

KAMIRANGA CERAMIC FUEL SWITCHING PROJECT



Document Prepared By Sustainable Carbon – Projetos Ambientais Ltda.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity was developed by *Carbono Social Serviços Ambientais Ltda.* (Social Carbon Company), which has changed its company name to *Sustainable Carbon - Projetos Ambientais Ltda.*

The project has been fully operational since the starting date of the crediting period. This means the ceramic factory is operating using exclusively renewable biomass, thus mitigating their baseline emissions.

The project activity involves *Kamiranga* Ceramic company which is a red ceramic factory located in *São Miguel do Guamá* municipality in the State of *Pará*, north of Brazil. The factory produces structural ceramic bricks mainly for the local market in *Belém* and for the northeast region of the state.

The project's objective is to stop using the native wood, which is a non-renewable fuel, and completely replace it with renewable biomasses to feed the kilns and fire their ceramic units, thus minimizing environmental impacts related to the native forest deforestation and consumption.

This fuel switching project reduces greenhouse gas (GHG) emissions through the replacement of native wood for renewable biomasses to generate thermal energy. It was concluded that this is feasible when considering the income derived from trading the resulting carbon credits. This move was originally unattractive due to the high investment costs of the adaptation of machinery for the new biomass and other barriers.

Therefore, GHG emissions from wood burning in the baseline scenario were not compensated by vegetation growth. In contrast, the renewable biomasses employed in this project activity have a carbon neutral lifecycle.

Unlike the identified baseline, the project activity generates thermal energy without causing deforestation by using abundant renewable biomasses.

The emission reductions attributable to the switching of non-renewable fuel (non-renewable wood) to renewable biomasses were equal to **108,187 tCO₂e** during the monitoring period from 01-10-2013 to 31-03-2016. The contribution to sustainability is being monitored applying the SOCIALCARBON® Standard, which is based on six main resources: Technology; Natural; Financial; Human; Social and Carbon Resources.

1.2 Sectoral Scope and Project Type

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

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

This is not an AFOLU project. This is not a grouped project.

1.3 Project Proponent

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

Organization name	<i>Cerâmica Kamiranga Indústria e Comércio LTDA.</i>
Contact person	Mr. Sigifério Alves de Oliveira and Mr. Nonato Fernandes
Title	Mr. Sigifério Alves de Oliveira: Director and owner. Responsible for information about the ceramic company, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramics devices market challenges. Mr. Raimundo Nonato Fernandes: Production Manager and Monitoring data responsible. Responsible for general data and information on inputs and outputs of the ceramic industry, detailed information on the acquisition of renewable biomasses and how this data is kept by the controller's office.
Address	Estrada Santa Rita da Barreira, s/n° – km 04 – Zona Rural São Miguel do Guamá – Pará, Brazil Postal Code: 68660-000
Telephone	+55 (91) 9112-8094
Email	kamiranga@bol.com.br

As the project authorized contact, Sustainable Carbon was given the responsibility of preparing the present project report and to accompany the proponents until the end of the crediting period.

Organization name	Sustainable Carbon – Projetos Ambientais Ltda.
Role in the project	Project developer, Project participant and Project idealizer.
Contact person	Denis Gonçalves dos Santos Fernanda Sayuri Suzuki Marcelo Hector Sabbagh Haddad Thiago Othero
Title	Denis Gonçalves dos Santos: Technical analyst Fernanda Sayuri Suzuki: Technical analyst Marcelo Hector Sabbagh Haddad: Technical coordinator Thiago Othero: Technical coordinator
Address	R. Doutor Bacelar, 368 – Conj. 23 – Vila Clementino Postal Code: 04.026-001 São Paulo – SP. Brazil
Telephone	+55 11 2649 0036
Email	tecnica@sustainablecarbon.com

1.4 Other Entities Involved in the Project

No other entity was involved in the project.

1.5 Project Start Date

According to version 2.3 of the VCS PD1, project start date was defined as 01/09/2007. On this date, the project began reducing or removing GHG emissions. The event that establishes this date is the end of the Hoffman kiln construction.

1.6 Project Crediting Period

The crediting period for this project started on 01/01/2008 and ends on 31/12/2017.

