CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Ceará Renewable Energy Bundled Project
Version 01.1
PDD completed in: 11/07/2011

A.2. Description of the small-scale project activity:

The project activity is the bundled project of five red ceramic factories belonging to Grupo Tavares, a family business that owns several ceramic factories in the State of Ceará, Brazil. The following ceramic factories are included in this project: Antônio Ceramic, Ceará Ceramic, Ceagra Ceramic, Eliane Ceramic and Santa Rita Ceramic. Antônio Ceramic and Eliane Ceramic are located at Itaitinga, in the state of Ceará, northeast region of Brazil. Ceará Ceramic and Ceagra Ceramic are located at Aquiraz, also in the State of Ceará. Santa Rita Ceramic is located at São Gonçalo do Amarante, also in the State of Ceará. The ceramic factories produce ceramic bricks, tiles and construction blocks, destined mainly for the regional market in the metropolitan area of Fortaleza.

All ceramics used to utilize predominantly wood without sustainable forest management as fuel. The use of this type of non-renewable biomass 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[1]. 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[2]. On the other hand, the project activity focuses on the use of renewable biomass for thermal energy supply.

A brief description of the situation on each ceramic before and after the initiation of the project activity follows:

Antônio Ceramic

This ceramic operates two Hoffmann[3] kilns using in the baseline predominantly native firewood (wood without sustainable forest management) as fuel. A small fraction of wood from areas with sustainable forest management plan was also used, though representing less than 5% of total fuel usage. As the project activity, the proponent has switched its fuel to renewable biomasses such as cashew nut shells, residues from cashew tree, coconut husk and increased amounts of wood from areas with sustainable forest management plan. The ceramic has also acquired new equipments, including automatic feeders, to allow an efficient use of renewable biomass as fuel.

Before being cooked in the kilns, the pieces must be dried. At Antônio Ceramic, the ceramic pieces are dried naturally, so no fuel is used for the drying process. During 2009, Antônio Ceramic has produced approximately 7,921 thousands of ceramic pieces. The identified baseline for this ceramic is the utilization of a total of around 5,407 tonnes of non-renewable woody biomass per year to provide thermal energy to the ceramics' kilns.

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[1] *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>. Last visited on 23/03/2011.*

[2] *Energy Research Company. National Energy Balance - energy consumption per sector. Available at: <https://ben.epe.gov.br/BEN2007_Capitulo3.aspx>. Last visited on 23/03/2011.*

[3] *"Hoffman" is a very old type of kiln, which has parallel chambers where the heat from one chamber is used in the next, therefore recycling the generated heat in the previous chambers.*

Figure 1. Hoffmann kiln being fed with renewable biomass in Antônio Ceramic.

Figure 2. Cashew nut shells stored prior to use as fuel in Antônio Ceramic.

Ceará Ceramic

This ceramic operates two Hoffmann[4] kilns and three round[5] kilns using in the baseline predominantly native firewood as fuel. A small fraction of wood from areas with sustainable forest management plan was also used, though representing less than 10% of total fuel usage. As the project activity, the proponent has switched its fuel to renewable biomasses such as cashew nut shells, residues from cashew tree, coconut husk and increased amounts of wood from areas with sustainable forest management plan. The ceramic has also acquired new equipments, including automatic feeders, to allow an efficient use of renewable biomass as fuel.

Before being cooked in the kilns, the pieces must be dried. At Ceará Ceramic, the ceramic pieces are dried naturally, so no fuel is used for the drying process. During 2009, Ceará Ceramic has produced approximately 11,453 thousands of ceramic pieces. The identified baseline for this ceramic is the utilization of a total of around 7,252 tonnes of non-renewable woody biomass per year on average to provide thermal energy to the ceramics' kilns.

[4] "*Hoffman" is a very old type of kiln, which has parallel chambers where the heat from one chamber is used in the next, therefore recycling the generated heat in the previous chambers.*

[5] *Round kilns are intermittent kilns with round shape and lateral furnaces. Intermittent kilns do not allow the continuous operation, as the fuel needs to be added and the kiln cleaned between each burning cycle. Intermittent kilns are not as efficient as continuous kilns (such as tunnel or Hoffmann kilns) because continuous kilns allow the better distribution of heat.*

Figure 3. Round kiln at Ceará Ceramic.

Figure 4. Hoffmann kiln being fed with renewable biomass in Ceará Ceramic.

<u>Ceagra Ceramic</u>

This ceramic operates two Hoffmann kilns using in the baseline predominantly native firewood (wood without sustainable forest management) as fuel. A small fraction of wood from areas with sustainable forest management plan was also used, though representing around 10% of total fuel usage. As the project activity, the proponent has switched its fuel to renewable biomasses such as cashew nut shells, residues from cashew tree, coconut husk and increased amounts of wood from areas with sustainable forest management plan. The ceramic has also acquired new equipments, including automatic feeders, to allow an efficient use of renewable biomass as fuel.

Before being cooked in the kilns, the pieces must be dried. At Ceagra Ceramic, the ceramic pieces are dried naturally, so no fuel is used for the drying process. During 2009, Ceagra Ceramic has produced around 14,862 thousands of ceramic pieces. The identified baseline for this ceramic is the utilization of a total of approximately 9,424 tonnes of non-renewable woody biomass per year to provide thermal energy to the ceramics' kilns.

Figure 5. Hoffmann kiln being fed with renewable biomass in Ceagra Ceramic.

Figure 6. Cashew nut shells stored prior to use as fuel in Ceagra Ceramic.

<u>Eliane Ceramic</u>

This ceramic operates one Hoffmann kiln and one chamber kiln using in the baseline predominantly native firewood (wood without sustainable forest management) as fuel. A fraction of wood from areas with sustainable forest management plan was also used, though representing around 10% of total fuel usage. As the project activity, the proponent has switched its fuel to renewable biomasses such as cashew nut husk, residues from cashew tree, coconut husk and increased amounts of wood from areas with sustainable forest management plan. The ceramic has also acquired new equipments, including automatic feeders, to allow an efficient use of renewable biomass as fuel. In Eliane Ceramic biomass is processed to be used as fuel by several Ceramics from Grupo Tavares. Different types of biomass (such as cashew nut shells, coconut residues and wood residues) are chopped and mixed into a single product. Machinery to process biomass includes electric shredders and screeners.

Before being cooked in the kilns, the pieces must be dried. At Eliane Ceramic, the ceramic pieces are dried naturally, so no fuel is used for the drying process. During 2009, Eliane Ceramic has produced around 8,186 thousands of ceramic pieces. The identified baseline for this ceramic is the utilization of a total of approximately 5,093 tonnes of non-renewable woody biomass per year to provide thermal energy to the ceramics' kilns.

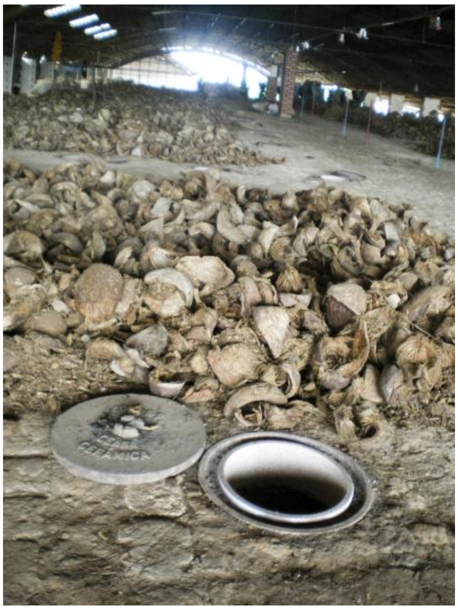

Figure 7. Hoffmann kiln being fed with renewable biomass (coconut residues) in Eliane Ceramic.

Figure 8. Biomass being processed to used as fuel in Eliane Ceramic.

Santa Rita Ceramic

This ceramic operates two Hoffmann kilns using in the baseline predominantly native firewood as fuel. A small fraction of wood from areas with sustainable forest management plan was also used, though representing less than 10% of total fuel usage. As the project activity, the proponent has switched its fuel to renewable biomasses such as cashew nut shells, residues from cashew tree, coconut husk and increased amounts of wood from areas with sustainable forest management plan. The ceramic has also acquired new equipments, including automatic feeders, to allow an efficient use of renewable biomass as fuel.

Before being cooked in the kilns, the pieces must be dried. At Santa Rita Ceramic, the ceramic pieces are dried naturally, so no fuel is used for the drying process. During 2009, Santa Rita Ceramic has produced around 8,424 thousands of ceramic pieces. The identified baseline for this ceramic is the utilization of a total of approximately 5,307 tonnes of non-renewable biomass per year on average to provide thermal energy to the ceramics' kilns.

Figure 9. Hoffmann kiln being fed with renewable biomass in Santa Rita Ceramic.

This project activity will reduce the greenhouse gases (GHG) emissions through the substitution of non-renewable biomass for renewable biomasses to generate thermal energy. As renewable biomasses, the project activity will utilize mostly biomass residues (such as cashew nut shells, residues from cashew tree, coconut husk) and wood from sustainable forest management plan areas to feed the ceramic's kilns. The project will also involve energy efficiency measures, such as improved fuel handling and kilns improvement to reduce the necessary energy per production output[6].

This project pointed out the possibility for switching from non-renewable biomass to renewable biomasses, which was unattractive due some barriers, including higher fuel costs, uncertainties associated to the fuel switch and the lack of knowledge to operate with renewable biomass. The barriers that prevented the implementation of this project are further described in Section B.5. The ceramic owners have considered the income from the commercialization of the carbon credits to make the project activity viable.

The main goal of this project activity is to minimize the negative impacts of deforestation to obtain firewood, whose consumption also leads to GHG emissions that contribute to climate change. Moreover, in opposition to the identified baseline, the project activity will generate thermal energy exclusively from renewable sources, by using abundant renewable biomasses in the region. All these measures contribute to sustainable development by promoting renewable energy, mitigating atmospheric pollution and improving the quality of employment for the ceramic workers.

Table below provides a brief history of the implementation of this project:

Table 1. Brief history on the project implementation.

Date	Event
October, 2008	Grupo Tavares and Sustainable Carbon begin the validation of their first GHG emission reduction project, entitled *Assunção Ceramic Fuel Switching Project*. The project involves fuel switching to renewable biomass in another Ceramic belonging to Grupo Tavares.
September, 2009	*Assunção Ceramic Fuel Switching Project* is validated under the Voluntary Carbon Standard as is able to generate carbon credits from fuel switching measures

[6] No emission reductions are claimed for energy efficiency measures, since these are applied after the complete fuel switch to renewable biomass.

January, 2010	Grupo Tavares begins tests with renewable biomass in the five ceramic factories included in the current project.
July, 2nd 2010 (starting date of the project activity)	Grupo Tavares and Sustainable Carbon sign contracts for the development of an GHG emission reduction project in the five ceramic factories included in the current project.
September,1st 2010	Starting date of the crediting period.

A.3. Project participants:

Name of the party involved(*) ((host) indicates a host party	**Private and/or public entity(ies) project participants (*)** **(as applicable)**	**Kindly indicate if the Party involved wishes to be considered as project participant** **(Yes/No)**
Brazil	Sustainable Carbon Projetos Ambientais Ltda	No
	Antônio Cavalcante de Souza Olaria-ME	No
	Ceará Cerâmica Ltda	No
	Ceagra – Cerâmica e Agropecuária Assunção Ltda	No
	Eliane Cavalcante de Souza EPP	No
	Cerâmica Santa Rita Ltda	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. However, this is a voluntary project. Hence, no approval from the Host Party is needed.		

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

The project is located in northeast region of Brazil, in the State of Ceará. Sections below provide more information on the exact location of each ceramic included in the project activity.

A.4.1.1. Host Party(ies):

Brazil

A.4.1.2. Region/State/Province etc.:

Ceará

A.4.1.3. City/Town/Community etc:

Itaitinga, Aquiraz and São Gonçalo do Amarante

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The ceramics are located in Brazil, in the state of Ceará in the northeast region of the country. The geographic location is illustrated in Figure 10.

Table 2. Location of the ceramics.

