new employees for this job too. In addition, training was needed, since it is not a common practice the use of this fuel.

With the purpose of maintain the quality of its ceramics products, since it was very hard in the beginning to control the burning cycle with the renewable biomass, the project proponent constructed two ceramic devices dryers, aiming to improve the efficiency and effectiveness of it burning process.

***GGP* Ceramic**

This ceramic has been operating since 1919, and the laborers were very used with the fossil fuel. The project proponent had seriously thought on returning to the use of heavy oil as fuel because of the difficulty in finding out the correct burning process and its ideal temperature.

Presently, *GGP* ceramic uses both wood chips and sawdust as fuel to supply the kilns. This ceramic had acquired a wood shredder, with the purpose to cut bigger part of the wood afforestation into wood chips. Thus, an employee was necessary to operate this machine.

GGP Ceramic had to reconstruct the kilns' entrances in order to install twenty-six mechanic burners to automatically insert both biomass and air into the kilns. However, the mechanic burners must be manually fed by the employees, process noticeable different when using heavy oil, which was automatically inserted into the kiln. The employees must be careful not to fill the devices with large amounts of biomass, which can clog the mechanic burner and consequently, cause disorder in the burning process.

There aren't losses of ceramic devices in the production, due to the correct functionality of the "Vagão" kilns, although the use of the biomass spoils some parts of the equipments used inside the kilns. The wood chips don't have a regular size, damaging the kilns entrances and in some cases breaking the mechanic burners.

The operators did not have knowledge of the ideal amount of renewable biomasses that was necessary to achieve the ideal temperature for the ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using heavy oil. So, two pyrometric systems (thermo couple) were also installed in order to control the burning in each kiln.

GGP Ceramic, with this project activity, intends to construct a biomass dryer, to develop its wood shredder and to acquire all the necessary equipments.

***Sul América* Ceramic**

This ceramic utilizes ten "Paulistinha" kilns and two ceramic devices' driers. The fuel-switch was initially to *Eucalyptus* firewood; however, one year later, the project proponent started burning wood residues with less surface area, such as sawdust, mainly due to the burning efficiency.

The Ceramic's kilns needed to have its entrances reconstructed in order to accomplish the thirty-six mechanic burners acquired as well as to improve the air circulation inside the kilns; thus, the ceramic devices' manage was modified and the internal channel was reformed. Other air channels were constructed with the intention of capturing the heat generated in the kilns in order to reutilize it in the ceramic devices drying process. In addition, it was installed doors with better thermal isolation in the kilns entrances in order to improve the burning efficiency.

Due to the adaptation to the new fuel, the Ceramic worked with reduced production during the reforms and constructions in the company. Furthermore, the Ceramic requested a consultancy, since there is a lack of knowledge and technology in the region.

As in A*rrozal* Ceramic, a chimney exhauster was necessary to be installed, in order to control the expelling out of the combustion gases from the kiln. In addition, when using oil, the fire was easily passed from a burning line to the next one in the "Hoffman" kiln. With the renewable biomasses, it is needed a chimney exhauster in order to draw the fire from a burning line to the next one.

Furthermore, the ceramic had to acquire two mechanic axes in order to transform the industries residues wood into wood chips/sawdust. With smaller size, this kind of biomass can be inserted into the mechanic burners and afterwards, be automatically inserted into the kiln.

The employees must be careful not to fill the devices with large amounts of biomass, which can clog the mechanic burner and consequently, cause disorder in the burning process. This 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.

Moreover, the ceramics must have its kilns cleaned more often than before the project activity implementation, since the use of renewable firewood generates ashes, which did not happen in the baseline scenario when employing heavy oil; and the frequency of kilns maintenance has also raised due to the firewood irregularity that causes damages in the mechanic burners as well as in the kilns’ entrances.

Thus, the project proponent had to find the best procedure to handle with the new biomass, which is far different when compared with the use of oil.

Besides these changes, there have been some new openings due to the fuel-change operation in the ceramics. These openings are necessary once the biomass requires more labor, like wood cut and transport from the shed to the kilns. The new openings were specifically for the burning section, cleaning and maintenance of the ceramics.

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 ceramics had to withstand more costs than if they had continued utilizing oil as fuel, namely in the form of payment for the biomass transportation, which includes driver, diesel, freight and costs with the truck maintenance. Furthermore, there is spending with electrical energy and with the equipment maintenance, so the new equipments can operate.