VCS project crediting period: 10 years, two times renewable.

1.7 Project Location

According to the applied methodology, the project boundaries for the project are the physical geographical areas of the renewable energy generation. Thus, the ceramic limits. Kamiranga ceramic is located in Brazil, in the State of Pará which is indicated in Figure 01.

Kamiranga Ceramic
Estrada Santa Rita da Barreira, s/nº – km 04 – Zona Rural
São Miguel do Guamá – Pará, Brazil

¹ Document available at: < http://www.vcsprojectdatabase.org/#/project_details/197>. Last visit on: 08/04/2016.

Postal Code: 68660-000

Geodetic Coordinates (SAD69): 1°36'53.0"S and 47°26'31.6"W / Meridian Convergence: 0° 4' 7.9"

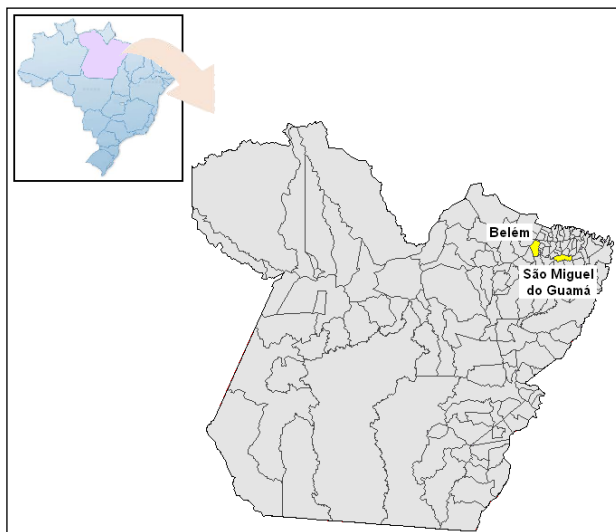


Figure 1. Geographic location of *São Miguel do Guamá* which has the following coordinates: 1°37'09.22"S and 47°28'33.68"W.

1.8 Title and Reference of Methodology

The project applies a small scale methodology approved under the Clean Development Mechanism, as follows:

Category AMS-I.E.: Switch from Non-Renewable Biomass for Thermal Applications by the User – Version 01, valid from 01/02/2008 to 08/04/20102. This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies.

1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: The project activity is not included in an emission trading program or any other mechanism that includes GHG allowance trading.
- Other Forms of Environmental Credit: The project activity is not creating any other form of environmental credit under any specific program.
- Participation under Other GHG Programs: The project activity is not registered under any other GHG program.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

VCS PD project was validated by the Designated Operational Entity TÜV Nord Cert GmbH and this present monitoring report will be verified by Rina Services S.p.A.

² This version of the methodology is available at: http://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSP4VBBO5G54RXDE9KQ6FJWMGHZLHFA5. Last visit on: 07/04/2016.

The project has been fully operational since the starting date of the crediting period. This means the ceramic is operating using exclusively renewable biomass, thus mitigating their baseline emissions.

As described on the VCS PD version 2.3, during the validation process the production at *Kamiranga Ceramic* encompassed two *Paulista* kilns³ and one Hoffman kiln⁴. These kilns produced, together, around 2,780 tonnes of ceramic units per month.

The Hoffman kiln has 30 cycles per month, producing around 78.86 tonnes of ceramic units per cycle. This totalizes 2,365.8 tonnes of ceramic units per month.

The *Paulista* kilns described on the VCS PD have 4 cycles per month, one producing around 43.22 tonnes of ceramic units per cycle, and the other one producing 60 tonnes per cycle. Thus, it totalizes 412.8 tonnes of ceramic units per month.

During the third monitoring period, *Kamiranga* ceramic factory has constructed two new *Paulista* kilns that were not mentioned in the VCS PD. The production of this new kiln was excluded from the third monitoring period since it was not possible to perform the additionality assessment due to the lack of data⁵.

In the fourth monitoring period both kilns have operated on a regular basis. The kilns 3 and 4 started to operate in January 2nd, 2012, and January 8th, 2012, respectively with capacity to burn 36 and 37 thousand pieces each. As the ceramic company has used exclusively renewable biomass in these new kilns, the additionality assessment was performed in order to include the production provided by the new kilns. The additionality assessment was based on the use of renewable biomass in both the new *Paulista* kilns, comparing the fuel costs during the fourth monitoring period scenario and the baseline scenario.