Ceramic	City	State
Antônio Ceramic	Itaitinga	Ceará
Eliane Ceramic		
Ceará Ceramic	Aquiraz	
Ceagra Ceramic		
Santa Rita Ceramic	São Gonçalo do Amarante	

The project sites have the postal addresses:

- Antônio Ceramic

Address: Rodovia BR 116, Km 28, s/n°, Riachão
CEP 61.880-000
Itaitinga

- Ceará Ceramic:

Address: Rodovia BR 116, Km 32, s/n°, Sítio Terra do Sol
CEP 61.700-000
Aquiraz

- Ceagra Ceramic

Address: Rodovia BR 116, Km 28, s/n°, Riachão
CEP 61.880-000
Aquiraz

- Eliane Ceramic

Address: Rodovia BR 116, Km 26, s/n°
CEP 61.880-000
Itaitinga

- Santa Rita Ceramic:

Address: Rodovia BR 222, Km 47, s/n°
CEP 62.670-000
São Gonçalo do Amarante

The ceramics are located at the following coordinates:

Table 3. Geographic coordinates of the Ceramics

Ceramic	Latitude	Longitude
Antônio Ceramic	4° 0'42.01"S	38°31'15.00"W
	4° 0'35.76"S	38°31'9.81"W
	4° 0'38.71"S	38°31'5.94"W
	4° 0'45.04"S	38°31'10.28"W
Ceará Ceramic	4° 1'26.94"S	38°29'42.65"W
	4° 1'19.36"S	38°29'50.76"W

	4° 1'14.27"S	38°29'46.78"W
	4° 1'21.63"S	38°29'36.64"W
Ceagra Ceramic	3°59'38.63"S	38°30'57.44"W
	3°59'27.09"S	38°30'56.27"W
	3°59'32.55"S	38°30'49.93"W
	3°59'39.20"S	38°30'53.34"W
Eliane Ceramic	3°58'36.08"S	38°30'52.04"W
	3°58'38.07"S	38°31'0.01"W
	3°58'32.51"S	38°31'0.85"W
	3°58'31.87"S	38°30'52.57"W
Santa Rita Ceramic	3°40'6.56"S	38°58'42.94"W
	3°40'1.80"S	38°58'49.15"W
	3°39'58.66"S	38°58'46.74"W
	3°40'6.56"S	38°58'42.94"W

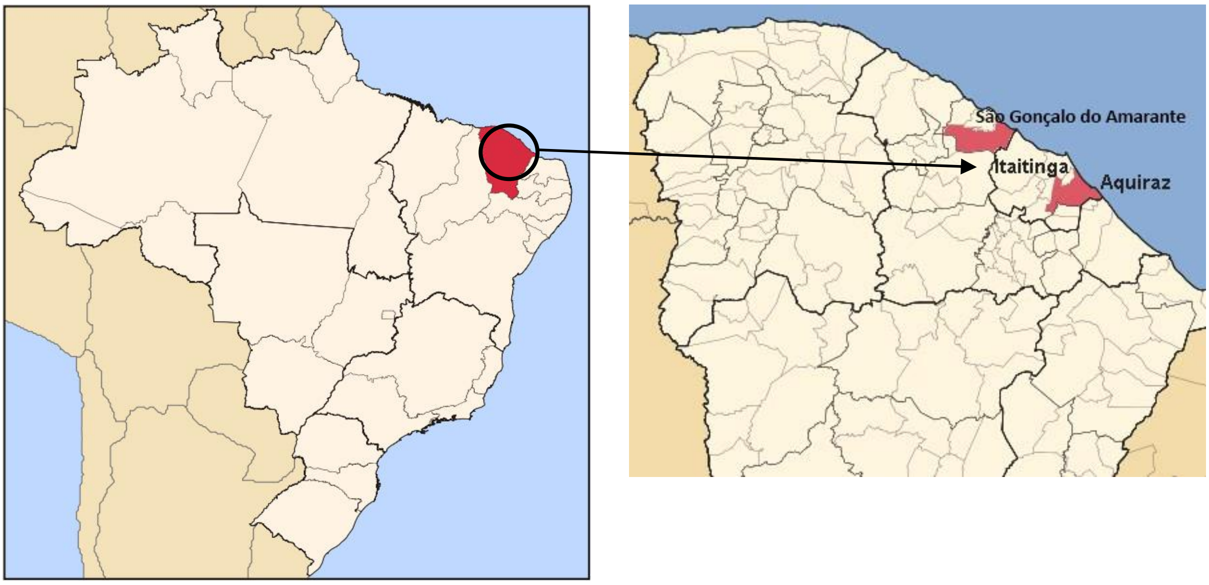

Figure 10. Geographic location of the cities of the project activity.

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

This is a voluntary project activity that fits into the following categories according to UNFCCC and Gold Standard definitions:

- **Project scale**: the project is a small scale project. It generates less than 45MWthermal.
- **Project type**: the project fits both the Renewable Energy Supply category and the End-use Energy Efficiency Improvement category, as it generates energy from non-fossil and non-depletable energy sources (renewable biomasses). The project will also include energy

efficiency measures, thus reducing the amount of energy required for producing non-energy physical goods (ceramic pieces). The project also fits in the following category of Annex C[7] of the Gold Standard Toolkit version 2.1[8]: "*Electricity and/or heat, and liquid biofuels from biomass resources*", since the project generates heat from biomass resources.

The project is also associated to the following scope, as per UNFCCC definitions:

1 - Energy industries (renewable - / non-renewable sources);

As it is further detailed in Section A.2, the project involves the fuel switching from non-renewable biomass to renewable biomass for the production process of five red ceramic factories located in Brazil. Although there are barriers associated to these practices (as described in Section B.5), such technologies/measures are considered environmentally safe and sound.

Sustainable Carbon has helped introducing this practice in several ceramic industries in Brazil, which have benefited from the voluntary carbon market to mitigate their environmental impacts. Sustainable Carbon experience with this type of project indicates that the use of renewable biomass is a safe and sustainable practice for red ceramic factories.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO2e					
	Antônio Ceramic	**Ceará Ceramic**	**Ceagra Ceramic**	**Eliane Ceramic**	**Santa Rita Ceramic**	**Total**
2010 (from 01/09/2010 to 31/12/2010)	2,811	3,771	4,900	2,648	2,617	16,747
2011	8,411	11,281	14,660	7,923	7,830	50,105
2012	8,411	11,281	14,660	7,923	7,830	50,105
2013	8,411	11,281	14,660	7,923	7,830	50,105
2014	8,411	11,281	14,660	7,923	7,830	50,105
2015	8,411	11,281	14,660	7,923	7,830	50,105
2016	8,411	11,281	14,660	7,923	7,830	50,105
2017	8,411	11,281	14,660	7,923	7,830	50,105
2018	8,411	11,281	14,660	7,923	7,830	50,105
2019	8,411	11,281	14,660	7,923	7,830	50,105
2020 (from 01/01/2020 to 31/08/2020)	5,600	7,510	9,760	5,275	5,213	33,358
Total estimated reductions (tonnes of CO_2e)	**84,110**	**112,810**	**146,600**	**79,230**	**78,300**	**501,050**
Total number of crediting years	10	10	10	10	10	10

[7] *Annex C available at: <http://www.cdmgoldstandard.org/fileadmin/editors/files/6_GS_technical_docs/GSv2.1/Annex_C.pdf>. Last visited on 20/01/2011.*

[8] *Toolkit available at: <http://www.cdmgoldstandard.org/fileadmin/editors/files/6_GS_technical_docs/GSv2.1/GSv2.1_Toolkit_Clean.pdf >. Last visited on 20/01/2011.*

Years	Annual estimation of emission reductions in tonnes of CO2e					
	Antônio Ceramic	**Ceará Ceramic**	**Ceagra Ceramic**	**Eliane Ceramic**	**Santa Rita Ceramic**	**Total**
Annual average of the estimated reductions over the crediting period (tonnes of CO_2e)	**8,411**	**11,281**	**14,660**	**7,923**	**7,830**	**50,105**

A.4.4. Public funding of the small-scale project activity:

There is no public funding involved in this project activity. The project does not receive Official Development Assistance.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to version 03 of the Guidelines on assessment of debundling for SSC project activities[9], a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(a) With the same project participants;
(b) In the same project category and technology/measure; and
(c) Registered within the previous 2 years; and
(d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

There are no projects that fit those conditions, according to a survey made by Sustainable Carbon both in the CDM project database[10] and on the Gold Standard Registry[11]. Therefore, the project is not a debundled component of a large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The project utilizes the following methodology approved under the Clean Development Mechanism for small scale projects: "**AMS-I.E: Switch from Non-Renewable Biomass for Thermal Applications by the User**", version 04[12], valid from 29/04/2011 onwards.

This category comprises activities to displace the use of non-renewable biomass by introducing renewable energy technologies. The technology in case of this project activity is determined as the ceramic facilities, which utilize thermal energy generated by the new renewable energy technology.

The project also utilizes the following tool: Tool for the demonstration and assessment of additionality, version 05.2[13].

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[9] *Document available at: <http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid17.pdf>. Last visited on 20/01/2011.*
[10] *Available at: <http://cdm.unfccc.int/Projects/projsearch.html>. Last visited on 20/01/2011.*
[11] *Available at: <http://goldstandard.apx.com/index.asp>.Survey performed on 23/03/2011.*
[12] *Methodology available at: <http://cdm.unfccc.int/methodologies/DB/I1DGDUD1D5J0KMLSZFWMD3W9Z47OZZ>. Last visited on 11/05/2011.*
[13] *Tool available on UNFCCC's website: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf. Last visited on: 23/03/2011.*

B.2 Justification of the choice of the project category:

The applied methodology is applicable for the generation of thermal energy by introducing renewable energy technologies that displace the use of non-renewable biomass. As the project involves the substitution of non-renewable biomass (wood from areas without forest management plan) with renewable biomass, the project complies with conditions described on this methodology.

As further detailed in Section B.6, the project qualifies as a small scale project activity and will remain under the limits of small-scale project activity types during every year of the crediting period. In 2009, the kilns in all ceramics included in the project have generated 674.09 TJ. Converting this number to MWh, it was generated 187,247 $MWh_{thermal}$ per year, which corresponds to a capacity of 21.38 $MW_{thermal}$ on average. The project will generate 100% of the needed energy from renewable biomasses and will involve energy efficiency measures, thus reducing the amount of energy per production output. As a conservative estimate, the project capacity for renewable energy generation is considered the same as the baseline scenario[14], which is less than the limits of 45 MWthermal for Type I Small scale project activities.

The table below provides an assessment of relevant applicability conditions and how the project complies with such conditions:

[14] *Energy production might vary during the crediting period depending on production. The production of the ceramics is expected to increase during the project activity. However, an increase beyond the limits of small scale project activities is not expected.*

Table 4. Assessment of the project compliance to the chosen methodology and to Gold Standard eligibility requirements.

Applicability conditions		**Assessment of project compliance to the applicability condition**
Section	**Description**	
AMS-I.E: Switch from Non-Renewable Biomass for Thermal Applications by the User, version 04		
1.	This category comprises activities to displace the use of non-renewable biomass by introducing renewable energy technologies. Examples of these technologies include but are not limited to biogas stoves, solar cookers, passive solar homes, renewable energy based drinking water treatment technologies (e.g. sand filters followed by solar water disinfection; water boiling using renewable biomass).	The main focus of this Project is to allow the substitution of non-renewable biomass with renewable biomass for thermal energy generation. Such biomass will be used to provide thermal energy in kilns of five red ceramic factories.
2.	Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.	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[15]. 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[16].
Gold Standard Toolkit Annex C, Table C-1.		
First item	Project activities making use of non-renewable biomass resources shall NOT be eligible for Gold Standard registration. The project applicant shall therefore provide convincing evidence that the project activities make use of renewable biomass resources, and shall include this in the Sustainability Monitoring Plan	The project will use exclusively demonstrably renewable biomasses whose source can be verified. Biomasses shall be considered renewable only if they are in accordance to the CDM EB definitions set out in Annex 18 of EB meeting 23[17].
Second item	Project activities planning to make use of biomass resources already in use (e.g. food, heating, etc.) shall NOT be eligible for Gold Standard registration unless convincing evidence is provided that the current users are in agreement with the new use envisioned. In the absence of such an agreement, the project applicants shall demonstrate that the project activities	In case the project utilizes existing biomass, it shall be demonstrated that only surplus biomass is used. Publications shall be used to determine biomass availability in the project region.

[15] *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>. Last visited on 23/03/2011.*
[16] *Energy Research Company. National Energy Balance - energy consumption per sector. Available at: <https://ben.epe.gov.br/BEN2007_Capitulo3.aspx>. Last visited on 23/03/2011.*
[17] *Document is available at: <http://cdm.unfccc.int/EB/Meetings/023/eb23_repan18.pdf>. Last visited on 23/03/2011.*

Applicability conditions		Assessment of project compliance to the applicability condition
Section	**Description**	
	makes use of surplus biomass, and shall include this in the Sustainability Monitoring Plan.	
Third item	Project activities making use of land currently in use for growing food crops to grow dedicated energy crops shall NOT be eligible for Gold Standard registration unless convincing evidence is provided showing that the energy crop is part of a traditional rotational cropping. The project applicant shall therefore demonstrate that the project activities make use of otherwise set aside or marginal land, and shall include this in the Sustainability Monitoring Plan.	The project is not expected to use lands to grow dedicated energy crops. If that occurs during the crediting period, compliance with that applicability condition will be assured.
Fourth item	Project activities making use of GMOs shall declare so in a transparent way. Local stakeholders opinion on GMOs shall prevail and appropriate mitigation measures shall be put in place to address their concerns, if any, in a satisfactory way.	The project is not expected to use Genetically Modified Organisms.

In addition to the applicability conditions described above, it is worth mentioning that the project does not involve biomass conversion neither will make use of palm oil and/or palm oil mill products or residues for electricity or heat generation.

B.3. Description of the project boundary:

According to the applied methodology, the project boundary for the project is the physical, geographical site of the use of biomass or the renewable energy. This means that the ceramic factories are the project boundary.

