Voluntary Carbon Standard
Project Description Template

19 November 2007

VCP PD Completed on September 09th , 2009

1 Description of Project:

1.1 Project title

Assunção Ceramic fuel switching project
Version 04
PDD completed on September 09th of 2009.

1.2 Type/Category of the project

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

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

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

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

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

Table 1. Emission reductions estimate during the crediting period.

Year	Annual estimate of emission reductions per ton of CO2equ
June to December-2007	33,136
2008	56,805
2009	56,805
2010	56,805
2011	56,805
2012	56,805
2013	56,805
2014	56,805
2015	56,805
2016	56,805
May – 2017	23,669
Total of estimate reductions (tonnes of CO2equ)	**568,050**

Number of years of the crediting period	10
Annual average of estimate reductions for the 10 year crediting period (tonnes of CO2equ)	56,805

1.4 A brief description of the project:

The project is applied at *Assunção* Ceramic which is situated at *Ceará* state on *Aquiraz* municipality located in the northeast region in Brazil.

The population reaches more than 60,500 inhabitants, which 50% are economically active. Spread in an area of 482.8 km², *Acquiraz* shares its economy between commercial stores, industries and mainly tourism.

Assunção ceramic produces structural ceramic units particularly ceramic bricks, mainly for supply the local market of *Aquiraz* and Fortaleza municipality witch is the biggest municipality in the region and Ceara’s capital.

Before the project activity implementation, *Assunção* Ceramic used to consume an average quantity of 3,680 m^3 of non-sustainable wood per month to feed the kilns and maintain the temperature of 900ºC to produce around 4,000 thousand of ceramic units per month which means 12,800 tons of ceramic units per month.

The purpose of this project activity is to utilize renewable biomass available in the region for effective generation of thermal energy for captive consumption. The project activity will indirectly help in reducing the Brazilian deforestation rates, the main source of greenhouse gas emissions in Brazil.

In developing countries such as Brazil, the deforestation rate is directly proportional to the greenhouse gases concentration in the atmosphere, which intensifies global warming.

In the baseline scenario, the ceramic company utilized wood from areas without sustainable forest management, which was a pioneer practice in the region. This type of wood is considered a non- renewable biomass, once it is not originated in areas with reforestation activities.

The proposed project approval would have a positive Contribution for the host country were *Assunção* Ceramic is based. That would contribute directly to the conservation of Brazilian biomes especially Caatinga Biome through the use of renewable biomass.

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

The ceramic is located in the Municipality of *Aquiraz* in the state of Ceará which is indicated in Figure 01.The project site has the postal address:
- *Assunção* Ceramic
BR 116, Km 22 – Aquiraz – Ceará- Brasil – Postal code:6170-000

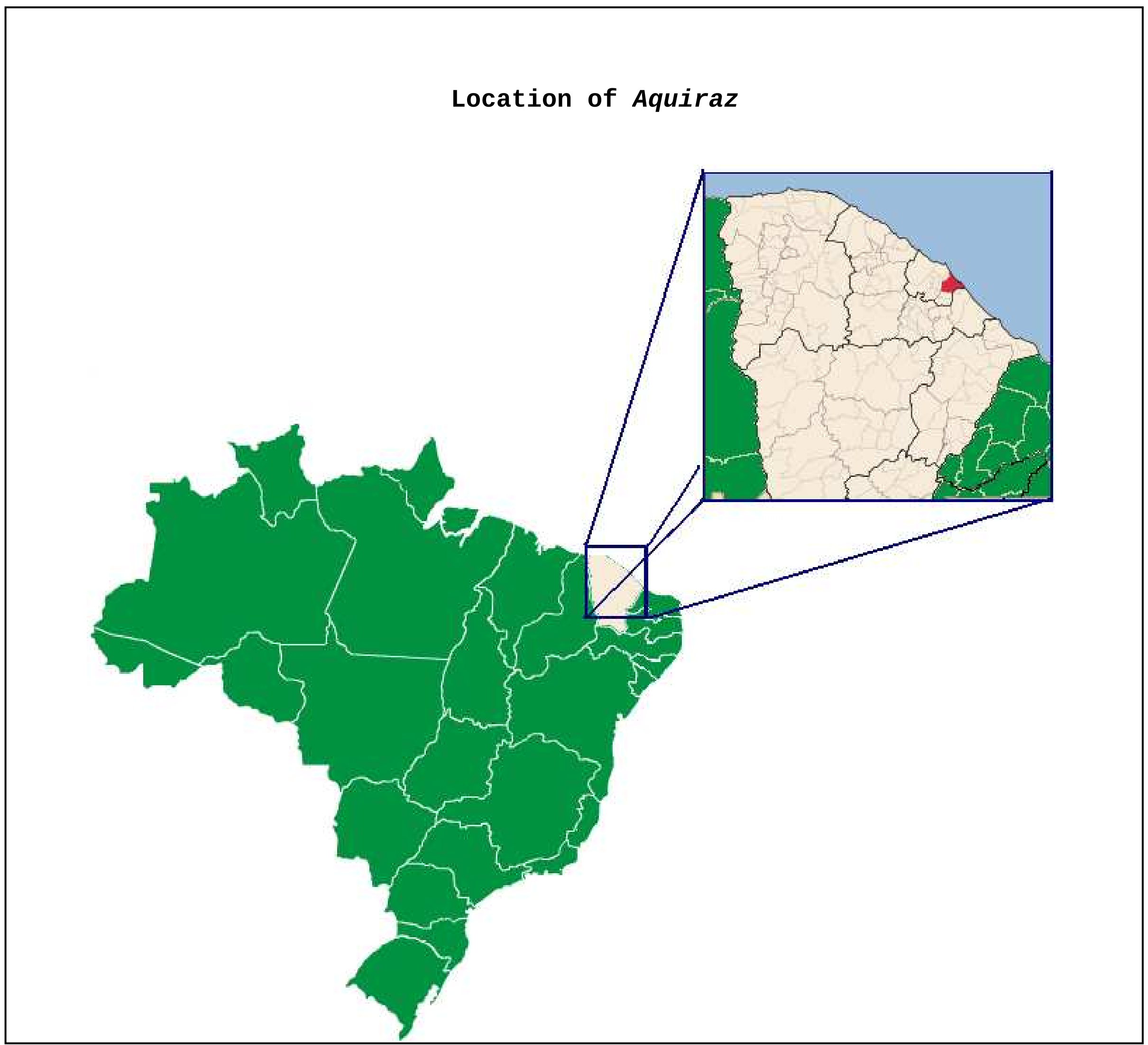

Figure 1- Geographic location of the city of the project activity that has the following coordinates: 3°54'05''S, 38°23'28''W.

The proposed project activity has the follow location coordinates: 3°54’39’’S, 38°23’01’’W.

1.6 Duration of the project activity/crediting period:

The proposed project starts its switch fossil fuel in April of 2007 and the fuel switching was totally achieved by the end of May 2007.

- Project start date[1]: 17/05/2007
- Date of initiating project activity[2]: 01/06/2007
- Date of terminating the project[3]: 31/05/2017

VCS project crediting period: 10 years, twice renewable.

1.7 Conditions prior to project initiation:

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

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

[2] *Date on which the project activity totally switched from non-renewable biomass to renewable biomass.*

[3] *Date on which the project activity completes 10 years of the first crediting period.*

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

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

Therefore, the employment of this fuel stimulates the increase in Brazilian deforestation rates. The baseline identified for this project activity is the employing of a total of 44,160 m3 of native wood per year to provide thermal energy to the ceramics' kilns.

The project activity focuses on the use of native wood from sustainable forest management plan areas, sawdust, cashew nut husk, residues from cashew tree and coconut husk as renewable biomasses for energy supply. The entrepreneur may utilize elephant grass in the future.

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

The emission reductions will be achieved by displacing the use of wood from areas with no sustainable forest management to provide thermal energy in the ceramic companies. Therefore, the emissions launched during the combustion of wood were not compensated by the replanting. An opposite scenario occurs with the renewable biomasses employed in this project activity, which have carbon neutral cycle.

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

Assunção Ceramic's burning process is constituted by 10 *kilns, where 2 are Hoffman kilns, 7 are round kilns and 1 is a semi-continuous kiln.* These kilns are commonly employed in Brazil to burn bricks.
In the project activity, Assunção Ceramic consumes renewable biomass to feed its kilns to obtain an approximate temperature of 900ºC, in order to sustain the production of 4,000,000 ceramic units per month which means 12,800 tones of ceramic units per month[7]. The purpose is to employ 100% of renewable biomass.