New equipments were acquired as mechanic burners, thermocouples and a wood shredder. These investments added an additional cost for the ceramics. Afterwards, new employees were necessary to operate these machineries, and training was demanded since this technology was not a common practice in the region, generating even more costs for the entrepreneur.

As the production rose in the ceramics in order to attend the market demand, and the cost’s comparison of transportation and fuel price have the need of identical scenarios, it was considered the same production in order to have the right assessment.

Table 10. Costs in the baseline scenario in *Arrozal* Ceramic

Scenario	Fossil Fuel		Renewable Biomass		
	Oil		Afforestation Wood	Wood Residues	
Production	1,100,000	pieces/month	1,100,000		pieces/month
Consumption of the fuel	220,000	L/month	900	450	m3/month
Fuel price	0.17	BRL/L of oil	50	10.00	BRL/m3
Total Costs	37,400	BRL/month	45,000	4,500	BRL/month
Cost per ceramic device	0.034	BRL	0.045		BRL

Investment Costs		
Loss of revenues - period for adaptation of the kiln for biomass	18,400	BRL
Waste of products in the testing period (3 months)	7,425	BRL
Waste of Biomass in the testing period (BRL)	37,125	BRL
Total Costs	**62,950**	**BRL**

Table 11. Comparison between costs due to the fuel switch in the baseline scenario and the project activity scenario of *GGP* ceramic

Scenario	**Fossil Fuel**		**Renewable Biomass**			
	Oil		**Wood chips**	**Sawdust**	**Afforestation Wood**	
Production	1,800,000	Pieces /month	1,800,000			Pieces /month
Consumption of the fuel	316,780	L/month	1,500	750	250	m3/month
Fuel price	0.17	BRL/L of oil	28	10.5	20	BRL/m3
Total Costs	53,853	BRL/month	42,000	7,875	5,000	BRL/month
Variable costs	**53,852.57**	BRL/month	**54,875.00**			BRL/month
Cost per ceramic device	0.0299	BRL	0.0305			BRL

Investment Costs		
Wood shredder	18,000	BRL
Waste of products in the testing period (3 months)	8,235	BRL
Waste of Biomass in the testing period (BRL)	41,156	BRL
Loss of revenues - period for adaptation of the kiln for biomass	22,400	BRL
Total Costs	**89,791**	**BRL**

Table 12. Comparison between costs due to the fuel switch in the baseline scenario and the project activity scenario of *Sul América* ceramic

Scenario	**Fossil Fuel**		**Renewable Biomass**			
	Oil		**Sawdust**		**Wood residues**	
Production	880,000	Pieces / month	880,000	Pieces / month	880,000	Pieces / month
Consumption of the fuel	220,000	L / month	2,250	m3 / month	788	Ton / month
Fuel price	0.17	BRL / L of oil	9	BRL / m3	50.00	BRL / ton
Fuel Costs	37,400.00	BRL / month	20,250	BRL / month	39,375	BRL / month
Total Costs	37,400.00	BRL / month	59,625.00			BRL / month
Cost per ceramic unit	0.0425	BRL	0.067755682			BRL

Investment Costs		
Wood shredder	36,000	BRL
Loss of revenues - period for adaptation of the kiln for biomass	35,200	BRL
Waste of products in the testing period (3 months)	8,943	BRL
Waste of Biomass in the testing period (BRL)	44,719	BRL
Total Costs	**124,862**	**BRL**

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

- **Institutional barriers**
  - **Risks of the project**

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

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

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

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

The combustion of afforestation wood and woody residues (such as wood chips, sawdust, industries residues wood, among others) to generate thermal energy is an innovation in the ceramic industry. The future demand of this alternative fuel (e.g. by other consumers) is not predictable. Moreover, there is a possibility that the prices will increase when the biomasses disposal problem is attenuated.

The ceramics are facing some difficulties in obtaining the renewable biomasses, which are becoming harder to find. These ceramics need to get them from others cities of the state of *Rio de Janeiro*, and also from the bordering states of *Minas Gerais, Espírito Santo* and *São Paulo*. Furthermore, the cost of these biomasses has also increased. On the other hand, the oil providers have been trying to lure the ceramic companies to return to using fossil fuels, which are economically attractive.

Even if the price of the biomass increases, the ceramic can not repass it, 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 grouped project activity is ceramic blocks.