Regarding the Financial Barrier, a comparison was made between the cost of energy generated on the baseline scenario of *Cavalcante Ceramic* and the fourth monitoring period of *Kamiranga Ceramic*⁶

The cost of non-renewable wood was updated according to local surveys in the Third Monitoring Report of *Cavalcante Ceramic*, a ceramic company that is located on the same city of *Kamiranga* and which is also involved in a fuel switching project with Sustainable Carbon. A conservative correction factor was applied annually for 2012 to the cost of the non-renewable biomass, in order to account for general price increases due to inflation. These surveys indicates that the costs for non-renewable biomass for the period was 260 BRL per 23 m³, resulting in 16.74 BRL/tonne.

³ "*Paulista*" is a kind of intermittent kiln with rectangular shape and lateral furnaces. The burning cycle with "*Paulista*" kilns comprises 6 hours to load the kiln with ceramic units, 40 hours of heating, 8 hours of firing, 24 hours of cooling, 6 hours to download, and approximately 30 minutes to clean. At *Kamiranga Ceramic*, one "*Paulista*" kiln produces approximately 43.22 tonnes of ceramic units per burning cycle, and the other "*Paulista*" kiln produces approximately 60 tonnes of ceramic units per burning cycle.

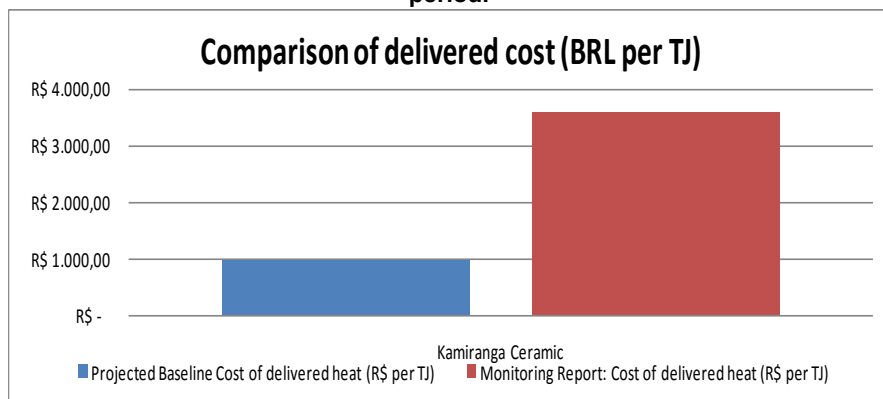
⁴ "*Hoffman*" kilns have parallel chambers where the heat from one chamber is used in the next, therefore recycling the generated heat in the previous chambers. The fuels are fed through entrances located on the top of this kiln. The most common fuels that are used in this type of kiln are fire wood and sawdust. The burning cycle with "*Hoffman*" kiln comprises 1 hours to load the kiln with ceramic units, 16 hours of heating, 40 minutes of firing, few hours of cooling, 1 hours to download, and approximately 30 minutes to clean. The "*Hoffman*" kiln at *Kamiranga Ceramic* produces approximately 78.86 tonnes of ceramic units per burning cycle.

⁵ The ceramic units produced by the new *Paulista* kiln were excluded in the third monitored period. Proportionally, the amount of biomass employed was also decreased due to the exclusion of the new kiln.

⁶ The cost of non-renewable wood was taken from the Third Monitoring Report from *Cavalcante Ceramic* due to lack of data regarding the cost of non-renewable wood in the baseline of *Kamiranga Ceramic*. *Cavalcante Ceramic* is also located in São Miguel do Guamá and operated under similar market conditions.

The annual rate of increase applied on the last monitoring period for *Kamiranga Ceramic* was 6.50%⁷, once it was the highest inflation rate evidenced since the year of 2004.

Chart 1. Comparison between the cost of delivery heat at the projected baseline and current monitored period.