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[4] *Brito, J.O. "Energetic use of Wood". Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES> visited on: March 13 th, 2009*

[5] *Energy Research Company. National Energy Balance - energy consumption per sector. Available at <http://www.mme.gov.br/download.do?attachmentId=16555&download> visited on: March 13th, 2009*

[6] *Seye, Omar. Análise de ciclo de vida aplicada ao processo produtivo de cerâmica estrutural tendo como insumo energético capim elefante (Pennisetum Purpureum Schaum) / Omar Seye. Campinas, SP: [s.n.], 2003.*

[7] Considering that one ceramic unit has the average weight of 3.2 Kg .

Table 2 Technical parameters of Hoffman kilns.

Technical Paramenters	Hoffman	round kiln	Semi-contínuos kiln
Average Consumption of firewood (ton of wood per ton of ceramic devices)	0.16	0.41	0.16
Number of Kilns	2	7	1
Features	Has parallel chambers where the heat from one chamber is used in the next.	*Intermittent with round shape and lateral furnaces*	Has parallel chambers and intermittent burn.
Maximum Temperature	900ºC	900ºC	900ºC
Average Production per burning cycle(units)	100,000	53,572	50,000
Average Production per burning cycle (tons)	320	171.43	160
Average ceramic units per month	1,000,000	214,286	500,000
Average ceramic tons per month	3,200	685.71	1,600
Average supposed capacity of each kiln (MW)	1.10	0.23	0.55
Hours of burning cycle	72	168	72
Hours of Loading	4	4	4
Hours of Heating an Burning	48	96	48
Hours of cooling	16	64	16
Hours for removing pieces and cleaning	4	4	4
Burning cycles per month	10	4	10

The renewable biomasses employed as fuel in *Assunção* Ceramic during its manufactory process preferentially are wood residues from cashew trees, cashew nut husks, coconut husk (figure 3), sawdust ,and native wood from areas with sustainable forest management. Due to harvest reasons, elephant grass can be employed. Follows the relation of main biomass providers.

Table 3. Main Biomass Providers

Biomass	Provider
Residues from cashew trees[8]	Ceagra Ceramica e Agropecuaria Ltda.
	Ceramica Ceara Matriz Ltda.
Cashew nut husk	Usubras Usina Brasileira de Oleos Ltda.
	Iracema Ind e Com de Castanha LTDA
	Companhia Ind de Oleos do Nordeste Ltda.
	Edson Inácio de Oliveira
Coconut Husk	Carlos Eduardo Viana Valente
Wood From Management Areas	Jeferson Novais de Oliveira
	Valdir Bezerra Alencar
	Ceagra Agoprcuaria Ltda.
	Verde Vida Engenharia Ambiental Ltda.
	Crianco Agropecuaria Ltda.
	Cerâmica Tavare Ltda.
Sawdust	Tuboart Industria e Comercio Ltda.

In spite of fact the productions of ceramic units and the number of kilns hasn’t changed after the fuel switch, the Ceramic had to acquire nine mechanic burners to feed the Kilns with the renewable biomasses. Also many adaptations have to be made in the kilns in order to start the use of the new renewable biomasses.

Due to the project activity, a set of adaptations were necessary, such as alterations to the furnaces and other machineries as well as the construction of a shed where the biomass must be stored so the ceramic can operate with the new biomasses.

Before the project activity, the process was noticeably different; the wood was inserted in the kilns by the employee and it was not necessary

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[8] Both providers of residues from cashew tree have the same owner. For that reason the invoices from both providers may be sign by the same person..

any machine experience or logistic modification like the shed prepared in order to attend the project’s needs.

The main characteristic’s changes of the project activity are described in the table below.

Table 4. Main overall characteristic’s changes during the period utilizing non-renewable biomass (before the project activity) and the period utilizing renewable biomass (after the project activity).

<table>
<tr><th>Scenario</th><th>Non-renewable biomass</th><th>Renewable biomass</th></tr>
<tr><td>Amount of biomass(Tons per month)</td><td>3,238</td><td><table>
<tr><th>Biomass</th><th>Native wood from management areas</th><th>Residues from cashew wood</th><th>Sawdust</th><th>Cashew nut husk</th><th>Coconut husk</th></tr>
<tr><td>tonnes</td><td>154</td><td>368</td><td>4</td><td>49</td><td>45</td></tr>
</table></td></tr>
<tr><td>Production (units per year).</td><td>4,000,000</td><td>4,000,000</td></tr>
</table>

The implementation of the project activity will save energy due to the following modifications:

- Use of biomass smaller than wood increasing the surface area.

- Insertion of air with the new fuels, increasing the oxygenation;

Reduction of thermal energy loss since the entrances will be kept closed or connected to the equipment.

- Injection of biomass controlled by equipment, avoiding wastage of fuel that often occurred when using wood.

Figure 2- Front view from *Assunção* Ceramic and some of their manufactured units.

Figure 3- Coconut husk utilized to displace the non-renewable biomass.

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

This project is in accordance to the CONAMA[9] Resolution, no. 237/97 which establishes that clay extraction activities and ceramic production must be supported by specific licenses, such as operational license, clay extraction license, environmental licenses and the permission of the Environmental Secretary of Ceará (SEMACE[10] 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)[11].

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

- Price of the renewable biomasses

The thermal energy generation through the combustion of biomasses is an innovation in the ceramic industry. 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 locally, however, it is possible that the demand and the prices would increase as well. If this scenario occurs, the project approval will make the continue use of renewable biomasses feasible.

- Availability of the renewable biomasses

There is a great amount of the biomasses available locally , however if a non foreseeable reason affect the availability of the biomasses, the ceramic owner will search for other type of renewable biomasses, such as and elephant grass, which will requires high investments.

- Difficulty related to the abrupt change

As affirmed before, the ceramic used wood in its kilns for 23 years, the sudden change claimed a lot of effort for each one in the ceramic, the main challenges are the reconfiguration of the internal logistic and the employee's resistance to the new situation.

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

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

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[9] *CONAMA (National Environmental Council), created in 1981 by Law 6.938/81, is the Brazilian's 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.*

10 SEMACE is the Environment Secretary in the State of Ceará responsible to issue the environmental licenses according to CONAMA resolution 237/97 . More information at: www.semace.ce.gov.br

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

Assunção Ceramic utilizes native wood to generate thermal energy in order to cook ceramic units in its kilns since 1986.

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

Assunção´s project is not creating any other form of environmental credit under any specific program. Social Carbon Methodology is being applied only as a Sustainability tool in association with VCS 2007.1 standard.

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

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

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

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

Project Proponent

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

Mr. *Lorival Assunção Tavares*, 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, how output data is handled, and how data is stored and kept by the *Cerâmica Assunção Ltda*.

Other information on the project's proponent:
Address:
BR 116, Km 22 –
Aquiraz – Ceará
Postal code:6170-000
Phone number: +55 (85) 3260-9753

Project Developer

Carbono Social Serviços Ambientais Ltda: Project participant, project idealizer and responsible to prepare the project report and accompany the proponent until the end of crediting period.

Cézar Braga Alves, Technical Analysts: Project Design Document writers, elaboration of GHGs Emissions' Inventory, direct contact between Carbono

Social Serviços Ambientais Ltda. and the ceramic companies, and responsible for collecting the necessary information. Coordinated by:

Flávia Yumi Takeuchi, Technical Coordinator and Rafael Ribeiro Borgheresi, Technical Analyst.

Other information of the project developer contact:

Address: *Rua Borges Lagoa, 1065 – Conj. 144 – Vila Clementino*
Postal Code: 04038 032
São Paulo – São Paulo, Brazil
Phone number: +55 11 2649 0036
Web site: http://www.socialcarbon.com
Email: cezar@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: High investments were necessary in order to make the project feasible ;
- Sectoral: incentive of good practices to the sector;
- Social: social carbon methodology will be applied which will improve long term sustainability. The culture of burning wood 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 exposed to the validator was withheld from the public version of the report.

