Voluntary Carbon Standard
Rio Negro Ceramic Fuel Switching Project Description

19 November 2007

Date of the VCS PD: February 02nd, 2011

Contents

1 Description of Project:

1.1 Project title

Rio Negro Ceramic Fuel Switching Project

Version 03

VCS PD completed on February 02nd, 2011.

1.2 Type/Category of the project

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

- **Category AMS-I.E: Switch from non – renewable biomass for thermal applications by the user – Version 02** - Valid from April 09th, 2010 to September 30th, 2010.
- This 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 CO_2 equivalent and less than 1,000,000 tons of CO_2 equivalent, thus classifying as a “project” under the VCS 2007.1 size groups (micro project, project, mega project).

Table 1. Emission reductions estimate during the crediting period

Voluntary Carbon Units generated due to avoiding non-renewable combustion	
Year	**Emission Reductions (tCO_2e)**
March 1st to December 31st - 2009	17,444
2010	20,932
2011	20,932
2012	20,932
2013	20,932
2014	20,932
2015	20,932
2016	20,932
2017	20,932
2018	20,932
January 1st to February 28th - 2019	3,488
Total	**209,320**
Average	**20,932**

1.4 A brief description of the project:

Rio Negro Ceramic is a small industry that produces ceramic units such as bricks and tiles, mainly for market in *Manaus*, State of *Amazonas*, Brazil. In the past years the fuel used to fire the ceramic units was non-renewable biomass – native wood without forest management plan obtained from the Amazon rainforest, which led to the deforestation of this biome.

Figure 1. *Rio Negro* Ceramic

The Amazonian Biome has greatly diversified fauna and flora and spreads over 60% of all Brazilian territory. Nowadays, the uncontrolled deforestation is breaking up the firm land forest. Without necessary care, entire regions with local fauna and old habitats of species are under a risk of completely destruction[1].

The fuel switch project will reduce the greenhouse gases (GHG) emissions, through substitution of non-renewable biomass for wood residues from the Industrial cluster of *Manaus*, from construction sector, and from furniture and wood-processing industries as well as sawdust and wood chips made of these residues. Other renewable biomasses in the region are bamboo, elephant grass, and other regional fruit residues, for example, *açaí* for thermal energy generation.

This fuel switch could only be feasible when considering the carbon credits revenues, as the adaptation of kilns to burn renewable biomass and purchase of new equipments required considerable investments and faced other technology barriers.

The main goal of this project activity is to minimize negative impacts of deforestation of the Amazonian biome by discouraging the exploitation of the area.

As opposed to the identified baseline, the project activity will generate thermal energy without stimulating deforestation and will use abundant renewable biomass.

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[1] *Margulis S. Causas do Desmatamento da Amazônia Brasileira. BANCO MUNDIAL. Brasil Julho 2003. Available at: <http://siteresources.worldbank.org/BRAZILINPOREXTN/Resources/3817166-1185895645304/4044168-1185895685298/010CausasDesmatamentoAmazoniaBrasileira.pdf>. Visited on June 13th, 2010.*

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

The ceramic facility is located in Brazil, in the state of *Amazonas*, in the north region of the country. The geographic location is illustrated in the Figure 2.

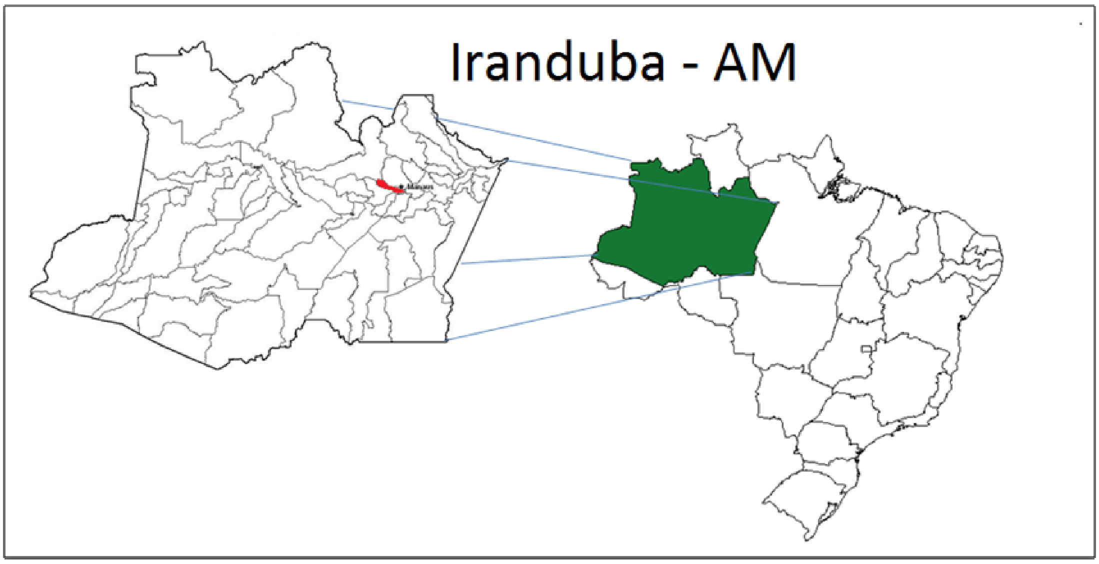

Figure 2. Geographic location of *Iranduba* Municipality which has the following coordinates: 3°17’6”S, 60°11’9” W

The project site has the following geographic location and postal address:

Table 2. *Rio Negro* Ceramic

Company name	*Cerâmica Rio Negro Ltda*
Address	*Estrada do Brito, s/nº, Zona rural - Cacau Pirera*
ZIP code	69405-000

Table 3. *Rio Negro* Ceramic coordinates

Ceramic facility coordinates	P1	P2	P3	P4	P5	P6
Latitude	3° 10' 12.71''	3° 10' 14.52''	3° 10' 16.68''	3° 10' 17.76''	3° 10' 18.11''	3° 10' 17.39''
Longitude	60° 4' 57''	60° 5' 0.23''	60° 4' 59.16''	60° 4' 57.72''	60° 4' 57.35''	60° 4' 54.11''

1.6 Duration of the project activity/crediting period:

- Project start date[2]: February 23rd, 2009
- Crediting Period Start Date[3]: March 1st, 2009.

[2] *Date on which the project began reducing or removing GHG emissions, i.e. date of the first date of purchase of renewable biomass.*

- Date of terminating the project[4]: February 28th, 2019.
- VCS project crediting period: 10 years, twice renewable.

1.7 Conditions prior to project initiation:

The conditions prior to project activity are the production through inefficient and traditional processes, using wood without forest management to generate thermal energy.

The use of non-renewable biomass from areas without reforestation activities is a common practice in the ceramic industry. Although firewood has been used for many decades as a fuel in Brazil, it is impossible to define a start date on which this kind of non-renewable biomass began to be applied. Firewood used to be the most employed source of primary energy until 1970's, when the petroleum started to supply the majority of Brazilian´s energy needs[5]. Moreover, the Brazilian Energy and Mine Ministry has been monitoring every energy sector of Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector[6].

According to *Seye* (2003)[7], red ceramic units are produced through an inefficient and traditional process using wood without forest management to generate thermal energy in Brazil. It happens because wood without forest management is widely offered at low prices.

The baseline identified for this project activity is the utilization of a total of approximately 30,218 m^3 of non-renewable biomass per year on average to provide thermal energy to the ceramic's kilns. On the other hand, the project activity focuses on the use of wood residues as renewable biomass for thermal energy supply.

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 sourcing of native wood, which provides thermal energy for the ceramic facility, from areas with no sustainable forest. Therefore, the emissions released due to combustion of native wood were not offset by replanting. In an opposite scenario the biomass which has carbon neutral cycle is utilized in this project activity.

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

The *Rio Negro* ceramic facility had operated two "Round" kilns with over 7 m diameter, before an additional one was commissioned on April 4th

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[3] *Date on which the first monitoring period commences.*

[4] *Date on which the project completes 10 years after the date on which the project proponent completed the fuel switch.*

[5] *BRITO, J.O. "The use of wood as energy". Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES>. Visited on June 14th, 2010.*

[6] *Energy Research Company. National Energy Balance - energy consumption per sector. Available at: <https://ben.epe.gov.br/BEN2007_Capitulo3.aspx>. Visited on June 14th, 2010.*

[7] *SEYE, OMAR. Análise de ciclo de vida aplicada ao processo produtivo de cerâmica estrutural tendo como insumo energético capim elefante (Pennisetum Purpureum Schaum) / Omar Seye. Campinas, SP: [s.n.], 2003. Available at: <http://libdigi.unicamp.br/document/?code=vtls000411276>. Visited on June 14th, 2010.*

2010, in order to maintain the baseline production levels despite longer burning cycle. The capacity of these kilns is around 25,000 per one burning cycle.

Moreover, the heat generated in the “Round” kilns is reused in the ceramic pieces dryer. This has the function of hasting the drying of the ceramic pieces before entering in the kiln to be burnt. A furnace that now uses renewable biomass instead of native wood helps in the generation of heat to the dryer.

In addition to that, two “*Paulista*” kilns with rectangular shape have been producing about 22,000 ceramic units per cycle.

Lastly, one continuous “Hoffmann” kiln with 84 chambers in two parallel lines, with the capacity of 1,600 units each, has been operating in a mode with 2 oppositely situated chambers being fired simultaneously.

The production is expected to be approximately 1,379 thousands of ceramic units per month. The average monthly fuel consumption is expected to be around 2,245 cubic meters of wood residues.

Due to the project activity, a set of adaptations were necessary, such as alterations of the kilns, purchase of a truck as well as construction of sheds where the biomass must be stored, so the ceramic facility can utilize dry renewable biomass. All of these changes to become able to utilize renewable biomass had been made counting on this project being approved and resulting in carbon credit revenues.

It is expected to achieve an increase in the burning efficiency thanks to utilization of the air injection. Furthermore, the use of a biomass with a smaller size and bigger surface area contributes to a better distribution of the energy inside the kilns and enables use of the mechanic feeders, which feed the kilns more precisely and efficiently. Thanks to the introduction of a temperature monitoring system in the “Round” kilns, it is expected to maintain or improve the standard of the production quantity and quality even with the barriers further detailed in this document.

Furthermore, the Ceramist Association of *Amazonas* State (ACERAM) intends to create a residue logistic center as a solution to provide biomass to the ceramic companies of *Iranduba* and *Maracapuru* municipalities.

This Logistic Central of residues will be responsible for collecting, processing, and commercializing the biomasses like wood residues from the construction sector and sawmills pallets from the Industrial Pole of *Manaus*, bamboo, and regional fruit residue, for example *açaí residues*.

There is a possibility that different type of biomass will have to be used in case there were problems with a supply of types of biomass currently used. There are back-up plans to use any of the types of biomass mentioned in the paragraph above or any other type available in the region, e.g., glycerin.

The ceramic owner also showed interest in elephant grass. Currently, elephant grass has been acquiring national importance as biomass to generate thermal energy due to its high productiveness and easy adaptation in almost all climate and soil Brazilian conditions[8].

All of these changes were made expecting the approval of this project, thus resulting in carbon credit revenues.