2. Identify possible types of baseline candidates.

Observing table below, the common fuels employed and therefore, the baseline candidates are: natural gas, charcoal, wood, other recuperations, diesel oil, fuel oil, liquefied petroleum gas, others from petroleum, piped gas, electricity and others non-specified. Other possible baseline candidate would be the use of renewable biomass without the carbon credits support.

Table 13. Distribution of fuel employed on the ceramic sector in *Brazil* in percentage

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

(Brazilian Energy Balance, source: http://www.mme.gov.br – Last visited on: June 15th,2009)

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

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

Therefore, data from table above were provided by a reliable source and it was considered 3 years of its historical data, including the most recent available data and the period when the ceramics have done their fuel switch.

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

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

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

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

Equally important, the local availability of fuel was criteria as the lack of fuel in the region excludes it as baseline candidates. An example may be the lack of natural gas distribution in some regions.

5. Identify a final list of baseline candidates.

Table 13 provides the percentage of the level of penetration of each fuel utilized in the ceramic sector during the average of the three last years available (2005, 2006 and 2007). Baseline candidates are the use of:

a) Wood: The fuel most used in the ceramic sector, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006[36]. As the Brazilian ceramic sector’s common practice states, the wood is from the Atlantic forest without sustainable management. This biome is extremely reduced due to the historical of high deforestation, which made the remaining areas to become preserved[37]. This fuel is not viable considering the inaccessibility of this Biome and its unavailability in the region.

b) Natural gas: it is restricted by the inconstant distribution of natural gas which made the project proponents not to trust in this fuel, therefore excluding this possibility. The risk of lack of offering[38] and high costs depending on the region of the country[39] discourages the scenario of investing in this type of fuel even in local with piped gas. The distribution of gas is preferentially performed to thermal power plants, increasing the risk of blackout of natural gas.

c) Fuel oil: This fuel is more expensive than wood, however it is more plausible to use it than natural gas or wood. The risks involving natural gas distribution are so considerable that PETROBRÁS[40] 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

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[36] *IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. Last visit on January 11th, 2009.*

[37] *Source: <http://www.rbma.org.br/anuario/mata_01_mataconhecemos.asp>. Last visit on January 19th, 2009.*

[38] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Last visit on February 01st, 2009.*

[39] *Source: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>. Last visit on January 19th, 2009.*

[40] *PETROBRÁS performs in oil and oil by product exploration, production, refining, marketing, and transportation, both in Brazil and abroad. More information available at: <http://www2.petrobras.com.br/ingles/ads/ads_Petrobras.html>. Last visit on February 05th, 2009.*

to the high investments, technological and institutional barrier, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries[41].

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

Therefore, the common practice is the use of oil, which is the fuel most employed, with 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 state of *Rio de Janeiro*.

Arrozal, GGP, and *Sul América* ceramics are three ceramic industries that had used heavy oil successfully for several years. Acquiring new equipments and switching the fuel represented a risk to the project proponents since the first practice was showing good results for many years.

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

Thus, the project activity is not a common practice.

Impact of projects approval

Presently, the ceramic industrial segment of the state of *Rio de Janeiro* is comprised mostly by small industrial units that still use varying technological models. The grand majority of ceramic industries in *Piraí (RJ)*, *Itaboraí (RJ)* and *Três Rios (RJ)* use heavy oil as fuel. These industries have some technological restrictions such as the energy exploitation and the efficiency of the machinery, so the project approval can improve the development of this sector.

Brazil is the third major contributor[42] 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 party will also implement the Social Carbon Methodology, which was developed by *Instituto Ecológica*, and focuses on a sustainable development and better social conditions for the communities where it is implemented.

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

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[41] *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.*

[42] *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 in Mar 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 each 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. Consequently, this data will be digitally stored in each ceramic.

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 tonnes of CO2e. The following table shows the frequency of the monitoring of each parameter.