2 VCS Methodology:

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

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

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

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

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

The methodology applied is Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Applications by the User – Version 01 from February 1st of 2008 onwards which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

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

There are no similar registered small-scale CDM project activities in the region of *Ceará* once *Carbono Social Serviços Ambientais Ltda.* has conducted 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)[12] and Brazilian´s Technology and Science Ministry[13]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted for by the other registered project activities.

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

Furthermore, firewood has been used for many centuries as fuel in Brazil[14]. Although, it is impossible to define a start date on which this kind of non-renewable biomass began to be applied, there are many documents to prove that wood has been used for thermal energy generation before 1989 as requested in the applied methodology. Firewood used to be the most employed source of primary energy until the decade of 1970, when the petroleum started to supply the majority of Brazilian’s energy

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[12] CDM activities registered by CDM Executive board are Available at: <http://cdm.unfccc.int/Projects/registered.html>. Visited on: September 06th, 2008.

[13] Brazilian´s Technology and Science Ministry is responsible for registry and approval of all CDM activities within Brazilian boundaries. CDM activities submitted to the Brazilian Inter-Ministerial Commission of CDM Activities are available at: <http://www.mct.gov.br/index.php/content/view/47952.html>. Visited on: September 06th, 2008.

[14] Uhlig, A. Lenha e carvão vegetal no Brasil: balance oferta-demanda e métodos para estimação de consumo, tese de doutorado, Universidade de São Paulo, São Paulo, 2008. 156 p. Available at: http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/>. Visited on: December 12th, 2008

needs[15]. Moreover the Brazilian's Energy and Mine Ministry has been monitoring every energetic sectors of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector[16]. Especially in the ceramic sector, the use of firewood is visible non-renewable and unsustainable, involving negative environmental impacts associated[17]. This way, it can be concluded that non-renewable biomass has been used since 31 December 1989 or previously.

The *coconut* husk, cashew nut husk ,and forest residues (sawdust) are agro-industries residues, so they are considered renewable according to option V of methodology definition of renewable biomass: "The biomass is the non-fossil fraction of an industrial or municipal waste".

The cashew tree pruning is considered renewable according to option II, as soon as it fits all the assumptions below:
"The biomass is woody biomass and originates from croplands and/or grasslands where:
(a) The land area remains cropland and/or grasslands or is reverted to forest; and
(b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
(c) Any national or regional forestry, agriculture and nature conservation regulations are complied with."
Residues from cashew trees fits all the three options above since just residues from the croplands area are utilized, i.e. the area remains a cropland with the use of the biomass. Moreover, the areas where the cashew trees fallows sustainable management practices, according to is cultivation and harvest techniques, where the pruning of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest period[18]. This way, in cashew cultivation must be cut undesirable branches of the cashew trees.
Besides, Brazilian's production presents the tendency of increasing so far, carried by the new technologies utilized and the higher national and international demand of cashew nuts[19]. This way, the Brazilian sources of residues from cashew trees will increase following the Brazilian production, due the fact that cashew cultivation requests it.

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

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[15] *Brito, J.O."Energetic use of Wood". Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES>. Visited on: September 06th, 2008.*

[16] *National Energy Balance- energy consumption per sector. Available at: <https://ben.epe.gov.br/BEN2007_Capitulo3.aspx> Visited on: September 06th, 2008.*

[17] *Uhlig, A. Lenha e carvão vegetal no Brasil: balance oferta-demanda e métodos para estimação de consumo, tese de doutorado, Universidade de São Paulo, São paulo, 2008. 156 p. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/>. Visited on: December 12th, 2008*

[18] *According with "Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural" Available at: <http://www.cepel.br/~per/download/rer/rt-789-00.pdf> visited on: March 13th, 2009*

[19] *Checked at: <http://www.nordesterural.com.br/nordesterural/matLerdest.asp?newsId=2219> visited on: March 13th, 2009*

areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
(c) Any national or regional forestry, agriculture and nature conservation regulations are complied with."
Currently, elephant grass has been acquiring national importance as biomass to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions[20]. In case of utilizing elephant grass it will be cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area.

Native wood provided from sustainable management areas are considered renewable biomasses according to option I, as long as it fits these options conditions stated below:
"The biomass is originating from land areas that are forests where:
(a) The land area remains a forest; and
(b) Sustainable management practices are undertaken on these land areas to ensure, in
particular, that the level of carbon stocks on these land areas does not systematically
decrease over time (carbon stocks may temporarily decrease due to harvesting); and
(c) Any national or regional forestry and nature conservation regulations are complied with."
The areas where these kind of biomasses are provided from management areas as stated in section 1.9. These areas follow the *Ceará´s* law which claims the sustainability rules for such activity[21]. Besides, it provides evidences that the sustainable management plans utilized from the project activity are undertaken and the level of carbon stocks will not decrease over time as required in the referenced option of the applied methodology.

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

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

According to the applied methodology, the project boundary is the physical, geographical area of the use of biomass or the renewable energy, thus, the ceramic limits.

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

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

	Gas	**Source**	**Included?**	**Justification/ Explanation**
Base line	CO_2	Emission from the combustion of non-	Yes	The major source of emissions in the

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[20] *According to EMBRAPA (Brazilian Agricultural Research Corporation's). Source: <http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Visited on: September 06th, 2008.*

[21] *According to SEMACE (normative instruction number 001/2003 from August 15th of 2003.) Available at: <http://www.semace.ce.gov.br/biblioteca/legislacao/conteudo_legislacao.asp?cd=315>. VisitedonMarch 04th, 2009.*

		renewable fuel		baseline
	CH_4	-	No	Deforestation rates will probably decay Excluded for simplification. This is conservative.
	N_2O	-	No	Possibly emissions from wood burning will be excluded for simplification. This is conservative.
Project Activity	CO_2	-	No	Excluded for simplification. This emission source is assumed to be very small.
	CH_4	-	No	Excluded for simplification. This emission source is assumed to be very small.
	N_2O	-	No	Excluded for simplification. This emission source is assumed to be very small.

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

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

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

BRAZILIAN ENERGY BALANCE 2007 - CERAMIC SECTOR EVALUATION Unit: 10^3 Tone of oil equivalent			
FUEL	**2004**	**2005**	**2006**
Natural Gas	767	831	901
Charcoal	52	70	42
Wood	**1,611**	**1,710**	**1,762**
Other recuperations	35	36	32
Diesel Oil	8	9	8
Fuel Oil	295	268	285
Liquified Petroleum Gas	134	148	151
Others from Petroleum	51	71	76
Piped gás	0	0	0
Electricity	262	270	276
Others non specified	0	0	0

(Brazilian Energy Balance, Available at: <http://www.mme.gov.br/download.do?attachmentId=16555&download> visited on January 05th, 2009)

The most probably scenario in the absence of native wood would be the use of fuel oil, which is not viable considering its higher prices when compared with firewood. Even tough, fuel oil presents a higher Net Calorific Value when compared with firewood; the costs with fuel oil are higher because of its expensive prices. Fuel oil presents an average price of 0,895R$/Kg and the firewood presents an average price of 35R$/m³. These values lead us to conclude that the price of oil fuel is of 0.000090587 R$/Kcal as long as the price of wood is 0.000014648R$/Kcal[22] utilizing the Net Calorific Value for both fuels. Therefore, the costs with the employment of fuel oil is about six times higher than the employment of firewood and adding the fact of the fuel oil required much more technology to be inserted, the conclusion is that the use of fuel oil is not attractive, at all.

Another plausible baseline scenario would be the use of Natural Gas. Although there is distribution/gas pipe in the region[23], the inconstant distribution of natural gas, as 40% of the natural gas consumed in Brazil proceeds from Bolivia[24] made the project developers not to trust in this fuel, therefore excluding this possibility.

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

Without the project activity, according to historical experience of *Assunção*, the ceramic would employ approximately 3,680 m³ of native wood per month from Caatinga biome in order to feed their 10 kilns to maintain the temperature of 900 °C producing around 12,800 tons of ceramic units monthly. Their installation is compounded by 2 hoffmans kilns, 7 round Kilns and 1 semi-continuous kiln. What lead us to an average efficiency around 0.2875 m³ of wood per tons of ceramic units produced. The efficiency of the Assunção Kilns is plausible when compared with values founded in the literature[25].

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

The methodology applied is Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Applications by the User – Version 01 which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.
Furthermore, the project activity will annually generate less than 45 MWthermal.