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[8] *EMBRAPA, Instrução Técnica para o Produtor de Leite- Formação e utilização de pastagens e capim elefante. Available from: <www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Visited on June 14th, 2010.*

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

This project is in accordance with the CONAMA[9] Resolution, no. 237/97 which establishes that clay extraction activities and ceramic production must be supported by specific licenses, such as operational license, clay extraction license, environmental licenses and the permission of the Environmental Protection Institute of *the Amazonas State* (IPAAM[10]) which must be valid.

The project attends the constraints at the operation license determined by the environmental agency competent at the region.

According to the IBAMA Normative Instruction N° 112 from August 21st, 2006;[11] the entrepreneur who uses raw material from native forests is obliged to use the DOF (Document of Origin Forestry) to control the origin, transport, and storage of forest products and by-products. However, it is not enforced namely due to the lack of control[12]. Therefore, to use firewood obtained from native forests in a sustainable manner, it is necessary to use the DOF, which is required by the Operational License of the state of *Amazonas*.

Furthermore, the *açaí* residues, bamboo, and the wood residues do not require documents for residues which do not fall under the by-product definition of *IBAMA* Normative Instruction N° 112/06. However, the Operational License of the state of *Amazonas* requires documents proving the origin of the wood residues.

The glycerin is a residue generated at the biodiesel process. The decree 11097/05, which introduces biodiesel in the Brazilian energy matrix states that renewable diesel (biodiesel) must be added into the fossil. As from 2008, the portion of biodiesel into the fossil diesel must be 2%. According to the same decree, after 2013, the portion of biodiesel added to fossil diesel must raise to 5%.[13] Currently, there is no Brazilian legislation regarding the disposal of glycerin, nor for energy purpose.

There are no specific laws regarding the utilization of the elephant grass in the State of *Amazonas*. Therefore, the legal requirements regarding the use of *elephant grass* do not necessitate documents demonstrating the origin of extraction, transport and storage.

The project is also in accordance with Federal Constitution, Article 20, which establishes the payment of a Financial Compensation by the

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[9] *CONAMA (National Environmental Council), created in 1981 by Law 6.938/81, is the Brazilians' department responsible for deliberation and consultation of the whole national environmental policy and it is chaired by the Minister of Environment. It is responsible for the establishment of standards and criteria relating to licensing of potentially polluting companies. More information is available at http://www.mma.gov.br/port/conama/estr.cfm. Visited on June 15th, 2010.*

[10] *IPAAM is the Environment Protection Institute of the State of Amazonas, responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at http://www.ipaam.am.gov.br/. Visited on June 18th, 2010*

[11] *BRASIL. INSTRUÇÃO NORMATIVA IBAMA Nº 112, DE 21 DE AGOSTO DE 2006. Available at: <http://www.cetesb.sp.gov.br/licenciamentoo/legislacao/federal/inst_normativa/2006_Instr_Norm_IBAMA_112.pdf>. Visited on: July 6th, 2009.*

[12] *Corte e poda de árvores pelo Dnit na BR-158 é considerado crime ambiental, Jornal Grande CPA, Available at: http://www.grandecpa.com.br/?p=noticia&id_noticia=129. Visited on March 27th, 2009.*

[13] *BRASIL. Presidência da República – Lei nº 11.097, de 13 de Janeiro de 2005. Available at: http://www.biodiesel.gov.br/docs/lei11097_13jan2005.pdf. Last visit on September 24th, 2009.*

Mineral Resources Exploitation. This financial compensation is annually paid to DNPM (National Department of Mineral Production[14]) due to the clay exploitation.

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

- Price of renewable biomass

The thermal energy generation through the combustion of biomass is an innovation in the ceramic industry. The future demand of this alternative fuel e.g. by other consumers is not easy to foresee. There is currently a great amount of various types of biomass available locally. However, it is possible that the demand and the prices might increase in the future. If this scenario occurs, the carbon credit revenues will help to sustain the utilization of renewable biomass feasible.

- Availability of renewable biomass

The current great amount of the biomass available locally was already described above, nonetheless if a non-foreseeable reason affects the availability of the biomass, the ceramic facility owner will resort to other types of renewable biomass as listed in the section 1.9.

- Closing of the ceramic business

If the ceramic company closes, it may substantially affect the project's GHG emission reductions, once other ceramic would probably supply the products consuming non-renewable native wood, which is the common practice of the region. However, there are currently good perspectives in the ceramic market. In addition, the organized administration verified at the ceramic industry avoids this possibility in short term.

- Difficulty related to the abrupt change

As affirmed before, the ceramic used non-renewable wood in its kilns for many years. The sudden change demanded a lot of effort from each employee in the ceramic; the main challenges are the reconfiguration of the internal logistic and the employees' resistance to the new situation.

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

The historical records of the ceramic industries of this project activity using non-renewable native wood as a fuel, clearly confirm that the project was not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

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[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. Available at: http://www.dnpm.gov.br/enportal/conteudo.asp?IDSecao=168&IDPagina=222. Visited on June 14th, 2010.*

Rio Negro Ceramic used to feed the kilns with non-renewable biomass to generate thermal energy in order to fire ceramic units since the beginning of its operation in the year 1997.

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

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

SOCIALCARBON Methodology[15] is being applied only as a Sustainability tool in association with VCS 2007.1 Standard.

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

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

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 proponent's roles and responsibilities, including contact information of the project proponent, other project participants:

Project Proponent

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

Mr. Antonio da Mata Silva, Director and responsible for monitoring: Information about the ceramic, detailed information on process and production line, environmental challenges, technological challenges, research and development history, ceramics units market challenges, general data and information on inputs and outputs of the ceramic, detailed information on the acquisition of renewable biomass and how this data is kept at controller's office.

Other information on the project's proponent:

Table 4 - Project proponent details

Company name	*Cerâmica Rio Negro Ltda*
Address	*Estrada do Brito, s/nº, Zona rural -*

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

	Cacau Pirera
ZIP code	69405-000
Company phone	+55 (92) 9142-9831

Project Developer and Project Proponent

Sustainable Carbon – Projetos Ambientais Ltda.: Project participant, project proponent and responsible for developing VCS PD and SOCIALCARBON reports.

The project developer directly involved:

Gabriel Fernandes de Toledo Piza and Mariana dos Santos Silva: Project Design Document writers, direct contact between *Sustainable Carbon – Projetos Ambientais Ltda.* and the ceramic companies, and are responsible for collecting the necessary information for the project.

Thiago de Avila Othero: Technical Consultant, responsible for reviewing the Project Design Document and acting as the point of contact for project related questions.

Coordinated by: *Marcelo Hector Sabbagh Haddad*, technical coordinator.

Table 5. Project developer details

Company name	*Sustainable Carbon – Projetos Ambientais Ltda.*
Address	*Rua Borges Lagoa, 1065 – Conj. 144 – Vila Clementino, São Paulo – SP, Brasil*
ZIP code	04038-032
Company phone	+55 (11) 2649 0036
Email 1	gabriel@sustainablecarbon.com
Email 2	marianas@sustainablecarbon.com
Email 3	thiago.othero@sustainablecarbon.com
Email 4	marcelo@sustainablecarbon.com
Web site	http://www.sustainablecarbon.com

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

The project is eligible according to:

- Legislative: the project attends all legal requirements related to the project activity;
- Technical: alterations/adaptations required are technically feasible;
- Economic: fuel switch project requires high investments;
- Sectoral: incentive of good practices to the sector;
- Social: SOCIALCARBON methodology is applied, which will improve long-term sustainability. The culture of burning native wood as a fuel will be gradually mitigated;
- Environmental: the project attends all legal requirements and no environmental impacts are predicted;

- Geographic-site specific: the plant can be uniquely geographically identified with no barriers regarding logistic;
- Temporal information: the project will not double count the GHG emissions during the ten years renewable of the crediting period.

There is no information concerning eligibility of this project activity, to which the project developer is privy that has not been described in this VCS PD.

1.17 List of commercially sensitive information (if applicable):

There is no information divulged to the validation team which was withheld from the public version of this Project Description.

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 02** - Valid from April 09th, 2010 to September 30th, 2010.
- This is not a grouped project
- The amount of non-renewable biomass (B_y) will be determined according to the option "a" of the applied methodology using historical records as a source of data.

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 02 - Valid from April 09th, 2010 to September 30th, 2010, which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

This category comprises activities to small thermal appliances that displace the use of non- renewable biomass by introducing new renewable energy end-user technologies The end-user technology in case of this project activity is established as the ceramic facility, which utilizes the thermal energy generated by the new renewable energy technology.

There were no similar registered small-scale CDM project activities in the region of *Iranduba* at the time the Sustainable Carbon Company conducted the last research. The sources of registered small-scale CDM project activity consulted were the United Nations Framework Convention on Climate Change (UNFCCC) [16] and Brazilian´s Technology and Science Ministry[17]. Therefore, the proposed project activity is not saving the non-renewable biomass accounted for by the other registered project activities.

Any firewood from area without any kind of forest management cannot be considered a renewable source of biomass, since its utilization results in a decrease of carbon pools and increases the carbon emissions to the atmosphere, thus worsening the greenhouse effect. Obviously, the non-renewable biomass provided from areas without a reforestation management plan does not comply with any of the options of UNFCCC definition of renewable biomass in Annex 18, EB 23.

Furthermore, firewood has been used as a fuel in Brazil for many decades[18]. Although, it is impossible to define a start date on which

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[16] CDM activities registered by CDM Executive board are Available at: < http://cdm.unfccc.int/Projects/registered.html>. Visited on June 13th, 2010.

[17] Brazilian´s Technology and Science Ministry is responsible for registry and approval of all CDM activities within Brazilian boundaries. CDM activities submitted to the Brazilian Inter-Ministerial Commission of CDM Activities are available at: http://www.mct.gov.br/index.php/content/view/47952.html. Visited on June 14th, 2010.

[18] 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:

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 December 31st, 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[19]. Moreover the Brazilian's Energy and Mine Ministry has been monitoring the use of all energy resources in Brazil since 1970, and firewood appears over the years monitored as a significant source of thermal energy for ceramic sector[20]. Especially in the ceramic sector, where the use of firewood is visibly non-renewable and unsustainable, involving negative environmental impacts associated[21].

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

Bamboo is considered renewable according to option IV of the UNFCCC definition of renewable biomass[22], as soon as it fits the following assumption:

"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."

Bamboo is a fast growing plant, and efficiently performs the functions of soil protection and carbon sequestration, and provides food and raw material for many applications. Furthermore, this plant is commonly utilized as quickset in rural properties, and its pruning is normally done in order to avoid the undesirable dispersion due to its invader characteristics. Unlike trees, the bamboo can be harvested without the destruction of the crop due to just the stem of the bamboo is utilized and the rhizome remains in the ground. When it is properly harvested and managed, the plantation continues full of younger individuals and it is difficult to realize that a harvest was done[23]. The limits of the area of environmental preservation and legal reserve as defined by legislation will be respected.

Wood residues like sawdust, wood chips, pallets, and the residues from construction sector and urban trees are forest residues while glycerin and residues from *açaí* are an agro-industries residue, so they are considered renewable according to option V of the UNFCCC definition of renewable biomass[24]:

"The biomass is the non-fossil fraction of an industrial or municipal waste".

<http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/>. Visited on June 14th, 2010.

