Voluntary Carbon Standard Project Description

19 November 2007

1 Description of Project:

1.1 Project title

Kitambar Switching Fuel Project
Version 02
PDD completed in: December 17th, 2008

1.2 Type/Category of the project

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

- **Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User** – Version 01 from February 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 tons of CO2 equivalent and less than 1,000,000 tons of CO2 equivalent, thus classifying as a *project* under the VCS 2007 size groups (micro project, project, mega project).

Table 1. Emission reductions estimate during the crediting period

Year	Emission Reductions (tons of CO2e)
2007	37,115
2008	42,120
2009	42,120
2010	42,120
2011	42,120
2012	42,120
2013	42,120
2014	42,120
2015	42,120
2016	42,120
Total Emission Reductions (ton of CO2e)	417,800
Number of years of the crediting period	10
Annual average of estimated emissions reductions for the 10 years of crediting period (ton of CO2e)	41,780

1.4 A brief description of the project:

The project is applied at *Kitambar* Ceramic, which is a small and prototypical ceramic industry that produces structural ceramic devices like roof tiles, destined for the regional market. This project consists on utilizing renewable biomasses to feed the kilns rather than using native wood from areas without sustainable forest management, which is a pioneer practice in the region. This type of wood is considered a non- renewable biomass, once it is not originated in areas with reforestation activities.

As renewable biomasses, *Kitambar* Ceramic utilizes mainly wood from *Algaroba* wood[1] and cashew tree residues[2]. In addition, the coconut husk is also utilized; however the technological difficulty in its burning limits its use.

This fuel switching project will reduce the greenhouse gases (GHG) emissions through the substitution of native wood without sustainable management for renewable biomasses to generate thermal energy. The project activity will also indirectly help in reducing the Brazilian deforestation rates, the main source of greenhouse gas emissions in *Brazil*. Furthermore, by avoiding the anaerobic decay of these biomasses, this project will also contribute to lower greenhouse gas emissions.

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

The *Caatinga* is an exclusively Brazilian biome and occupies 895 Km^2, equivalent to 12% of the territory of the country. Although being rich in natural resources, the *Caatinga* is one of the most threatened ecosystems on the planet. Its high calorific value causes a major cause of its decline. In a region where the shortage of rivers leads to less access to electric energy, native firewood and charcoal account for thirty percent of the total energy utilized in the industries of the region, which has intensified the local deforestation[3].

The *Caatinga* is a biome with a strong propensity to desertification and its deforestation consequently brings forward an increase in this possibility. With the loss of natural vegetation, the exposed soil becomes more susceptible to erosion and salinization. These processes are responsible for changing the system of rivers, which makes the water supply of local communities and family farming scarce.

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 *Brazil*, in the state of *Pernambuco*, in the municipality of *Caruaru*, in the northeast region of the country. The geographic location is illustrated in Figure 1. The project site has the postal address:

- *Kitambar* Ceramic

  Address: BR 232, Km 136, Distrito Industrial, *Caruaru*, *PE* – Postal code: 55.000-000. The ceramic is located at the coordinates: 8° 18’ 16” S and 35° 58’ 25” W.

[1] The wood from afforestation in the northeast region of Brazil is mainly consisted of Algaroba (Prosopis juliflora).

[2] The cashew tree’s pruning occurs due to its fructification, which happens more intensely in new branches.

[3] http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47

Figure 1. Geographic location of the city of the project activity that has the following coordinates in *Pernambuco* State: *Caruaru*: 8° 16′ 58″ S, 35° 58′ 33″ W.

1.6 Duration of the project activity/crediting period:

- Project start date[4]: December of 2006

As the complete fuel-switch occurred by the end of December of 2006, the crediting period start date was defined as the date when the ceramic has begun to use 100% of biomasses as fuel.

- Date of initiating project activity: 01/01/2007
- VCS project crediting period: 10 years renewable

1.7 Conditions prior to project initiation:

The use of native wood without sustainable management as fuel is a prevalent practice among the ceramics industries in Brazil. Wood from deforestation is delivered and utilized in the ceramic facilities and this non renewable biomass is offered with low prices. The baseline identified for this project activity is the utilization of a total of 32,700 m³ of native wood per year to provide thermal energy to the ceramic's kilns.

The project activity focuses on the use of *Algaroba* wood and cashew tree wood as renewable biomasses for energy supply. Since part of the biomasses that can be utilized are residues, such as coconut husk, sugar cane bagasse and forest residues, which could otherwise be disposed in open dumps, the project activity also reduces adverse environmental effects, of local and global order, because the methane emissions originating from the natural decay of these biomasses in on-site places could be avoided. In spite of the fact that these emission reductions may occur once the renewable biomasses employed in the project are residues and this kind of solid waste disposal site is common in Brazil, they will not be considered in this project.

However, elephant grass, which is one possible biomass utilized in this project, is not considered a residue, since it would be cultivated in order to supply the ceramic fuel needs. Therefore, this specific renewable biomass would not be disposed in open dumps reducing adverse environmental effect because of the methane emissions originating from the natural decay.

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

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

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

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

The ceramic industry produces structural ceramic devices like roof tiles, which are mainly used in the construction sector. The *Kitambar* Ceramic uses eight "Round[5]" kilns, which are commonly utilized in Brazil to burn bricks and roof tiles.

Nowadays, with the project activity implemented in the ceramic, the average production is 1,050,000 of roof tiles per month and the biomass consumption is around 1,714 m³ per month. The purpose is to employ around 70% of *Algaroba* wood and 30% of cashew tree residues, considering that the use of coconut husk was presently interrupted (when using coconut husk, the percentages were around 65%, 25% and 10% of *Algaroba* wood, cashew tree pruning and coconut, respectively); however, these kinds of fuels can be replaced by other renewable biomasses.

Table 2. Scenario of *Kitambar* Ceramic

	Kitambar
Actual production (devices per month)	1,050,000
Algaroba wood consumption (m³/month)	1,210
Cashew tree wood consumption (m³/month)	504
Total Biomass Consumption (m³/month)	1,714

As renewable biomasses, *Kitambar* Ceramic utilizes *Algaroba* wood, cashew tree residues and sparsely, coconut husk. In case of lack of these kinds of biomasses, the project proponent can use forest residues, sugar cane bagasse or elephant grass. The ceramic has already utilized constantly coconut husk, nevertheless its use was interrupted due to the maintenance costs in the kilns as the coconut husks damage the interior of the kiln in the burning process.

Algaroba was introduced in the Northeast region of Brazil with the aim of providing food to animals and to be utilized for reforestation actions. However, currently, due to its competitive skills when compared with other local species, *Algaroba* spreads through several regions of Brazilian semi-arid areas[6]. Therefore, the availability of this kind of biomass is high in this region. Besides, Algaroba presents a considerable capacity of regeneration and dispersal[7], which means that the tree does not die, actually it sprouts again stead.

The Brazilian sources of residues from cashew trees will increase following the Brazilian production and demand, 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[8].