Table 14. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass	Tones	Measured by the project proponents	Monthly
Origin of renewable biomass	Renewable origin of the biomass	Not applicable	Controlled by the project proponents	Each crediting period
PRy	Production of ceramic pieces	Unity of ceramic devices	Controlled by the project proponents	Monthly
Renewable Biomass Surplus	Amount of the biomasses available	Tones or m^3	Monitored by articles and database	Annually
Leakage of Fossil Fuel	Leakage resulted from the fossil fuel	tCO2e	Monitored by articles and database	Annually
EF_{CO2}	CO2 Emission factor of residual fuel oil	tCO2/TJ	Bibliography	Not monitored
NCVoil	Net Calorific Value of fossil fuel	TJ/Tone of oil	Bibliography	Not monitored
ρ oil	Specific gravity of fossil fuel	tone/L	Bibliography	Not monitored

BFy	Consumption of fossil fuel per thousand of ceramic devices produced per year	L/thousand of ceramic devices	Data from project proponents	Function of PRy
ηth	The efficiency of the ceramics using fossil fuel in the absence of the project activity	Percentage	Data from project proponents	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 *Arrozal* Ceramic, about 175.989 liters of oil to produce 1,000 ceramic devices in *GGP* Ceramic and around 250 liters of oil in *Sul América* ceramic.

Nowadays, *Arrozal* ceramic sustains a production of 1,100,000, *GGP* ceramic sustains a production of 1,800,000 ceramic devices per month; and *Sul América* ceramic sustains a production of 880,000 ceramic devices per month.

The quantity of heavy oil that would be used in the ceramics will be calculated through the multiplication of the ceramics' 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)

Arrozal Ceramic

Qoil = 1,100 x 200 = 220,000 L oil / month

GGP ceramic

Qoil = 1,800 x 175.9888 = 316,780 L oil / month

Sul América ceramic

Qoil = 880 x 250 = 220,000 L oil / month

The responsible to monitor data provided in Table 14 will be: *Mr. Marcus Vinicius* from *Arrozal* Ceramic; *Mr. André Luiz de Aguiar Vicente* from *GGP* Ceramic; and *Mr. Rodrigo Lima* from *Sul América* 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

Data / Parameter:	**Q renbiomass**
Data unit:	Ton per month
Description:	Amount of renewable biomasses
Source of data to be used:	Measured by the project proponents

Value of data	<table><tr><th></th><th>*Arrozal* Ceramic</th><th>*GGP Ceramic*</th><th>*Sul América Ceramic*</th></tr><tr><td>Biomasses (tons/month)</td><td>616.5</td><td>1,026.75</td><td>1,338.75</td></tr></table>
Description of measurement methods and procedures to be applied:	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 m³, therefore it is necessary the conversion to tones through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project are: <table><tr><th>Biomass</th><th>Wood from afforest ation</th><th>Wood chips</th><th>Sawdust</th><th>Woody residues (described below)</th></tr><tr><td>Specific gravity (tones/m³)</td><td>0.510</td><td>0.477</td><td>0.245</td><td>0.35</td></tr></table> The sources of these data are: - Wood from afforestation IPCC: Intergovernmental Pannel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS. Capítulo 3: Orientación sobre las buenas prácticas en el sector de CUTS - Wood chips Variação da densidade a granel de cavacos de Eucalyptus saligna em função das suas dimensões e da umidade <http://www.celso-foelkel.com.br/artigos/ABTCP/abtcp.%20para%20site%202002c.pdf>. Last visited on: June 15th, 2009 It was utilized the normal type of wood chips. - Woody Residues (pallets, construction residues wood, city garden residues, among others) SIMIONI, F. J. **Análise diagnóstica e prospectiva da cadeia produtiva de energia de biomassa de origem florestal no planalto sul de Santa Catarina** - Curitiba: UFPR, 2007. 132p.: il. Available at: <http://dspace.c3sl.ufpr.br/dspace/handle/1884/10294>. Last visit on: February 3rd, 2009. It was utilized the specific gravity for wood chips. - Sawdust Masses and Dead Loads of Concrete and Other

	Materials <http://www.cca.org.nz/pdf/Masses.pdf>. Last visited on: June 15th, 2009
QA/QC procedures to be applied:	The ceramic has spreadsheets of the quantity of biomass acquired. It will be rechecked according to the receipts of purchase.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later

<table>
<tr><th>Data / Parameter:</th><th>PRy</th></tr>
<tr><td>Data unit:</td><td>Unity of ceramic devices</td></tr>
<tr><td>Description:</td><td>Production of ceramic devices per month</td></tr>
<tr><td>Source of data to be used:</td><td>Controlled by the project proponents.</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions</td><td>
<table>
<tr><th>Production (approximated)</th><th><i>Arrozal</i></th><th><i>GGP</i></th><th><i>Sul América</i></th></tr>
<tr><td>Ceramic Devices</td><td>1,100,000</td><td>1,800,000</td><td>880,000</td></tr>
</table>
</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The measurement will be done by an internal control sheet monitored by the project proponents, which will be fed daily.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>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.</td></tr>
<tr><td>Any comment:</td><td>The production stated above is referent to the year of 2008.
Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later</td></tr>
</table>