Without the project activity, *Assunção* Ceramic would consume around 3,680 m³ of native fire wood per month to feed its kilns to obtain an approximate temperature of 900°C, in order to produce 12,800 tons ofceramic units.

To demonstrate that the project is additional it will be used the test 1 of section 5.8 of the Voluntary Carbon Standard - Specification for the

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[22] *According to data values and facts from "Estudo Comparativo da Queima de Óleo BPF e de Lenha em Caldeiras". Comparation made between wood from eucalyptus and fuel oil.Also the NCV of oil fuel itulized was 9880Kcal/Kg as stated in the source applied. Available at: <http://www.abcm.org.br/xi_creem/resumos/TE/CRE04-TE01.pdf>. Visited on: September 06th, 2008.*

[23] *Source: <http://www.ctgas.com.br/template02.asp?parametro=2547>. Visited on September 06th, 2008.*

[24] *Source: <http://ecen.com/eee51/eee51p/gn_bolivia.htm>. Visited on May 05th, 2009.*

[25] *Source: TAPIA, R. E. C. et al.* ***Manual para a indústria de cerâmica vermelha.*** *Rio de Janeiro: SEBRAE/RJ, 2005. (Série Uso Eficiente de Energia).*

project-level quantification, monitoring and reporting as well as validation and verification of greenhouse gas emission reductions or removals.

Test 1 – The project test

Step 1: Regulatory Surplus
The project is not mandated by any enforced law, statute or other regulatory framework in Federal, State and Municipal levels in the survey performed.

Step 2: Implementation Barriers
The project shall face at least one distinct barrier compared with barriers faced by alternative projects.

- ***Technological and technical barrier***

In the small project activity, the ceramic found some technological barriers. In the baseline scenario, using the wood, the operators feed the kilns manually, procedure unfeasible when applied to the new biomasses mainly sawdust and cashew nut husk. Also, the new machineries needed some adjustments in order to use the new biomasses.

The utilization of mechanic burners is widely important for the renewable biomass employment in the firing process. That’s because the renewable biomass utilized through the mechanic burners are the smallest ones (cashew husk and sawdust), and these biomasses are responsible for initiating the firing process increasing the temperature faster than if just utilizing wood. Moreover, the mechanic burners are responsible for inserting air inside the kilns, what makes the burning process much more efficient.

Also, with the use of mechanic burners, the employees do not have near contact to kiln entrances contributing to preserve their health and safety.

In addition to the alterations in the machineries, the kilns sustained some adaptations due to the new fuel implemented and to work in accordance with the mechanic burners and the new fuel employed. Moreover, the ceramic had to acquired an electronic burning control in order to supervise the temperature of firing and decrease the lost of ceramic units. With the electronic system Assunção ceramic is able to control the temperature even utilizing different kinds of biomasses.

Furthermore, the fuel substitution represented some weeks more to get adapted to the burn with the new biomass and get the final product with the same quantity and quality than in the baseline scenario.

Part of the new biomass employed are composed by small granulated material that undoubtedly makes the kilns harder to be cleaned, so it now takes longer to let the kiln ready for the next burning cycle.

Other barriers are listed below:

- Variation in the color of the final ceramic units, which affects the quality of the products;
- Cracks on the ceramic units and the explosion of some of them;

Thus, Assunção Ceramic had to find the best procedure to handle with the new biomass, which is far different when compared with the use of wood.

- ***Financial barrier***

With the project implementation, the ceramic had to withstand more costs than if it had continued employing native wood as fuel, namely because of high investments necessary to initiate the biomass switching such as mechanic burners, a new shed, and a electronic monitoring system.

A new storage shed of approximately 1,140 m^2 has been constructed in order to store the new biomass volume, mainly the sawdust, the cashew nut husk and the coconut husk. These biomasses are stored in order to overcome scarcity and rainy period.

When the new production techniques have been introduced in the ceramic plant, there was an adaptation period and a testing period. For the adaptation of the kilns a still period of a burning cycle for each kiln had to be considered. Also the testing period of approximately one week, required in order to identify the correct burning curve, lead to waste of considerable amount of biomass (average 25%) in each burning cycle. All this resulted in prejudice for the company financial Profit and Loss balance.

In order to find the best temperature and amount of renewable biomass to be employed in its firing process, Assunção Ceramic acquired an electronic system control. This electronic system control gives information about the temperature inside the kiln in real time. Such acquisition was crucial in order to utilize the new unknowing biomass.

The demonstrations of the main costs after and before the project activity can be checked in the tables of costs below.

Table 7. Main costs before and after the project activity

Investment				
Scenario	**Non-Renewable Biomass**		**Renewable Biomass**	
Costs with equipment acquisition (including freight)	---------	BRL	R$ 89,975.00	BRL
Loss of revenues - period for adaptation of the kiln for biomass	---------	BRL	R$ 196,000.00	BRL
Waste of products in the testing period (One week)	---------	BRL	R$ 9,800.00	BRL
New biomass storage shed	---------	BRL	R$ 616,797.00	BRL
Total Invested	**0**	**BRL**	**R$ 912,572.00**	**BRL**

Figure 4- Mechanic Burner bought in order to feed the kilns with renewable biomass.

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 *Assunção* Ceramic in a less competitive position when compared to its competitors which are mostly using wood. The consequences of this commercial disadvantage would make the fuel switching and the continued use of the needed machinery unfeasible without the existence of the carbon markets.

- ***Institutional barriers***

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

The new biomass presented a larger volume, which in turn required the construction of a new storage shed, thus changing the established logistic system of the ceramic. The shed, moreover, contribute to keep the biomass dried, increasing the burning efficiency.

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

Furthermore, the arrival of a carbon credit project is accompanied by an environmental concern and conscience development in the entire region. Organizations such as SEBRAE[26] support the effort and assist in the

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[26] SEBRAE- Serviço Brasileiro de Apoio a Micro e Pequenas Empresas (Small Business Support Brazilian´s Service) is a respected National service responsible for developing applicable Business knowledge.

implementation of environmental management systems, which upgrade the regional environmental quality.

- ***Risks of the project***

The use of wood from areas without sustainable forest management is a traditional and well-known process, the fact of which presented a risk to the owner of *Assunção* ceramic with the implementation of the fuel switching project, since the introduction of a previously unknown type of fuel and machines added a significant amount of insecurity to the production process.

After the project implementation the main barrier was the maintenance costs, which are higher than the ceramics which still use non-renewable biomasses.

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

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

The thermal energy generation through the combustion of biomasses is an innovation in the ceramic industry. The future demand of this alternative fuel e.g. by other consumers is not easy to foresee. Although there is currently a great amount of these types of biomasses available locally, it is a possible that the demand and the prices would increase as well. If the price of the biomass increases, in the other hand, the products cannot increase, once it would not have competitive prices in relation to other ceramics which did not made the fuel switch.

Step 3: Common Practice

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

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

The product of the project activity are ceramic bricks.

2. Identify possible types of baseline candidates.

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

Table 8. Percentage of fuel employed on the ceramic sector in Brazil

BRAZILIAN ENERGY BALANCE 2007 - CERAMIC SECTOR EVALUATION			
FUEL	**2004**	**2005**	**2006**
Natural Gas	24%	24%	26%
Charcoal	2%	2%	1%
Wood	50%	50%	50%
Other recuperations	1%	1%	1%
Diesel Oil	0%	0%	0%
Fuel Oil	9%	8%	8%
Liquified Petroleum Gas	4%	4%	4%
Others from Petroleum	2%	2%	2%

Piped gás	0%	0%	0%
Electricity	8%	8%	8%
Others non specified	0%	0%	0%

(Brazilian Energy Balance, source: http://www.mme.gov.br visited on: January 05th, 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[27] from Mines and Energy Ministry of Brazil is the most representative and reliable source of information about the ceramic sector and its fuel employed.

Therefore, data from table 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 Assunção Ceramic did its fuel switch.