Sugar cane bagasse is generated by industries to produce alcohol. Each ton of sugar cane used for alcohol production generates around 140 Kg of sugar cane bagasse, which can be either compacted into briquettes or

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[5] *"Round" Kiln is a closed circular kiln, where the fuel is inserted through entrances along its perimeter.*

[6] *EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Avaliable at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Visited in: 14th December, 2008.*

[7] *EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Avaliable at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Visited in: 14th December, 2008.*

[8] *According with EMBRAPA(Brazilian Agricultural Research Corporation's). Available at: http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratosculturais.htm*

utilized in natura for thermal energy generation.[9] The forest residues (sawdust) are resulted from wood manufacturing, considering that around 22% of the wood produced will generate sawdust[10]. Eventually, the coconut husk is widely generated due to the utilization of the coconut fruit for diverse finalities[11].

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

The providers listed at the table below are only a few of those that work for the ceramic; nevertheless, it does not exclude the possibility of buying biomass from others.

Table 3. Main biomass providers

Biomass	Provider	Location
Algaroba wood	Leodório Pereira da Silva CPF: 021.721.516-91	Rua Sérgio de Souza Padilha, 73 – Centro. *Arco Verde - PE*
Cashew tree residues	Erivonaldo Alves CPF: 030.783.834-07	Rua do Sol, 150 – Centro. Barra de *Guabiraba - PE*
Coconut husk	Osmário de Lima	Rua São Fernando, 110 - Maurício Nassau. *Caruaru - PE*

Before the project activity, the process was noticeably different; the native wood was inserted in the kilns by the employee and it was not necessary any machine experience or logistic modification in order to attend the project's needs.

In the beginning of 2008, the project developer installed thermo couples, due to the lack of experience with the biomasses, aiming the temperature and burning control at the kilns. At the same period, molten iron grills were installed in all 6 entrances of each "Round" Kiln in order to sustain the burning biomasses and to intercept its incandescence fall, which used to accumulate on the floor. The biomasses are manually inserted on these grills by an operator.

Under the grills, machines to oxygenize the burning process were installed, therefore increasing its efficiency. Moreover, the biomasses suffer a better combustion consequently reducing the incandescence originated from the burning of the new fuels. This procedure resulted in a reduction of 95% of the ashes produced by the ceramic, contributing to preserve the employees' health and safety, who manually feed the kilns. The remaining ashes generated are incorporated to the clay and used in the kilns' door.

Beyond those technologies, the pavements of the kilns were reconstructed for better accommodation and distribution of the ceramic devices in the kiln.

As the complete fuel-switch occurred in December of 2006, the project start date is defined as the date when the ceramic has begun to use 100% of biomasses as fuel.

All of the adaptations that were required, as well as the new equipments purchase, were made counting on this project approval in order for the ceramic to become able to receive the biomass to be used. The following figures show some of the changes at the ceramic industry.

[9] *Source: <www.herbario.com.br/atual2005_4/cana_energia.htm>*

[10] *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.*

[11] *Source: <www.sbpcnet.org.br/livro/60ra/textos/SI-GoreteMacedo.pdf>.*

Figure 2. One of the eight "Round" kilns and the ***Algaroba* wood** employed as fuel

Figure 3. Coconut husks

Figure 4. Cashew tree wood

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

This project is in accordance to the CONAMA[12] Resolution, no. 237/97 that establishes that clay extraction activities and ceramic production must be supported by specific licenses, such as operational license, clay extraction license, environmental licenses and the permission of the Science, Technology and Environmental Secretary of *Pernambuco* (SECTMA[13]) 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[14]).

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

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

- Difficulty related to the common practice

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[12] 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.

[13] SECTMA is the Science, Technology and Environment Secretary in the State of Pernambuco, responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: www.sectma.pe.gov.br

[14] 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.

As affirmed before, the ceramic utilized native wood from deforestation areas in its kilns, activity maintained for sixteen years. The sudden change claimed a lot of effort to make the adaptation successfully. Furthermore, the employees' resistance to the new situation was another difficulty faced by the ceramic. Therefore, acquiring new equipments due to the fuel-switch represents a risk to the project developer since the original practice had shown good results for many years.

- Closing of the ceramic business
If the ceramic company closes, it may substantially affect the project's GHG emission reductions; however, there are currently good perspectives in the ceramic market and the organized administration, avoiding this possibility.

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

The fact that the ceramic has historically operated using wood without sustainable management as fuel, clearly confirms the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

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

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

This 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 standard.

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

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

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

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

Mr. *Antônio Marcos Tavares Barbosa*, 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, numbers on sales, how output data is handled, and how data is stored and kept by the *Kitambar*'s office.

Other information on the project's proponent:

Address: BR 232, Km 136, Distrito Industrial, Caruaru, PE – Postal Code: 55.000-000

Phone number: +55 (81) 3726-1668

Social Carbon Company: Project participant, project idealizer and responsible for contracting CantorCO2e Brasil to prepare the project report and accompany the proponent until the end of crediting period.

As the project Authorized contact, Social Carbon Company was given the responsibility of preparing the present project report and to accompany the proponent until the end of the crediting period. The assessors directly involved are:

Marcelo Hector Sabbagh Haddad, Technical Analyst: Project Design Document writer, elaboration of GHGs Emissions' Inventory, direct contact between CantorCO2e Brasil and the ceramic, and responsible for collecting the necessary information. Coordinated by:

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

Other information on the project's developer's contact:
Address:
R. Borges Lagoa, 1065 – Conj. 146 – Vila Clementino
Postal Code: 04038 032
São Paulo – SP, Brazil
Phone number: +55 11 5083 3252
Web site: http://www.cantorco2e.com
Email: mhaddad@cantorco2e.com.br
ftakeuchi@cantorco2e.com.br
rborgheresi@cantorco2e.com.br

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

The project is eligible according to:

- Legislative: the project attends all legal requirements;
- Technical: alterations/adaptations required are technically feasible;
- Economic: carbon credits will 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 disclosed to the validator was withheld from the public version of the report.

2 VCS Methodology:

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

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

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

There are no similar registered small-scale CDM project activities in the region of *Caruaru* once CantorCO2e Brasil made a research and did not find any registered small–scale CDM Project activity in the region. The sources of registered small-scale CDM project activity consulted were the United Nations Framework Convention on Climate Change (UNFCC)[15] and Brazilian´s Technology and Science Ministry[16]. 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 can not 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[17]. 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 de decade of 1970, when the petroleum started to supply the majority of Brazilian's energy needs[18]. 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[19]. Especially in the ceramic sector, the use of firewood is visible non-renewable and unsustainable, involving negative environmental impacts associated[20].

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[15] *CDM activities registered by CDM Executive board are Available at:< http://cdm.unfccc.int/Projects/registered.htm>l.*

[16] *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.*

[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 in: December, 12th 2008*

[18] *Brito, J.O."Energetic use of Wood". Available at: http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES*

[19] *National Energy Balance- energy consuption per sector. Available at: https://ben.epe.gov.br/BEN2007_Capitulo3.aspx*

[20] *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 in: December, 12th 2008*

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

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[21]. 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[22]. 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 assumptions below:

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

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

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

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

Currently, elephant grass has been acquiring national importance as biomass to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions[23]. The elephant grass is cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area.