[19] *Brito, J.O. "The use of wood as energy". Available at: <http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES>. Visited on June 14th, 2010.*

[20] *National Energy Balance- energy consumption per sector. Available at: < https://ben.epe.gov.br/BENSeriesCompletas.aspx>. Visited on June 14th, 2010.*

[21] *UHLIG, A. Lenha e carvão vegetal no Brasil: balance oferta-demanda e métodos para estimação de consumo, tese de doutorado, Universidade de São Paulo, São Paulo, 2008. 156 p. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/>. Visited on June 14th, 2010.*

[22] *UNFCCC - EB 18, annex 23 – "DEFINITION OF RENEWABLE BIOMASS". Available at: http://cdm.unfccc.int/EB/023/eb23_repan18.pdf. Visited on June 13th, 2010.*

[23] *According to "Projeto Bambu". Available at: < http://www.a-ponte.org.br/modulos/projetos/projeto_10/index.php?pgn=prj_bambu.php>. Last visit in: June 16th, 2010.*

[24] *UNFCCC - EB 18, annex 23 – "DEFINITION OF RENEWABLE BIOMASS". Available at: http://cdm.unfccc.int/EB/023/eb23_repan18.pdf. Visited on June 13th, 2010.*

The elephant grass is considered renewable according to option III of the UNFCCC definition of renewable biomass[25] as soon as it complies with all the conditions 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[26]. 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. In case of utilizing elephant grass, the limits of the area of environmental preservation and legal reserve as defined by legislation will be respected.

The total thermal power of all the kilns in the project activity is 9.18 $MW_{Thermal}$ which is less than 45 $MW_{Thermal}$ (for CDM Methodologies Type I). As a result, the project activity is eligible for being considered a small-scale project.

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

According to the applied methodology, the project boundaries for the project are the physical, geographical areas of the use of biomass or the renewable energy, thus, the ceramic facility limits.

Project activity emissions of CO_2 and any other GHG were excluded because the applied methodology does not encompass this type of emissions. Furthermore, if it was considered, the value would be very small as the project emission of CO_2 would be only related to electricity consumption.

In the baseline scenario, non-renewable biomass was utilized to fire ceramic units in kilns at the ceramic facility. This practice is responsible for discharge of carbon that was stored in the wood (known by a carbon sink) into the atmosphere.

Table 6. Gases included in the project boundary and brief explanation

	Gas	Source	Included?	Justification/ Explanation
Baseline	CO_2	Emission from the combustion of non- renewable biomasses	Yes	The major source of emissions in the baseline
	CH_4	-	No	Excluded for simplification. This emission source is assumed to be very small.
	N_2O	-	No	Excluded for simplification. This emission source is

[25] UNFCCC - EB 18, annex 23 – "DEFINITION OF RENEWABLE BIOMASS". Available at: http://cdm.unfccc.int/EB/023/eb23_repan18.pdf. Visited on June 13th, 2010.

[26] According to EMBRAPA (Brazilian Agricultural Research Corporations). Source: http://www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292

				assumed to be very small.
Project Activity	CO_2	-	No	Excluded for simplification. This emission source is assumed to be very small.
	CH_4	-	No	Excluded for simplification. This emission source is assumed to be very small.
	N_2O	-	No	Excluded for simplification. This emission source is assumed to be very small.

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

Common fuels employed and therefore candidates for baseline fuels are (as shown in the Table 7): natural gas, charcoal, wood, other recuperations, diesel oil, fuel oil, liquefied petroleum gas, others from petroleum, piped gas, electricity and others none specified.

The most probable scenario, in the absence of the non-renewable biomass (i.e. firewood), would be the use of the fuel oil due to a lot of problems concerning the natural gas distribution, which is better described in the section 2.5 – Step 3: Common Practice. The fuel oil scenario is not viable considering higher prices of the fuel oil in comparison with non-renewable biomass, despite higher Net Calorific Value of the fuel oil, which is sold at an average price of 895 R$/ton[27] and firewood was purchased for 34.58 R$/ton in the baseline scenario. Utilizing the Net Calorific Value of both fuels brings following price/energy content comparison: for fuel oil 0.00009 R$/Kcal,[28] whereas 0.000008 R$/Kcal for firewood[29]. Besides being less cost-efficient, the fuel oil also requires more technology to be used, making it without any doubt less attractive.

Table 7. Distribution of fuel utilized on the ceramic sector in Brazil

BRAZILIAN ENERGY BALANCE 2009[30] - CERAMIC SECTOR EVALUATION **Unit: 10^3 Tone of oil equivalent**			
FUEL	**2006**	**2007**	**2008**
Natural Gas	901	960	1,007
Charcoal	42	33	9
Wood	1,762	1,885	2,122
Other recuperations	32	35	53
Diesel Oil	8	7	8

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

[28] *CAETANO L.; DUARTE JR. A. Estudo Comparativo da Queima de Óleo BPF e de Lenha em Caldeiras”. Available at: <http://www.abcm.org.br/xi_creem/resumos/TE/CRE04-TE01.pdf>. Visited on June 14th, 2010. The Net Calorific Value of fuel oil considered by the same source is : 9,880 kcal/kg.*

[29] *According to the historic records, the Rio Negro caramic facility paid 34.58 BRL per ton of non-renewable biomass before the project activity. The values of NCV and density utilized are the same as in the monitoring section (NCV=0.0182 TJ/t and specific gravity = 0.5542 ton/m³).*

[30] *Brazilian Energy Balance, Chapter 3 Available at: https://ben.epe.gov.br/BENSeriesCompletas.aspx. Visited on June 24th, 2010.*

Fuel Oil	285	313	322
Liquefied Petroleum Gas	151	153	166
Others from Petroleum	76	170	173
Piped gas	0	0	0
Electricity	276	284	298
Others non specified	0	0	0
TOTAL	**3,533**	**3,841**	**4,157**

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.

According to the identified baseline scenario for this project activity, the ceramic company would utilize nowadays around 1,396 tons of non-renewable biomass per month, the fuel most commonly utilized in Brazilian ceramic industries, to provide thermal energy to the ceramic' kilns in order to produce an average of 1,379 thousands of ceramic units per month. The wood consumption of the ceramic in the baseline scenario is 1.0120 tons of wood per thousands of ceramic units.

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

- The methodology applied is Category AMS-I.E: Switch from non – renewable biomass for thermal applications by the user – Version 02 Valid from April 09th, 2010 to September 30th, 2010, which is applicable for project activities that avoid greenhouse gas emissions by using renewable biomass in order to generate thermal energy.

Furthermore, the project activity will annually generate less than 45 $MW_{thermal}$, as shown in Section 2.2.

To demonstrate the additionality of the project activity the test 1 from section 5.8 of the Voluntary Carbon Standard was used – namely: Specification for the project-level quantification, monitoring and reporting as well as validation and verification of greenhouse gas emission reductions or removals.

Test 1 – The project test

Step 1: Regulatory Surplus

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

Legal requirements, as stated by the Constitution of the Federal Republic of Brazil[31] as well as Federal and State Regulations, do not require entrepreneurs, which use raw forest materials as an energy source, to switch from non-renewable biomasses to renewable biomasses. Therefore, the project activity is not a legal obligation. Moreover, in accordance with Article 5 of the Constitution of the Federative Republic of Brazil, nobody can be forced to follow a course of action if it is not addressed by law.

[31] BRASIL. CONSTITUIÇÃO DA REPÚBLICA FEDERATIVA DO BRASIL DE 1988. Available at: http://www.planalto.gov.br/ccivil_03/constituicao/constitui%C3%A7ao.htm. Visited on July 6th, 2009.

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 control[32].

The consumption of non-renewable biomass by the ceramic industry was related by several authors (NERI, 2003[33]; ALBUQUERQUE *et al*, 2006[34]; BRASIL, 2001[35]; VIANA, 2006[36]; CARDOSO, 2008[37]).

Probably, the fuel switch would not be to renewable biomass, once the common practice at the ceramic sector is the use of non-renewable fuel.

Step 2: Implementation Barriers

The project faces distinct barriers compared with barriers faced by alternative projects.

- **Technological barrier**

As affirmed in previous sections, the use of native wood from areas without sustainable forest management is a traditional and well-known process. Therefore, a sudden change of this process requires a lot of effort from each employee of the ceramic facility. The main technological barriers were the non-availability of human knowledge to design, install, operate and maintain the new technology; the internal logistic modification; and the employees' resistance to the new technologies.

Before the project activity, the production process was noticeably different - non-renewable biomass was manually fed in the kilns by employees and no experience with machines was needed. Another big difference is the logistic modification - nowadays, the new biomass must be stored in covered sites, in order to achieve a better burning efficiency. Most importantly the biomass has to be processed (especially in case of pallets and other solid residues) into smaller pieces in order to fit into the feeding openings of the kilns. That requires substantial physical effort or use of machinery. No less demanding is the logistics of biomass itself which requires a mechanic loader operated from the truck.

The kiln operators did not have knowledge of the ideal amount of renewable biomass that was necessary to achieve the optimal temperature of about 900ºC for firing the ceramic units, in order to achieve the

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[32] *Corte e poda de árvores pelo Dnit na BR-158 é considerado crime ambiental, Jornal Grande CPA, Available at: http://www.grandecpa.com.br/?p=noticia&id_noticia=129. Visited on March 27th, 2009.*

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

[34] *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.*

[35] *BRASIL. Ministério de Ciências e Tecnologias.* ***Levantamento da Situação e das Carências Tecnológicas dos Minerais Industriais Brasileiros****: com enfoque na mineração de: Argila para cerâmica, Barita, Bentonita, Caulim para carga, Talco / Agalmatolito e Vermiculita. Brasília, 2001. Available at: < http://www.cgee.org.br/prospeccao/doc_arq/prod/registro/pdf/regdoc710.pdf> . Visited on March 27th, 2009.*

[36] *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>. Visited on March 27th, 2009.*

[37] *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.*

final product with sufficient quality and to maintain the optimal process, as they did when the native wood was used. It took a lot of time an effort and experiments to acquire the know-how regarding the optimal operation of the mechanic feeders, which is crucial influent of the burning process especially in the Hoffmann kiln where any malfunction of the feeding would result in halted burning process, stop of the rotation of the fire in the chambers and thus, it influences the ceramic facility production. The lack of knowledge and expertise added a significant amount of uncertainty into the production process.

Furthermore, application of air injectors and modification of some kilns has significantly influenced the air flow inside the kilns. Hence, correct operation of the air injectors has become crucial in order to maintain the exact firing conditions. For that purpose, the system of kiln temperature monitoring was purchased and installed in the “Round” kilns. Such a level of “technology and automation” has no precedence in this industry in this region among the work force. All these changed parameters of the firing process resulted in lengthy adaptation and testing periods (3 months) characterized by big amount of broken or low-quality ceramic units.

The ceramic has a dryer in order to decrease the humidity of part of the pieces that enter in the kiln. This results in a better burning efficiency inside the kiln. This dryer has a furnace that has made the fuel switch together with the kilns. Furthermore, the heat in the dryer is also supplied by part of the heat generated in the "Round" kilns.

The employees must be careful not to fill the kilns with too large amounts of biomass, which can clog the feeding openings of the kilns, and consequently, cause disorder in the burning process. That was one of the major causes of the production losses throughout the adaptation period. So, the kiln’s feeding has to be gradually done, demanding even more time and labor.