For the determination of the baseline emissions, it is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs. This means that baseline emissions are those resulting from the use of non-renewable fuels to burn ceramic pieces. This practice is responsible to discharge in the atmosphere the carbon that was stored in the fuel. Project activity emissions are not included according to the applied methodology. An increase in emissions due to transportation of renewable biomass is not likely to be significant, since similar means of transportation were used in the baseline scenario for the transportation of non-renewable biomass. Table below provides more information on the emission sources included in the project boundary.

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

	Gas	Source	Included?	Justification/ Explanation
Baseline	CO_2	Emission from the combustion of fossil fuels	Yes	The major source of emissions in the baseline
	CH_4		No	Excluded for simplification. This is conservative.
	$N_2$0		No	Excluded for simplification. This is conservative.
Project Activity	The methodology does not include any source of project emissions.			

B.4. Description of baseline and its development:

The baseline scenario is identified according to general guidance to the small-scale CDM methodologies[18]. The baseline scenario is identified by assessing possible alternatives to the project that could provide similar levels of activity. The baseline assessment is made once for all ceramics included in the project. Since they all operate in similar conditions (in terms of technology availability, market conditions, legal framework, amongst others) this approach is considered appropriate[19]. Furthermore, the scenario existing prior to the project initiation was similar for all ceramics included in the project, namely the predominant use of non-renewable biomass as fuel to produce ceramic pieces

The possible alternatives to the project consist in the production of ceramic pieces by using different types of fuels to obtain thermal energy. Common fuels employed and therefore candidates for

[18] *Available at: < https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid06.pdf>. Last access on 23/03/2011.*

[19] *Although this process is done once for all ceramics, baseline emissions are calculated individually for each ceramic, taking in consideration historical fuel consumption and production. Baseline calculation is detailed in Section B.6.1.*

baseline fuels are (as shown in the Table 6): 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 fossil fuels taking in considerations historic fuel usage by the ceramic sector in Brazil and barriers to the project as detailed in Section B.5.

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

BRAZILIAN ENERGY BALANCE 2009[20] - CERAMIC SECTOR EVALUATION Unit: 10^3 Tonnes of oil equivalent				
FUEL	**2006**	**2007**	**2008**	**2009**
Natural Gas	901	960	1,007	1,000
Charcoal	42	33	9	1
Wood	1,762	1,885	2,122	2,081
Other recuperations	32	35	53	52
Diesel Oil	8	7	8	8
Fuel Oil	285	313	322	322
Liquefied Petroleum Gas	151	153	166	162
Others from Petroleum	76	170	173	179
Piped gas	0	0	0	0
Electricity	276	284	298	300
Others non specified	0	0	0	0
TOTAL	**3,533**	**3,841**	**4,157**	**4,107**

The baseline is identified as the amount of non-renewable biomass displaced with the fuel switching project. 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, *Antônio* ceramic would utilize around 450.63 tonnes of non-renewable biomass per month and around 9.17 tonnes of renewable woody biomass to provide thermal energy to the ceramic's kilns and obtain an approximate temperature of 950ºC, in order to produce an average of around 660 thousands of ceramic units per month. Therefore, the wood consumption of the ceramic in the baseline scenario is 0.6964 tonnes of woody biomass per thousands of ceramic pieces produced.

The identified baseline scenario for *Ceará* ceramic would be the utilization of around 604.34 tonnes of non-renewable biomass per month and around 50.31 tonnes of renewable woody biomass with the aim of providing thermal energy to the ceramic's kilns and obtain the ideal temperature, in order to produce an average of around 954 thousands of ceramic units per month. Therefore, the wood consumption of the ceramic in the baseline scenario is 0.6859 tonnes of woody biomass per thousands of ceramic units produced.

The identified baseline scenario for Ceagra Ceramic would be the use of around 785.40 tonnes of non-renewable biomass per month and around 79.04 tonnes of renewable woody biomass to provide

[20] Brazilian Energy Balance, Chapter 3 Available at: https://ben.epe.gov.br/BENSeriesCompletas.aspx. Last visited on 23/03/2011.

thermal energy to the ceramic's kilns and obtain an approximate temperature of 950ºC, in order to produce an average of 1,238 thousands of ceramic units per month. Therefore, the wood consumption of the ceramic in the baseline scenario is 0.6979 tonnes of woody biomass per thousands of ceramic pieces produced.

The identified baseline scenario for Eliane Ceramic would be the utilization of around 424.45 tonnes of non-renewable biomass per month and around 45.83 tonnes of renewable woody biomass with the aim of providing thermal energy to the ceramic's kilns and obtain the ideal temperature, in order to produce an average of around 682 thousands of ceramic units per month. Therefore, the wood consumption of the ceramic in the baseline scenario is 0.6894 tonnes of woody biomass per thousands of ceramic units produced.

The identified baseline scenario for Santa Rita Ceramic would be the utilization of around 442.27 tonnes of non-renewable biomass per month and around 38.13 tonnes of renewable woody biomass with the aim of providing thermal energy to the ceramic's kilns and obtain the ideal temperature, in order to produce an average of around 702 thousands of ceramic units per month. Therefore, the wood consumption of the ceramic in the baseline scenario is 0.6843 tonnes of woody biomass per thousands of ceramic units produced.

Table 7. Baseline scenario of the project activity[21]

	Antônio Ceramic	**Ceará Ceramic**	**Ceagra Ceramic**	**Eliane Ceramic**	**Santa Rita Ceramic**
Production (thousands of ceramic pieces per month)	660.166	954.417	1,238.565	682.167	701.975
Consumption of non-renewable woody biomass (native firewood) without the project activity (tonnes per month)	450.63	604.34	785.40	424.45	442.27
Consumption of renewable biomass (wood from areas with sustainable forest management) without the project activity (tonnes per month)	9.17	50.31	79.04	45.83	38.13
BF_y (quantity of woody biomass per thousand of ceramic units fired)	0.6964	0.6859	0.6979	0.6894	0.6843

The identified barriers are described in Section B.5. Please refer to this Section to obtain more information on the criteria for the elimination and ranking of the identified alternatives. As a result of the

[21] *In the absence of the project activity, the fuel utilized to fire the ceramic units would be native firewood. This biomass is classified as woody biomass.*

barriers test, only one alternative remains: the continuation of the practice observed prior to the project initiation, which involves the predominant use of non-renewable biomass to provide thermal energy.

This situation was also the scenario existing prior to the initiation of the project in all ceramics included in the project and is the prevailing practice in the project region. Native firewood has been used to provide most of the thermal energy for the production process.

Therefore, the baseline presents the use of around 0.69 tonnes of woody biomass per thousands of ceramic pieces produced, the majority of such biomass being non-renewable. During the project, the annual production is expected to vary based on market demand. Annual production will be monitored during the crediting period to transparently calculate emission reductions. Emission reductions will be claimed for the amount of non-renewable fuel that would otherwise be used in the absence of the project activity.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The methodology applied is "**AMS-I.E: Switch from Non-Renewable Biomass for Thermal Applications by the User**", version 04, which comprises activities to displace the use of non-renewable biomass by introducing renewable energy technologies. The technology in case of this project activity is determined as the ceramic facilities, which utilize thermal energy generated by the new renewable energy technology. The project involves the substitution of non-renewable biomass with renewable biomass in existing red ceramic factories, thus complying with the referred methodology.

The starting date of the project activity (as defined in Section C.1.1) is considered 02/07/2010. The starting date of the project is before the "*Time of first submission*" as per Gold Standard definitions. Hence, the project is applying for retroactive registration according to Gold Standard Toolkit Section 1.2.6.

The baseline scenario is the use of non-renewable biomass to provide thermal energy during the production process of the ceramic factories. This is a common practice in ceramic factories in Brazil, as related by several authors (UHLIG, 2008[22]; NERI, 2003[23]; BRITO[24]; BRASIL, 2001[25]; CARDOSO, 2008[26]). Project additionality is explained according to the Tool for the demonstration and assessment of additionality, version 05.2. This tool provides for a step-wise approach to demonstrate and assess additionality. The steps are described below:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project activity:

[22] *UHLIG, A.* ***Lenha e carvão vegetal no Brasil: balanço oferta-demanda e métodos para a estimação do consumo****.2008, 156f. Dissertação (Pós graduação em Energia) – Universidade de São Paulo. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/publico/UHLIG_Tese1.pdf>. Last visited on 13/03/2011.*

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

[24] *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>. Last visited on 23/03/2011.*

[25] *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> . Last visited on 13/03/2011.*

[26] *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.*

The identified alternatives to the project activity consist in the use of different types of fuels to obtain thermal energy. More specifically, this includes:

a. The continuation of the current (pre-project) practice, where no project is undertaken and non-renewable biomass remains being the predominant fuel used.
b. The extensive use of renewable biomasses without being undertaken as a GHG emission reduction project;
c. The use of fossil fuels commonly used by the ceramic sector in Brazil.

As described in Section B.4, common fuels employed by the ceramic sector in Brazil include natural gas, charcoal, wood, other recuperations, diesel oil, fuel oil, liquefied petroleum gas, others from petroleum, piped gas, electricity and others none specified. As available on table 6, fossil fuels are the main energy source when native firewood is excluded from consideration. These fuels are locally available and could provide the same levels of activity of the project. The use of natural gas is not considered the most probable alternative to this project activity. The Brazilian Energy Balance results (available in Table 6) 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 and its high costs[27]. The use of natural gas also involves risks of insufficient supply and higher costs when compared to other fuels, thus discouraging investment in this scenario even in places with piped gas availability. Furthermore, the project locations are neither served by the existing natural gas distribution system in Ceará[28] nor included in future expansion plans of the distribution system[29]. Electricity is shown on Table 6 as an important energy source for the ceramic sector, but it is not considered a credible alternative because it cannot be used in kilns to provide thermal energy. Hence, the use of fossil fuels is considered the most likely scenario in the absence of the non-renewable biomass.

Outcome of Step 1a: At the end of Step 1, realistic and credible alternatives that could provide the same levels of activity than the project are identified. These include the use of fossil fuels, the extensive use of renewable biomass without being undertaken as a GHG emission reduction project and the continuation of the pre-project situation, where non-renewable biomass is predominantly used as fuel.

Sub-step 1b: Consistency with mandatory laws and regulations:

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[30][31]. The consumption of wood as fuel is still the major driver for deforestation in the Caatinga biome, despite the

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[27] *Revista Brasil Energia Percalços do gás natural na indústria. Available at: <http://www.energiahoje.com/brasilenergia/noticiario/2002/12/01/361782/percalcos-do-gas-natural-na-industria.html>. Last visited on 13/03/2011.*

[28] *Current natural gas distribution pipeline only serves seven cities in Ceará: Fortaleza, Euzébio, Maracanaú, Pacatuba, Caucaia, Horizonte and Pacajús. Information available at: <http://www.cegas.com.br/index.php?option=com_content&view=article&id=79&Itemid=161>. Last visited on: 13/03/2011.*

[29] *Future expansion plans of the gas distribution systems shall include the following cities: Aracati, Caucaia, Limoeiro/Iguatu, Sobral and Pecém. Information available at: <http://www.cegas.com.br/index.php?option=com_content&view=article&id=80&Itemid=162>. Last visited on: 11/07/2011.*

[30] *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>. Last visited on 23/03/2011.*

[31] *Revista Eco21. A Caatinga é um dos biomas mais ameaçados do Planeta. Available at: <http://www.eco21.com.br/textos/textos.asp?ID=1341>. Last visited on 11/07/2011.*

small reduction in deforestation rates[32]. The consumption of non-renewable biomass by ceramic industry was noted by several authors (UHLIG, 2008[33]; NERI, 2003[34]; BRITO[35]; BRASIL, 2001[36]; CARDOSO, 2008[37]). This was also observed in other industries, for example in production of steel[38], which has a much better structure and internal organization when compared to ceramic factories that are generally small and family-run enterprises. BRASIL (2001)[39], suggests that it is important to stimulate the miner sector, especially to respect the environment.

According to Sub-step 1b, paragraph (3), if an alternative does not comply with all mandatory applicable legislation and regulations, then it must be demonstrated, based on an examination of current practice in the country or region in which the law or regulation applies, that those applicable legal or regulatory requirements are systematically not enforced and that noncompliance with those requirements is widespread in the country. Given the exposed above, it is evidenced that restrictions on the use of non-renewable biomass is widely not enforced in Brazil.

There are no other legal requirements demanding ceramic industries to mitigate GHG emission or to use renewable sources of fuel. Therefore, it is considered that all alternatives identified in sub-step 1a are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country.

Outcome of Step 1: At the end of Step 1, credible alternatives to the project activity that are consistent with current laws and regulations (taking into account the enforcement in the region or country) have been identified. All three alternatives identified in 1a are considered credible alternatives to the project activity. The additionality assessment will now move to Step 2 – Investment analysis.

Step 2: Investment analysis

According to the referenced tool, the investment analysis is used to determine whether the project activity is not:

(a) The most economically or financially attractive; or

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[32] Portal Brasil. Ritmo de desmatamento da Caatinga caiu entre 2008 e 2009, diz Ibama. Available at: <*http://www.brasil.gov.br/noticias/arquivos/2011/06/17/ritmo-de-desmatamento-da-caatinga-caiu-entre2008-e-2009-diz-ibama/view*>. Last visited on 11/07/2011.