Data / Parameter:	**Leakage of fossil fuel**
Data unit:	tCO2e
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><th>Data / Parameter:</th><th>Renewable biomass surplus</th></tr>
<tr><td>Data unit:</td><td>tone 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>Woody Residues (sawdust/wood chips) in m^3</td><td>5,737,174.08</td><td>2007</td></tr>
<tr><td>Industrial wood residues in tones</td><td>749,839</td><td>2006</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 measurement of the leakage will be based in national and international articles and database every monitoring period. The sources will provide information about the biomass availability in the project activity’s region.</td></tr>
<tr><td>QA/QC procedures to be applied :</td><td>Data available regarding the ceramic industries fuel consumption will be employed to monitor</td></tr>
</table>

	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 proponents
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 wood from afforestation and woody residues 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 (Wood from afforestation and woody residues) 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:	tonne/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. Last visited on: June 15th, 2009
Value applied:	0.000978 tonne/L
Justification of the choice of data or description of	The amount of oil used in the baseline was measured by volume units.

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

Data / Parameter:	**NCVoil**
Data unit:	TJ/tonne 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. Last visited on: June 15th, 2009
Value applied:	0.0404 TJ/Tonne
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 will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later

Data / Parameter:	**BFy**
Data unit:	L of oil per thousand of devices
Description:	Consumption of fossil fuel per thousand of ceramic devices produced per year
Source of data used:	Historical data from project proponents
Value of applied:	

<table>
<tr><td></td><td><table><tr><th>Ceramic</th><th>Arrozal</th><th>GGP</th><th>Sul América</th></tr><tr><td>BFy</td><td>200</td><td>175.9888</td><td>250</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied:</td><td>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 utilize the same type of kilns and produce the same type of ceramic devices.
The value is employed to calculate the real amount of heavy oil displaced to maintain the ceramic production in the baseline scenario.</td></tr>
<tr><td>Any comment:</td><td>Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later</td></tr>
</table>

Data / Parameter:	**EF_{CO2}**
Data unit:	tCO2/TJ
Description:	CO2 Emission factor of residual fuel oil
Source of data used:	Source of data: IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. Last visit on: May 21st, 2009.
Value applied:	77.4 tCO2/TJ
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 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:	**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 proponents
Value applied:	<table><tr><th>Ceramic</th><th>*Arrozal*</th><th>*GGP*</th><th>*Sul América*</th></tr><tr><td>**ηth**</td><td>100%</td><td>100%</td><td>100%</td></tr></table>
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:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan shall be the owners of the companies. The project proponents 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 authorities for the registration, monitoring, measurements and reporting are: *Mr. Marcus Vinicius Cunha Filho* from *Arrozal* Ceramic; *Mr. André Luiz de Aguiar Vicente* from *GGP* Ceramic; and *Mr. Rodrigo Lima* from *Sul América* 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

$$BEy = HGy * EF\ CO2 / \eta th \qquad \text{(Equation 01)}$$

Where:

BEy: The baseline emissions from steam/heat displaced by the project activity during the year y in tCO2e.

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

EFCO2: The CO2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO2/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 (tonne/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 15. 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 as well as industries/construction residues wood. All the ceramics utilize some kind of wood or wood residues and the providers are mainly wood industries. There are plenty of industries of this category in the state of *Rio de Janeiro*, and also in the bordering states: *São Paulo, Espírito Santo* 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:

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[43]. 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[44].

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[45]. As a consequence, *Brazil* withholds the best productivity taxes (in m³/ha/year) over the world due to the adaptation of

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

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

[45] *MCT/IPEF.* ***Silvicultura e Manejo.*** *Source: <http://www.ipef.br/mct/MCT_03.htm>. Last visit on February 25th, 2009.*

these species to the Brazilian territory and the success of the experiments of genetic improvement[46].

The production of wood from afforestation in the state of *Rio de Janeiro* was of 368,710 m³ [47] and in *São Paulo*, which is a bordering state, was of 7,407,385 m³ [48] in 2007. As the consumption of this kind of fuel is around 13,850 m³ per year for this project activity, it represents around 0.19% of the total of wood from afforestation produced in the region.