The *Algaroba* wood *(Prosopis juliflora),* is considered renewable according to option IV: "The biomass is a biomass residue and the use of that biomass residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from".
The utilization of *Prosopis juliflora is in according with option IV since it is considered a biomass residue due its competitive characteristics.* A research made by EMBRAPA[24], which encompass the States of *Pernambuco* and *Bahia*, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts[25]. This source stated that there were several centers of *Algaroba* operation highlighting the *San Francisco* Basin, which is comprised for many municipalities from the states of *Bahia* and *Pernambuco*, including this project region.

The forest residues (sawdust), sugar cane bagasse and coconut husk are agro-industries residues, so they are considered renewable according to option V of methodology definition of renewable biomass: "The biomass is the non-fossil fraction of an industrial or municipal waste". As mentioned in section 4.1, sugar cane bagasse, coconut husk and forest residues are common residues in the region generated. Bagasse is generated by industries to produce alcohol. Each ton of sugar cane used for alcohol production generates around 140 Kg of sugar cane bagasse, which can be either compacted into briquettes or utilized in natural for thermal energy generation.[26] The forest residues are resulted from wood manufacturing. Eventually, the coconut husk is widely generated due to the utilization of the coconut fruit for diverse finalities.

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[21] *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*

[22]*Checked at: http://www.nordesterural.com.br/nordesterural/matLerdest.asp?newsId=2219*

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

[24] *EMBRAPA is the Brazilian Agricultural Research Corporation's which its mission is to provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer.*

[25] *Araujo, J. L. P., Correia, R. C., Araujo, E. P., Lima, P. C. F. Cadeia Produtiva da Algaroba no Pólo de Produção da Bacia do Submédio São Francisco. EMBRAPA. Petrolina -PE – Brazil.*

[26] *Source: <www.herbario.com.br/atual2005_4/cana_energia.htm>*

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 ceramic's kilns. This practice is responsible to discharge in the atmosphere the carbon that was stored inside of the wood (well-known by a carbon sink).

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

	Gas	Source	Included?	Justification/ Explanation
Baseline	CO2	Emission from the combustion of non- renewable fuel	Yes	The major source of emissions in the baseline
	CH4	-	No	Deforestation rates will probably decay Excluded for simplification. This is conservative.
	N20	-	No	Possibly emissions from wood burning will be excluded for simplification. This is conservative.
Project Activity	CO2	-	No	Excluded for simplification. This emission source is assumed to be very small.
	CH4	-	No	Excluded for simplification. This emission source is assumed to be very small.
	N20	-	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 5. Distribution of fuel employed on the ceramic sector in Brazil in percentage.

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

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

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[27] 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[28], the inconstant distribution of natural gas 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.

The calculations regarding the quantity of non-renewable wood required in the burning process were done according to the efficiency of the kilns on the production, which would require around 2.6 m³ or 2.28 tonnes of wood to produce 1,000 ceramic devices. Another way of confirming this value is through the efficiency of the kilns requiring around 109 m³ of wood from deforestation areas in each burning cycle. The “Round” kilns have efficiency between 1.5 to 2 m³ per thousand of pieces[29], therefore concluding that the kilns operated a little below the expected efficiency due to the lack of technology in the region and the indiscriminate use of the deforestation wood.

In the baseline scenario, according to historical experience, the ceramic utilized approximately 28,800 m³ of native wood per year from *Caatinga* biome in their 8 Round kilns to maintain the temperature of 920ºC for 50 hours producing around 11,100,000 ceramic devices per year.

In the absence of this project activity, the identified baseline scenario would be the consumption of around 32,700 m³ of non-renewable native wood per year to feed their kilns to sustain an annual production of 12,600,000 ceramic devices. This increase of production occurred chiefly to attend the market demand. If afterwards, the production in the ceramic rises, it will be reported in the monitoring report.

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[27] *According to data values and facts from “Estudo Comparativo da Queima de Óleo BPF e de Lenha em Caldeiras”. Comparation made between wood from eucaliptus and fuel oil. Available at: http://www.abcm.org.br/xi_creem/resumos/TE/CRE04-TE01.pdf*

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

[29] *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).*

Table 6. General description of *Kitambar* Ceramic

	Kitambar
Production at baseline (devices per year)	11,100,000
Non-renewable wood consumption at baseline (m^3 per year)	28,800
Actual production (devices per year)	12,600,000
Non-renewable wood consumption without the project activity (m^3 per year)	32,700

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

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

Furthermore, the project activity will annually generate less than 45 MWthermal.

Without the project activity, *Kitambar* Ceramic would consume around 28,800 m³ of native fire wood per year to feed its kilns to obtain an approximate temperature of 920ºC with a burning period of 50 hours, in order to produce 11,100,000 ceramic devices. After the beginning of 2008, the ceramic industry increased its production to 12,600,000 ceramic devices per year namely to attend the market demand, which means that the consumption of native wood would have a value around 32,700 m³.

The production during the baseline scenario could increase, since there is no lack of non-renewable wood offer. The high devastation rate of *Caatinga* Biome makes available large amounts of wood.

According to ASPAN[30], the major industries, mainly the steel, plasterer and ceramic industries are primarily responsible for the use of native firewood as fuel in their productions. Of a total of 895,000 km², currently it is remaining 50% of the local biome, even with 365,000 hectare of annual loss of all the biome[31].

Therefore, assuming that the deforestation rate maintains constant, the native wood would be enough to ensure the increase in Ceramics production for at least the next 15 years, which is over the project activity life-time.

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

Test 1 – The project test

Step 1: Regulatory Surplus

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

Step 2: Implementation Barriers

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

- **Technological Barrier**

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[30] Source: Association for the nature defense of Pernambuco. http://www.aspan.org.br/ Brazilian Institute of Environment and Renewable Natural Resources

[31] http://www.faunabrasil.com.br/sistema/modules/wfsection/article.php?articleid=47

As affirmed before, the use of wood from areas without sustainable forest management is a traditional and well-known process, and as a result of the sudden change, a lot of effort from each employee in the ceramic was necessary. The main technological barriers were the non-availability of human knowledge to operate and maintain the new technology, the internal logistic modification and the employee's resistance to the new technology.

Before the project activity, the process was noticeably different; native wood was inserted in the kilns by the employees and it was not necessary any machine experience or logistic modification in order to attend the project's needs, e.g. It is necessary to dry the cashew wood[32] when utilized as fuel since its phloem has to be removed from the wood before its burn. Otherwise the phloem from cashew wood may potentially obstruct the air flow inside the kiln. It requires a specific attention once the humidity degree of the biomass affects directly on the burning process. Thus, as soon as the biomass arrives at the ceramic, it passes through a logistic system until its insertion in the kiln.