[33] *UHLIG, A.* ***Lenha e carvão vegetal no Brasil: balanço oferta-demanda e métodos para a estimação do consumo****.2008, 156f. Dissertação (Pós graduação em Energia) – Universidade de São Paulo. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/publico/UHLIG_Tese1.pdf>. Last visited on 13/03/2011.*

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

[35] *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>. Last visited on 23/03/2011.*

[36] *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>. Last visited on 13/03/2011.*

[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.*

[38] Instituto Observatório Social. O Aço da Devastação. Available at: <http://www.observatoriosocial.org.br/portal/noticia/780>. Last visited on 11/07/2011.

[39] *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> . Last visited on 13/03/2011.*

(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

The project proponents have chosen to follow option (a), and shall demonstrate that the project activity is not the most economically attractive following the sub-steps of the tool described below.

Sub-step 2a: Determine appropriate analysis method

There are three possible methods to demonstrate the investment analysis, according to the referred tool: simple cost analysis, investment comparison analysis or benchmark analysis. Simple cost analysis is applicable to projects that generate no financial or economic benefits other than CDM (or carbon credits) related income. As the proposed project activity includes fuel switching, a possible income arises from saving on fuel purchase, in case the new fuel is cheaper than the baseline fuel. Hence, simple cost analysis is not appropriate.

According to the Guidelines on the assessment of investment analysis (version 03, EB51, Annex 58)[40], the investment comparison analysis shall be applied if the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services. As the proposed baseline (as any of its credible alternatives) demands investments in the purchase of fuel to produce ceramic pieces, investment comparison analysis is considered the most appropriate method to perform the investment analysis.

Sub-step 2b: Option II. Apply investment comparison analysis:

The financial indicator most suited for the investment comparison analysis is the unit cost of service, more specifically the cost of delivered heat, measured in R$ per TJ of thermal energy delivered. This indicator is the most appropriate since fuel purchase is one of the major cost components of the ceramic factories and the one most affected by this fuel switching project.

The most important parameters determining the cost of delivered heat are the unit cost of fuel (R$ per ton or m³ of each fuel), the Net Calorific Value of each fuel (in TJ per ton) and the total amount of fuel to be employed (in tonnes or m³). These parameters combined determine the total cost of fuel for a given production output.

Sub-step 2c: Calculation and comparison of financial indicators

Table below provides data on the non-renewable fuel costs[41].

Table 8. Data determining baseline fuel costs.

Parameter	Unit	Antônio Ceramic	Ceará Ceramic	Ceagra Ceramic	Eliane Ceramic	Santa Rita Ceramic
Non-renewable fuel used	N/A	Native firewood				
Production	Thousand pieces per month	660.166	954.417	1,238.565	682.167	701.975
Monthly consumption of fuel	Tonnes	450.63	604.34	785.40	424.45	442.27
Cost of fuel	R$/ton	R$16.61	R$16.27	R$16.23	R$15.95	R$16.25
Net Calorif	TJ/ton	0.0192				

[40] Available at: http://cdm.unfccc.int/EB/051/eb51_repan58.pdf. Last visited on: 23/03/2011.
[41] Historical data from each ceramic are used for the quantification of these parameters, including the cost of fuel. Evidences are available for the validation team.

Value of the fuel[42]						
Thermal energy delivered	TJ	8.64	11.59	15.06	8.14	8.48
Monthly fuel cost	R$	R$ 7,438	R$ 9,834	R$12,744	R$6,768	R$7,187
Cost of delivered heat	**R$/TJ**	**R$ 866.15**	**R$ 848.63**	**R$ 846.23**	**R$ 831.61**	**R$ 847.43**

As demonstrated above, fuel costs for the baseline scenario were in the range of BRL 831.61 to BRL 866.15 per TJ of thermal energy. As the project activity, the baseline non-renewable fuel is being replaced by renewable biomasses such as cashew nut shells, residues from cashew tree, coconut husk and increased amounts of wood from areas with sustainable forest management plan.

An investment comparison is made to demonstrate how these fuels compare to native firewood in terms of cost per energy delivered. Table below provide the parameters used for such analysis.

Table 9. Data determining fuel costs for renewable biomasses.

Fuel type	**Cost of fuel[43] (R$/ton)**	**Net Calorific Value (TJ/ton)**	**Energy demand (TJ)[44]**	**Necessary monthly consumption to meet energy demand (tonnes)[45]**	**Cost of delivered heat (R$/TJ)**
Cashew nut shell	R$ 17.65	0.0197	1.00	50.83	**R$ 896.96**
Coconut residues	R$ 100.00	0.0167	1.00	59.72	**R$ 5,972.29**
Residues from cashew tree	R$ 52.38	0.0201	1.00	49.77	**R$ 2,606.95**
Wood from sustainable forest management plan areas	R$ 22.73	0.0192	1.00	52.15	**R$ 1,185.27**

As the tables above show, the fuels applied by the project are more costly on an energy basis than the baseline non-renewable fuel. This represents a significant barrier for the fuel switching. The continuation of the current practice, where no project is undertaken and non-renewable biomass remains

[42] *Please check Section B.6.2, item $NCV_{biomass}$ for more information on the determination of this parameter.*
[43] *Fuel costs were determined based on purchases of biomass by ceramic factories belonging to Grupo Tavares during 2009 and 2010. Evidences are available for the validation team.*
[44] *This table provides the calculation on the cost of fuel to provide 1 TJ of energy, in order to compare such cost with the baseline cost of delivered heat.*
[45] *This parameter is calculated based on the Net Calorific Value of each fuel and represents the amount of fuel needed to obtain 1 TJ of thermal energy.*

being the predominant fuel used is therefore a more economically attractive scenario than the measures proposed by the project activity.

Also, the use of renewable biomass as a fuel involves significant risks, such as the risk of instability of energy flow rates. Alternative fuels, such as biomass residues, are naturally subject to significant variation on its chemical and energy properties. Such materials might present variations in terms of density, particle size, humidity and other characteristics that affect its efficiency as fuel. These risks are only mitigated if proper handling and storage of biomass is continuously observed, thus demanding increased efforts from the ceramics employees[46].

Finally, the fuel switch to renewable biomass also demanded other costs besides the increase in fuel cost, such as the purchase of automatic feeders and equipments to process biomass. These equipments were needed to allow the efficient use of biomass and would not be necessary if the ceramic owners remained using native firewood as fuel. These costs will likely result in energy efficiency (and consequently in reduced costs on fuel purchase). However, savings from energy efficiency are not easy to be determined upfront, since these measures follow the application of a new type of fuel (renewable biomass) which is more expensive and more unstable than the baseline fuel.

The fuel switching also involves a period of adaptation until the kiln operators learned to operate with the new fuel. In this adaptation period, income loss generally results from losses of fuel and losses of ceramic pieces damaged by irregular burning cycles. All these additional costs would not be needed if the fuel switching did not occur, making the continued use of non-renewable fuels an attractive scenario.

Sub-step 2d: Sensitivity analysis

The objective of this sub step is to show that the conclusion regarding the financial attractiveness of the project is robust to reasonable variations of the critical assumptions. According to the Guidelines on the assessment of investment analysis, variables that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation, the results of which should be presented in the PDD.

However, for the calculation of the selected indicator (cost of delivered heat), it is considered that the variation of only one variable, namely the cost of fuel (in R$ per ton), is sufficient for the sensitivity analysis. This is because in this case the variation of any of the other variables, such as the Net Calorific Value would provide redundant results, as the indicator (expressed in R$/TJ) is directly proportional to both the cost of fuel and the Net Calorific Value. Tables below provide the sensitivity analysis on the cost of delivered heat based on the variation on the cost of fuels.

[46] *Such barriers are commonly attributed to the use of biomass as fuel. See for instance the following presentation on biomass as fuel: <http://www.unep.org/ClimateChange/LinkClick.aspx?fileticket=JDGR4kratWY%3D&tabid=4845&language=en-US>. Last visit on 23/03/2011.*

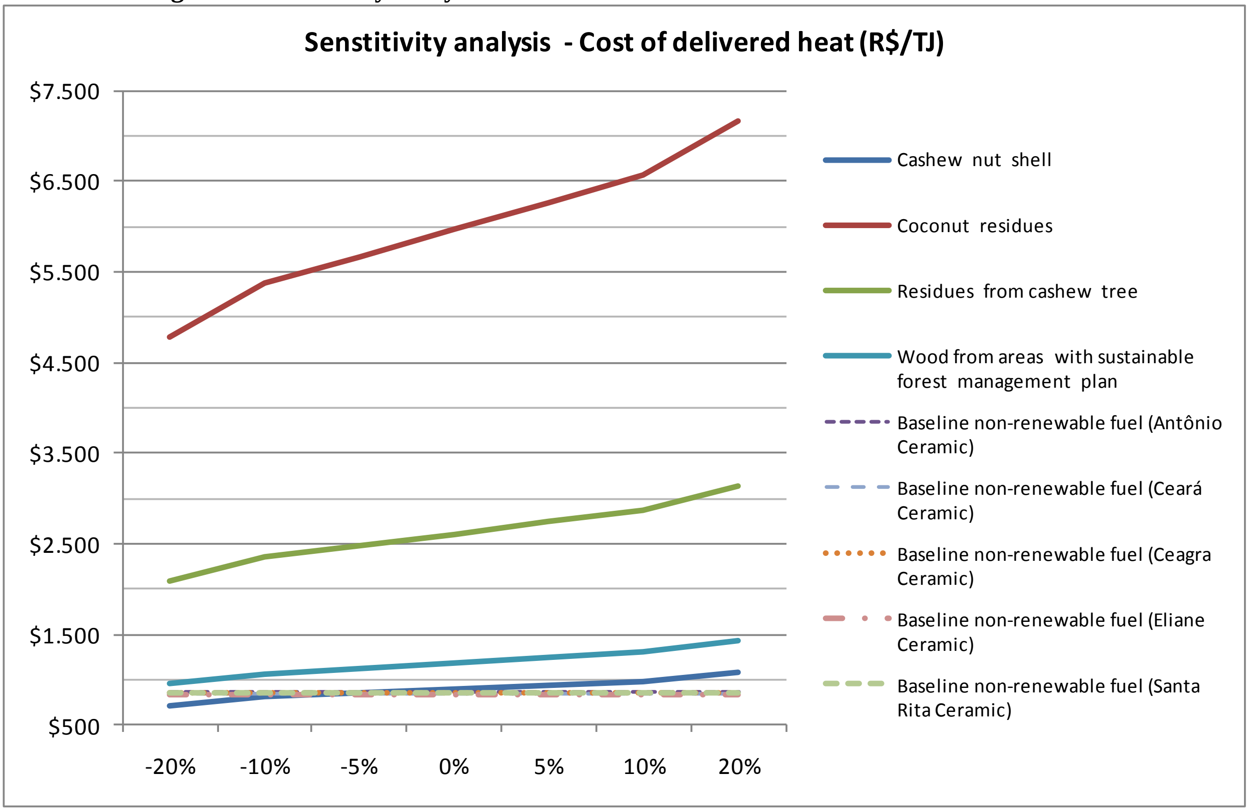
Table 10. Sensitivity analysis based on the variation on the cost of fuels for Antônio Ceramic.

	Cost of delivered heat according to variation on the cost of fuel						
Fuel type	**-20%**	**-10%**	**-5%**	**0%**	**5%**	**10%**	**20%**
Cashew nut shell	R$ 717.57	R$ 807.27	R$ 852.12	R$ 896.96	R$ 941.81	R$ 986.66	R$ 1,076.36
Coconut residues	R$ 4,777.83	R$ 5,375.06	R$ 5,673.67	R$ 5,972.29	R$ 6,270.90	R$ 6,569.52	R$ 7,166.75
Residues from cashew tree	R$ 2,085.56	R$ 2,346.26	R$ 2,476.60	R$ 2,606.95	R$ 2,737.30	R$ 2,867.65	R$ 3,128.34
Wood from areas with sustainable forest management plan	R$ 948.21	R$ 1,066.74	R$ 1,126.00	R$ 1,185.27	R$ 1,244.53	R$ 1,303.79	R$ 1,422.32
Baseline non-renewable fuel **(Antônio Ceramic)**	R$ 866.15						
Baseline non-renewable fuel **(Ceará Ceramic)**	R$ 848.63						
Baseline non-renewable fuel **(Ceagra Ceramic)**	R$ 846.23						
Baseline non-renewable fuel **(Eliane Ceramic)**	R$ 831.61						
Baseline non-renewable fuel **(Santa Rita Ceramic)**	R$ 847.43						

The sensitivity analysis shows that the fuels proposed by the project activity are significantly more costly than the baseline non-renewable fuel (native firewood). Some renewable biomasses present competitive prices (such as cashew nut shells and wood from areas with sustainable forest management plan) and might even become more attractive in case of negative variations on the cost of fuel occur.

However, the project activity will necessarily involve using a combination of several renewable biomasses, since it is not feasible for the ceramic owners to rely on a single source of renewable biomass. This would require a very reliable supply chain that is not easy to establish for fuels such as biomass residues or forest resources, which are typically dependant on harvest seasons and are commonly obtained from several independent providers. The use of cashew nut shell is not likely to be representative enough to result in reduced cost of delivered heat. Hence, the actual cost of fuels will likely be higher due to the necessary use of more costly biomasses to maintain the level of activity and to prevent shortages of fuel supply. The graphic below provides a summary of the sensitivity analysis.