The Chart above displays the comparison of cost of delivered heat at the projected baseline scenario (year 2012) and at the fourth monitoring period (from 01/03/2011 to 01/04/2012). It can be observed that the non-renewable biomass is more financially attractive than using the renewable biomasses currently employed by the project activity: sawdust and *açaí* pits.

With the project activity's implementation, the fuel spending has increased. Comparing the cost per energy generated, *Kamiranga ceramic* spent with renewable biomass BRL 3,607.28 per TJ generated against BRL R\$ 979.57 per TJ that could be expected in case non-renewable wood was used (projected baseline scenario for 2012, considering a conservative correction of 6.50% annually). The operation of the new kilns with renewable biomass, shows to be less financially attractive due to the fact that the use of renewable biomass is more expensive than using non-renewable wood.

According to the National Institute for Space Research⁸⁹, *Pará State* was responsible for almost one third of Amazon deforestation recorded in August of 2011, despite the reduction in deforestation rates evidenced in the Amazon biome from August, 2010 to July, 2011¹⁰. The consumption of non-renewable biomass by ceramic industry was noted by several authors (UHLIG, 2008¹¹; NERI, 2003¹²; BRITO¹³; CARDOSO, 2008¹⁴). This was also observed in other industries,

⁷ Available at: <http://agenciabrasil.ebc.com.br/noticia/2012-01-06/inflacao-oficial-registra-em-2011-maior-taxa-desde-2004> last visited at 08/04/2016

⁸ Instituto Nacional de Pesquisas Espaciais (INPE).

⁹ LOURENÇO, I. Agência Brasil. **Pará foi campeão de desmatamento em agosto**. Available at: <http://agenciabrasil.ebc.com.br/noticia/2011-10-03/para-foi-campeao-de-desmatamento-em-agosto>. Last visited on 08/04/2016.

¹⁰ BRASIL. Brasil.gov.br. **Desmatamento na Amazônia brasileira em 2011 apresenta menor taxa já registrada**. Available at: <http://www.brasil.gov.br/noticias/arquivos/2011/12/6/desmatamento-na-amazonia-brasileira-em-2011-apresenta-menor-taxa-ja-registrada>. Last visited on 08/04/2016.

¹¹ 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 08/04/2016.

¹² NERI, J.T. **Energia Limpa, Sustentável ou de Subsistência? Cerâmica Industrial**, Rio Grande do Norte; V,8, n.1,35 -6,2003. Available at: http://www.ceramicaindustrial.org.br/pdf/v08n01/v8n1_5.pdf. Last visited on 08/04/2016.

¹³ BRITO, J.O. **O uso energético da madeira**. Available at: http://www.scielo.br/scielo.php?pid=S0103-40142007000100015&script=sci_arttext&tlng=ES. Last visited on 08/04/2016.

for example in production of steel¹⁵, which has a much better structure and internal organization when compared to ceramic factories that are generally small and family-run enterprises. Therefore, the statements described above evidence that the use of non-renewable wood still can be a hypothetically feasible scenario for the project activity.

In the fifth monitoring period, there were no changes in the kilns of Kamiranga Ceramic. The factory operated with one *Hoffman* kiln and four *Paulista* kilns, which are daily fed with renewable biomass, such as: sawdust and *açaí* pits.

In the current monitoring period, there were no changes in the kilns of Kamiranga Ceramic. The renewable biomass used were: sawdust, *açaí* pits and wood residue

None of the changes described above have significant effects on the project monitoring or on its capacity to mitigate GHG emissions. The monitoring data was kept according to the monitoring plan described in the project description document. This Monitoring Report refers to the sixth monitoring period of this project and includes data from 01-10-2013 to 31-03-2016.

2.2 Deviations

2.2.1 Methodology Deviations

There were no methodology deviations during this monitoring period.

2.2.2 Project Description Deviations

The registered VCS PD version 2.3 establishes that the project proponent (meaning the ceramic owner) would monitor the amount of renewable biomass (parameter $Q_{\text{renbiomass}}$) in accordance to the weight described in the receipts or invoices from the providers.