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

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

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

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

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

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

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[27] *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.*

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

[29] *ALBUQUERQUE, J.L.B. et al. Águia-cinzenta (Harpyhaliaetus coronatus) e o Gavião-real-falso (Morphnus guianensis) em Santa Catarina e Rio Grande do Sul: prioridades e desafios para sua conservação.* ***Revista Brasileira de Ornitologia,*** *v.14, n.4, p. 411 – 415, dez. 2006. Available at: <http://www.ararajuba.org.br/sbo/ararajuba/artigos/Volume144/ara144not3.pdf>. Access at: September 10th, 2008.*

[30] *BRASIL. Ministério de Ciências e Tecnologias.* ***Levantamento da Situação e das Carências Tecnológicas dos Minerais Industriais Brasileiros****: com enfoque na mineração de: Argila para cerâmica, Barita, Bentonita, Caulim para carga, Talco / Agalmatolito e Vermiculita. Brasilia, 2001. Available at: < http://www.cgee.org.br/prospeccao/doc_arq/prod/registro/pdf/regdoc710.pdf>. Access at: September 10th, 2008.*

[31] *VIANNA, F.M.A.* ***Participação Pública em Programas Ambientais: Um Estudo em Área Suscetível a Desertificação no Estado do Rio Grande do Norte.*** *2006, 109f. Dissertação (Mestrado em Engenharia de Produção) – Universidade Federal do Rio Grande do Norte, Natal, 2006. Available at: <http://www.pep.ufrn.br/publicacoes.php?enviou=1>. Access on September 10th, 2008.*

other industries as in the production of steel (BRASIL, 2005[33]), which has a much better structure and internal organization when compared with the ceramic industry, that is usually a small and familiar enterprise. BRASIL (2001) suggests that it is important to stimulate the miner sector, especially who are respecting the environment. The incomes from carbon credits can be this incentive which would contribute to avoid the consumption of non renewable biomass illegally. Therefore laws and regulations will not be considered to constraint the geographical area and temporal range of the final list of the baseline candidates.

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

5. Identify a final list of baseline candidates.

Table 9 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 (2004, 2005, and 2006). Baseline candidates are the use of:

a) Wood: The fuel most used, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006[34].

b) Natural gas: it is restricted by the inconstant distribution, its high costs[35] and lack of availability[36]. The risk of lack of offering and higher costs when compared with other fuels discourages the scenario of investing in this type of fuel even in local with piped gas. The distribution of gas is preferentially performed to thermal power plants, increasing the risk of blackout of natural gas.

c) Fuel oil: This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas. The risks involving natural gas distribution are so considerable that PETROBRÁS[37] was offering subsidy to the consumption of fuel oil in spite of natural gas in the State of São Paulo.

d) Renewable biomass: despite the high biomass availability, the main problems concerning the use of renewable biomass are related to the high investments, technological and institutional barrier, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries[38].

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

In Brazil, the red ceramic devices are generally produced through an inefficient and traditional process using wood without forest management

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*[32] CARDOSO, C.F.R. **Panorama do Setor Florestal: o que tem sido feito na esfera do Governo Federal**, Rio de Janeiro, 03 Set. 2008. Report presented in 1º SEMINÁRIO DE MADEIRA ENERGÉTICA, 2008.*

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

[34] Source: IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. visited on 13th March, 2009.

[35] Source: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm> visited on 13th March, 2009.

[36] Source: <http://www.gasnet.com.br/novo_entrevistas.asp?cod=145> visited on 13th March, 2009.

[37] PETROBRÁS performs in oil and oil by product exploration, production, refining, marketing, and transportation, both in Brazil and abroad. More information available on <http://www2.petrobras.com.br/ingles/ads/ads_Petrobras.html>. Visited on September 06th, 2008.

[38] The use of renewable biomass was not included in table 08 which shows the fuel most employed in the ceramic sector according to Brazilian Energy Balance.

to generate thermal energy technologies[39]. In this industry segment the use of wood represents about 98% of the total fuel employed stimulating the increase in Brazilian deforestation and desertification rates. It happens because wood without forest management is offered with lower prices than wood from areas with forest management[40].Furthermore, using non-renewable wood is a simple procedure and well known by the kiln operators.

The native forest without any kind of sustainable management has always been a source of firewood, which seemed inexhaustible, due to the amount generated in the expansion of the agriculture frontier bringing forward environmental impacts, with regard to the degradation of soil, change in the regime of rainfall and consequent desertification[41].

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

Thus, the common practice is the use of wood and its non-renewable fraction, which is the fuel most employed and with less risk associated.

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

Thus, the project activity is not a common practice.

Impact of project approval

Presently, the ceramic industrial segment of *Ceará* state comprises mostly small industrial units that still use the most diverse technological models, and the grand majority of them, use native firewood from the *Caatinga* biome as fuel. These industries have some technological restrictions in the areas of energy exploitation and the efficiency of the machinery, but the project's approval can dramatically improve the development of this sector.

Moreover, measures should be taken to preserve *Caatinga* biome and the project activity represents an example that can be followed by other activities.

The project activity contributes to the reduction of the greenhouse gas (GHG) emissions by diminishing deforestation of the *Caatinga* biome. Rich in natural resources, *Caatinga* is one of the most threatened ecosystems of the planet. In

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[39] *ABREU, Y. V.; GUERRA, S. M. G. Indústria de Cerâmica no Brasil e o Meio Ambiente. Chile: IV Congreso Nacional de Energía, 2000. Available at: <http://www.nuca.ie.ufrj.br/bgn/bv/abreu2.htm>. Visited on November, 20th 2008.*

[40] *Seye, Omar. Análise de ciclo de vida aplicada ao processo produtivo de cerâmica estrutural tendo como insumo energético capim elefante (Pennisetum Purpureum Schaum) / Omar Seye. Campinas, SP: [s.n.], 2003.*

[41] *UHLIG, A. Lenha e carvão vegetal no Brasil: balance oferta-demanda e métodos para estimação de consumo, tese de doutorado, Universidade de São Paulo, São paulo, 2008. 156 p. Available at: http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/ >. Visited on December, 12th 2008*

[42] *PAULETTI, M. C. Modelo para Introdução de Nova Tecnologia em Agrupamentos de Micro e Pequenas Empresas: Estudo de Caso das indústrias de Cerâmica Vermelha no Vale do Rio Tijucas. 2001. Available at: < http://www.spg.sc.gov.br/menu/desenv_economico/camara_apls/estudos/Trabalhos_sobre_economia_catarinense/Ceramica_estrutural/2001_Tecnologia_ceram_verm_vale_tijucas_dissertacao.pdf >. Visited on November 20th, 2008.*

addition, its high calorific power is the main cause of its degradation. In a region where the scarcity of rivers implies lesser access to the electric energy, the firewood and charcoal correspond of 30% of the used energy matrix in the industries of the region, which intensifies the local deforestation.

In the last years, the deforestation verified rated an annual average of approximately 5,000 km^2 within the boundaries of the *Caatinga* biome.[43]

Table 9 shows the approximate area of all the biomes in Brazil, and the area occupied by the *Caatinga* is highlighted.

Table 9 . Brazilian biomes in decreasing order of importance

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

(Source: http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169&id_pagina=1) *visited on 13th March , 2009*

3 Monitoring:

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

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

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

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

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

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

The monitoring will be done with the aim of determine the most approximate quantity of wood without sustainable management 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 CO_2e.

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[43] *Source: <http://www.ongacema.org.br/meioambiente/caatinga.html> visited on March 13th, 2009.*

Table 10. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
$Q_{renbiomass}$	Amount of renewable biomass	tonnes	Measured by the project proponent	Monthly
Origin of renewable biomass	Renewable origin of the biomass	Not Applicable	Controlled by the project proponent	Annually
PR_y	Production of ceramic pieces	Tonnes per month	Controlled by the project proponent.	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tonnes or m^3	Monitored by articles and database	Annually
Leakage of Non-Renewable Biomass	Leakage resulted from the non-renewable biomasses	tCO_2e	Monitored by articles and database	Annually
$EF_{projected\ fossil\ fuel}$	CO_2 Emission factor of residual fuel oil	tCO_2/TJ	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf. Page 2.18. Table 2.3.	Not monitored
$NCV_{biomass}$	Net Calorific Value of non-renewable biomass	TJ/ton of Wood	Bibliography	Not monitored
$\rho_{biomass}$	Specific gravity of non-renewable biomass	ton/ m^3	Bibliography	Not monitored
$f_{NRB,y}$	Fraction of biomass (wood) used in the absence of the project activity established as non- renewable biomass using survey methods	Percentage	Data from project proponent and bibliography	Annually
BF_y	Consumption of non-renewable biomass per	tons of wood/tons of	Data from project proponent	**PR_y Function**

	tons of ceramic devices produced	ceramic units of ceramic devices		

In the monitoring plan, the amount of non-renewable biomass (**B_y**) will be determined using the option ‘b’ of the applied methodology:

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

As stated before, the *Assunção* ceramic employed around 3,680 m³ of native wood without sustainable management per month producing 12,800 of ceramic units. This information leads to the number of 0,2875 m³ of native wood to produce a ton of ceramic devices.