Training was required for the staff in order to clarify new measures linked to the machinery, sustaining the quality of the final product and thus partially diminishing the technical barrier. Another big bottleneck of the implementation was the lack of design of the new communication among the workers operating the temperature monitoring system and those feeding the kilns, especially with the help of the mechanical feeders.

Furthermore, there was a lack of infrastructure to utilize the new technology. The region of *Iranduba* is well-known for not being up-to-date with new technologies in the Ceramic sector and very resistant to changes or improvements to its production processes and general practices.

Moreover, the use of new types of biomass represented a high risk to the project proponent because of possible unavailability of the biomass, even though there is currently a great amount of various types of biomass locally available. Major supply volatility may occur because thermal energy generation through combustion of biomass is an innovation in the ceramic industry in, especially in this region, and future demand for renewable biomass (e.g. by other consumers) is uneasy to project.

It means that *Rio Negro* had to find the best procedures to handle the new technology, i.e. the new biomass, logistic and machines, through a demanding self-learning process.

All of these changes to become able to utilize renewable biomass had been made counting on this project being approved and resulting in carbon credit revenues which will be further invested into future production process improvements in terms of efficiency and automation.

- ***Financial barrier***

Additional costs

The additional costs incurred due to the fuel switch can be divided into two groups:

a) Initial investments in technology
b) Monthly additional costs

Ad a)

Due to the implementation of the project activity, the ceramic had to purchase some technology, as detailed in the Table 8 below - for instance machines to inject air inside the kilns and the mechanic feeders for feeding the biomass. In addition to that, the existing dryer furnace was reformed to the use of biomass.

Table 8. Investments costs of *Rio Negro* Ceramic

Investment Costs		
Costs with mechanic feeders	15,000	BRL
Costs with air injectors	33,600	BRL
Reform and construction of the dryer furnace	12,000	BRL
Total Costs	**60,600**	**BRL**

Ad b)

Higher fuel prices and lower NCV of the renewable biomass resulted in increased monthly fuel costs. Also, fuel transportation costs increased (gas combustion, ferry fees).

When the new production techniques were introduced at the ceramic plant, there was an adaptation period and a testing period, 2 months in total. For the adaptation of the kilns a still period had to be considered. Also the testing period was necessary in order to identify the correct burning curve. All these adaptations resulted in losses at the financial profit and economical balance of the company.

Monthly loss of revenues incurred because the ceramic units with inferior quality (as described in the paragraph above) could not be sold to customers thus, it led to a waste during 2 monthly productions.

All this resulted in prejudice regarding the company's financial profit and loss balance. Due to all mentioned reasons the ceramic facility had to deal with a high investment that made the ceramic to consider halting the fuel switch project.

All the above mentioned additional costs are depicted in the Table 9 below. Table 10 and Figure 3 provide a resume of the sensitivity analyses of the yearly fuel costs with the variation of the costs +-25% for all potential types of biomass available in the region, current scenario and baseline scenario.

Table 9. Main Costs before and after the project activity at *Rio Negro* Ceramic

***Rio Negro* Ceramic**				
Scenario	**Non-renewable wood**		**Renewable Biomass[38]**	
Production	1,378,917	pieces/month	1,378,917	pieces/month
Monthly consumption of the fuel	1,396	ton/month	Wood Residues	Biomass
			1,699	ton/month
Cost per m^3	R$ 34.58	BRL/ton	R$ 35.03	BRL/ton
Total Fuel	R$ 48,264.86	BRL/month	R$ 59,525.08	BRL/month

[38] *The project uses exclusively wood residues, which qualify as woody biomass.*

Costs				
Cost per ceramic device	R$ 0.035	BRL/ceramic device	R$ 0.043	BRL/ceramic device

Table 10. Fuel cost sensitivity analysis

	Biomasses	Biomass Costs [BRL/ tons]	Estimated Amount to be Employed [tons/yr]	Energy Generated [TJ/yr]	-25%	-15%	-10%	-5%	0%	5%	10%	15%	25%
Alternative fuels	Glycerin	250.00	11,527	289.519	R$ 2,161,367	R$ 2,449,549	R$ 2,593,640	R$ 2,737,731	R$ 2,881,822	R$ 3,025,913	R$ 3,170,004	R$ 3,314,095	R$ 3,602,278
	Bamboo	33.50	18,693	289.519	R$ 469,649	R$ 532,269	R$ 563,579	R$ 594,889	R$ 626,199	R$ 657,509	R$ 688,819	R$ 720,129	R$ 782,749
	Açaí	20.75	25,252	289.519	R$ 392,932	R$ 445,323	R$ 471,519	R$ 497,714	R$ 523,910	R$ 550,105	R$ 576,301	R$ 602,496	R$ 654,887
	Elephant Grass	67.45	21,606	289.519	R$ 1,092,990	R$ 1,238,722	R$ 1,311,588	R$ 1,384,454	R$ 1,457,320	R$ 1,530,186	R$ 1,603,051	R$ 1,675,917	R$ 1,821,649
Current scenario	Wood residue	35.01	20,389	289.519	R$ 535,726	R$ 607,156	R$ 642,871	R$ 678,586	R$ 714,301	R$ 750,016	R$ 785,731	R$ 821,446	R$ 892,876
Baseline Scenario	Non-renewable wood	34.58	16,747	303.1	R$ 579,178	R$ 579,178	R$ 579,178	R$ 579,178	R$ 579,178	R$ 579,178	R$ 579,178	R$ 579,178	R$ 579,178

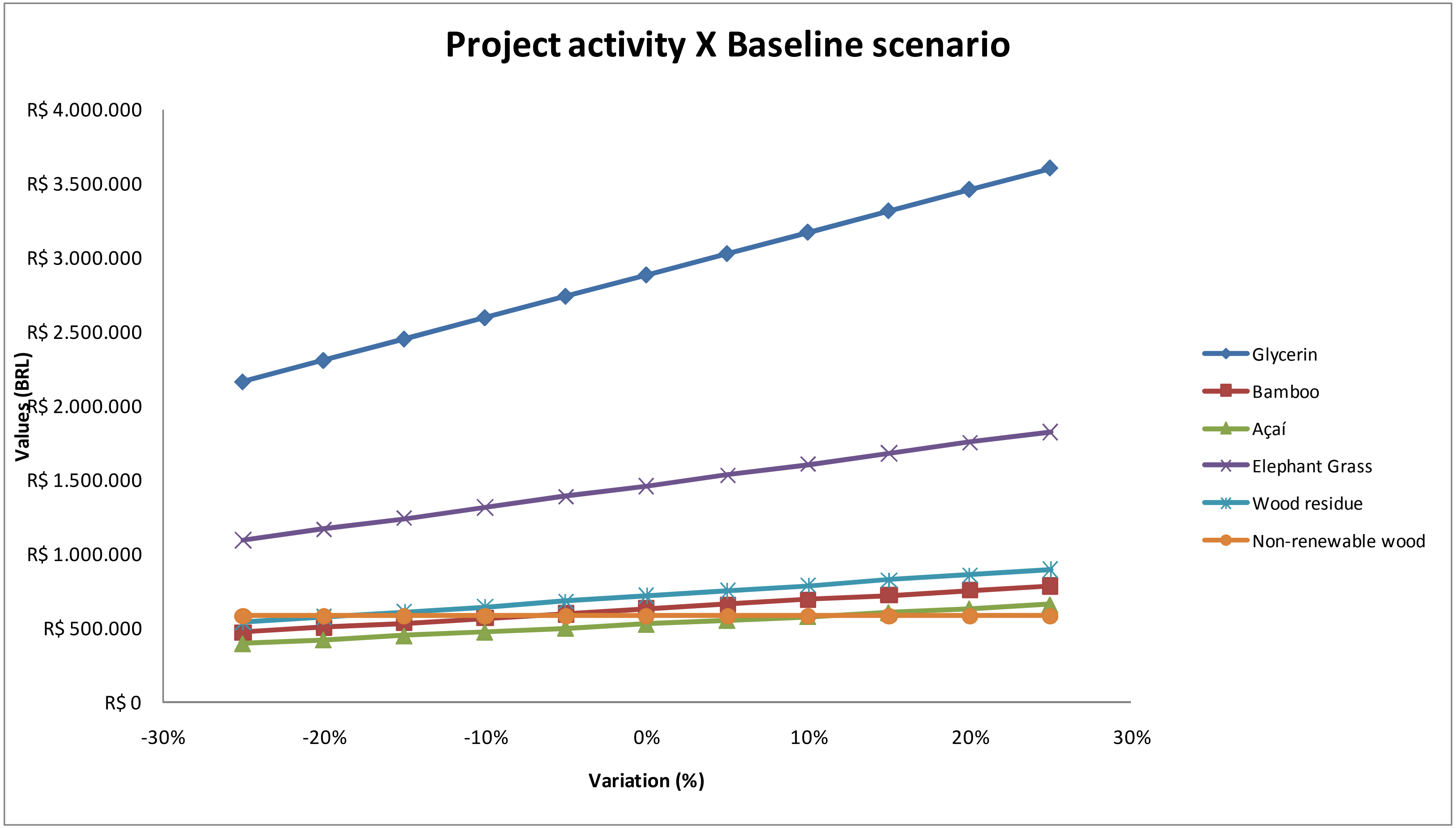

Figure 3. Fuel cost sensitivity analysis

Therefore, with the project activity's implementation, the total spending has increased, as can be verified in the tables and figure 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 barrier***

Since almost all in the production process was modified, replaced and improved by in many cases advanced technology, it became quickly clear that the ceramic facility owner was facing a lack of qualified work force to sustain an efficient production process resulting in quality products. Therefore, it was necessary to capacitate workers in logistics, the kiln operators as well as the administrative staff and truck drivers to obtain additional necessary knowledge and in some cases skills in order to assure smooth operation.

Burning of biomass resulted in a larger volume of fuel being brought to the ceramic facility, fed into the kilns the right way and finally burnt the optimal controlled way. Hence, the most effected part of the production process was the burning control, feeding and logistics. The acceptance and willingness to learn how to benefit from such systems were surprisingly low. Only after overcoming the human dimension of the problem coupled with technical issues and many errors, the production process has stabilized.

As most of the work force in the region doesn't have more than an elementary education, they are extremely reluctant to changes from "conventional" production processes which may result in increased pressure upon them in terms of getting more qualification and using the qualification and other skills in the operation. As a result, there was a high resistance of the employees of the new technology. Motivating this kind of work force, where most are only interested in earning their low wages, but not in any additional education, and where an employee turnover is an issue, presented a significant institutional barrier.

Risks of the project

The project activity implementation presented a risk to the project proponent, because a use of a new fuel type and necessity to use more mechanization added a significant amount of insecurity to the production process, where on a contrary a use of non-renewable biomass is a traditional and well-known process.

Furthermore, the ceramic can face a period in which there might be lack of biomass available, which represents another risk especially because the *Manaus* region is the only industrial region in *Amazonas* of a considerable size and the *Iranduba* and *Manacapuru* districts are accessible only by ferries, thus making the supply dependent on natural conditions.

The human side of the project – transfer of know-how, trainings and low acceptance level among workers combined with their significant turnover may cause problems in the future or increase push of qualified workers on company costs.