Woody Residues (Sawdust/ Wood Chips)

The production of wood generates a large amount of residues, which can be reused to generate thermal energy, considering that around 22% of the wood produced will generate sawdust/wood chips[49]. The production of wood log in the state of *Rio de Janeiro* was of 111,600 m³[50] and in *São Paulo*, which is a bordering state, was of 25,966,464 m³ [51] in 2007. Thus, the production of sawdust/wood chips in the region was around 5,737,174.08 m³ per year. As the consumption of this project activity was around 54,000 m³ per year, it represented around 0.9% of the total of woody residues produced in the region.

Industrial and construction 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 *Rio de Janeiro*, 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[52].

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[53].

It was utilized this estimative to calculate the percentage of consumption of these residues in the project activity. Moreover, it was only considered the availability of industrial wood residues, which is 749,839 tonnes per

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

[47] *According to IBGE(Geographic and Statistic* Brazilian *Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=rj&tema=extracaovegetal2007>. Last visit on January 19th, 2009.*

[48] *According to IBGE(Geographic and Statistic* Brazilian *Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=extracaovegetal2007>. Last visit on January 19th, 2009.*

[49] *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.*

[50] *According to IBGE(Geographic and Statistic* Brazilian *Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=rj&tema=extracaovegetal2007>. Last visit on January 19th, 2009.*

[51] *According to IBGE(Geographic and Statistic* Brazilian *Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=sp&tema=extracaovegetal2007>. Last visit on January 19th, 2009.*

[52] *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 at: January 27th, 2009.*

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

year (around 5% of the total of industrial solid residues). The consumption of these kinds of biomasses in this project activity was around 9,450 tonnes per year, corresponding around 1.3% 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[54] 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)[55]. In case of employing this kind of biomass, the project proponents will cultivate, by themselves, 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.

In spite of the fact that the ceramic industries do not represent the main share of fossil fuel consumption, the project activity contributes to petrol reserves conservation since it will switch the use of non renewable fuel to renewable biomass. The implementation of this project in the ceramics is breaking the culture of fossil fuel burning in the state of *Rio de Janeiro* 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 6,441,360 liters per year of heavy oil helping the conservation of petrol reserves, which are decreasing rapidly.

Emissions Reductions

$$\boxed{\textbf{ERy = BEy – Leakagey} \qquad \text{(Equation 03)}}$$

Where:

ERy: Emission reduction in the year “y” (tonnes of CO2 eq.)

BEy: Baseline emissions of CO2 that would be generated through heavy oil burning (tonnes of CO2 eq.)

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

Emission Reductions

Arrozal Ceramic – Year of 2007

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

HGy = 2,640,000 L of oil x 0.000978 tonne/L x 0.04040 TJ/tonne = 104.309 TJ

BEy = (77.4 tCO2/TJ x 104.309) / 1 = 8,073 tCO2

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[54] *Source: <www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292> Last visit on January 10th, 2009.*

[55] *Source: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Last visit on January 10th, 2009.*

GGP Ceramic – Year of 2007

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

HGy = 3,801,360 L of oil x 0.000978 tonne/L x 0.04040 TJ/tonne = 150.196 TJ

BEy = (77.4 tCO2/TJ x 150.196 TJ) / 1 = 11,625 tCO2

Sul América Ceramic – Year of 2007

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

HGy = 2,640,000 L of oil x 0.000978 tonne/L x 0.04040 TJ/tonne = 104.309 TJ

BEy = (77.4 tCO2/TJ x 104.309) / 1 = 8,073 tCO2

Table 16. Emission reductions without considering the leakage

Year	***Arrozal* Total Baseline Emissions (tons of CO2e)**	***GGP* Total Baseline Emissions(tons of CO2e)**	***Sul América* Total Baseline Emissions (tons of CO2e)**
April to December - 2006	6,054	8,718	6,054
2007	8,073	11,625	8,073
2008	8,073	11,625	8,073
2009	8,073	11,625	8,073
2010	8,073	11,625	8,073
2011	8,073	11,625	8,073
2012	8,073	11,625	8,073
2013	8,073	11,625	8,073
2014	8,073	11,625	8,073
2015	8,073	11,625	8,073
January to March - 2016	2,018	2,906	2,018
Total Baseline Emissions (tons of CO2e)	**80,729**	**116,249**	**80,729**
Number of years of the crediting period	10	10	10
Annual average of estimated baseline emissions for the 10 years of crediting period (tons of CO2e)	**8,073**	**11,625**	**8,073**
Total Baseline Emissions (tons of CO2e)	**277,707**		