The operators did not have knowledge of the ideal amount of renewable biomasses that was necessary to achieve the temperature of about 920ºC for its ceramic devices cooking, to acquire the final product with same quality and to maintain the optimal process as they did when using native wood. So, pyrometric systems (thermocouples) were installed aiming the temperature and burning control of the kilns, due to the lack of experience with the biomasses. As a consequence of this barrier, there were variations in the color of the final ceramic devices, affecting the quality of the products; cracks on the ceramic devices; the explosion of some of them and cracks along the kilns; adding a significant amount of insecurity to the production process.

In the beginning of 2008, molten iron grills were installed in all six "Round" kiln entrances to intercept the fall of the biomasses' incandescence, which used to accumulate on the floor. Under these grills, oxygenation machines were installed to improve the burning process; therefore the biomasses suffer a better combustion increasing the Kilns' efficiency. However, the employees had to get used with these technologies, as the way of inserting the biomass in the kilns changed.

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

Furthermore, there was a lack of infrastructure to utilize the new technology. The region of *Pernambuco* is well known for not being updated with new technologies in the Ceramic sector and very resistant to changes or improvements to its work process and general practices. Another arduous barrier faced by the project developer was the employees' resistance of the changes, who were very used to the traditional situation.

In addition, the utilization of coconut husk was interrupted due to the maintenance costs in the kilns as the coconut husks damage the interior of the kiln in the burning process. The technological difficulty in its burning limits its use. Thus, the utilization of coconut husk in order to generate thermal energy to cook the ceramic devices is sparsely done.

Moreover, the use of new biomasses represented a high risk to the project developer. Although there is currently a great amount of these types of biomasses available locally, it is possible the unavailability of the biomasses. It may happen because thermal energy generation through the combustion of biomasses is an innovation in ceramic industry and their future demand (e.g. by other consumers) is not easy to foresee.

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

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

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

- **Financial Barrier**

With the project implementation, the ceramic had to withstand more costs than if it had continued employing native wood from deforestation areas as fuel, namely in the form of payment for the biomass transportation, which includes driver, diesel, freight and costs with the truck maintenance. Furthermore, there is spending with electrical energy.

[32] Algaroba and native wood do not need to be dried.

New equipments were acquired as thermocouples, oxygenation machines and molten iron grills, adding an additional cost for the ceramic[33].

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

[33] These equipments were acquired however invoices are not available for the validation team and therefore these costs were not considered as initial investment in table 7. In similar ceramics, the investment per each kiln was around 700 BRL.

Table 7. Comparison between costs due to the fuel switch in the baseline scenario and the project activity scenario of *Kitambar* ceramic

Kitambar Ceramic				
Scenario	**Non renewable biomass**		**Renewable biomass**	
Variable Costs				
Production of ceramic devices	1,050,000	roof tiles per month	1,050,000	roof tiles per month
Biomass Cost per unit	11.00	BRL/m³	26.97	BRL/m³
Truck capacity	45	m³ per truck	49.3	m³ per truck
Number of trucks	61		35	trucks/month
Biomass Cost	30,195.00	BRL	46,531.56	BRL
Costs with freight	149.98	Freight(BRL/truck)	368.69	Freight(BRL/truck)
Costs with transportation	9,148.54	BRL per month	12,904.19	BRL per month
Costs of electrical energy with the equipments acquired	---------	BRL per month	518.18	BRL per month
Total Variable Costs	**39,494**	**BRL per month**	**60,323**	**BRL per month**
Total Variable Costs per unit of ceramic device	**0.04**	**BRL per unit**	**0.06**	**BRL per unit**
Investment				
Costs of the oxygenation machines and the molten iron grills	---------	BRL	12,000	BRL
Total Invested	**-**	**BRL**	**12,000**	**BRL**

With the project activity's implementation, the total expenditure has increased (0.02 BRL per unit produced), as can be verified in the table above. The income from the commercialization of the carbon credits is essential to maintain the fuel switch, as this change needs more resources than previously to maintain operations. This disparity obviously puts the ceramic in a less competitive situation, which would make the fuel switching and the continued use of the needed machinery unfeasible without the existence of the carbon markets.

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

Since the use of native wood without sustainable management is an established and well-known process, the project activity implementation represents a risk to the project developer because the use of a new biomass and its machines adds a significant amount of insecurity to the production process. This change an extensive period of fiscal vulnerability for the ceramic, since during the reconstruction of the kilns, the ceramic production was low. In addition, there is the transition period, where the ceramic lost production due to the adaptation to the use of biomasses and to the new machineries.

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

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

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

The combustion of coconut husk, cashew tree residues and *Alagaroba* to generate thermal energy is an innovation in the ceramic industry. The future demand of this alternative fuel (e.g. by other consumers) is not predictable. Although there is currently a great amount of these biomasses available, there is a possibility that the prices will increase, when the problem with biomasses disposal be attenuated.

Kitambar ceramic is facing some difficulties in obtaining the renewable biomasses, which are becoming harder to find. The ceramic needs to get them from others cities of the state of *Pernambuco*, and also from states that border the state of *Pernambuco*. Furthermore, the cost of these biomasses has also increased. An example is the case of the *Algaroba* wood, which sometimes is obtained around 700 Km far from the ceramic, and is 20% more expensive than the native wood from deforestation areas. On the other hand, the wood from deforestation providers have been trying to lure the ceramic company to return to using this fuel, which is economically attractive and is obtained near to the ceramic.

Even if the price of the biomass increases, the ceramic can not repass it, once it would not have competitive prices in relation to other ceramics which did not made the fuel switch. These circumstances make the commercialization of the carbon credits essential to the maintenance of the fuel switch.

Step 3: Common practice

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

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

The product of the project activity is ceramic roof tiles.

2. Identify possible types of baseline candidates.

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

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

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

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

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[34]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 Kitambar 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 [35]; ALBUQUERQUE et al, 2006[36]; BRASIL, 2001[37]; VIANA, 2006[38]; CARDOSO, 2008[39]). This have also been

[34] *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.*

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

[36] *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.*

[37] *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 /*

observed in other industries as in the production of steel (BRASIL, 2005[40]), 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.

5. Identify a final list of baseline candidates.

Table 8 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[41].

b) Natural gas: it is restricted by the absence of pipes, its high costs[42] and lack of availability[43]. 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[44] was offering subsidy to the consumption of fuel oil in spite of natural gas in the State of São Paulo.

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 to generate thermal energy technologies[45]. 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[46].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

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Agalmatolito e Vermiculita. Brasília, 2001. Available at: < http://www.cgee.org.br/prospeccao/doc_arq/prod/registro/pdf/regdoc710.pdf>. Access at: September 10th, 2008.

[38] *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 at: September 10th, 2008.*

[39] *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.*

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

[41] *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.*

[42] *Source: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>.*

[43] *Source: <http://www.gasnet.com.br/novo_entrevistas.asp?cod=145>.*

[44] *PETROBRÁS performs in oil and oil byproduct exploration, production, refining, marketing, and transportation, both in Brazil and abroad. More information available in: <http://www2.petrobras.com.br/ingles/ads/ads_Petrobras.html>.*

[45] *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 in: November, 20th 2008*

[46] *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.*

environmental impacts, with regard to the degradation of soil, change in the regime of rainfall and consequent desertification[47].