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

Barrier due to the price of the biomass

The thermal energy generation through the combustion of renewable biomasses such as wood and fruit residues is innovation in the ceramic industry. The future demand of these alternative fuels e.g. by other consumers is not easy to foresee. Although there is currently a great amount of these types of biomass available locally, there is a possibility that the prices would increase as well, especially between harvests periods, when the problem with biomass disposal is mitigated. If the price of the biomass increases, the ceramic cannot substitute its fuel. In that case the ceramic company would not have competitive prices in comparison with its competition which did not undertake 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 thermal energy for the production of ceramic units such as bricks and tiles.

2. Identify possible types of baseline candidates.

Observing Table 11, the common fuels employed in the ceramic sector and therefore, the baseline candidates are: natural gas, wood, fuel oil, electricity and others. Other possible baseline candidate would be the use of renewable biomass without the carbon credits support.

Table 11. Distribution of fuel employed on the ceramic sector in Brazil in percentage

BRAZILIAN ENERGY BALANCE 2009[39] - CERAMIC SECTOR EVALUATION			
FUEL	**2006**	**2007**	**2008**
Wood	49.9%	49.1%	51.0%
Natural Gas	25.5%	25.0%	24.2%
Fuel Oil	8.1%	8.1%	7.7%
Electricity	7.8%	7.4%	7.2%
Others	8.7%	10.4%	9.8%

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[40] from Mines and Energy Ministry of Brazil is the most representative and reliable source of information about the ceramic sector and its fuel employed. Furthermore, there was no local data regarding to the ceramic sector and its energy source in the State of *Amazonas*. Therefore, data from the table above were provided by a reliable source and three years of historical data were considered, including the most recent available data and the period when *Rio Negro* Ceramic started the fuel switch.

[39] Brazilian Energy Balance, Chapter 3 Available at: <https://ben.epe.gov.br/BENSeriesCompletas.aspx>. Visited on June 14th, 2010.

[40] 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.

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.

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

Additionally, the fuel cost is another criterion, because high costs of fuel may discourage project proponents of investing in this type of fuel.

Equally important, the local availability of technology and fuel are criteria considered, because a 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 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 control[41]. The consumption of non-renewable biomass by ceramic industry was noted by several authors (NERI, 2003[42]; ALBUQUERQUE et al, 2006[43]; BRASIL, 2001[44]; VIANA, 2006[45]; CARDOSO, 2008[46]). This was also observed in other industries, for example in production of steel (BRASIL, 2005[47]), which has a much better structure and internal organization when compared to ceramic industries that are generally small and family-run enterprises. BRASIL (2001) suggests that it is important to stimulate the miner sector, especially to respect 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 as criteria to exclude baseline candidates and to constrain the geographical area and temporal range of the final list of the baseline candidates.

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[41] *Jornal Grande CPA. Corte e poda de árvores pelo Dnit na BR-158 é considerado crime ambiental. Available at: <http://www.grandecpa.com.br/?p=noticia&id_noticia=129>. Visited on June, 14th 2010.*

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

[43] *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.*

[44] *BRASIL. Ministério de Ciências e Tecnologias.* ***Levantamento da Situação e das Carências Tecnológicas dos Minerais Industriais Brasileiros****: com enfoque na mineração de: Argila para cerâmica, Barita, Bentonita, Caulim para carga, Talco / Agalmatolito e Vermiculita. Brasília, 2001. Available at: < http://www.cgee.org.br/prospeccao/doc_arq/prod/registro/pdf/regdoc710.pdf>. Visited on June, 13th 2010.*

[45] *VIANNA, F.M.A.* ***Participação Pública em Programas Ambientais: Um Estudo em Área Suscetível a Desertificação no Estado do Rio Grande do Norte.*** *2006, 109f. Dissertação (Mestrado em Engenharia de Produção) – Universidade Federal do Rio Grande do Norte, Natal, 2006. Available at: < http://bdtd.bczm.ufrn.br/tedesimplificado//tde_busca/arquivo.php?codArquivo=571>. Visited on June, 15th 2010.*

[46] *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.*

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

The project activity implementation without the carbon credit revenues is also a criterion thanks to biomass availability at the moment.

5. Identify a final list of baseline candidates.

Table 11 provides the percentage of the level of penetration of each fuel employed in the ceramic sector during the last three available years (2006, 2007 and 2008). Baseline fuel candidates are:

a) **Wood:** The fuel most employed, which would be the scenario of highest GHG emissions, once its emission factor is the highest according to IPCC 2006[48].

b) **Natural gas:** The Brazilian Energy Balance results showed significant percentage of natural gas consumption for production of ceramic tiles (used to finish floor or wall). On the other hand, in the case of structural ceramic, the use of natural gas is restricted by the absence of pipes, its high costs[49] and the lack of availability[50]. A risk of insufficient supply and higher costs when compared to other fuels discourages investment in this scenario even in places with piped gas availability. The distribution of gas is preferentially performed to thermal power plants, increasing the risk of blackout of natural gas. Among the biggest concerns regarding natural gas is future increase in prices or it's volatility due to political instability in the countries supplying natural gas, like Bolivia and Colombia. Furthermore, prices of natural gas are set by intergovernmental contracts or by government owned utilities. There's a huge lack of trust of private sector in public sector and public-owned companies, which is significantly driven by previous instabilities and experiences with local and federal politicians. There is no guarantee that present prices will remain stable for the lifetime of the project, which makes any investment decision extremely hard.

c) **Fuel oil:** This fuel is more expensive than wood, however it can be a more probable of substitute of wood than natural gas. However, in the baseline scenario, the use of fuel oil is not feasible due to high costs associated with an atomization system required for burning of natural gas, which demands frequent maintenance[51].

d) **Renewable biomass:** despite the high biomass availability in the region at the moment of the investment decision, the main problems concerning the use of renewable biomass are related to the high investments and prices as well as technological and institutional barriers, mainly the risk of changing for a biomass not consolidated as fuel for ceramic industries[52].

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

In Brazil, the red ceramic units are produced through an inefficient and traditional processes using wood without forest management to generate thermal energy technologies[53]. It happens because wood without forest management is offered for much lower prices than wood from areas

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[48] *Source: IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Visited on June 14th, 2010.*

[49] *Revista Brasil Energia Percalços do gás natural na indústria. Available at: <http://www.dep.fem.unicamp.br/boletim/BE31/artigo.htm>. Visited on June 14th, 2010.*

[50] *Folha Online. Custo de obra do gasoduto Urucu-Manaus cresce 84%. Available at: http://tools.folha.com.br/print?site=emcimadahora&url=http%3A%2F%2Fwww1.folha.uol.com.br%2Ffolha%2Fbrasil%2Fult96u578040.shtml. Visited on June 21st, 2009.*

[51] *Source: <http://www.ctgas.com.br/template04.asp?parametro=155>. Visited on March 7th, 2009.*

[52] *The use of renewable biomass was not included in Table 11 which shows the fuel most employed in the ceramic sector according to Brazilian Energy Balance.*

with forest management[54]. 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 traditionally been a source of firewood for the ceramic sector[55], which seemed inexhaustible, due to the amounts generated due to an expansion of the agriculture frontier. Unfortunately, hand in hand with it came environmental impacts like soil degradation, change in the rainfall regime and consequent desertification.

The ceramic industry sector has practically not evolved compared to the past, mainly due to the simple manufacturing techniques. Moreover, the major equipments (chiefly kilns) of the production process have not improved significantly in terms of technology or efficiency recently. Many of the ceramics producing companies still use non-renewable wood in their kilns and the drying process occurs naturally, without any energy utilization. On the other hand, the influence of the market as a drive for improvements in this sector is very insignificant[56].

Thus, common practice is a use of wood – more precisely its non-renewable fraction, which is the fuel most often employed, most viable and associated with the least risks.

To sum up, the project activity is not a common practice.

Impact of project approval

Nowadays, the ceramic industrial segment of the state of *Amazonas* constitutes of small facilities that still use the diverse technological setups. The ceramics production sector comprises 31 companies, making it the main economy sector of the town of *Iranduba*. The fuel used in almost all companies is solely the non-renewable biomass from Amazonian Biome, and there are some technological restrictions associated with it, such as the energy utilization and the efficiency of the machinery.

Brazil is the third major contributor[57] to the carbon dioxide emissions in the year of 2003, though contemporary studies generally place Brazil fourth in the ranking of the countries that emit the most GHGs.

The Amazonian Biome deforestation, which can be observed in Table 12 and Figure 4, aggravates because of the grazing practice, agriculture and site preparation which involves extraction and burning of wood and firewood commercialization[58].

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[53] *ABREU, Y. V.; GUERRA, S. M. G. Indústria de Cerâmica no Brasil e o Meio Ambiente. Chile: IV Congreso Nacional de Energía, 2000. Available at: <http://www.nuca.ie.ufrj.br/bgn/bv/abreu2.htm>. Visited on June 14th, 2010*

[54] *Seye, Omar. Análise de ciclo de vida aplicada ao processo produtivo de cerâmica estrutural tendo como insumo energético capim elefante (Pennisetum Purpureum Schaum) / Omar Seye. Campinas, SP: [s.n.], 2003.Available at: <http://libdigi.unicamp.br/document/?code=vtls000411276>. Visited on June 14th, 2010.*

[55] *UHLIG, A. Lenha e carvão vegetal no Brasil: balance oferta-demanda e métodos para estimação de consumo, tese de doutorado, Universidade de São Paulo, São Paulo, 2008. 156 p. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/>. Visited on June 14th, 2010.*

[56] *PAULETTI, M. C. Modelo para Introdução de Nova Tecnologia em Agrupamentos de Micro e Pequenas Empresas: Estudo de Caso das indústrias de Cerâmica Vermelha no Vale do Rio Tijucas. 2001. Available at: <http://biblioteca.universia.net/html_bura/ficha/params/id/597230.html>. Visited on June 14th, 2010.*

[57] *Goldemberg & Moreira. Política Energética no Brasil. Estudos Avançados 19 (55), 2005. Available at: <http://www.scielo.br/pdf/ea/v19n55/14.pdf>. Visited on June 14th, 2010.*

[58] *FERREIRA, Leandro Valle; VENTICINQUE, Eduardo and ALMEIDA, Samuel. O desmatamento na Amazônia e a importância das áreas protegidas. Estud. av.*

The First Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions[59] – Background Reports indicates that the major source of GHG emissions in *Brazil* is due to deforestation, which mainly occurres in *Amazonian* (59% of the deforestation) and *Cerrado* biomes (26%). Currently, every part of the society should be involved in efforts to minimize the degradation of the Amazonian biome and prevent its extinction. Even though Amazonian Rainforest is the biggest tropical forest in the world, further increasing trend in the deforestation rate could be very dangerous[60]. Furthermore, this biome is a great source of biodiversity, holding the biggest variety of species in the world. There are still many unknown vegetal and animal species in this magnificent biome.