The quantity of native wood that would be used in the ceramics will be calculated through the multiplication of the ceramics’ monthly production in tonnes by the consumption of the kiln, as the following example for *Assunção* Ceramic:

By = (Monthly production(tons)) x Kiln Consumption (BF_y) x Fraction of non-renewable biomass

By = 12,800 (tons of ceramic units per month) x 0.2875 m³ of wood/tons of ceramic units x 0.994 x 0.880 ton/m3 x 12 months per year

By = 38,627 tonnes of native wood/year

The responsible to monitor data provided in table 11 will be Mr. Francisco Evanildo de Sousa 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:	Tonnes per month
Description:	Amount of renewable biomass
Source of data to be used:	estimated by the project developer
Value of data applied for the purpose of calculating expected emission reductions	Predicted to. **Biomass** / **Native wood from management areas** / **Cashew wood** / **Sawdust** / **Coconut husk** / **Cashew nut husk** tonnes / 154 / 368 / 4 / 45 / 49
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. The values in the receipts may be described in m³, therefore it is necessary the conversion to tonnes through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project is:

Biomass	**Native wood from management areas**	**Cashew wood**	**Sawdust**	**Coconut husk**	**Cashew nut husk**
tonnes	154	368	4	45	49

Biomass	Native wood from management areas	Cashew wood	Sawdust	Coconut husk	Cashew nut Husk[44]
Specific gracity (tonnes/ m3)	0.88	0.42	0.245	0.5	--

The sources of these data are:

Sawdust:
Masses and Dead Loads of Concrete and Other Materials- <http://www.cca.org.nz/pdf/Masses.pdf> visited on March 13th, 2009.

Native wood from management areas:
The same applied in ρbiomass.

Residues from cashew trees:
LORENZI, H. Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002.

Native wood from management areas:
The same applied in ρbiomass.

Density of Coconut Husk available at :
<www.ufpa.br/gedae/BIOMASSAEENERGIA2006.pdf> visited on March 13th, 2009.

QA/QC procedures to be applied:	Amount of biomass will be double checked with receipt of purchase. The energy balance will be verified according to the amount of biomass applied.
Any comment:	The use of sawdust will provide a more efficient process then when using wood.

Data / Parameter:	**Pry**
Data unit:	Tons of units per month.
Description:	Production of ceramic pieces
Source of data to be used:	Controlled by the project developer.
Value of data applied for the purpose of calculating expected emission reductions	Approximately 12,800 tons of pieces per month
Description of measurement methods and procedures to be applied:	The amount was acquired by counting the total production of one year. The measurement will be done by an internal control sheet monitored by the project proponent, which will be filled daily. The production is a representative sample to ensure that all appliances are still in operation.
QA/QC procedures to be applied:	The ceramics have an internal control of the quantity of pieces produced. It will be rechecked according to the biomass employed and the kiln consumption of renewable biomass
Any comment:	

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[44] *The cashew nut husks are bought by its weight, for this reason the cashew nut husk does not need its density value in order to be measured its quantity in tons.*

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 developer.
Value of data	renewable biomass
Description of measurement methods and procedures to be applied:	The guarantee of acquiring renewable wood will be achieved by invoices from the providers. The origin of the cashew tree pruning will be evidenced with a declaration from the provider that the sustainable plan had been followed. As stated in the section 2.2, the biomasses (cashew nut husk, coconut husk, Elephant grass and Sawdust) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied :	The biomass will be considered as renewable if it is according to the definition given by Methodology AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User – Version 01 from February 01 of 2008 onwards.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Leakage of non-renewable biomass.**
Data unit:	tCO$_2$e
Description:	Leakage resulted from the non-renewable biomass
Source of data to be used:	Monitored
Value of data	0
Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in the applied methodology will be monitored. Scientific articles, official statistical data, regional and national surveys will be provided in order to ensure that there is no leakage from non-renewable biomass (or to estimate the leakage).
QA/QC procedures to be applied :	Data available regarding the ceramic industries fuel consumption will be utilized to monitor the leakage.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

<table>
<tr><th>Data / Parameter:</th><th>Renewable biomass surplus</th></tr>
<tr><td>Data unit:</td><td>ton or m³</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>Harvest</th><th>Quantity per year</th></tr>
<tr><td>Forest Residues (sawdust) in m³</td><td>10,775.38</td></tr>
<tr><td>Coconut husk (tonnes)</td><td>6,700,000</td></tr>
<tr><td>Wood from management areas(*m³*)</td><td>4,595,695</td></tr>
<tr><td>Residues from cashew trees (tonnes)</td><td>196,625</td></tr>
<tr><td>Cashew nut husk</td><td>Not measured</td></tr>
<tr><td>Elephant Grass</td><td>Not measured</td></tr>
</table>
Detailed information in section 4.1 – Leakage.
</td></tr>
</table>

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

Data / Parameter:	$f_{NRB,y}$
Data unit:	*Fraction of biomass or (percentage)*
Description:	*Fraction of biomass (wood) used in the absence of the project activity in year y.*
Source of data used:	Survey methods.
Value of applied:	0.994
Justification of the choice of data or description of measurement methods and procedures actually applied :	Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramics owner. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, considering that 0.11% of *Caatinga* biome has sustainable forest management plan, the fraction of non-renewable biomass is 99.89%. Also it was add the amount of wood saved by similar projects that are being developed by Carbono Social Serviços Ambientais Ltda. with the same methodology in the region. It was measured the amount of 6,242,408 m3 of wood in 10 years, representing around 0.04% of total Caatinga area. Hence, the Fraction of non-renewable biomass applied in a conservative way is 0.994%. Source: <http://www.cnip.org.br/planos_manejo.html>. Visited on March 04th, 2009.
QA/QC procedures to be applied :	The monitoring of this parameter will be based in national and international articles and database every monitoring period. The sources will provide information about the sustainable use of *Caatinga* biome. Wood saved from projects with same biome and applied methodology developed by *Carbono Social Serviços Ambientais Ltda* was considered in this fraction. CDM or VCS registered projects will also be included in this fraction if placed in the same region and methodology. Moreover the amount of non-renewable biomass applied in the project activity will be monitored monthly and will be considered in the value of Fnrb parameter.
Any comment:	It will be employed in order to estimate the amount of non renewable biomass.

Fixed Parameters

Data / Parameter:	**EFprojected_fossil fuel**
Data unit:	tCO_2/TJ
Description:	CO_2 Emission factor of residual fuel oil
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. visited on march 13th, 2009.
Value applied:	77.4 tCO_2/TJ

Justification of the choice of data or description of measurement methods and procedures actually applied:	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas due to risks involving natural gas distribution.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction. The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits income for this project activity, whichever occurs later.

Data / Parameter:	**NCV biomass**
Data unit:	TJ/ton of wood
Description:	Net Calorific Value
Source of data to be used:	National data
Value of data applied for the purpose of calculating expected emission reductions	0.019
Description of measurement methods and procedures to be applied:	This value will provide the energy generated by the amount of wood that would be used in the absence of the project. The species used to calculate the average value are typical trees of *Caatinga* Biome that are usually utilized as fuel in the ceramic industries of the region. Sources: - Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Available at <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf> visited in March 13th, 2009. - Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir . Available at: <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf> visited in March 13th, 2009.
Any comment:	IPCC default values shall be used only when country or project specific data are not available or difficult to obtain, according to "Guidance on IPCC default values" (Extract of the report of the twenty-fifth meeting of the Executive Board, paragraph 59).