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[48].

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 developer 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 920ºC 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 machinery in order to sustain the quality of the final product.

Thus, the project activity is not a common practice.

Impact of project's approval

Presently, the ceramic industrial segment of the state of *Pernambuco* is comprised mostly of small industrial units that still use varying technological models, the grand majority using native wood without sustainable management as fuel. These industries have some technological restrictions such as the energy exploitation and the efficiency of the machinery, so the project approval can improve the development of this sector.

Brazil is the third major contributor[49] to the carbon dioxide emissions in the year of 2003, due mainly to deforestation. Contemporary studies generally place Brazil fourth in the ranking of the countries that emit the most GHGs.

Renewable sources are relatively less prejudicial to the environment, in terms of local emissions (particle material, sulphur and lead) and greenhouse gases. Furthermore, GHGs emissions will also be reduced by avoiding the anaerobic decay of mainly cashew tree residues.

The use of wood from deforestation brings forward serious environmental problems such as global warming, the loss of biodiversity, alterations on the hydrological cycle and in the soil quality. These are huge environmental impacts, which this project indirectly intends to reduce.

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

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

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[47] *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 in: December, 12th 2008*

[48] *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://teses.eps.ufsc.br/defesa/pdf/4217.pdf>. Visited in: November, 20th 2008.*

[49] *Source: Goldemberg & Moreira. Política Energética no Brasil. Estudos Avançados 19 (55), 2005. Available in: <http://www.scielo.br/pdf/ea/v19n55/14.pdf> Access at: December, 14th 2008..*

3 Monitoring:

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

The methodology applied is Category AMS-I.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 *Kitambar* ceramic. This section will focus on information management related to production.

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

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

The monitoring will be done with the aim of determining the most approximate quantity of wood without sustainable management that, in the absence of the project, would be used in the ceramic's kilns and consequently the amount of GHG that would be emitted in tons of CO2e.

Table 9. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
Qrenbiomass	Amount of renewable biomass	Tons	Measured by the project developer	Monthly
Origin of renewable biomass.	Renewable origin of the biomass	Not applicable	Controlled by the project developer	Anually
PRy	Production of ceramic pieces	Units	Controlled by the project developer.	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tons or m^3	Monitored by articles and database.	Annually
Leakage of Non-Renewable Biomass	Leakage resulted from the non-renewable biomasses	tCO2e	Monitored by articles and database.	Annually
EFprojected fossil fuel	CO_2 Emission factor of residual fuel oil	tCO2/TJ	IPCC 2006 Guidelines for National Greenhouse Gas Inventories . Source: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf. Page 2.18. Table 2.3.	Not monitored
NCVbiomass	Net Calorific Value of non renewable biomass	TJ/Ton of Wood	Bibliography	Not monitored
ρ wood	Specific gravity of non renewable biomass	ton/ m^3	Bibliography	Not monitored
***f*NRB,y**	Fraction of biomass (wood) used in the absence	Percentage	Data from project developer and survey	Annualy

	of the project activity in year y can be established as non renewable biomass using survey methods		methods	
BFy	Consumption of non renewable biomass per thousand of ceramic devices produced	tons/ thousand of ceramic devices	Data from project developer	Function of PRy

In the monitoring plan, the amount of non-renewable biomass (**B**$_y$) will be determined using the option 'b' of the applied methodology, i.e. it will be calculated from the thermal energy generated in the project activity as:

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

As stated before, the ceramic utilized around 2,112 tons of native wood per month producing 925,000 ceramic devices. This information leads to the number of around 2.28 tons of native wood to produce a thousand of ceramic devices. In addition, it was informed by *Kitambar* Ceramic that the kiln capacity of production is 42,000 ceramic devices per burning cycle in each "Round" kiln, leading to the number of 22 burning cycles per month or around 2.75 burning cycles per kiln per month. Therefore, the burning efficiency with wood is permanently 95.45 tons per burning cycle.

Nowadays, with a production of around 1,050,000 ceramic devices per month, the ceramic has also increased the number of burning cycles per month. There are 25 burning cycles per month or around 3.125 burning cycles per kiln per month. The quantity of burning cycles will be monitored by the ceramic's monthly production.

The quantity of native wood that would be used in the ceramics will be calculated through the multiplication of the ceramic's monthly production by the efficiency of the kiln, as the following example:

By = (Monthly production / 1000) x Kiln efficiency (BFy)

By = 1,050 x 2.28 tons of wood/thousand pieces

By = 2,394 tons of native wood/month = 28,728 tons of native wood/year

The responsible to monitor data provided in table 9 will be Mr. Antônio Marcos Tavares Barbosa. 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:

<u>Monitored Parameters</u>

Data / Parameter:	**Q renbiomass**
Data unit:	Tons
Description:	Amount of renewable biomasses
Source of data to be used:	Measured by the project developer
Value of data	1,223
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 are described in m³, therefore it is necessary the conversion to tons through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project are: Biomass / *Algaroba* wood / Wood from cashew tree / Coconut husk Specific gravity (tonnes/m3): 0.836 / 0.42 / 0.5 The sources of these data are: *Algaroba* wood: -PEREIRA, J. C. D.; LIMA, P. C. F. **Comparação da Qualidade da Madeira de seis Espécies de Algarobeira para a Produção de Energia.** Colombo: Embrapa Florestas, 2002. p. 99-107. Available at:

	<http://www.cnpf.embrapa.br/publica/boletim/boletarqv/bolet45/pag-99_106.pdf>. Checked at 31/07/2008- Wood from cashew tree: -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.- Coconut husk: -PINHEIRO, G. F.; RENDEIRO, G.; PINHO J. T. **Densidade Energética de Resíduos Vegetais.** 2006. Available at: <www.ufpa.br/gedae/BIOMASSAEENERGIA2006.pdf>. Checked at: 31/07/2008.
QA/QC procedures to be applied:	Amount of biomass will be checked according to the receipts of purchase. The energy balance will be verified according to the amount of biomass applied.
Any comment:	1,223 tonnes = 1,714 m³ (please see table 2)

Data / Parameter:	**Pry**
Data unit:	Unity of ceramic pieces
Description:	Production of ceramic devices
Source of data to be used:	Controlled by the project developer.
Value of data	1,050,000 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 developer, which will be fed daily. The production is a representative sample to ensure that all appliances are still in operation
QA/QC procedures to be applied:	As the ceramic must have an internal control of the production and sale at the end of every month, the PRy value cannot be manipulated.
Any comment:	

Data / Parameter:	**Leakage of non-renewable biomass.**
Data unit:	tCO_2e
Description:	Leakage resulted from the non-renewable biomass
Source of data to be used:	Monitored
Value of data	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 industry 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.