On the current monitoring period the ceramic owner used an indirect method of measurement of $Q_{\text{renbiomass}}$ involving measuring the dimensions of the vehicles trucks that delivery the biomass. With this information, staff from Kamiranga Ceramic issues a receipt describing the total volume of biomass (in m³), the biomass provider and the price paid. This receipt is used as an internal control and also used for the monitoring of $Q_{\text{renbiomass}}$ during the current monitoring report. This new method increased the quality of measurements of the parameter $Q_{\text{renbiomass}}$.

During the third monitoring period, *Kamiranga* ceramic factory has constructed two new *Paulista* kilns that were not mentioned in the VCS PD. The two new kilns, 3 and 4, started to operate in January 2nd, 2012, and January 8th, 2012, respectively with capacity to burn 36 and 37 thousand pieces each.

As the ceramic company has used exclusively renewable biomass in these new kilns, the additionality assessment was performed in order to include the production provided by the new kilns. The additionality assessment was based on the use of renewable biomass in both the new

¹⁴ 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.

¹⁵ Instituto Observatório Social. O Aço da Devastação. Available at: <http://www1.ethos.org.br/EthosWeb/arquivo/0-A-620Pesquisa_A%20Devasta%C3%A7%C3%A3o%20do%20A%C3%A7o.pdf>. Last visited on 08/04/2016

Paulista kilns, comparing the fuel costs during the fourth monitoring period scenario and the baseline scenario which is described in section 2.1 above.

It is important to note that these deviation did not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

2.3 Grouped Project

Not applicable. This is not a grouped project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	EF_{projected fossil fuel}
Data unit	tCO ₂ /TJ
Description	CO ₂ Emission factor of residual fuel oil
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Source: < http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf > Page 2.18. Table 2.3. IPCC. Last visited on 07/04/2016.
Value applied	77.4 tCO ₂ /TJ
Justification of choice of data or description of measurement methods and procedures applied	In the baseline scenario, the probable fossil fuel that would be consumed in the absence of native wood without sustainable forest management would be the heavy oil. This fuel is more expensive than wood, however it can be a more plausible of substitute of wood than natural gas due to risks involving natural gas distribution.
Purpose of the data	This parameter was used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario, in the absence of non-renewable wood.
Comments	Applicable for stationary combustion in the manufacturing industries and construction. The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits income for this project activity, whichever occurs later.

Data / Parameter	NCV_{biomass}
Data unit	TJ/tonne
Description	Net Calorific Value

Source of data	Sources: QUIRINO. W. F. et al. Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Biomassa & Energia. v.1. n.2. p. 173-182. 2004. Available at: < http://www.renabio.org.br/06-B&E-v1-n2-2004-173-182.pdf >. Last visited on 07/04/2016. SANTOS. E. C. S. et al. Caracterização Energética de Espécies Lenhosas Nativas da Amazônia. XXXVI Congresso Brasileiro de Engenharia Agrícola. Bonito. MS. 2007. Some sources of data used provide the Gross Calorific Values (GCV) of the Amazon species. In order to transform the GCV to NCV. It was utilized the equation which is available at the VCS MR Calculation spreadsheet.
Value applied	0.0182
Justification of choice of data or description of measurement methods and procedures applied	This value will provide the energy generated by the amount of wood that would be used in the absence of the project.
Purpose of the data	This parameter was used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario. It provides the energy generated by the amount of non-renewable biomass that would be used in the absence of the project.
Comments	IPCC default values shall be used only when country or project specific data are not available or difficult to obtain, according to "Guidance on IPCC default values" (Extract of the report of the twenty-fifth meeting of the Executive Board. paragraph 59). The species used to calculate the average value are typical trees of Amazon Biome that are usually utilized as fuel in the ceramic industries of the region. 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	ρ_{wood}
Data unit	tonne/m ³
Description	Specific gravity
Source of data	Sources: 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. LORENZI. H. Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil. vol.2. 4.ed. Nova Odessa. SP: Instituto Plantarum. 2002. QUIRINO. W. F. et al. Poder Calorífico da Madeira e de Resíduos Lignocelulósicos. Biomassa & Energia. v.1. n.2. p. 173-182. 2004. Available at: <http://www.renabio.org.br/06-B&E-v1-n2-2004-173-182.pdf>. Last visit on: 07/4/2016.
Value applied	0.67
Justification of choice of data or description of measurement methods and procedures applied	The amount of wood used in the baseline was measured by volume units, so this data is used to the unity conversion.
Purpose of the data	This parameter was used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario. The amount of wood used in the baseline was measured in volume units, so this data is used to convert measured values to tonnes.
Comments	The species used to calculate the average value are typical trees of Amazon Biome that are usually utilized as fuel in the ceramic industries of the region. 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	BF_y
Data unit	Tonnes of native wood per tonnes of ceramic units fired
Description	Baseline consumption of non-renewable biomass per tonnes of ceramic units produced in year y
Source of data	Historical data from the project proponent
Value applied	0.81
Justification of choice of data or description of measurement methods and procedures applied	The value was acquired through the average consumption and production of ceramic units during the years when the ceramic facilities used to consume non-sustainable wood. This value is in accordance with the data acquired in other ceramics that employ the same type of kiln. If nowadays the plants still used native firewood their consumption