Figure 11. Sensitivity analysis on the cost of delivered heat for renewable biomasses.



Step 4: Common Practice analysis

This Step is a credibility check to complement the investment analysis (Step 2) or barrier analysis (Step 3).

Sub-step 4a: Analyze other activities similar to the proposed project activity

In Brazil, the red ceramic pieces are produced through an inefficient and traditional processes using predominantly wood without forest management to generate thermal energy[47]. It happens because

[47] *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>. Last visited on 15/3/2011. See also Ïnforme Setorial Cerâmica Vermelha", from Banco do Nordeste (Sectorial Information Report from Bank of Northeast). Available at:*

wood without forest management is offered for much lower prices than wood from areas with forest management[48]. 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[49], 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 factories still use non-renewable wood in their kilns and the drying process occurs naturally, without any energy utilization. Also, the influence of the market as a drive for improvements in this sector is very insignificant[50].

Thus, the common practice is the use of wood – more precisely its non-renewable fraction, which is the fuel most often employed, most viable and associated with the lower risks. Similar activities to the project were not found in the region, except those being developed within the carbon market[51] (as voluntary project activities) and hence cannot be included in this analysis.

Sub-step 4b: Discuss any similar Options that are occurring:

As described above, similar activities are not widely observed in the project region. According to the referenced tool for the demonstration and assessment of additionality, if similar activities cannot be observed then the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Below, a description of the equations and procedures used for the calculation of emission reductions follows:

Emission Reductions

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

Where:

<http://www.bnb.com.br/content/aplicacao/etene/etene/docs/ano4_n21_informe_setorial_ceramica_vermelha.pdf >. Last visited on 23/03/2011.

[48] *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>. Last visited on 15/3/2011.*

[49] *UHLIG, A.* ***Lenha e carvão vegetal no Brasil: balanço oferta-demanda e métodos para a estimação do consumo****.2008, 156f. Dissertação (Pós graduação em Energia) – Universidade de São Paulo. Available at: <http://www.teses.usp.br/teses/disponiveis/86/86131/tde-14052008-113901/publico/UHLIG_Tese1.pdf>. Last visited on 13/03/2011.*

[50] *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>. Last visited on 23/03/2011.*

[51] *Such as several projects developed by Sustainable Carbon under the Voluntary Carbon Standard. Information on such projects available at: <http://www.markit.com/en/products/registry/markit-environmental-registry-public-view-reports.page#registered_projects>. Access this site and type Sustainable Carbon in the search field. Last visit on 23/03/2011.*

ER_y: Emission reductions during the year y in tCO_2e
B_y: Quantity of woody biomass that is substituted or displaced in tonnes
$fNRB_{,y}$: Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass using survey methods
$NCV_{biomass}$: Net calorific value of non-renewable woody biomass that is substituted, in TJ/ton
$EF_{projected\ fossil\ fuel}$: Emission factor for substitution of non-renewable woody biomass by similar consumers, in tCO_2e/TJ[52].

B_y is calculated according to option (a) of the selected methodology, as follows:

(a) **B_y** is calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year);

More specifically, appliances are the kilns producing ceramic pieces in each ceramic. The consumption of woody biomass in the kilns is calculated as the amount of products (ceramic pieces) produced and the consumption of woody biomass per thousand of ceramic pieces fired in year y, as follows:

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

Where:

PR_y: Amount of products produced in year y, in thousand of ceramic pieces

BF_y: Quantity of woody biomass per thousand of ceramic units fired in year y.

The value of BF_y was determined with the use of the historical records from the ceramics included in the project, by dividing monthly average consumption in the baseline by monthly average baseline production.

According to procedures on the applied methodology, the project participants shall determine the shares of renewable and non-renewable woody biomass in B_y using nationally approved methods. Also, the following principles shall be taken into account:

Demonstrably Renewable woody biomass[53] (DRB)

Woody biomass is "renewable" if one of the following two conditions is satisfied:

1. The woody biomass is originating from land areas that are forests[54] where:
   (a) The land area remains a forest;
   (b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
   (c) Any national or regional forestry and nature conservation regulations are complied with.
2. The biomass is woody biomass and originates from non-forest areas (e.g. croplands, grasslands) where:

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

[52] *According to the applied methodology, a value of 81.6 tCO2/TJ shall be used for this emission factor, representing the mix of fossil fuels to be used for the present and future.*
[53] *This definition uses elements of Annex 18, EB 23. Document available at: <http://cdm.unfccc.int/EB/Meetings/023/eb23_repan18.pdf>. Last visit on 15/03/2011.*
[54] *The forest definitions as established by the country in accordance with the Decisions 11/CP.7 and 19/CP.9 should apply.*

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

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

Non-renewable biomass

Non-renewable woody biomass (*NRB*) is the quantity of woody biomass used in the absence of the project activity (B_y) minus the *DRB* component, as long as at least two of the following supporting indicators are shown to exist:

- A trend showing an increase in time spent or distance travelled for gathering fuel-wood by users (or fuel-wood suppliers) or alternatively, a trend showing an increase in the distance the fuel wood is transported to the project area;

- Survey results, national or local statistics, studies, maps or other sources of information such as remote sensing data that show that carbon stocks are depleting in the project area;

- Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;

- Trends in the types of cooking fuel collected by users, suggesting scarcity of woody biomass.

Thus the fraction of woody biomass saved by the project activity in year *y* that can be established as non-renewable is:

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} \qquad \text{(equation 3)}$$

Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramic owner. Thus, the majority of the fuel employed in the baseline scenario was from non-renewable origin. A small fraction of baseline fuel was from sustainable origin, namely woody biomass for which a DOF (*Documento de Origem Florestal*, Document of Origin Forestry) was available. According to the IBAMA Normative Instruction Nº 112 from 21/08/2006[55], the entrepreneur who uses raw material from native forests is obliged to use the DOF to control the origin, transportation, and storage of forest products and by-products. This document ensures that the related forest products were obtained from legalized areas where conservation measures are applied. Therefore, firewood with DOF is considered renewable.

Furthermore, studies demonstrate that 0.3% of *Caatinga* biome has sustainable forest management plan[56], and thus an equivalent fraction of the native firewood is considered as renewable biomass. Also, as a conservative measure, the amount of wood saved by similar projects developed or under development by *Sustainable Carbon – Projetos Ambientais Ltda* with the same methodology in the

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[55] *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 23/03/2011.*

[56] *Centro Nordestino de Informações sobre Plantas, 2007. Available at: <http://www.cnip.org.br/planos_manejo.html>. Visited on 23/03/2011.*

same region is excluded from the amount of non-renewable biomass[57]. Section B.6.3 provides more information on the quantification of $fNRB_{,y}$.

The remaining fraction of the Caatinga biome is considered to be non-renewable. This approach is considered appropriate, since there is evidence to support that carbon stocks are depleting in the project area[58] and that there is a trend showing an increase in time spent or distance travelled for gathering fuel-wood by users[59].

Leakage (LE_y)

According to the applied methodology, leakage relating to the non-renewable woody biomass saved by the project activity shall be assessed based on *ex post* surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples). The following potential source of leakage shall be considered:

(a) The use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project households/users, that is attributable to the project activity, then B_y is adjusted to account for the quantified leakage. Alternatively, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

This source of leakage shall be assessed for each crediting period, but leakage emissions from this source are not expected since the common practice in the region (especially for ceramic industries) is the use of non-renewable biomasses. The fuel switching project is not expected to result in local alteration on fuel prices, since the volume of fuels used in the project are not significant compared to total availability of both baseline fuels (native firewood) and project fuels (renewable biomasses).

Leakage from the use of renewable biomass must be considered using the general guidance on leakage in biomass project activities (attachment C of Appendix B)[60]. Also, the specific rules on biomass resources as set out in the applicable version of the Gold Standard, especially ToolKit Annex C shall be complied with.

For this project activity, the following sources of leakage are included: A. *Shifts of pre-project activities*; B. *Emissions related to the production of Biomass*, and C. *Competing uses for the biomass*.

The Attachement C to Appendix B of the Indicative simplified baseline and monitoring methodologies provides different emission sources based on type of biomass being considered. For biomass from forests and biomass from croplands or grasslands, the project boundary shall include the area where the biomass is extracted or produced. Table below summarizes the sources of leakage.

[57] *All projects were validated or are under validation process by an accredited DOE in UNFCCC. Therefore, the values assumed to do the calculations of non-renewable biomass consumption of all projects were taken from the Project Design Documents (or equivalents) of these projects. Information on such projects available at: <http://www.markit.com/en/products/registry/markit-environmental-registry-public-view-reports.page#registered_projects>. Access this site and type Sustainable Carbon in the search field. Last visit on 23/03/2011.*

[58] *The Second Brazilian Inventory of Anthropogenic Emissions and Removals of Greenhouse Gases provides data on net carbon emissions from Land Use Change for each Brazilian biome on Table 3.111, page 249. Net carbon emissions for the Caatinga biome indicate carbon pools have constantly decreased between 1990 and 2005. Document available at: <http://www.mct.gov.br/upd_blob/0214/214077.pdf>. Last visit on 15/3/2011.*

[59] *DA SILVA, E.R.* ***A exploração da lenha da caatinga como fonte de energia para as lavanderias de jeans em Toritama – Pernambuco.*** *Information on Page 2 shows increasing distances to obtain firewood in the Caatinga biome. Document available at: <* http://www.eventosufrpe.com.br/jepex2009/cd/resumos/R1451-2.pdf *>. Last visited on 23/03/2011.*

[60] *Document available at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf>. Last visit on 24/01/2011.*

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

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

Observing the table above, the sources of leakage relevant to the present project activity are the competing use of biomass for biomass from existing forests and for biomass residues or waste. The source of leakage of the present project is assessed below, for each type of biomass:

Cashew nut shell

The cashew nut production in *Ceará* was of 104,421 tonnes during the year of 2009[61]. The cashew nut shell constitutes a serious environmental problem in Brazilian's northeast region. Its disposal in landfills is not recommended due to the large volume of production[62]. For that reason, measures that avoid its disposal in open dumps while giving a sustainable destination for such residues are substantial for the development of the project region.

The cashew nut shell represents 45% of the nut on a weight basis (not including the Cashew Nut Shell Liquid, which is used in the chemical industry)[63]. Thus, in Ceará approximately 46,989 tonnes of this biomass residue are generated each year. The project will use several types of biomass and the use of cashew nut shell is expected to represent a fraction of total biomass used. In case the project would use cashew nut shell to provide 25% of its energy demand, 8,566 tonnes of this biomass would be needed, which represents 18.2% of the total of these residues generated in the State of *Ceará*. Hence, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

[61] According to IBGE (Geographic and Statistic Brazilian Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=lavourapermanente2009>. Last visited on 21/03/2011.

[62] According to Unicamp (University of Campinas) news. Document available at: <http://www.unicamp.br/unicamp/unicamp_hoje/ju/maio2009/ju427_pag08c.php>. Last visited on 23/03/2011.

[63] Source: <http://www.mecol.com.br/portugues/informacajuebrasil.htm>. Last visited on 21/03/2011.

Cashew tree wood

Since all ceramics utilize wood residues from cashew trees, it is important to analyze the cashew production in the project region. Cashew cultivation is an important activity to the Brazilian economy, especially in the northeast region, that concentrates nearly 100% of Brazilian´s cashew production[64].

The Brazilian production achieved 183,000 tonnes of cashew-nuts in 2003, spread in an area of around 680,000 hectares. The State of Ceará was responsible for 59% of national production. Such production provides a steady source of residues from cashew trees, due to the fact that cashew cultivation requires continuous cutting of cashew trees. The cut of cashew trees is necessary in order to allow an appropriate formation of the tree and to maintain favorable conditions for the next harvest. Hence, cashew cultivation involves cutting undesirable branches of the cashew trees[65]. Moreover, dry branches on the ground compound a considerable amount of residues from cashew trees cultivation.

There is no estimate on the amount of residues from cashew trees, however its abundant availability is well-known, especially in the project region, that concentrates the majority of national production. According to "*EMPARN – Empresa de Pesquisa Agropecuária do Rio Grande do Norte* (*Agricultural Research Corporation of the State of Rio Grande do Norte)*" cashew trees cultivation presents a density of at least 100 plants per hectare[66], and the production of firewood residues from each tree is 2.5 kg³ per year[67]. Hence, it can be estimated that around 100,300 tonnes of residues from cashew trees are produced each year in the State of Ceará[68].

The project will use several types of biomass and the use of residues from cashew trees is expected to represent a fraction of total biomass used. In case the project would use cashew tree wood to provide 25% of its energy demand, 8,387 tonnes of this biomass would be needed, which represents 8.4% of the total of these residues generated in the State of *Ceará*. Hence, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

Coconut Husk

Regarding the coconut scenario, the Brazilian production is within the five biggest productions in the world[69]. Moreover, the Brazilian production has been increasing in order to supply the growing healthy food market[70]. The coconut has diverse uses, which briefly is used for food, water, fibers, among others. In the northeast region of Brazil, 6.7 millions of tonnes of coconut husks are generated yearly, which can represent up to 70% of the municipal solid waste of coastal cities[71].