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

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

Table 12. Average area of deforestation observed in the states of Amazonian Biome (km²/year)[61]

States of Amazonia Biome	2005	2006	2007	2008	2009	2010
Acre	592	398	184	254	167	273
Amazonas	775	788	610	604	405	474
Amapá	33	30	39	100	70	SD*
Maranhão	922	651	613	1,272	828	679
Mato Grosso	7,145	4,333	2,678	3,258	1,049	828
Pará	5,731	5,505	5,425	5,606	4,281	3,710
Rondônia	3244	2049	1611	1136	482	427
Roraima	133	231	309	574	121	SD*

[online]. 2005, vol.19, n.53, pp. 157-166. ISSN 0103-4014. Available at: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-40142005000100010&lng=en&nrm=iso>.Visited on June 14th, 2010.

[59] *MCT. Primeiro Inventário Brasileiro de Emissões Antrópicas de Gases de Efeito Estufa - Relatórios de Referência. Available at: < http://www.mct.gov.br/index.php/content/view/17341.html>. Visited on June 14th, 2010.*

[60] *PERES, C. A. Porque precisamos de megareservas na Amazônia. Megadiversidade, Vol. 1, Número 1, julho 2005. Available at: <http://www.unifap.br/ppgbio/doc/23_Peres.pdf>. Visited on June 14th, 2010.*

[61] *INPE – Brazilian Institute of Space Studies. Ministry of Science and Technology. PRODES 2010 - Estimates of Amazon deforestation in the period 2009-2010. Available at: www.dpi.inpe.br/gilberto/present/prodes_taxa2010.ppt.Visited on December 15th, 2010.*

Tocantins	271	124	63	107	61	60
Legal Amazon	18,846	14,109	11,532	12,911	7,464	6,451

***Data to be confirmed by INPE (Brazilian Institute of Space Studies), without data to estimate.**

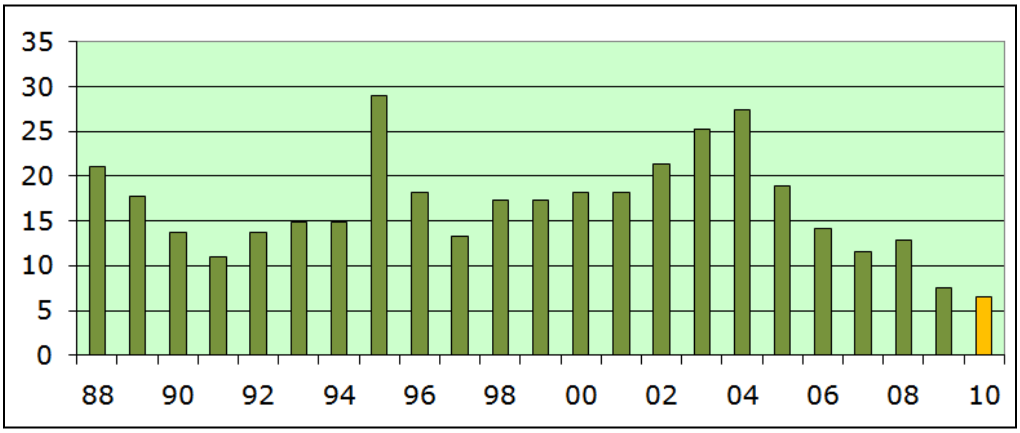

Figure 4 – Average area deforested (thousands of km² per year) in the Amazonian Biome during the period 1988 - 2010[57]

3 Monitoring:

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

- Category AMS-I.E: Switch from non – renewable biomass for thermal applications by the user – Version 02 - Valid from April 09th, 2010 to September 30th, 2010.

- This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The project's emissions from the combustion of non-renewable biomass 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 limits of 45 MWthermal for Type I small scale project activities.

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

The monitoring will be done with the aim of determining the most approximate quantity of non-renewable wood that, in the absence of the project, would be used in the Ceramic's facilities and, consequently, the amount of GHG that would be emitted in tons of CO_2e.

Table 13. Data reported in monitoring estimation

Parameters	Description	Units	Origin	Frequency
$Q_{renbiomass}$	Amount of renewable biomass	Tons	Calculated from receipts and invoices describing the weight of each renewable biomass	Monthly
Origin of Renewable Biomass	Renewable origin of the biomass	Not applicable	Controlled by the project proponent	Annually
PR_y	Production of ceramic pieces	Thousands of ceramic units produced per month	Calculated with use of the internal control of fired ceramic units.	Monthly
Renewable Biomass Surplus	Amount of renewable biomass available	Tons or m^3	Monitoring based on articles and databases, which are described in the leakage section	Annually

Parameters	Description	Units	Origin	Frequency
Leakage of Non-Renewable Biomass	Leakage resulted from the non-renewable biomasses	tCO_2e	Monitoring based on articles and databases, which are described in the leakage section	Annually
$EF_{projected\ fossil\ fuel}$	CO_2 Emission factor of residual fuel oil	tCO_2/TJ	IPCC 2006[62]	Not monitored
$NCV_{biomass}$	Net Calorific Value of non-renewable biomass	TJ/ton of Wood	Bibliography, described in respective table at section 3.3.	Not monitored
ρ_{wood}	Specific gravity of non-renewable biomass	ton/m³	Bibliography, described in respective table at section 3.3.	Not monitored
$f_{NRB,y}$	Fraction of biomass (wood) used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods	Percentage	Bibliography, described in respective table at section 3.3.	Annually
BF_y	Consumption of non-renewable biomass per thousand of ceramic units produced per year	Tons of non-renewable biomass/ thousand of ceramic units produced	Data from project proponent	Function of PR_y

In the monitoring plan, the amount of non-renewable biomass ($\mathbf{B_y}$) will be determined using the option 'a' of the applied methodology, i.e. it will be calculated from the thermal energy generated in the project activity as:

$$\mathbf{B_y = PR_y \times BF_y}$$

Where:

$\mathbf{PR_y}$ = Thousand of ceramic pieces produced per month;

$\mathbf{BF_y}$ = Tons of non-renewable biomass per thousand of ceramic units produced.

The responsible to monitor data provided in Table 13 will be *Mr. Antonio da Mata Silva.* Internal audit will guarantee data quality.

[62] *IPCC.* ***IPCC 2006 Guidelines for National Greenhouse Gas Inventories****. Page 2.18. Table 2.3. Available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf. Visited on June 14th, 2010.*

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

Monitored Parameters

Data / Parameter:	PR_y
Data unit:	Thousands of ceramic units produced per month
Description:	Production of ceramic pieces
Source of data to be used:	Controlled by the project proponent (ceramic company)
Value of data applied for the purpose of calculating expected emission reductions	1,378.917
Description of measurement methods and procedures to be applied:	The amount was acquired by counting the average of sold ceramic devices one year before the project start date (from January 2008 to December 2008). In 2008, it was considered the production according to the sales due to the non-availability of the control of the pieces that enter in the kiln. The measurement as from January 1st, 2009 will be done by an internal control sheet monitored by the project proponent, which will be fed daily. The production is a representative sample to ensure that all appliances are still in operation.
QA/QC procedures to be applied:	The ceramic has an internal control of the quantity of pieces fired through a sheet that is daily fed by an operator inside of the ceramic company that counts the total of pieces that enter inside the kiln. It will be compared to the biomass employed and the kiln consumption of renewable biomass.
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:	$Q_{renbiomass}$
Data unit:	Tons per month
Description:	Amount of renewable biomass
Source of data to be used:	Measured by the biomass providers and controlled by the ceramic owner
Value of data applied for the purpose of calculating expected emission reductions	The project proponent will preferentially employ wood residues in its burning process, as can be verified in the table below. <table><tr><td rowspan="2">Biomass</td><td>Renewable biomass</td></tr><tr><td>Wood residues</td></tr><tr><td>$Q_{renbiomass}$</td><td>1,700</td></tr></table>
Description of measurement methods and procedures to be applied:	The amount of renewable biomass was monitored from receipts or invoices values during the period from February, 2009 to April, 2010. The specific gravity will be used for conversions from m³ to tons.

Data to be applied are:

Biomass	**Renewable biomass**
	Wood residues
Specific Gravity of biomass [ton/m³]	0.7575

It was utilized Specific Gravity values from *Pinus* and *Eucalyptus* woodchips values, once the wood residues composition is mainly made of the woodchips of these species of trees.
The values are available at: <http://www.ipef.br/publicacoes/scientia/nr74/cap02.pdf>. Last visit on: December 10th, 2010.

The biomass providers bring the biomass to the ceramic company with invoices or receipts. Some of these evidences describe the amount of biomass in tons, which requires a calibration of the equipment used to measure the weight. Since this information is used for commercial purposes, it is considered that even though calibration of equipment does not occur, data from the suppliers are a reliable source.

As a conservative measure, the project developer is considering a 5% error margin in the measurement. Therefore, the amount of biomass that arrives in tons will be multiplied by 95%.

The properly working and calibration of the equipments by the biomass providers will be checked annually. If this is not done, the amount of biomass that arrives in tons will be multiplied by 95%.

QA/QC procedures to be applied:	It was monitored through receipts of purchase from the biomass providers. The ceramic industry controls the quantity of biomass through an internal spreadsheet, which is fed with the measured values of all the biomass that arrive from the providers. This internal spreadsheet was double checked with all the receipts and invoices of biomass employed.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Origin of Renewable Biomass**
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data to be used:	Controlled by the project proponent
Value of data applied for the purpose of calculating expected emission reductions	Renewable biomass
Description of measurement methods and procedures to be applied:	This information was given by the biomasses providers. The guarantee of acquiring renewable biomass is achieved by invoices/receipts from the providers. As stated in the section 2.2, the biomasses (wood residues, elephant grass, *açaí* pits, glycerin, and bamboo) 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 UNFCCC definition of renewable biomass[63].
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	**Leakage of non-renewable biomass**
Data unit:	tCO_2e
Description:	Leakage resulted from the non-renewable biomass
Source of data to be used:	Monitored
Value of data applied for the purpose of calculating expected emission reductions:	0
Description of measurement methods and procedures to be applied:	The three sources of leakages predicted in methodology applied will be monitored.
QA/QC procedures to be applied :	Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage. More information at Section 4.1, Leakage, Part B).
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 that is established as non-renewable biomass using survey methods
Source of data to be used:	Survey methods.
Value of data applied for the purpose of calculating expected emission reductions	0.8923
Description of measurement methods and procedures to be applied:	Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramic facility owner. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, according to SOCIOAMBIENTAL (2010)[64], Amazonian Biome has only 10.75% of its total area with sustainable use. According to a research made by Brazilian Environmental

[63] *UNFCCC - EB 18, annex 23 – "DEFINITION OF RENEWABLE BIOMASS". Available at: http://cdm.unfccc.int/EB/023/eb23_repan18.pdf. Visited on June 13th, 2010.*

[64] *SOCIOAMBIENTAL. Instituto Socioambiental, 2010. Unidades de Conservação na Amazônia Legal. Available at: <http://www.socioambiental.org/uc/quadro_geral>. Last visit on: December 15th, 2010.*