Data / Parameter:	**ρ biomass**
Data unit:	ton/ m^3
Description:	Specific gravity
Source of data to be used:	National data
Value of data applied for the purpose of calculating expected emission reductions	0.88 ton/m^3. Value average checked at: -IPCC: Intergovernmental Panel on Climate Change. Orientácion del IPCC sobre las buenas prácticas para UTCUTS - chapter3 – Table 3A.1.9-2 - LORENZI, H. Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002. - *Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd)*. Available at <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf> visited in March 13th, 2009. - Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Available at:

	<http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf> visited in March 13th, 2009. - <http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&ca racteristica=139> visited on March 13th, 2009.
Justification of the choice of data or description of measurement methods and procedures actually applied:	The amount of wood used in the baseline was measured in volume units. This datum will be used for the unit conversion.
Any comment:	The species used to calculate de average value are typical trees of *Caatinga* Biome and usually utilized as fuel in the ceramic industries of the region.

Data / Parameter:	**BFy**
Data unit:	Tons of wood per tons of ceramic units.
Description:	Consumption of non-renewable biomass per tons of ceramic devices
Source of data used:	Historical data from project proponent
Value of applied:	0.253 tons of wood per tons of units of ceramic devices.
Justification of the choice of data or description of measurement methods and procedures actually applied :	It will be employed in order to estimate the amount of non-renewable biomass.
Any comment:	Data is in accordance with TAPIAS, 2000[45], which estimates an approximate value for these kinds of kilns.

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan shall be the owners of the companies. The project developer 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, measurement and reporting will be Francisco Evanildo de Sousa. All the monitored parameters will be checked annually as requested in the methodology Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User – Version 01 from February 01 of 2008 onwards.

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[45] *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).*

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.

The party will also implement a social carbon monitoring plan through the social carbon methodology, which was developed by *Instituto Ecológica* Palmas focused on a sustainable development and better social conditions to the communities where it is implemented.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

Methodology AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User – Version 01 from February 01st of 2008 onwards, which comprises project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy. The project's emissions from the combustion of native wood are accounted in the same way as fossil fuel combustion, once it is not renewable and emits CO_2.

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

Baseline

$$\mathbf{ER_y = B_y \times \mathit{f}_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel}} \qquad \text{(Equation 01)}$$

Where:

ER_y: Emission reductions during the year y in tCO_2e

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

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

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

$EF_{projected\ fossil\ fuel}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO_2e/TJ[46].

B_y is determined using the following option:

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

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

Where:

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

η_{old} : Efficiency of the system being replaced

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

Where:

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

PR_y: Amount of product produced in year y in tons of ceramic units.

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

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

Where:

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

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

Where:

BF$_y$: Amount of native firewood needed to produce a certain amount of product in tons of ceramic units/tonnes of ceramic devices

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

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

As shown in the calculations above, the ηold is not required to calculate the Emission Reductions, thus it was excluded from the By calculation.

Leakage (LE)

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

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

The leakage from biomass projects, like the project activity, shall also be estimated according to the "General guidance on leakage in biomass project activities" (attachment C of appendix B).of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on the type of biomass considered (described in the table 11).

Table 11.Sources of leakage according to the type of the biomass.

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

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

Observing table 11, the possible sources of leakage of the present project activity is the competing use of native wood from management areas, residues from cashew trees, coconut husk, cashew nut husks, elephant grass and sawdust. All of these biomasses have enough availability as showed below demonstrating the lack of leakage for each biomass.

Forest Residues

Forest Residues are also a probable fuel to be used for the ceramic devices burning. The production of wood generates a large amount of residues, which can be reused to generate thermal energy. As can be observed in the figure 3, the potential of energy generation in the state of *Ceará* is plentiful, which means that there is an enormous availability of this kind of fuel to be employed in the project activity. This way, this biomass does not have potential to generate leakage emissions due to its high availability.

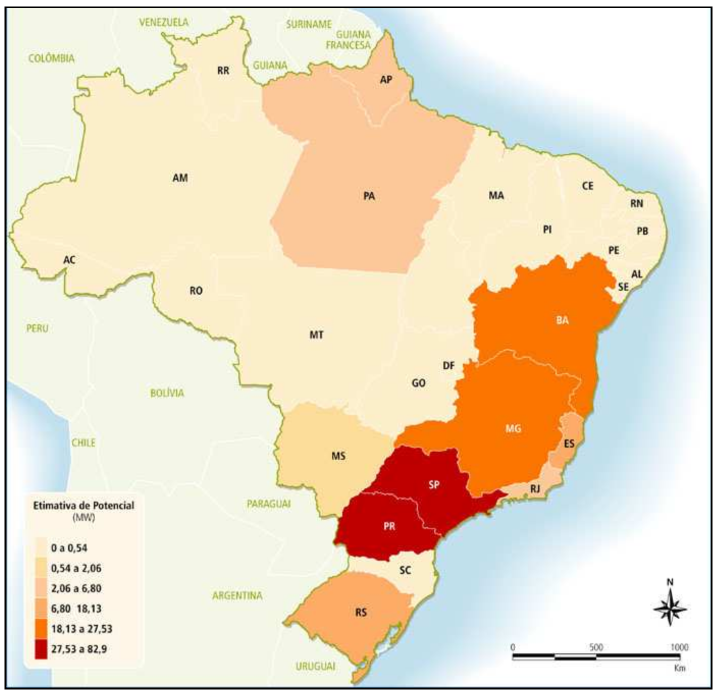

Figure 3. Forest Residues Potential for Energy Generation[47]

Considering that around 22% of the wood produced will generate sawdust[48]. The production of wood in the state of *Ceará* was of 48,979 m^3[49] in 2007, thus, will generate 10,775.38 m^3 of sawdust.

The project activity will employ approximately 48 tonnes per year, thus 196 m^3 of sawdust per year which represents 1.8% of the total of these residues generated in the State of *Ceará*.

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

[48] *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.*

[49] *According to IBGE(Geographic and Statistic Brazilian Institute) available from: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007>*

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

Cashew nut Husk

The cashew nut production in Ceará state hits the number of 53,420 tons during the year of 2008.[50] Moreover the cashew nut husk constitute a serious environmental problem in Brazilian’s northeast region. Besides, its disposal in landfills are not recommended since the cashew nuts presents a large volume of production.[51] For that reason its utilization in activities that avoids its disposal in open dumps and give to it a sustainable destination are substantial for the northeast environment. Thus the utilization of such residue ,even not measured, is not a common practice and presents a higher production than its consumptions by industries in north east region.

Cashew tree wood

Since *Assunção* Ceramic utilizes wood residues from cashew trees, it is important to analyze the cashew scenario within Brazilian borders. The cashews cultivation is extremely important to Brazilian economy, where it is responsible for generate 150 million dollars per year. The cashew production is important especially in the northeast region, representing about 95% of Brazilian´s cashew production. Besides, cashew production is responsible for generating job opportunities for 35,000 fieldworkers, 15,000 in the manufacturing process and 200,000 indirect job opportunities[52]. The Brazilian production achieved 143,000 tonnes of cashew-nuts in 2005 spread in an area of 650,000 Hectares[68].Moreover, Brazilian´s production presents the tendency of increasing so far, carried by the new technologies utilized and the higher national and international demand of cashew nuts[53]. This way, the Brazilian sources of residues from cashew trees will increase following the Brazilian production, due the fact that cashew cultivation request continuous cut of cashew trees. The cut of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest time. This way, in cashew cultivation must be cut undesirable branches of the cashew trees[54]. Moreover, dry branches on the ground compound a considerable amount of residues from cashew trees cultivation.

There is no estimated amount of residues from cashew trees, however its abundant availability is well-known all over the country. Besides, in order to destine the great amount of residues from cashew trees, the Brazilian´s government allowed the utilization of this residue as firewood[55].
According to *“Plantio do Caju”* cashew trees cultivation presents a density of 121 units of trees per hectare[56], and the production of

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[50] http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=lavourapermanente2007 visited on June 10th 2009.

[51] According to Unicamp (University of Campinas) news <http://www.unicamp.br/unicamp/unicamp_hoje/ju/maio2009/ju427_pag08c.php> visited on June 16th 2009.