The State of Ceará is responsible for around 12.75% of the coconut production in the Northeast region of Brazil[72]. Hence, more than 854,000 tonnes of coconut husks are produced yearly. The project

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*[64] USAID/Brasil. **Análise da Indústria da Castanha de Caju**. Information on Table 16. Available at: <http://pdf.usaid.gov/pdf_docs/PNADM250.pdf>. Last visited on 22/03/2011.*

[65]According to EMBRAPA (Brazilian Agricultural Research Corporation's). Available at: <http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Caju/CultivodoCajueiro/tratosculturais.htm>. Last visited on 23/03/2011.

[66]Information taken from "Recomendações Técnicas para o Cultivo do Cajueiro. Document available at: <http://www.emparn.rn.gov.br/contentproducao/aplicacao/emparn/arquivos/pdf/cartilha_cultivo%20do%20caju.pdf>. Last visited on 22/03/2011.

[67]Information taken from Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural.

*[68] The following calculation is made to obtain such value: 680,000 hectares of cashew tree * 59% of Ceará share of national production * 100 plants per hectare * 0.0025 tonnes of cashew wood per plant.*

[69] According to "Toda Fruta"Available at: <http://www.todafruta.com.br/todafruta/mostra_conteudo.asp?conteudo=12743>. Last visited on 21/03/2011.

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

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

[72] According to "Toda Fruta"Available at: <http://www.todafruta.com.br/todafruta/mostra_conteudo.asp?conteudo=12743>. Last visited on 21/03/2011.

will use several types of biomass and the use of coconut husks is expected to represent a fraction of total biomass used. In case the project would use cashew tree wood to provide 25% of its energy demand, 10,065 tonnes of this biomass would be needed, which represents 1.2% of the total of these residues generated in the State of *Ceará*. Hence, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

Wood from sustainable management areas

The State of Ceará presented a production of 4,524,309m³ of firewood in 2009[73], or 3,981,391 tonnes if a specific gravity of 0.88 tonnes/m³ is considered[74]. Although merely a fraction is produced in areas with sustainable forest management plans, it can be assumed for the analysis of competing uses of biomass that other users could equally use wood from unpreserved areas, as this is the common practice in the region (as described in Section B.5).

The project will use several types of biomass and the use of coconut husks is expected to represent a fraction of total biomass used. In case the project would use wood to provide 25% of its energy demand, 8,789 tonnes of this biomass would be needed, which represents around 0.2% of the total wood generated in the State of *Ceará*. Hence, this renewable biomass does not have potential to generate leakage emissions due to its high availability.

According to the applied methodology, another source of leakage is to be considered: leakage associated to equipment transference from outside the project boundary. The project does not involve the transfer of any equipment, since only the existing kilns in each ceramic are used to burn biomass. Hence, no leakage from this source is expected.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EF_{projected\_fossilfuel}$
Data unit:	tCO_2/TJ
Description:	Emission factor for substitution of non-renewable woody biomass by similar consumers.
Source of data used:	Approved small scale methodology AMS-I.E “Switch from Non-Renewable Biomass for Thermal Applications by the User”, version 04.
Value applied:	81.6 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	In the baseline scenario, non-renewable biomass was used as an energy source. This is the common practice for the red ceramic sector in the project region. As described in Section B.5, the use of fossil fuels is the most likely scenario in the absence of non-renewable biomass. This emission factor is recommended by the applied methodology to represent the mix of fossil fuels to be used for the present and future.
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/ton

[73]*According to IBGE (Geographic and Statistic Brazilian Institute) available at: <http://www.ibge.gov.br/estadosat/temas.php?sigla=ce&tema=lavourapermanente2009>. Last visited on 21/03/2011.*

[74] *Please see Section B.6.2, item $\rho_{biomass}$ for more information on the determination of this parameter.*

Description:	Net calorific value of the non-renewable woody biomass that is substituted
Source of data used:	This value will provide the energy generated by the amount of wood that would be used in the absence of the project. Sources: - *Poder Calorífico da Madeira e de Resíduos Lignocelulósicos*. Available at: <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107.pdf>. Last visited on 22/03/2011. - *Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora* (Willd.) Poir. Available at: <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf>. Last visited on 22/03/2011.
Value applied:	0.01917
Justification of the choice of data or description of measurement methods and procedures actually applied :	In the baseline scenario, non-renewable biomass was used as an energy source. This is the common practice for the red ceramic sector in the project region. The species used to calculate the average value of this parameter are typical trees of *Caatinga* Biome that are usually utilized as fuel in the ceramic industries of the region.
Any comment:	

Data / Parameter:	$\rho_{biomass}$
Data unit:	Tonnes/m³
Description:	Specific gravity of non-renewable biomass type *j*
Source of data used:	-IPCC: Intergovernmental Panel on Climate Change. Orientácion del IPCC sobre las buenas prácticas para UTCUTS - chapter3 – Table 3A.1.9-2 - LORENZI, H. *Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil*, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002. - *Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.*). Available at: <http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf>. Visited on: 22/03/2011. - *Poder Calorífico da Madeira e de Resíduos Lignocelulósicos*. Available at: <http://www.renabio.org.br/arquivos/p_poder_lignocelulosicos_11107. - IBAMA (Brazilian Institute for Environment and Renewable Resources): http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139. Last visited on 22/03/2011.
Value applied:	0.88
Justification of the choice of data or description of measurement methods and procedures actually	The amount of wood used in the baseline was measured in volume units. This data is used for the unit conversion. The species used to calculate the average value of this parameter are typical trees of *Caatinga* Biome that are usually utilized as fuel in the ceramic industries of the region.

applied :	
Any comment:	

Data / Parameter:	BFy
Data unit:	tonnes of wood per thousand of ceramic pieces
Description:	Quantity of woody biomass per thousand of ceramic units fired in year y
Source of data used:	*Historical* data from project proponent
Value of data	0.6964 for Antônio Ceramic 0.6859 for Ceará Ceramic 0.6979 for Ceagra Ceramic 0.6894 for Eliane Ceramic 0.6843 for Santa Rita Ceramic
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value was acquired using historical data on woody biomass consumption and production of ceramic pieces when the ceramic used to consume non-renewable wood. Data from 2009 was used. The value is employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Emission reductions are calculated with equations described in Section B.6.1. The quantity of woody biomass per thousand of ceramic units fired (BF_y) is calculated based on historical information on production and fuel consumption in each ceramic. Data from 2009 (the last year before the project measures became operational) was used. Table below provides information on production and fuel consumption for each ceramic factory.

Table 12. Baseline information for each ceramic industry.

Parameter	Antônio Ceramic	Ceará Ceramic	Ceagra Ceramic	Eliane Ceramic	Santa Rita Ceramic
2009 production (thousands of ceramic pieces)	7,921	11,453	14,863	8,186	8,424
2009 consumption of non-renewable native firewood (tonnes)	5,407.60	7,252.08	9,424.80	5,093.44	5,307.28
2009 consumption of wood from areas with sustainable forest management plan (tonnes)	110.00	603.68	948.53	550.00	457.60

Parameter	Antônio Ceramic	Ceará Ceramic	Ceagra Ceramic	Eliane Ceramic	Santa Rita Ceramic
Quantity of woody biomass per thousand of ceramic units fired in year y (BF_y)	0.6964	0.6859	0.6979	0.6894	0.6843
Quantity of woody biomass that is substituted or displaced in tonnes (B_y)	5,516.87	7,855.61	10,372.73	5,643.43	5,764.34

All ceramics have used predominantly native firewood prior to the project initation. This type of biomass is considered non-renewable woody biomass. Small fractions of wood from areas with sustainable forest management plan were also used. Additionally, as described in Section B.6.1, another share of the biomass is considered to be renewable, as a conservative measure. Studies demonstrate that 0.3% of *Caatinga* biome has sustainable forest management plan[75]. Hence, an equivalent fraction of native firewood is considered as renewable biomass. Also, as a conservative measure, the amount of wood saved by similar projects developed or under development by *Sustainable Carbon – Projetos Ambientais Ltda.* with the same methodology in the same region is excluded from the amount of non-renewable biomass[76]. Tables below describe data used to calculate fNRB according to equation 3.

Table 13. Data used for the determination of $f_{NRB,y}$.

Parameter	Antônio Ceramic	Ceará Ceramic	Ceagra Ceramic	Eliane Ceramic	Santa Rita Ceramic
Consumption of non-renewable woody biomass for (tonnes)	5,407.60	7,252.08	9,424.80	5,093.44	5,307.28
Consumption of demonstrably renewable woody biomass (tonnes)	110.00	603.68	948.53	550.00	457.60
Fraction of non-renewable woody biomass used in 2009 (calculated with equation 3)	0.9800	0.9231	0.9085	0.9025	0.9206

Table 14. Data used for conservative determination of $f_{NRB,y}$.

Parameter	Unit	Value	Source
Total area of Caatinga biome	Km²	844,453	IBGE (Brazilian Institute of Geography and Statistics). Available at: <http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=169&id_pagina=1>
Area of Caatinga with no sustainable use[77]	Km²	841,919.64	Centro Nordestino de Informações sobre Plantas, 2007. Available at:

[75] *Centro Nordestino de Informações sobre Plantas, 2007. Available at: <http://www.cnip.org.br/planos_manejo.html>. Visited on 23/03/2011.*

[76] *All projects were validated or are under validation process by an accredited DOE in UNFCCC. Therefore, the values assumed to do the calculations of non-renewable biomass consumption of all projects were taken from the Project Design Documents or equivalents) of these projects. Information on such projects available at: <http://www.markit.com/en/products/registry/markit-environmental-registry-public-view-reports.page#registered_projects>. Access this site and type Sustainable Carbon in the search field. Last visit on 23/03/2011.*

[77] *The reference source indicates that 0.8% of the Caatinga is from strictly protected areas, 0.11% is from sustainable use areas and 0.15% is from indigenous areas. Hence, only 1.06% of the Caatinga can be considered as having sustainable uses.*

			<http://www.cnip.org.br/planos_manejo.html>.
Amount of wood per hectare	m³/hectare	20	Brazilian Environment Ministry, Normative Instruction n. 6 of 2006, Article 9°. Available at: http://www.fatma.sc.gov.br/index.php?option=com_docman&task=doc_download&gid=89. Last visited on 22/03/2011.
Non-renewable woody biomass (NRB)	m³	1,683,839,282	Calculated with the above information. This value represents the available wood in areas with no sustainable use.
Demonstrably Renewable woody biomass (DRB) in Caatinga	m³	5,066,718	Calculated with the above information. This value represents the available wood in areas with sustainable use.
Fraction of non-renewable biomass in Caatinga	Fraction	0.9970	Calculated according to equation 3.
Wood saved by Sustainable Carbon projects	% of non-renewable biomass in Caatinga	0.2691	Calculated with information from Sustainable Carbon Projects[78]. A spreadsheet version is available for the validation team.
Fraction of non-renewable woody biomass in Caatinga taking in consideration wood saved by other projects by Sustainable Carbon	Fraction	0.9943	

Thus, the calculated values of non-renewable woody biomass used by each ceramic (available on Table 13) were multiplied by the fraction of non-renewable woody biomass in Caatinga, as available on Table 14. Hence, the following values of $f NRB_{,y}$ are calculated for each ceramic factory:

- $f NRB_{,y}$ for Antônio Ceramic: **0.9744** (0.9800 * 0.9943);
- $f NRB_{,y}$ for Ceará Ceramic: **0.9178** (0.9231 * 0.9943);
- $f NRB_{,y}$ for Ceagra Ceramic: **0.9033** (0.9085 * 0.9943);
- $f NRB_{,y}$ for Eliane Ceramic: **0.8973** (0.9025 * 0.9943);
- $f NRB_{,y}$ for Santa Rita Ceramic: **0.9153** (0.9206 * 0.9943).

Finally, table below provides values applied for the calculation of emission reductions according to equation 1.

[78] *. Information on such projects available at: <http://www.markit.com/en/products/registry/markit-environmental-registry-public-view-reports.page#registered_projects>. Access this site and type Sustainable Carbon in the search field. Last visited on 23/03/2011.*

Table 15. Data used for the calculation of emission reductions.

Parameter		Antônio Ceramic	Ceará Ceramic	Ceagra Ceramic	Eliane Ceramic	Santa Rita Ceramic
B_y	Quantity of woody biomass that is substituted or displaced in tonnes	5,516.87	7,855.61	10,372.73	5,643.43	5,764.34
$fNRB_{,y}$	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass	0.9744	0.9178	0.9033	0.8973	0.9153
$NCV_{biomass}$	Net calorific value of non-renewable woody biomass that is substituted, in TJ/ton	0.001917				
$EF_{projected\ fossil\ fuel}$	Emission factor for substitution of non-renewable woody biomass by similar consumers, in tCO_2e/TJ	81.6				
ER_y	Emission reductions in the year y	8,411	11,281	14,660	7,923	7,830

It is important to state that the actual production and use of renewable biomass might be different during the crediting period. Production naturally fluctuates according to market demand. The ceramics might manage to use higher amounts of renewable biomass in case the production increases, which is expected to occur during the crediting period. In case of shortages of the biomass described in this PDD, the ceramics may compensate by buying different kinds of renewable biomass, as long as its origin is verifiable. The consumption of each type of renewable biomass will be monitored during the crediting period. Emission reductions will be calculated based on monitored values of production and fuel usage.