Data / Parameter:	**Renewable biomass surplus**
Data unit:	ton or m³
Description:	Amount of renewable biomass available
Source of data to be used:	Monitored
Value of data	(see table below)

Harvest	**06/07**	**07/08**
Algaroba wood		2,500,000
Sugar Cane Bagasse (in tonnes)	2,141,118	2,454,977
Forest Residues (sawdust) in m³		319,891.88
Coconut Husk (Tonnes per year)		6,700,000
Residues from cashew trees (Tonnes pre year)		196,625
Elephant Grass		Not measured

	Detailed information in section 4.1 – LEAKAGE.
Description of measurement methods and procedures to be applied:	It will be used to calculate the leakage of renewable biomass. The sources of leakages predicted in methodology applied will be monitored. The measurement of the leakage will be based in national and internal articles and 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:	**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:	This information will be given by the biomasses providers. 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 (Algaroba wood, Coconut husk, Elephant grass, Sawdust and Sugar Cane bagasse) are considered renewable as fulfilling the options described in the methodology applied.
QA/QC procedures to be applied:	The biomass will be considered as renewable if it is according to the definition given by the applied methodology.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$f_{NRB,y}$
Data unit:	Percentage
Description:	Fraction of biomass (wood) used in the absence of the project activity in year y can be established as non renewable biomass using survey methods
Source of data used:	Survey methods.
Value of applied:	99.7%
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 0.3% of Caatinga biome has sustainable forest management plan, the fraction of non-renewable biomass is 99.7%. Source: http://www.cnip.org.br/planos_manejo.html
Any comment:	It will be employed in order to estimate the amount of non renewable biomass. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

<u>Fixed Parameters</u>

Data / Parameter:	**NCV non-renewable wood**
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 in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf - Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir . Available in:http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf
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 wood**
Data unit:	ton/ m3
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/m³. 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 in: http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf - Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Available in: http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf -http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&ca racteristica=139
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:	**EFprojected_fossil fuel**
Data unit:	tCO2/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.
Value applied:	77.4 tCO2/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:	**BFy**
Data unit:	ton of wood per thousand of devices
Description:	Consumption of non-renewable biomass per thousand of ceramic devices produced per year
Source of data used:	Historical data from project developer
Value of data	2.28
Justification of the choice of data or	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramic used to consume non sustainable wood. This

description of measurement methods and procedures actually applied :	value is in accordance with the data acquired in other ceramics that employ the same type of kilns. The value is employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
Any comment:	

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan shall be the owner of the company. 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 authority for the registration, monitoring, measurements and reporting is Mr. Antônio Marcos Tavares Barbosa. All the monitored parameters will be checked annually as requested in the methodology AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User – Version 01 from February 01 of 2008 onwards.

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

With the carbon credits income, in order to complement the monitoring of the production of ceramic devices, equipments from Alutal will monitor each burning cycle of the 8 kilns through graphics of the temperature reached in the kiln versus time.

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

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 01 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

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

Where:

ER_y: Emission reductions during the year y in tCO_2e

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

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

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

$EF_{projected\ fossil\ fuel}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO_2e/TJ[50].

B_y is determined using the following option:

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

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

Where:

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

η_{old} : Efficiency of the system being replaced

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

Where:

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

PR_y: Amount of product produced in year y in thousand of ceramic devices

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

Where:

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

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

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

Where:

BF_y: Amount of native firewood needed to produce a certain amount of product in tonnes/thousand of ceramic devices

Using the Equations 3, 4 and 5 in the Equation 1, it results to:

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

As shown in the calculations above, the ηold and the NCV biomass are not required to calculate the Emission Reductions, thus they were excluded.

Leakage (LE)

The methodology I.E (version 01) 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 below).

Table 10. Sources of leakage according to the type of the biomass

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

Observing the table above, the source of leakage of the present project is the competing use of *Algaroba* wood and cashew tree pruning. Although the *Algaroba* wood has been obtained from *Caruaru*'s region and from states that border the state of *Pernambuco*, this kind of biomass is plenty available in the region. Both cashew and coconut trees are typical fruit trees in the northeast region of the country. Therefore, the project activity will not disturb in any aspects these renewable fuel markets once there is plenty of this kind of biomasses available. The source of leakage of the present project is showed below according to each type of biomass:

Algaroba wood

According to Silva (2007)[51], *Algaroba*[52] (*Prosopis juliflora* (Sw.) D.C.) is a tropical tree legume fairly common in the semi-arid region of Brazil, which thrives in dry environments where other plants would hardly survive.

At the beginning of 40's, this specie was introduced in the Northeast region of Brazil with the aim of providing food to animals and to be utilized for reforestation actions. However, currently, due to its competitive skills, *Algaroba* spreads through several regions of Brazilian semi-arid areas[53].

A research made by EMBRAPA[54], which encompass the States of *Pernambuco* and *Bahia*, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts[55]. This source stated that there were several centers of *Algaroba* operation highlighting the *San Francisco* Basin, which is comprised for many municipalities from the states of *Bahia* and *Pernambuco*, including this project

[51] Silva, C. G. M, Melo Filho, A. B., Pires, E. F., Stamford M. Physicochemical and microbiological characterization of mesquite flour (Prosopis juliflora (Sw.) DC). Ciênc. Tecnol. Aliment., Campinas, 27(4): 733-736, out.-dez. 2007.

[52] Algaroba may also be known as mesquite

[53] EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Avaliable at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Visited in: 14th December, 2008.

[54] EMBRAPA is the Brazilian Agricultural Research Corporation's which its mission is to provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer.

[55] Araujo, J. L. P., Correia, R. C., Araujo, E. P., Lima, P. C. F. Cadeia Produtiva da Algaroba no Pólo de Produção da Bacia do Submédio São Francisco. EMBRAPA. Petrolina -PE – Brazil.

region. Besides, Algaroba presents a considerable capacity of regeneration and dispersal[56], which means that the plant does not die, it sprouts again stead.

The research's author reported that wood from *Algaroba* exploration on *San Francisco* Basin is mainly commercialized as fuel for industries of vegetable oil, leather, ceramic and bakeries. On the other hand, *Algaroba* wood is not sold for stake[57], pegs and poles uses.

The factors which contribute most to the expansion of *Algaroba* uses, as firewood in these industries sectors, were its wide availability in the region and its legal release extraction from IBAMA[58].

Furthermore, this research showed that *Algaroba* is not used as a unique source of fuel for thermal energy generation in these industries sectors, e.g. corresponding only for 30% of the fuel's source in bakeries of the region studied.

The same research estimated that in the Northeast semi-arid region there were about 500 hundreds hectares spread through every type of its region land. Moreover, according to EMBRAPA (1992) [59], wood's production by *Algaroba* is at least 5 m³/ha/year, i.e. the production in the project's region is about 2,500 thousands of m³ per year, what represents less than 0.01% the total of *Algaroba* used by *Kitambar* Ceramic per year[60]

Therefore, this kind of fuel does not encompass any type of leakage since there is current a great amount of these renewable biomasses available locally as described before.