	Ministry, there are around 60m³ of wood per hectare in *Amazonia* biome[65]. Thus, the amount of non-renewable woody biomass (NRB) available at *Amazonia* biome is around 26,808,826,464 m³. The amount of demonstrably renewable woody biomass (DRB) is around 3,229,754,100 m³. So, according to the equation presented in the methodology applied, the fraction of non-renewable biomass is around 0.8924. Two sheets were made in order to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the *Amazonia* biome. The other sheet calculates the amount of wood consumed regarding only *Rio Negro* Ceramic. Dividing these values by the total of wood available, it was achieved the amount of renewable biomass that has been saved by all the project activities, or only by *Rio Negro* Ceramic Fuel Switching Project, respectively.[66] Finally, each value was subtracted from the fraction of non-renewable biomass to achieve the $f_{NRB,y}$, in order to be ensured that the proposed project activity is not saving the non-renewable biomass accounted for by the already registered project activities. Therefore, it was taken the smaller value in order to be more conservative. These sheets are available at the VCU Estimates spreadsheet.
QA/QC procedures to be applied:	The monitoring of this parameter will be based on national and international articles, databases, data monitored by the project developer such as project activities at the same region. The sources will provide information about the sustainable use of Amazonian biome. Wood saved from projects to which the same methodology was applied, which are in the same biome and applied methodology developed by *Sustainable Carbon – Projetos Ambientais Ltda.* was considered in this fraction. CDM or VCS registered projects will also be included in this fraction if placed in the same region and methodology.
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:	Tons or m³
Description:	Amount of renewable biomass available
Source of data to be used:	Monitored
Value of data applied for the purpose of calculating expected emission reductions:	**Harvest** / **07/08**: Wood Residues (m³) = 1,904,728

Harvest	**07/08**
Wood Residues (m³)	1,904,728

[65] *Source: Brazilian Environment Ministry, Normative Instruction nº 6 of 2006. Available at: <http://www.carvaomineral.com.br/abcm/meioambiente/legislacoes/bd_carboniferas/geral/in_06-2006_mma_n.pdf>. Last visit on: August 12th, 2009.*

[66] *According to data from project activities at Sustainable Carbon Company.*

	Açaí Pits (tons) — 87,508; Glycerin (m^3) — 129,370; Elephant Grass and bamboo — 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 on national and international articles and databases every monitoring period. These 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. More information at Section 4.1, Leakage, Part A).
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Fixed Parameters

Data / Parameter:	**$EF_{projected\ fossil\ fuel}$**
Data unit:	tCO_2/TJ
Description:	CO_2 Emission factor of residual fuel oil
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf>. Page 2.18. Table 2.3. Visited on June 14th, 2010
Value of data applied for the purpose of calculating expected emission reductions:	77.4
Description of measurement methods and procedures actually applied :	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of non-renewable biomass without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible substitute of wood than natural gas due to risks involving natural gas distribution and supply conditions.
QA/QC procedures to be applied:	The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction.

Data / Parameter:	**$NCV_{biomass}$**
Data unit:	TJ/ton
Description:	Net Calorific Value of non-renewable biomass
Source of data used:	BARROS, S. V. S. Avaliação da biomassa de espécies exóticas e nativas como fonte alternativa para geração de energia. 2006. 76f. Dissertação (Mestrado). Universidade Federal do

	Amazonas, Manaus, 2006. Available at: http://www.ppgcifa.ufam.edu.br/dissertacoes/S%E2mia%20Valeria%20dos%20Santos%20Barros/S%E2miaValeiraBarros.pdf. Visited on October 12th, 2010.
Value of data applied for the purpose of calculating expected emission reductions:	0.0181
Description of measurement methods and procedures actually applied:	This value will provide the energy generated from 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 Amazon Biome that are usually employed as fuel in the ceramic industries of the region. 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).
QA/QC procedures to be applied:	Species that are usually employed as fuel from Amazonia Biome in the ceramic sector according to “BARROS, S. V. S.” were included.
Any comment:	

Data / Parameter:	ρ_{wood}
Data unit:	ton/m^3
Description:	Specific gravity of non-renewable biomass
Source of data used:	BARROS, S. V. S. Avaliação da biomassa de espécies exóticas e nativas como fonte alternativa para geração de energia. 2006. 76f. Dissertação (Mestrado). Universidade Federal do Amazonas, Manaus, 2006. Available at: http://www.ppgcifa.ufam.edu.br/dissertacoes/S%E2mia%20Valeria%20dos%20Santos%20Barros/S%E2miaValeiraBarros.pdf. Visited on October 12th, 2010.
Value of data applied for the purpose of calculating expected emission reductions:	0.5542
Description of measurement methods and procedures actually applied:	The amount of wood used in the baseline was measured by volume units, so this data is used for unit conversion.
QA/QC procedures to be applied:	Species that are usually employed as fuel from Amazonia Biome in the ceramic sector according to “BARROS, S. V. S.” were included.
Any comment:	

Data / Parameter:	**BF_y**
Data unit:	Tons of non-renewable biomass per thousand of ceramic units produced
Description:	Consumption of non-renewable biomass per thousand of ceramic units produced per year
Source of data used:	Historical data from project proponent
Value of data applied for the purpose of calculating expected emission reductions:	1.0120
Description of measurement methods and procedures actually	The BF_y parameter was calculated based on the data of production and consumption of native wood from one year before the project start date, which corresponds to the period from

applied:	January 2008 to December 2008. The production was calculated through the control of pieces that enter in the kiln. It is measured by quantity of pieces, which is given in thousands. The values of non-renewable biomass were based on data acquired from receipts and invoices provided by ceramic internal control. If nowadays the facility still used non-renewable biomass its consumption would be around 1,396 tons of non-renewable biomass per month to produce approximately 1,379 thousand of ceramic units. These values are employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
QA/QC procedures to be applied:	These values lead to efficiencies of 1.0120 tons of non-renewable biomass to produce one thousand of ceramic pieces at *Rio Negro* ceramic. *Rio Negro* Ceramic's kilns are less efficient than average for a "Tunnel" kiln[67]. This value is discrepant because of the lack of technology in the region, and the indiscriminate use of the sawdust/wood chips from native wood without sustainable forest management.
Any comment:	The period from January, 2008 to December, 2008 was considered in order to determine the BF_y of *Rio Negro* ceramic. This period was chosen based on the type of information available on historical production. During 2008, production was monitored based on Sales report of the ceramic, whereas since January, 2009 production is monitored by controlling the amount of pieces that enter the kiln. This is done through an internal control sheet monitored by the project proponent, which is fed daily. Hence, to avoid using two different data sets, BF_y is determined with data from 2008 (January to December).

3.4 Description of the monitoring plan

The party responsible for implementing the monitoring plan will be the owner of *Rio Negro* Ceramic. The project proponent will also be responsible for developing the forms and registration formats for data collection and further classification. Data monitored will be kept during the crediting period and 2 years after. For this purpose, the authority for the registration, monitoring, measurement and reporting will be *Mr. Antonio da Mata Silva*. All the monitored parameter will be checked annually as requested in the methodology AMS-I.E: Switch from non – renewable biomass for thermal applications by the user – Version 02 valid from April 09th, 2010 to September 30th, 2010.

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.

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

With the carbon credits income, in order to complement the monitoring of the production of ceramic units, the project participant intends to acquire equipments which will monitor each burning cycle of the kilns through graphics of the temperature reached in the kiln versus time.

Sustainable Carbon Company will also implement the sustainability report following the SOCIALCARBON methodology, which was developed by *Instituto Ecológica* and focus in implementing the environmental and social activities within the fuel switching project. Social Carbon Company follows the SOCIALCARBON Guidelines available at: <http://www.socialcarbon.org/Guidelines/>.

In addition, the SOCIALCARBON Reports will be available at Markit Environmental Registry /SOCIALCARBON Registry (http://www.tz1market.com/socialpublic.php) once the project is registered.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. The project's emissions from the combustion of non-renewable biomass are accounted in the same way as fossil fuel combustion, once it is not renewable and emits CO_2.

Emission Reductions

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

Where:

ER_y: Emission reductions during the year y in tCO_2e

B_y: Quantity of biomass that is substituted or displaced in 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[68].

B_y is calculated as a product of the number of appliances multiplied by the estimate of average annual consumption of biomass per appliance:

$$B_y = PR_y \times BF_y \quad \text{(Equation 02)}$$

Where:

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

BF_y: Consumption of non-renewable biomass (tons) per thousand of ceramic units produced in year y.

The value of BF_y was determined with a use of the historical records of the *Rio Negro* Ceramic by dividing monthly consumption in the baseline by monthly baseline production.

Leakage (LE)

The methodology Category AMS-I.E: Switch from non – renewable biomass for thermal applications by the user – Version 02 Valid from April 09th, 2010 to September 30th, 2010, predicts the following possible three sources of leakage:

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

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 14).

Table 14. Sources of leakage according to the type of the biomass

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

Observing Table 14, the sources of leakage of the present project activity are the competing use of biomass for biomass residues or waste and the emissions from biomass generation/cultivation in case of biomass from cropland.

Elephant grass

In case of using elephant grass it will be cultivated in pasture or degraded areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, therefore the leakage that would be applicable is the emissions from biomass generation/cultivation. Currently, elephant grass has been acquiring national importance as biomass[69] 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)[70]. In case of using this

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[69] *Osava M. Energia: Capim elefante, novo campeão em biomassa no Brasil. Available at:<www.mwglobal.org/ipsbrasil.net/nota.php?idnews=3292>. Visited on June 14th, 2010.*

[70] *Embrapa. Formação e Utilização de Pastagem de Capim-Elefante. Instrução Técninca para o produtor de Leite. Available at:*

kind of biomass, the ceramic company will cultivate, by itself, elephant grass in abandoned areas, in which there is no vegetation to be deforested. Therefore, this practice will not generate competing use of biomass and it will not deforest a vegetated area, i.e. only the leakage from biomass cultivation will be monitored in case of its use.

Wood Residues

Wood Residues are also a fuel to be used for the ceramic units burning. The main wood residues to be applied in *Iranduba* Ceramic Pole are from the construction sector and sawmills as well as pallets from the Industrial Pole of *Manaus*.

According to Biasi et al. (2006) [71], 80% volume of the wood consumed from the Amazon Biome is from small companies with low technical support, which therefore results in high levels of waste.

Consequently, the large amount of waste generated from production from the wood industry, was burnt in order to dispose of it from the site, without reusing this waste as a potential energy generator.

The efficiency of wood used in the industrial process varies depending on the function, type and scale of the industry and equipment used, among other factors. The main residues are wood chips and sawdust, with the index of residue produced varying from 25% to 70% of the total volume of wood consumed (Biasi et al., 2006).

Therefore, being conservative, around 25% of the wood produced will be residues. The production of wood in the state of *Para*, which is a bordering state, was 7,618,912 m^3 in 2008[72]. Thus, at least 1,904,728 m^3 will be wood residues.

The project activity should utilize around 26,940 m^3 of wood residues per year, which represents approximately 1.4 % of the total of these residues generated in the State of *Pará.*

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

***Açaí* Residues**

According to IBGE – Brazilian Institute of Geography and Statistics, the fruit of *açaí* production in the Brazilian North Region was 106,296 tons in the year 2009. The states of *Amazonas* and *Pará* were responsible for the production of 102,951 tons in the year 2009. [73, 74] The pit corresponds to 85% of the weight of *açaí* [75]; therefore the *açaí* pit

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<www.cnpgl.embrapa.br/nova/informacoes/pastprod/textos/17Instrucao.pdf>. Visited on June 14th, 2010.