Therefore, baseline emissions are calculated based on historical data on production levels and fuel consumption in each ceramic. Tables below provide the calculated baseline emissions for each ceramic. More information on baseline emissions can be found in Annex 3. Project emissions are not considered according to the approved methodology. Emissions due to transportation of the renewable biomasses are not expected to significantly increase compared to emissions resulting from the transportation of the baseline fuel (non-renewablebiomass). Leakage emissions are estimated to be zero, since the project will use primarily abundant biomass residues, thus not causing emissions from any of the leakage sources described in Section B.6.1. Table below provides information on baseline emissions for each ceramic across the crediting period.

Table 16. Baseline emissions of each ceramic (in tCO_2e).

Year	Antônio Ceramic	Ceará Ceramic	Ceagra Ceramic	Eliane Ceramic	Santa Rita Ceramic	Total Baseline emissions
2010 (from 01/09/2010 to 31/12/2010)	2,811	3,771	4,900	2,648	2,617	16,747
2011	8,411	11,281	14,660	7,923	7,830	50,105
2012	8,411	11,281	14,660	7,923	7,830	50,105
2013	8,411	11,281	14,660	7,923	7,830	50,105
2014	8,411	11,281	14,660	7,923	7,830	50,105
2015	8,411	11,281	14,660	7,923	7,830	50,105
2016	8,411	11,281	14,660	7,923	7,830	50,105
2017	8,411	11,281	14,660	7,923	7,830	50,105
2018	8,411	11,281	14,660	7,923	7,830	50,105
2019	8,411	11,281	14,660	7,923	7,830	50,105
2020 (from 01/01/2020 to 31/08/2020)	5,600	7,510	9,760	5,275	5,213	33,358
Total baseline emissions (tCO2e)	**84,110**	**112,810**	**146,600**	**79,230**	**78,300**	**501,050**
Number of years of the crediting period	10	10	10	10	10	10
Annual average of estimated baseline emissions for the 10 years of crediting period (tCO2e)	**8,411**	**11,281**	**14,660**	**7,923**	**7,830**	**50,105**

The project capacity for thermal energy generation was calculated based on the amount of woody biomass used as fuel in 2009 and on the net calorific value of such fuel. These parameters allow quantifying the amount of thermal energy produced (in TJ). A conversion factor was used to obtain the amount of energy produced in 2009 in $MWh_{thermal}$. This value was divided by 8,760 hours per year to determine the equivalent capacity of the project. Table below provides more information on such calculation.

Table 17. Data used for the calculation of the project thermal energy capacity.

Parameter	Unit	Value	Source
Amount of woody biomass fired in 2009	Tonnes	35,155	Historical data from the ceramics
Net calorific value of woody biomass	TJ/ton	0.01917	Please see Section B.6.2, item $NCV_{biomass}$
Energy generated	TJ	674.09	Calculated with the information above

from woody biomass			
Energy generated from woody biomass	MWh	187,247	Calculated with a conversion factor of 277.78 MWh/TJ was used. Source: ANEEL (Brazilian Electricity Regulatory Agency). Available at: <http://www.aneel.gov.br/arquivos/PDF/atlas_fatoresdeconversao_indice.pdf>
Equivalent energy capacity	MW	21.38	Calculated as the energy generated (in MWh) divided by 8,760 hours per year.

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Total Baseline emissions (tCO_2e)	Total Project emissions (tCO_2e)	Leakage (tCO_2e)	Total emission reductions (tCO_2e)
2010 (from 01/09/2010 to 31/12/2010)	16,747	0	0	16,747
2011	50,105	0	0	50,105
2012	50,105	0	0	50,105
2013	50,105	0	0	50,105
2014	50,105	0	0	50,105
2015	50,105	0	0	50,105
2016	50,105	0	0	50,105
2017	50,105	0	0	50,105
2018	50,105	0	0	50,105
2019	50,105	0	0	50,105
2020 (from 01/01/2020 to 31/08/2020)	33,358	0	0	33,358
Total Emission Reductions (tCO_2e)	**501,050**	**0**	**0**	**501,050**
Number of years of the crediting period	10	10	10	10
Annual average of estimated emissions reductions for the 10 years of crediting period (tCO2e)	**50,105**	**0**	**0**	**50,105**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**PR_y**
Data unit:	Thousands of ceramic pieces
Description:	Amount of products produced in year y

Source of data to be used:	Controlled by the ceramic owners
Value of data	Values applied for ex-ante calculation are described in Section B.6.3. Detailed information is available in Annex 3.
Brief description of measurement methods and procedures to be applied:	This parameter is monitored by employees on each ceramic, counting the total production on a daily or weekly basis. Values used for the calculations are taken either from sales reports or from production control documents. Data will be aggregated on a monthly and yearly basis. Measurements are done by an internal control sheet monitored by the project proponent. The production might also be used to ensure that all appliances are still in operation.
QA/QC procedures to be applied:	All ceramics have internal controls to assure proper monitoring of this parameter. Data will be compared to the amount of renewable biomass employed.
Any comment:	This parameter is determined individually for each ceramic industry. 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:	Tonnes
Description:	Amount of renewable biomass used during year y of the crediting period
Source of data to be used:	Measured by the biomass providers and controlled by the ceramic owners
Value of data	This parameter is not directly used for the calculation of emission reductions. It is assumed that the consumption of renewable biomass will be enough to provide 100% of the energy demand for the production of ceramic pieces.
Brief description of measurement methods and procedures to be applied:	It is monitored through purchase invoice, delivery notes or other documents concerning the acquisition of renewable biomasses. Biomass providers measure the amount of products delivered to the ceramics to determine due financial compensation. In case any renewable biomass is measured in volume, default values of specific gravity shall be used to convert it to tonnes. Values below might be applied for the given biomass types: **Biomass type** / **Specific gravity (tonnes/m³)**: Coconut residues: 0.5 Residues from cashew trees: 0.42 Sawdust: 0.25 Wood from sustainable management plan areas: 0.88 These values were taken from the sources below: - Coconut residue and residues from cashew trees: LORENZI, H. *Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil*, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002. - Sawdust: PINHEIRO, G.F., RENDEIRO, G., PINHO, J.T. *Densidade Energética de resíduos vegetais*. Available at: http://www.ufpa.br/gedae/BIOMASSAEENERGIA2006.pdf .

	- Wood from sustainable management plan areas: considered to be the same as for native firewood. Please check parameter $\rho_{biomass}$ on section B.6.2 for more information.
QA/QC procedures to be applied:	The ceramics shall store all documents related to the purchase or acquisition of renewable biomass. Data will be compared to production output.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	$f_{NRB,y}$
Data unit:	Fraction or percentage
Description:	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable using survey methods
Source of data to be used:	Survey methods.
Value of data	0.974 for Antônio Ceramic 0.9178 for Ceará Ceramic 0.9033 for Ceagra Ceramic 0.8973 for Eliane Ceramic 0.9153 for Santa Rita Ceramic
Brief description of measurement methods and procedures to be applied:	The monitoring of this parameter will be based on national and international articles, databases and data monitored by the project developer such as project activities at the same region. The sources will provide information about the sustainable use of the Caatinga biome. Wood saved from projects developed by Sustainable Carbon with the same methodology and in the same biome will also be monitored by assessing current status of all projects developed by the company.
QA/QC procedures to be applied:	Data from published sources will be used to determine this parameter. Subtracting the amount of wood saved by similar projects developed by Sustainable Carbon provides a conservative calculation of this parameter.
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 ceramic owners
Value of data	Not applied for the calculation. It is assumed that all biomass used during the crediting period is demonstrably renewable.
Brief description of measurement methods and procedures to be applied:	This information will be given by the biomasses providers. The guarantee of acquiring renewable biomass will be achieved by invoices from the providers. As stated in section B.6.1, the biomasses are considered renewable as fulfilling definitions of renewable biomass approved by the CDM Executive Board.
QA/QC procedures to be applied:	Ceramic owners shall store invoices, receipt of sales or other documents to allow the traceability of the renewable biomass.
Any comment:	The biomasses will be considered as renewable if they are in accordance to the definition by the CDM Executive Board. 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 due to competing uses of biomass***
Data unit:	tCO_2e
Description:	This source of leakage is relevant for biomass residues and biomass from existing forests, according to the general guidance on leakage in biomass project activities. The quantity of renewable biomass available will be assessed annually to determine the occurrence of leakage.
Source of data to be used:	Monitored by surveys and publications
Value of data	0 (zero). The amount of biomass available is described in Section B.6.1. It is considered that there is sufficient biomass surplus in the region to avoid the occurrence of leakage. The following biomass availability in the project region is considered:
Brief description of measurement methods and procedures to be applied:	Biomass availability will be used to calculate leakage from renewable biomass. The sources of leakages predicted in the methodology applied will be monitored. The measurement of the leakage will be based in national and international articles and databases every monitoring period. These sources will provide information about the biomass availability in the project's regions.
QA/QC procedures to be applied:	Data available regarding the ceramic industry fuel consumption will be utilized to monitor the leakage.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Biomass type	Availability	Year
Sawdust	14,588 m^3	2009
Cashew nut shell	46,989 tonnes	2009
Cashew tree wood	100,300 tonnes	2003
Coconut residues	854,000 tonnes	2006

Data / Parameter:	***Leakage of non-renewable woody biomass***
Data unit:	tCO_2e
Description:	Leakage relating to non-renewable woody biomass
Source of data to be used:	Monitored
Value of data	0 (zero). It is assumed that no emissions occur due to this source, as explained in Section B.6.1.
Brief description of measurement methods and procedures to be applied:	The sourced of leakage from non-renewable biomass will be monitored according to the applied methodology.
QA/QC procedures to be applied:	Data available regarding the ceramic industry fuel consumption will be employed to monitor the leakage.
Any comment:	The biomasses will be considered as renewable if they are in accordance to the

	definition by the CDM Executive Board. 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.

Monitoring shall also include checking of all appliances or a representative sample thereof, at least once every two years to ensure that they are still operating or are replaced by an equivalent in service appliance. The production of ceramic pieces (parameter PR_y) might be used as evidence that all appliances (kilns) are still operating.

B.7.2 Description of the monitoring plan:

The party responsible for implementing the monitoring plan will be the owner of each ceramic. The ceramic owners will also be responsible for developing the forms and registration formats for data collection and further classification. Monitored 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. For this purpose, the authority for the registration, monitoring, measurement and reporting will be Mr. Francisco Evanildo de Souza, for Antônio Ceramic, Ceará Ceramic, Ceagra Ceramic and Eliane Ceramic. The authority for these scopes for Santa Rita Ceramic is Mr. Erinaldo Duarte.

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. Monitored parameters are described in Section B.7.1 and will be monitored with the frequency described in Table below.

Table 18. Further information on the monitored parameters.

Parameters	Description	Units	Origin	Frequency
$\mathbf{PR_y}$	Amount of products produced in year y	Thousands of ceramic pieces	This parameter is monitored by employees on each ceramic, counting the total production. Measurements are done by an internal control sheet monitored by the project proponent. Values used during the project monitoring might be taken either from sales reports or from production control documents.	Measured on a daily or weekly basis. Data will be aggregated on a monthly and yearly basis.
$\mathbf{Q_{renbiomass}}$	Amount of renewable biomass used during year y of the crediting period	Tonnes	Measured by the biomass providers and controlled by the ceramic owners. Data is calculated from receipts, invoices and other documents regarding the acquisition of biomass	Monthly
$f_{NRB,y}$	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable	Fraction	Survey methods, as described in Section B.7.1	Annualy
Origin of	Renewable origin of	Not applicable	Controlled by the ceramic	Annualy

Parameters	Description	Units	Origin	Frequency
Renewable Biomass	the biomass		owners	
Leakage due to competing uses of biomass	This source of leakage is relevant for biomass residues and biomass from existing forests. The quantity of renewable biomass available will be assessed annually to determine the occurrence of leakage	tCO_2e	Monitored by surveys and publications	Annually
Leakage of non-renewable woody biomass	This source of leakage assesses the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources.	tCO_2e	Monitored by surveys and publications	Annually

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

The application of the baseline and monitoring methodology was finalized on 11/07/2011.The following entity is responsible for applying the baseline and monitoring methodology:

SUSTAINABLE CARBON - PROJETOS AMBIENTAIS LTDA
Project developers: Thiago de Avila Othero and Gabriel Fernandes de Toledo Piza, Technical Analysts.
Coordinated by: Marcelo Hector Sabbagh Haddad, Technical Coordinator.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

02/07/2010. On this date, the ceramics included in the project have signed contracts with Sustainable Carbon to develop an emission reduction project. The starting date of the project is before the "*Time of first submission*" as per Gold Standard definitions[79]. Hence, the project is applying for retroactive registration according to Gold Standard Toolkit Section 1.2.6.

C.1.2. Expected operational lifetime of the project activity:

30 years 0 months.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/09/2010.

C.2.2.2. Length:

10 years, 0 months.