Cashew tree wood

Since *Kitambar* 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[61]. The Brazilian production achieved 143,000 tons of cashew-nuts in 2005 spread in an area of 650,000 Hectares[68]. 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[62]. 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[63]. 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.
According to "Plantio do Caju" cashew trees cultivation presents a density of 121 units of trees per hectare[64], and the production of firewood residues from each tree is 2.5 kg per year[65]. The cultivation of cashew is located in an

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[56] *EMBRAPA, Projeto vai definir manejo para evitar invasão da Algaroba no ambiente semi-árido. Avaliable at: <http://www.embrapa.gov.br/imprensa/noticias/2002/agosto/bn.2004-11-25.4648301041/>. Visited in: 14th December, 2008.*

[57] *Heavy pole to which cattle is tied.*

[58] *IBAMA (Brazilian Institute for Environment and the Renewable Natural Resource) is the environmental agency of Brazil affiliated with Ministry of Environment. The main missions of IBAMA are: Environmental Protection, Environmental Licensing, Environmental Quality and Sustainable Use of Forest Management and Animal Resources. More information about IBAMA is available at: <www.ibama.gov.br >.*

[59] *EMBRAPA, Comunicado Técnico Nº, Nov/92, p.1-2. Available at: <http://www.cpatsa.embrapa.br/public_eletronica/downloads/COT51.pdf>. Visited in: 14th December, 2008.*

[60] *Kitambar Ceramic consumes approximately 21,200 m³ of Algaroba wood per year.*

[61] *According with EMBRAPA (Brazilian Agricultural Research Corporation's) Available at :http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/index.htm*

[62]*Checked at: http://www.nordesterural.com.br/nordesterural/matLerdest.asp?newsId=2219*

[63] *According with EMBRAPA(Brazilian Agricultural Research Corporation's). Available at: http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratosculturais.htm*

[64]*According with "Resposta Técnica" from CETEC (Technologic Center of Minas Gerais) considering a space of 10 meters from each tree. Available at: http://sbrtv1.ibict.br/upload/sbrt4555.pdf?PHPSESSID=76a9111889defa6787039ca56b380c58*

area of 650,000 hectares[68]. This way, the Brazilian production of residues from cashew trees is around 196,625 tons per year. Therefore, the *Kitambar´*s consumption of residues from cashew trees (7,600 tons per year) represents around 3.8 % of the total production of residues from cashew trees. Thus, the amount of residues from cashew trees necessary to provide thermal energy in *Kitambar´*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[66] to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions; it also dismisses the use of fertilizers (NPK)[67]. In case of employing this kind of biomass, the project developer 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.

Sugar Cane Bagasse

Sugar Cane Bagasse is another probable biomass to be utilized in the project activity in case of lack or non availability of the biomasses utilized in this project activity. A study made by *Universidade Estadual de Campinas* and *Universidade de São Paulo* (two of the most respected universities in Brazil) showed that in Brazil there are around three hundred sugar cane plants. Each plant produces around 1.5 million tons of cane yearly[68]. One ton of sugar cane produces about 140 kilograms of cane bagasse and finally 90% of this amount can be used to energy production.[69]

According to the table 11, the state of *Pernambuco* presents a great amount of cane bagasse, i.e. the ceramic has enough availability of this kind of biomass, what avoid the possibility of leakage generation in case of the sugar cane utilization as fuel source. In case *Kitambar* ceramic starts utilizing this type of biomass, it would be consumed around 4,800 tons per year, representing 0.2% of the total production of sugar cane bagasse.

Table 11. Production of Sugar Cane in the State of Pernambuco. Text adapted from : http://www.unica.com.br/downloads/estatisticas/processcanabrasil.xls

Harvest	04/05	05/06	06/07	07/08
Production of Sugar Cane (in tonnes)	16,684,867	13,858,319	15,293,700	17,535,548
Sugar Cane Bagasse (in tonnes)	2,335,881	1,940,165	2,141,118	2,454,977

Sugar cane bagasse is also employed for cogeneration systems. However figure 7 presents the excess of energy in Brazil from sugar cane bagasse. Please observe that the State of *Pernambuco* presents a large surplus of this biomass.

[65] *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*

[66] *Source: <www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>*

[67] *Source: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>*

[68] Triangulo Mineiro.com - Universidades unem pesquisas sobre biomassa da cana. Avaliable at: <http://www.triangulomineiro.com/noticia.aspx?catNot=59&id=3097&nomeCatNot=Ci%C3%AAncia> . Visited in:12th December, 2008.