[71] *Biase, C. P.; Rocha, M. P. RENDIMENTO EM MADEIRA SERRADA E QUANTIFICAÇÃO DE RESÍDUOS PARA TRÊS ESPÉCIES TROPICAIS. FLORESTA, Curitiba, PR, v. 37, n. 1, jan./abr. 2007. Available at: http://ojs.c3sl.ufpr.br/ojs2/index.php/floresta/article/viewFile/7845/5537. Visited on June 6th, 2010.*

[72] *IBGE. Extração Vegetal e Silvicultura 2007. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=am&tema=extracaovegetal2008>. Visited on June 14th, 2010.*

[73] *IBGE. Extração vegetal e silvicultura 2009. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=am&tema=extracaovegetal2009>. Visited on December 13th, 2010.*

[74] *IBGE. Extração vegetal e silvicultura 2009. Available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=pa&tema=extracaovegetal2009>. Visited on December 13th, 2010.*

[75] *Frutas Brasil. Importância Economica do Açaí. Available at: <http://minhasfrutas.blogspot.com/2008/12/importancia-economica-do-aai.html>. Visited on April 27th, 2009.*

production on the states of *Amazonas* and *Pará* was around 87,508 tons in the year 2009.

Furthermore, the *Codajás* municipality, which is located in the state of Amazonas, does not have adequate use of its *açaí* and wood residues. The amount of residues generated is very high and it is usually thrown away into rivers or left on inadequate places causing water and soil pollution[76].

To solve this problem, the mayor of *Codajás* and *Sebrae*/AM (Brazilian Service to support Micro and Small size companies) made a partnership to collect *açaí* and wood residues to be applied as energy source in the Ceramic Poles of *Iranduba*/AM and *Manacapuru*/AM.

The project activity would employ approximately 25,252 tons of *açaí* pits per year, representing around 28.85% of the total of the amount produced. Therefore, the project activity will not disturb in any aspects this renewable fuel market once there is plenty of this kind of biomass available.

Bamboo

Bamboo is a fast growing plant, and efficiently performs the functions of soil protection and carbon sequestration, and provides food and raw material for many applications. Furthermore, this plant is commonly utilized as quickset in rural properties, and its pruning is normally done in order to avoid the undesirable dispersion due to its invader characteristics. Unlike trees, the bamboo can be harvested without the destruction of the crop due to just the stem of the bamboo is utilized and the rhizome remains in the ground. When it is properly harvested and managed, the plantation continues full of younger individuals and it is difficult to realize that a harvest was done[77].

There is perspective of the amount that this project activity would use of Bamboo. However, there is no source of the production of Bamboo in the Amazon Biome. If the ceramic company uses this kind of biomass in the future, the availability and production of Bamboo will be measured in order to guarantee that the project activity will not disturb this renewable fuel market.

Glycerin

The glycerin is a residue generated at the biodiesel process, which is named transesterification.[78] As the production of biodiesel is growing in Brazil, the offering of glycerin is also growing.[79]

A study carried out by *Universidade Federal do Rio de Janeiro* states that for 90 m³ of biodiesel, it is generated 10 m³ of glycerin.[80] As the

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[76] *RTS. No lugar de madeira resíduos de açaí. Available at: http://www.rts.org.br/noticias/destaque-1/no-lugar-de-madeira-residuos-de-acai. Visited on June 4th, 2010.*

[77] *According to "Projeto Bambu". Available at: < http://www.a-ponte.org.br/modulos/projetos/projeto_10/index.php?pgn=prj_bambu.php>. Last visit in: June 16th, 2010.*

[78] *AUTH, et. al; Estudo e preparação do biodiesel.UNIVATES – Centro Universitário; Programa de Pós-graduação em Ensino de Ciências Exatas. Available at: http://www.univates.br/ppgece/docs/PT_Eniz1.pdf. Last visit on: December 08th, 2010.*

[79] *MELLLO et al. Visões Ambientais para o Financiamento de Biocombustíveis no Brasil. Departamento de Meio Ambiente do BNDES. Available at: http://www.conservacao.org/publicacoes/files/15_Finaciamento_Biocombust_BNDES.pd. Last visit on December 08th, 2010.*

[80] *GONÇALVES, et. al. Universidade Federal do Rio de Janeiro – Instituto de Química. Biogasolina: Produção de Éteres e Ésteres da Glicerina. Rio de Janeiro. Available at: http://www.biodiesel.gov.br/docs/congressso2006/Co-Produtos/Biogasolina3.pdf. Last visit on December 08th, 2010.*

Brazilian production of biodiesel in 2008[81] was 1,164,332 m³, the amount of glycerin generated was 129,370 m³, which corresponds to 153,950.3 tons of glycerin[82].

The project activity would employ approximately 11,527 tons of *glycerin* per year, representing around 7.5% of the total of the amount generated in the year 2008. Therefore, the project activity will not disturb in any aspects this renewable fuel market once there is plenty of this kind of biomass available.

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

The following potential sources of this type of leakage were identified:

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

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

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

It is expected that the carbon credit revenues will stimulate the use of renewable biomass by other ceramic facilities presenting a huge possibility for sustainable development in the region. The reason is, that it is predicted that the project activity will not displace use of renewable biomass of a non-project user, due to a currently great amount of non-renewable and renewable biomass available locally as described before. Hence, diversion from utilization of non-renewable biomass by the project activity won’t result in any significant decrease in prices of non-renewable biomass in the local market. Similarly, it won’t have any significant effect on prices of renewable biomass in terms of project activity consumption being relatively big enough to push the renewable prices up. Conclusion is that the fuel switch isn’t expected to make the use of renewable biomass for its current users less viable and on the other hand isn’t expected to result in higher viability of return back to non-renewable biomass.

The non-renewable biomass which is employed in this project activity will not be saved for other project activities, since other ceramic facilities were already consuming wood from non-sustainable forest management (see Common practice section). Henceforth, there is no need

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[81] *SÃO PAULO, Estado - Instituto de Economia Agrícola. Desempenho da Produção Brasileira de Biodiesel em 2008. Avaiable at: http://www.iea.sp.gov.br/out/verTexto.php?codTexto=10115. Last visit on: December 08th, 2010.*

[82] *The specific gravity of glycerin is 1.190 tons/m³, according to: PIRES, L.F. Uso da energia nuclear para fins pacíficos: medidas de densidade, umidade e comprimento de materiais usando radiação gama. Ponta Grossa, PR. Available at: <http://revista.cefet-al.br/index.php/edutec/article/viewFile/8/2>. Last visit on November 25th, 2009.*

to use the non-renewable biomass which won't be used by the project activity for creation or justification of any possible future project.

All in all, this source of leakage is not considered in this project activity.

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

This leakage is not applicable for this project activity at *Rio Negro* Ceramic as no transfer of equipment occurred. Only new equipments were acquired and existing kilns modified without any transfer of previously used technology.

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

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

The applied methodology does involve project emissions into the emission reductions calculation. Therefore, taking into account that the leakage is zero, the emission reductions are equal to baseline emissions, calculation of which is demonstrated below:

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

B_y, total = 16,547 thousands of ceramic units per year x 1.0120 tons of wood/thousand of ceramic units = 16,746 tons of non-renewable wood consumed per year

BE_y, total = 16,746 tons of non-renewable wood x 0.8923 x 0.0181 TJ/tons x 77.4 tCO_2e/TJ = 20,932 tCO_2e

Table 15. Baseline Emissions of the project

Voluntary Carbon Units generated due to avoiding non-renewable combustion	
Year	**Baseline Emissions (tCO_2e)**
March 1st to December 31st - 2009	17,444
2010	20,932
2011	20,932
2012	20,932
2013	20,932
2014	20,932
2015	20,932
2016	20,932
2017	20,932
2018	20,932
January 1st to February 28th - 2019	3,488
Total	**209,320**
Average	**20,932**

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

Project activity emissions of CO_2 and any other GHG were excluded because the applied methodology does not encompass this type of emissions. Furthermore, if it was considered, the value would be very small as the project emission of CO_2 would be only related to electricity consumption.

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

Table 16. Emission Reductions of the project

Year	Baseline Emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
March 1st to December 31st - 2009	17,444	0	17,444
2010	20,932	0	20,932
2011	20,932	0	20,932
2012	20,932	0	20,932
2013	20,932	0	20,932
2014	20,932	0	20,932
2015	20,932	0	20,932
2016	20,932	0	20,932
2017	20,932	0	20,932
2018	20,932	0	20,932
January 1st to February 28th - 2019	3,488	0	3,488
Total(tCO_2e)	209,320	0	209,320
Number of years of the crediting period	10	10	10
Annual average for the 10 years of crediting period (tCO_2e)	20,932	0	20,932

5 Environmental Impact:

The environmental impacts were analyzed by considering possible impacts of the project regarding the following environmental factors: soil, air, climate, water/hydric resources, fauna, and flora. As can be observed in table 17, 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 mixture used as thermal insulator in the kilns entrance.

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

Table 17. 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
Fauna	Biodiversity preservation	Positive
Flora	Biodiversity preservation	Positive

The project does not cause any additional negative impacts as all energy is generated utilizing renewable biomass only, which is a naturally greatly abundant natural resource, use of which actually has positive impacts on environment in comparison with leaving it to decay.

On the contrary, the project activity will improve the local environmental conditions by promoting collection and further productive use of the renewable biomass and also by contributing to reduction of the deforestation rate. Necessity of proving the origin of the renewable biomass promotes forest management which will consequently positively impact other areas of environment, like water resources, soil quality, flora and fauna diversity, etc.

Environmental Laws related to the plant activities

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

An EIA was not required for this project activity.

In addition, the project activity will contribute to the sustainable development of the host country, such as:

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

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

6 Stakeholder comments:

The main stakeholders considered in this project are the Environmental Protection Institute of *the Amazonas State* (IPAAM), the *Iranduba* City Hall, the ceramic sector syndicate (ACERAM), SEBRAE/AM, SDS - Government of the State of *Amazonas*, Federation of Industries of Amazonas State (FIEAM), and ceramic facility employees. A letter was sent to the stakeholders informing about the project activity. In addition to that, the letter was posted on the employee´s board in the ceramic facility, which is a visible place with high circulation of employees. The letter was available during 7 days and the comments were expected for a period of 7 days after the letter has been posted.

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

The ceramic sector syndicate keeps relationships with local development agencies, like SEBRAE (Brazilian Service to support Micro and Small size companies), among others so it will help in the diffusion of project results and practices.

7 Schedule:

- Project start date[83]: February 23rd,2009
- Crediting period start date: March 1st, 2009
- Date of terminating the project: February 28th, 2019
- Validation Report predicted to: February 10th, 2011
- First Verification Report predicted to: March 31st, 2011
- VCS project crediting period: 10 years renewable
- Monitoring and reporting frequency: preferentially from 6 to 12 months, since the beginning of the crediting period.

[83] *Date on which the project began reducing or removing GHG emissions, i.e. defined as the date of the first purchase of renewable biomass.*

8 Ownership:

8.1 Proof of Title:

Ceramic's article of incorporation and the contract between *Sustainable Carbon – Projetos Ambientais Ltda* – project developer and project proponent – and *Rio Negro* Ceramic will proof the title, demonstrating the rights to the GHG emissions reductions and the ownership of the project. These proofs of title will be checked by the DOE and are available at *Rio Negro* Ceramic for consultation.

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

Not applicable.