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 17. Estimation of overall emission reductions

Year	Baseline Emissions (tons of CO2e)	Leakage (tons of CO2e)	Emission Reductions (tons of CO2e)
April to December - 2006	20,826	0	20,826
2007	27,771	0	27,771
2008	27,771	0	27,771
2009	27,771	0	27,771
2010	27,771	0	27,771
2011	27,771	0	27,771
2012	27,771	0	27,771
2013	27,771	0	27,771
2014	27,771	0	27,771
2015	27,771	0	27,771
January to March - 2016	6,942	0	6,942
Total			**277,707**
Average			27,771

Table 18. Estimation of overall emission reductions

Year	*Arrozal* Total Emission Reduction (tons of CO2e)	*GGP* Total Emission Reduction (tons of CO2e)	*Sul América* Total Emission Reduction (tons of CO2e)	Total Emission Reductions (tons of CO2e)
April to December - 2006	6,054	8,718	6,054	20,826
2007	8,073	11,625	8,073	27,771
2008	8,073	11,625	8,073	27,771

2009	8,073	11,625	8,073	27,771
2010	8,073	11,625	8,073	27,771
2011	8,073	11,625	8,073	27,771
2012	8,073	11,625	8,073	27,771
2013	8,073	11,625	8,073	27,771
2014	8,073	11,625	8,073	27,771
2015	8,073	11,625	8,073	27,771
January to March - 2016	2,018	2,906	2,018	6,942
Total Emission Reductions (tons of CO2e)	**80,729**	**116,249**	**80,729**	**277,707**
Number of years of the crediting period	10	10	10	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tons of CO2e)	**8,073**	**11,625**	**8,073**	**27,771**
Total Emission Reductions (tons of CO2e)	**277,707**			

5 Environmental Impact:

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

An EIA was not required due to the project activity.

The project activity contributes to the reduction level of greenhouse gas (GHG) emissions by avoiding the incentive of fossil fuels utilization. In addition, the project activity will contribute to the sustainable development of the host country, such as:

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

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

As can be observed in table 19, 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 CO2, as well as when using heavy oil. 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 on the use of fossil fuels.

Table 19. Summary of the environmental impacts

Environmental Factor	Environmental Impact	Classification
Air	Production of ash.	Negative
Air	Avoidance of nitrogen oxides, sulfur dioxide, volatile organic compounds and heavy metals emissions.	Positive
Climate	GHG emission reduction	Positive
Water/hydric resources	Preservation of the water, avoiding the risk of accidents during petrol transportation	Positive
Energy	No more use of a polluting residues as fuel for energy production	Positive

Fauna	Biodiversity preservation avoiding the risk of accidents	Positive
Flora	Biodiversity preservation avoiding the risk of accidents	Positive

6 Stakeholders comments:

The main stakeholders considered in this project are the ceramic sector national association (ANICER)[56] 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 two letters (one for *GGP* ceramic and the other for *Sul América* ceramic) stating their support to the present project activity[57].

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.

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[56] *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>. Last visit on February 18th, 2009.*

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

7 Schedule:

- Project start date: Date on which the project began reducing or removing GHG emissions, i.e. when the project proponents began employing renewable biomass.

Table 20. Ceramics' project start date

Ceramic	***Project Start Date***
Arrozal	Estimated to January 2004
GGP	Estimated to January 2003
Sul América	Estimated to July 2004

- Date of initiating the project activity: 01/04/2006;
- Validation Report predicted to: 30/05/2009;
- First Verification Report predicted to 30/05/2009;
- VCS project crediting period: 10 years, two times renewable;
- Monitoring and reporting frequency: preferentially from 6 to 12 months, since the beginning of the crediting period;
- Date of terminating the project: 31/03/2016.

After the project start date, the ceramic owners made adaptations due to the use of new biomasses and its technology encompassing, for example, tests using the new biomasses, the ideal mix of renewable biomasses (different percentages of each biomass) and technological adaptations.

8 Ownership:

8.1 Proof of Title:

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

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

Not applicable.