[69] Source: <www.cgee.org.br/arquivos/estudo003_02.pdf>

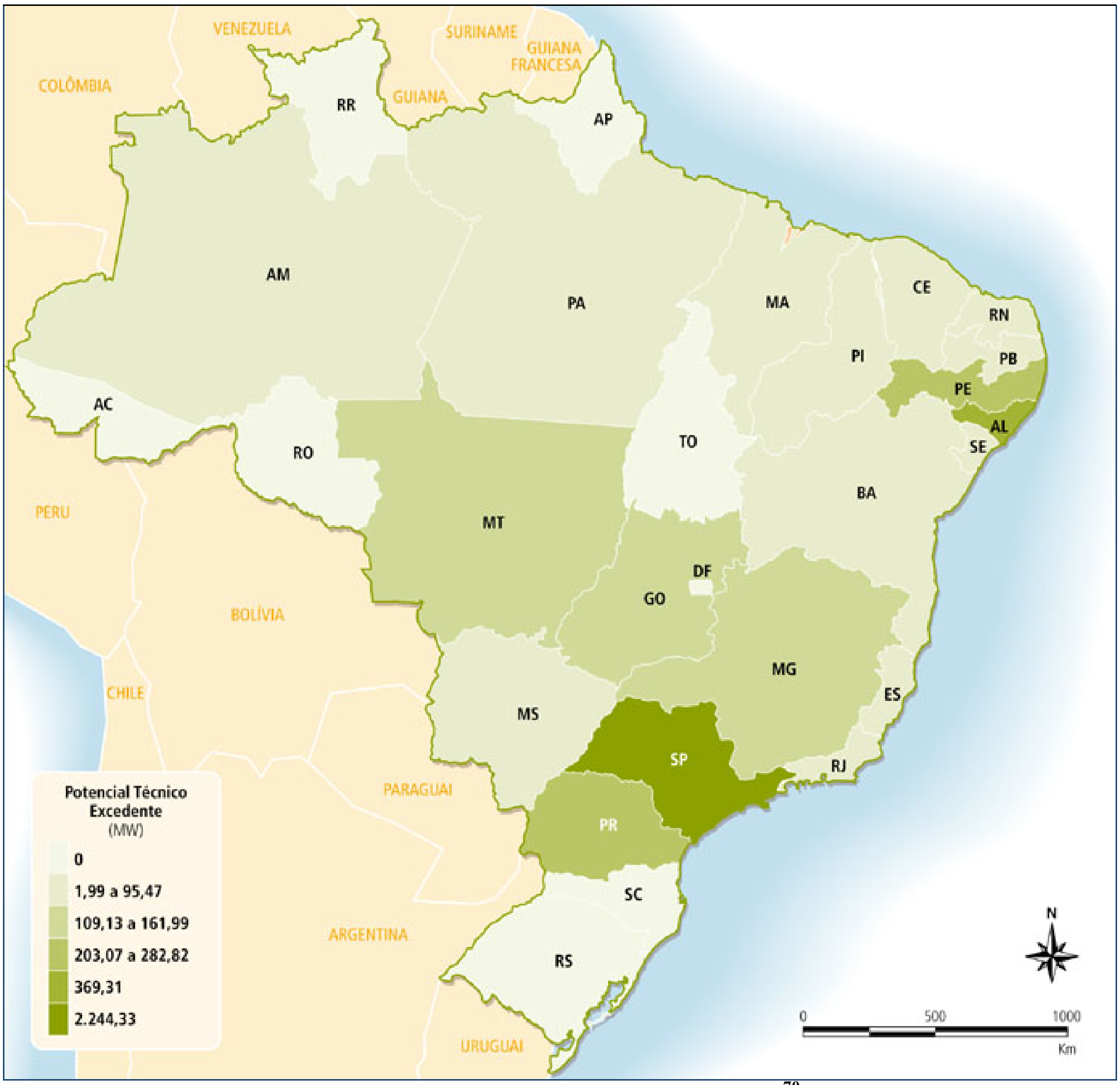

Figure 5. Sugar Cane Residue Potential for Energy Generation[70]

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, considering that around 22% of the wood produced will generate sawdust[71]. The production of wood in the state of *Pernambuco* was of 1,454,054 m3[72] in 2007. Thus, the production of sawdust is around 319,891.88 m3 per year. Comparing with other ceramic that has the same type of kiln and production capacity[73], *Kitambar* ceramic would utilize 18,000 m3 per year, i.e. the ceramic would utilize less than 6 % of the biomass availability in the state of *Pernambuco*.

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

Coconut Husk

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

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

[71] *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.*

[72] *According to IBGE(Geographic and Statistic Brazilian Institute) available at: http://www.ibge.gov.br/estadosat/temas.php?sigla=pe&tema=extracaovegetal2007*

[73] *According to Guaraí ceramic – Itaboraí - RJ*

of coastal cities[74]. This way, *Kitambar* ceramic utilizes just 0,025% of coconut husk availability[75]. 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.

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 could 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 in *Kitambar* Ceramic will not cause the type of leakage described in item B, CantorCO2e Brasil made a research about the ceramics industries in the state of *Pernambuco*, and the result was that there are around 150 ceramic facilities in the state, nevertheless around 90% use native wood without sustainable management[76]. Therefore, it can be concluded that the wood which was avoided by the present project activity is not being used by other ceramists.

In spite of the fact that the ceramic industries do not represent the main share of wood consumption, the project activity contributes to wood conservation since it will switch the use of wood to renewable biomass. The implementation of this project in *Kitambar* Ceramic is breaking the culture of wood burning in the state of *Pernambuco* and consequently, several ceramics are becoming interested in implementing this project, given them the possibility of receiving incomes derived from the sale of carbon credits. The possibility of spreading the use of renewable biomass to other ceramics presents huge possibilities for sustainable development in the region.

The project activity will not displace the use of renewable biomass of a non-project user, due to the likely decrease in the use of non renewable biomass in the region.

With the implementation of the project activity, the ceramic will avoid the consumption of about 32,700 m³ per year of non-renewable wood helping the conservation of forests in *Caatinga* biome, besides the ecological and social benefits to the region.

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

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

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

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

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

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

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[74] *Source: <www.sbpcnet.org.br/livro/60ra/textos/SI-GoreteMacedo.pdf>.*

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

[76] *Programa de Apoio à Competitividade das Micro e Pequenas Indústrias (PROCOMPI) – Tecnologia Cerâmica. SENAI (PE), 2008.*

Year of 2008

$$ER_y = B_y \text{ x } f_{NRB,y} \text{ x } NCV_{biomass} \text{ x } EF_{projected\_fossil\ fuel}$$

By,total = 12,600 thousand of ceramic devices per year x 2.28 ton of wood/thousand of ceramic devices = **28, 728 tons of wood**

ERy, total = 28,728 tons of wood x 99.7% x 0.019 TJ/ton x 77.4 tCO2/TJ = 42,120 tCO2

By, total considers all the non-renewable 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 12. Emission reductions without considering the project emissions and leakage

Year	Emission Reductions (tons of CO2e)
2007	37,115
2008	42,120
2009	42,120
2010	42,120
2011	42,120
2012	42,120
2013	42,120
2014	42,120
2015	42,120
2016	42,120
Total Emission Reductions (ton of CO2e)	417,800
Number of years of the crediting period	10
Annual average of estimated emission reductions for the 10 years of crediting period (ton of CO2e)	41,780

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 (tCO2e)	Estimation of project activity emissions (tCO2e)	Estimation of leakage (tCO2e)	Estimation of overall emission reductions (tons of CO2e)
2007	38,720	0	0	38,720
2008	42,120	0	0	42,120
2009	42,120	0	0	42,120
2010	42,120	0	0	42,120
2011	42,120	0	0	42,120
2012	42,120	0	0	42,120
2013	42,120	0	0	42,120
2014	42,120	0	0	42,120
2015	42,120	0	0	42,120
2016	42,120	0	0	42,120
Total	417,800	0	0	417,800

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 CO2, as well as when using wood. However, the emission reductions of GEE 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 Factor	***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*
Economic-social	*Improvement of the competitiveness*	*Positive*
Economic-social	*Increment of job opportunities in the region*	*Positive*

Summary of the environmental impacts.

Environmental Laws related to the plant activities

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

An EIA was not required due to the project activity.

6 Stakeholders Comments

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

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

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

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

For example, the letter received from the Centro Cerâmico do Brasil (Brazilian Ceramic Center), which is a non-profit organization accredited by INMETRO for Quality Management System (ISO 90001:2000) and Products. This institution also has a Technological Innovation Center specialized in Ceramic, and therefore a large experience and knowledge in this type of industries. CCB sent a letter supporting the Voluntary Carbon Project in the Red Ceramic Sector, which in their judgment is a very important action to the Civil Construction in Brazil, due to environmental and social benefits as well as quality improvement in their products.

7 Schedule:

- Project start date: December of 2006. As the complete fuel-switch occurred by the end of December of 2006, the crediting period start date was defined as the date when the ceramic has begun to use 100% of biomasses as fuel.
- Date of initiating project activity: 01/01/2007;
- Validation Report predicted to 19/11/2008;
- 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;
- Date of terminating the project: 31/12/2016.

After the project start date, the ceramic owner made adaptations due to the use of new biomass and its technology encompassing, for example, tests using the new biomasses, the ideal mix of renewable biomasses (different percentages of each biomass) and technological adaptations such as the installation of molten iron grills in all six "Round" kiln entrances.

8 Ownership:

8.1 Proof of Title:

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