[52] *According with EMBRAPA (Brazilian Agricultural Research Corporation's Available at :<http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/index.htm> visited on March 13th, 2009.*

[53] *Checked at: <http://www.nordesterural.com.br/nordesterural/matLerdest.asp?newsId=2219>. Accessed on March 04th, 2009.*

[54] *According to EMBRAPA(Brazilian Agricultural Research Corporation's). Available at: http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratosculturais.htm> visited on March 13th, 2009*

[55] *Source: <http://tribunadonorte.com.br/motoresrn/noticias.php?id=83885>. Visited on May 06th, 2009.*

[56] *According to “Resposta Técnica” from CETEC (Technologic Center of Minas Gerais) considering a space of 10 meters from each tree. Available at:*

firewood residues from each tree is 2.5 kg per year[57]. The cultivation of cashew is located in an area of 650,000 hectares[68]. This way, the Brazilian production of residues from cashew trees is around 196,625 tonnes per year. Therefore, the *Assunção´s* consumption of residues from cashew trees (4,416 tonnes per year) represents around 2.3 % of the total production of residues from cashew trees. Thus, the amount of residues from cashew trees necessary to provide thermal energy in *Assunção´s* kilns represents a non-representative quantity of this kind of biomass, which avoids the possibility of leakage.

Coconut Husk

Specifying the coconut scenario, the Brazilian production is within the five biggest productions in the world[58]. Moreover, the Brazilian production has been increasing in order to supply the crescent health food market[59]. It is important to note that Brazilian's law incentives the use of residues from coconut[60], such as coconut husk as long as its production and consumption produces a high quantity of residues. The coconut has diverse uses, which briefly is used for aliment, water, fiber among others. In the northeast region of Brazil, 6.7 millions of tons of coconut husks are generated yearly, which can be up to 70% of the solid residues of coastal cities[61]. This way, Assunção ceramic utilizes less than 0,001% of coconut husk availability[62]. Therefore, this biomass is widely available in the region, once its use for generate thermal energy may be a solution for the solid waste disposal in these cities.

Wood from management areas

Ceará state presents a production of 4,595,695 m^3 of fire wood[63], being one of the largest productions among Brazilian's states. The present project intends to utilize around 2,100 m^3 of wood from management areas per year. In this way, the project will utilize 0.04% of the total biomass availability in *Ceará* state. Thus, the amount of fire wood from management areas necessary to provide thermal energy in *Assunção´s* kilns represents a non-representative quantity of this kind of biomass, which avoids the possibility of leakage.

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[64] 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

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<http://sbrtv1.ibict.br/upload/sbrt4555.pdf?PHPSESSID=76a9111889defa6787039ca56b380c58> visited on March 13th, 2009

[57] *According to "Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural" Available at: <http://www.cepel.br/~per/download/rer/rt-789-00.pdf> visited on March 13th, 2009.*

[58] *Source: <http://www.todafruta.com.br/todafruta/mostra_conteudo.asp?conteudo=12743> visited on March 13th, 2009.*

[59] *Source: <http://www.urutagua.uem.br/005/22eco_senhoras.htm> visited on March 13th, 2009.*

[60] *Law number 594 from 24/12/1948*

[61] *Source: <www.sbpcnet.org.br/livro/60ra/textos/SI-GoreteMacedo.pdf>. visited on March 13th, 2009.*

[62] *Considering that Kitambar ceramic utilized 1,650 tons of coconut husk per year, according to historical data.*

[63] *According to IBGE(Geographic and Statistic Brazilian Institute) available from: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=extracaovegetal2007> visited on March 13th, 2009.*

[64] *Source: <www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292> visited on March 13th, 2009.*

fertilizers (NPK)[65]. In case of employing this kind of biomass, the project proponent will cultivate, by himself, elephant grass in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, i.e. this leakage will not exist.

Therefore, the biomass needs in the project activity can be totally supplied for the Brazilian's sources of biomass.

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

The following potential sources of this type of leakage can be identified:

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

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

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

To ensure that the project activity will not cause the type of leakage described in item B, Carbono Social Serviços Ambientais Ltda will make a research with ceramics located in the region with the purpose of checking the fuel employed in the kilns, and it is expected that the carbon credits incomes will stimulate the use of renewable biomass to other ceramics presenting a huge possibilities for sustainable development in the region. Therefore, the sources of leakages mentioned above will probably not applicable as it is predicted that:

The project activity will not displace the use of renewable biomass of a 1non-project user, due to the likely decrease in the use of non renewable biomass in the region The non-renewable biomass employed which would be employed in this project activity will not being saved for other project activity, since other ceramics was already consuming native wood (common practice).

It will occur a decrease in using non-renewable biomass, especially due to the incentive of carbon credits.

Therefore, it can be concluded that the wood which was avoided by the present project activity is not being used by other ceramists.

It is important to report that initially the project developer consumed wood from the nearby areas, however, as time went by, this resource became scarce and the distance from wood suppliers was gradually increasing. This fact shows how this impact of baseline activities is prominent and how the project activities can reduce deforestation.

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[65] *Source: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf> visited on March 13th, 2009.*

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

The leakage is not applicable for this project activity in *Assunção* Ceramic, once there is no transference of equipment , in spite of new equipments had to be acquired.

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

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

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

$$\mathbf{ERy= B_{y} \; x \; f_{\mathit{NRB},y} \; x \; NCV_{biomass} \; x \; EF_{projected\_fossil\ fuel}}$$

By,total = 153,600 tons of ceramic units per year x 0.2875 m^3 of wood/tonnes of ceramic devices x 0.88 tonnes of wood/m^3 = 38,860 **tonnes of wood**

ERy, total = 38,860 tonnes of wood x 0.994 x 0.019 TJ/ton x 77.4 tCO_2/TJ = **56,805 tCO_2e**

By, total considers all the biomass that is dismissed. Thus, there is no need to calculate By, savings in the baseline emission in the estimative, it will be calculated only in the monitoring.

Table 12Emission reductions without considering the project emissions and leakage.

Year	Baseline Emission Reductions (tons CO2eq)
June – 2007	33,136
2008	56,805
2009	56,805
2010	56,805
2011	56,805
2012	56,805
2013	56,805
2014	56,805
2015	56,805
2016	56,805
May - 2017	23,669
Total	**568,050**
Average	**56,805**

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 enhancement for the GHG project:

Table 13 Estimation of overall emission reductions.

Year	Baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Emissions Reductions(tCO_2e)
June to December – 2007	33,136	0.00	33,136
2008	56,805	0.00	56,805
2009	56,805	0.00	56,805
2010	56,805	0.00	56,805
2011	56,805	0.00	56,805
2012	56,805	0.00	56,805
2013	56,805	0.00	56,805
2014	56,805	0.00	56,805
2015	56,805	0.00	56,805
2016	56,805	0.00	56,805
January to May - 2017	23,669	0.00	23,669
Total	**568,050**	**0.00**	**568,050**
Annual Average	**56,805**	**0.00**	**56,805**

5 Environmental Impact:

As can be observed in table 14, the only negative impact identified is that the project activity will generate ashes due to the burning of the biomass, but this impact will be mitigated by incorporating the ashes into the clay used as thermal insulator in the kilns entrance.

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

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

Table 14. Summary of the environmental impacts.

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

Environmental Laws related to the plant activities

The National Environmental Policy (PNMA), instituted by the Brazilian Law 6.938/81, has the purpose of preservation, improvement and recovery of the environmental quality, with the intention to assure conditions for the social-economic development and the protection of human dignity in the country. The PNMA establishes that the construction, installation, amplification and operation of any enterprise or activity which may exploit natural resources, and are considered potentially pollutant, or capable of degrading the environment, will be possible only if they obtain a previous environmental permission, according to the Brazilian Constitution of 1988. One of the tools settled by the PNMA, in order to monitor and study the potential impacts generated by these kinds of enterprises, is the Environmental Impact Assessment (EIA).

An EIA was not required due to the project activity.

6 Stakeholders comments:

The main stakeholders considered in this project are the local government, the ceramic sector association and the employees. It was sent a letter to those stakeholders informing about the project. In the ceramic’s facilities, the letter was fastened in the employees’ board which is a visible place with high circulation of employees. The letter is available during 7 days and the outcomes are waited for a period of 7 days after the letter has been sent.

No outcomes were received until the end of the VCS PD elaboration.

7 Schedule:

- Project start date: 17/05/2007
- Crediting period start date: 01/06/2007
- Validation Report predicted to: 12/07/2008
- First Verification Report predicted to 19/12/2008
- VCS project crediting period: 10 years renewable
- Monitoring and reporting frequency: preferentially from 6 to 12 months, since the beginning of the crediting period.

8 Ownership:

8.1 Proof of Title:

Ceramic's article of incorporation and the contract between *Social Carbon* – project developer – and *Assunção* Ceramic 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 *Assunção* 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.