SECTION D. Environmental impacts

This project is in accordance with the CONAMA[80] 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[81], environmental licenses and the permission of the Environmental Superintendence of the State of Ceará (SEMACE[82]) which must be valid. The project also satisfies the constraints at the operation license determined by the environmental agency competent at the region.

[79] *According to Gold Standard Requirements version 2.1, the time of first submission means submission of the Local Stakeholder Consultation Report for projects proceeding under the regular project cycle, and submission of the required Gold Standard project activity documentation for a Pre-Feasibility Assessment and payment of the applicable fee under the retroactive project cycle.*

[80] *CONAMA (National Environmental Council), created in 1981 by Law 6.938/81, is the Brazilians' department responsible for deliberation and consultation of the whole national environmental policy and it is chaired by the Minister of Environment. It is responsible for the establishment of standards and criteria relating to licensing of potentially polluting companies. More information is available at <http://www.mma.gov.br/port/conama/estr.cfm>. Last visited on 23/03/2011.*

[81] *Clay extraction licenses in Brazil are subject to the development of a Environmental Control Plan and other actions to reduce the impact of such activity. More information on the clay extraction licensing is available at: <http://www.dnpm.gov.br/conteudo.asp?IDSecao=64&IDPagina=60 >. Last visited on 11/07/2011.*

[82] *SEMACE is the environmental authority in the State of Ceará, responsible to issue the environmental licenses according to CONAMA resolution 237/97. More information at: <http://www.semace.ce.gov.br/>. Last visited on 24/03/2011.*

According to the IBAMA Normative Instruction Nº 112 from August 21st, 2006[83], 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. Therefore, to use firewood obtained from native forests in a sustainable manner, it is necessary to use the DOF, which is required by national law. This requirement it is not enforced namely due to the lack of control, and constitutes the baseline scenario, as described in Section B.5. During the project, however, all firewood used will have DOF, thus demonstrating to be sustainable.

Furthermore, the other renewable biomasses likely to be used by the project, such as residues from cashew tree, cashew nut shells and coconut residues, do not require documents for residues, since they do not fall under the forest by-products definition of *IBAMA* Normative Instruction N° 112/06.

The project is also in accordance with Federal Constitution, Article 20, which establishes the payment of a Financial Compensation by the Mineral Resources Exploitation. This financial compensation is annually paid to DNPM (National Department of Mineral Production[84]) due to the clay exploitation.

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The analysis of environmental impacts is not required by the host party for this project activity.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Environmental impacts are not considered to be significant. The following mitigation measures are established as part of the Detailed Impact Assessment:

- **Monitoring the procedures related to the control and disposal of ashes**: the project might result in environmental pollution in case appropriate procedures to manage and dispose ashes are not followed. The project proponent will rely in site visits and interviews to determine the level of control over the handling and disposal of ashes. The aim of the project is to assure environmental impacts are avoided and a sustainable use and disposal of ashes is obtained.
- **Monitoring actions of Health and Security on each ceramic**: The project might expose workers to the risk of accidents and other safety related concerns if due caution is not taken. The project proponent will rely in site visits and interviews to assess the project situation regarding health and security measures. The aim of the project is to allow an improvement in the quality of employment for the workers in each ceramic.
- **Monitoring the origin of biomass**: The origin of the renewable biomass will be assessed storing documents (receipts, invoices) from the biomasses providers, thus allowing to determine its origin. The biomasses shall be considered renewable as fulfilling definitions of renewable biomass approved by the CDM Executive Board.

[83] *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>. Last visited on: 24/03/2011.*

[84] *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. Last visited on 24/03/2011.*

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

An informal Stakeholders consultation was performed on March 2011. Table below provides a list of stakeholders that have been informed on the project development via postal service. A letter was sent to each stakeholder providing details on the project and its expected contribution on sustainable development. The Brazilian Designated National Authority under the UNFCCC was also informed on the project development on this manner.

Table 19. Listo f stakeholders that have been informed on the project development.

Entity name	Contact person	Location	Type of entity
Associação Beneficente dos Moradores de Pau-Pombo	Francisco José Cavalcante de Souza	Aquiraz/CE	Local community
Associação Comunitária dos Moradores do Batoque	Francielma Alves da Silva	Aquiraz/CE	Local community
Associação Comunitária do mutirão Tavera, Jabuti, Gereraú, Caracanga e Becos de Moça, do Garrote e da Joana em Itaitinga - CE	Francisco Meneses Mendonça	Gererau/CE	Local community
Fundação Nova Esperança	Iracy Mendes Soares	Aquiraz/CE	Local community
Associação Comunitária dos Moradores da Caponga da Bernarda	Maria Dione Lopes Gomes	Aquiraz/CE	Local community
Prefeitura de Itaitinga	Dr. Abdias Patrício de Oliveira	Itaitinga/CE	Local authority
Secretaria de Meio Ambiente de Itaitinga	Lúcio Flávio de Sousa Benevides	Itaitinga/CE	Local environmental authority
Secretaria de Trabalho e Assistência Social de Itaitinga	Maria Anete Cavalcante Mota	Itaitinga/CE	Local authority
Câmara Municipal de Itaitinga	Presidente Alonzo Dessa da Silva	Itaitinga/CE	Local authority
Prefeitura de Aquiraz	Prefeito Edson Sá	Aquiraz/CE	Local authority
Secretaria de Meio Ambiente e Desenvolvimento Urbano	Francisco José Aquino Cabral	Aquiraz/CE	Local environmental authority

Entity name	Contact person	Location	Type of entity
Câmara Municipal de Aquiraz	Presidente Homero Silva	Aquiraz/CE	Local authority
Prefeitura Municipal de São Gonçalo do Amarante	Pref. Walter Ramos de Araújo Júnior	São Gonçalo do Amarante/CE	Local authority
Secretaria do Meio Ambiente de São Gonçalo do Amarante	Michele Mourão Matos	São Gonçalo do Amarante/CE	Local environmental authority
Câmara Municipal de São Gonçalo do Amarante	Presidente Francisco Marcio Martins de Brito	São Gonçalo do Amarante/CE	Local authority
Superintendência Estadual do Meio Ambiente – SEMACE Ceará	Superintendente Maria Lúcia de Castro Teixeira	Fortaleza/CE	State environmental authority
Secretaria Executiva da Comissão Interministerial de Mudança Global do Clima	Dr. José Domingos Gonzalez Miguez	Brasília/DF	Brazilian Designated National Authority under the UNFCCC
Sindicato das Indústrias de Cerâmicas do Estado do Ceará	Presidente Fernando Antônio Ibiapina Cunha	Fortaleza/CE	Non-governmental organization
SENAI-CE	Sebastião Feitosa Freitas Filho	Fortaleza/CE	Non-governmental organization
Associação Nacional da Indústria Cerâmica	Presidente Luis Lima	Rio de Janeiro/RJ	Non-governmental organization
SEBRAE-CE	Presidente Jorge Parente Frota Júnior	Fortaleza/CE	Non-governmental organization

Stakeholders were encouraged to provide comments via e-mail or letter. So far, no comments have been received. As part of the Stakeholders feedback round, a physical meeting with stakeholders shall be performed following Gold Standard requirements and procedures before the end of the validation.

E.2. Summary of the comments received:

No comments have been received so far.

E.3. Report on how due account was taken of any comments received:

Not applicable. No comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Sustainable Carbon Projetos Ambientais Ltda
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Represented by:	Lorival Assunção Tavares
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Middle Name:	Assunção
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FAX:	Not available
E-Mail:	Not available
URL:	Not available
Represented by:	Lorival Assunção Tavares
Title:	Director
Salutation:	Mr.
Last Name:	Tavares
Middle Name:	Assunção
First Name:	Lorival
Department:	General Management
Mobile:	Not available
Direct FAX:	Not available
Direct tel:	Not available
Personal E-Mail:	Not available

Organization:	Ceagra – Cerâmica e Agropecuária Assunção Ltda
Street/P.O.Box:	Rodovia BR 116, Km 28, s/n°, Riachão
Building:	Not applicable
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State/Region:	Ceará
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Country:	Brazil
Telephone:	+55 85 3377-1262
FAX:	Not available
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URL:	Not available
Represented by:	Lorival Assunção Tavares
Title:	Director
Salutation:	Mr.
Last Name:	Tavares
Middle Name:	Assunção
First Name:	Lorival
Department:	General Management

Mobile:	Not available
Direct FAX:	Not available
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Personal E-Mail:	Not available

Organization:	Eliane Cavalcante de Souza EPP
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Building:	Not applicable
City:	Itaitinga
State/Region:	Ceará
Postfix/ZIP:	CEP 61.880-000
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FAX:	Not available
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URL:	Not available
Represented by:	Lorival Assunção Tavares
Title:	Director
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Middle Name:	Assunção
First Name:	Lorival
Department:	General Management
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Personal E-Mail:	Not available

Organization:	Cerâmica Santa Rita Ltda
Street/P.O.Box:	Rodovia BR 222, Km 47, s/n°
Building:	Not applicable
City:	São Gonçalo do Amarante
State/Region:	Ceará
Postfix/ZIP:	CEP 62.670-000
Country:	Brazil
Telephone:	+55 85 3377-1262
FAX:	Not available
E-Mail:	Not available
URL:	Not available
Represented by:	Lorival Assunção Tavares
Title:	Director
Salutation:	Mr.
Last Name:	Tavares
Middle Name:	Assunção
First Name:	Lorival

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in this project activity. The project does not receive Official Development Assistance.

Annex 3

BASELINE INFORMATION

Consumption of woody biomass:

Period	Antônio Ceramic		Ceará Ceramic	
	Native firewood (non-renewable woody biomass)	Wood from areas with sustainable forest management plan (renewable woody biomass)	Native firewood (non-renewable woody biomass)	Wood from areas with sustainable forest management plan (renewable woody biomass)
	Quantity (tonnes)		Quantity (tonnes)	
January 2009	553.52	0	0	0
February 2009	0	0	528.88	0
March 2009	520.96	0	494.56	0
April 2009	0	0	367.84	0
May 2009	451.44	0	398.64	0
June 2009	469.04	0	489.28	0
July 2009	0	0	965.36	0
August 2009	841.28	0	0	0
September 2009	877.36	0	1,051.60	0
October 2009	902.88	0	1,231.12	555.28
November 2009	0	13.20	858.00	48.40
December 2009	791.12	96.80	866.80	0
Total	**5,407.60**	**110.00**	**7,252.08**	**603.68**
Average	**450.63**	**9.17**	**604.34**	**50.31**

Period	Ceagra Ceramic		Eliane Ceramic		Santa Rita Ceramic	
	Native firewood (non-renewable woody biomass)	Wood from areas with sustainable forest management plan (renewable woody biomass)	Native firewood (non-renewable woody biomass)	Wood from areas with sustainable forest management plan (renewable woody biomass)	Native firewood (non-renewable woody biomass)	Wood from areas with sustainable forest management plan (renewable woody biomass)
	Quantity (tonnes)		Quantity (tonnes)		Quantity (tonnes)	
January 2009	685.52	0	789.36	0	418.88	0
February 2009	499.84	0	0	0	718.08	0
March 2009	667.04	0	838.64	0	359.92	0
April 2009	491.04	0	0	0	493.68	0
May 2009	0	0	656.48	35.20	659.12	0
June 2009	1,074.48	0	0	79.20	315.92	0
July 2009	638.88	0	866.80	96.80	426.80	0
August 2009	936.32	0	0	118.80	433.84	0
September 2009	1,026.96	0	588.72	66.00	349.36	176.00
October 2009	1,137.84	206.80	0	66.00	376.64	211.20
November 2009	1,475.76	473.33	611.60	0.00	270.16	70.40
December 2009	791.12	268.40	741.84	88.00	484.88	0
Total	**9,424.80**	**948.53**	**5,093.44**	**550.00**	**5,307.28**	**457.60**
Average	**785.40**	**79.04**	**424.45**	**45.83**	**442.27**	**38.13**

Baseline production:

Period	**Antônio Ceramic**	**Ceará Ceramic**	**Ceagra Ceramic**	**Eliane Ceramic**	**Santa Rita Ceramic**
	Quantity (thousands of ceramic pieces)				
January 2009	492.000	1,144.000	1,083.500	652.000	701.975
February 2009	544.000	1,104.000	855.300	391.000	701.975
March 2009	768.000	1,078.000	578.950	739.000	701.975
April 2009	717.000	420.000	803.800	419.000	701.975
May 2009	694.000	188.000	49.900	762.000	701.975
June 2009	617.000	459.000	1,108.100	622.000	701.975
July 2009	729.990	658.000	980.000	931.000	701.975
August 2009	620.000	852.000	1,646.150	878.000	701.975
September 2009	537.000	1,711.000	1,872.900	631.000	701.975
October 2009	27.000	1,731.000	2,096.380	911.000	701.975
November 2009	1,263.000	1,101.000	1,824.698	454.000	701.975
December 2009	913.000	1,007.000	1,963.100	796.000	701.975
Total	7,921.990	11,453.000	14,862.778	8,186.000	8,423.702
Average	660.166	954.417	1,238.565	682.167	701.975

Annex 4

MONITORING INFORMATION

Monitoring information is available on Section B.7.