	would be around 1,944 tonnes of native firewood (per month to produce 2,780 ceramic units). These values are employed to calculate the real amount of wood displaced to maintain the ceramic units' production in the baseline scenario.
Purpose of the data	This parameter was used to calculate baseline emissions from the use of the fossil fuel that would be used in the baseline scenario. It is employed to calculate the real amount of non-renewable wood displaced to maintain the ceramic production in the baseline scenario.
Comments	Values from 2004, 2005, 2006 and 2007 were applied to estimate the baseline consumption of non-renewable biomass in the ceramic's kilns (<i>Hoffman and Paulistas</i>).

3.2 Data and Parameters Monitored

Data / Parameter	$Q_{renbiomass}$								
Data unit	Tonnes per month								
Description	Amount of renewable biomass used								
Source of data	Measured by the biomass providers and monitored by the ceramic owner. The registered VCS PD v.2.3 establishes that the ceramic owner would measure this parameter and to do it the ceramic owner uses an indirect method of measuring the dimensions of the trucks that delivery the biomass. With this information a receipt is issued containing the total volume of biomass and the price paid, as an internal control								
Description of measurement methods and procedures to be applied	The amount of biomass was monitored in accordance to the volume measured from the truck dimensions. The VCS PD establishes that values in the receipts described in m³ (when applicable), shall be converted into tonnes through the specific gravity of each biomass. The specific gravity values of each renewable biomasses used in this project is: <table><tr><td>Biomass</td><td>Sawdust</td><td>Açaí Pits</td><td>Wood Residue</td></tr><tr><td>Specific gravity (tonne/m³)</td><td>0.35</td><td>0.723</td><td>0.7575</td></tr></table> Sources of data:	Biomass	Sawdust	Açaí Pits	Wood Residue	Specific gravity (tonne/m³)	0.35	0.723	0.7575
Biomass	Sawdust	Açaí Pits	Wood Residue						
Specific gravity (tonne/m³)	0.35	0.723	0.7575						

	<u>Sawdust:</u> SIMIONI. F. J. Análise diagnóstica e Prospectiva da cadeia produtiva de energia de biomassa de origem florestal no planalto sul de Santa Catarina. Curitiba. 2007. Available at: <http://hdl.handle.net/1884/10294>. Last visit on: 04/04/2016. <u>Açaí Pits:</u> PADILHA et al. Avaliação do Potencial dos Caroços de Açaí para a geração de energia. Biomassa & Energia. v. 2. n. 3. p. 231-239. 2005. Available at: <http://www.renabio.org.br/07-B&E-029-JLPadilha-2005-p231-239.pdf>. Last visit on: 04/04/2016. <u>Wood Residue:</u> SILVA, S.A.M., et AL. Avaliação da distribuição da densidade em MDF a partir da técnica da onda de ultra-som. Scientia Forestalis. n. 74, p. 19-26, junho 2007. The values are available at: <http://www.ipef.br/publicacoes/scientia/nr74/cap02.pdf>. Last visit on: 07/04/2016																												
Frequency of monitoring/recording	Monthly																												
Value monitored	Total amount during the this monitoring period (tonnes): <table><tr><th colspan="4">Calculations of <i>Kamiranga</i> Ceramic - Renewable Biomass Monitored Data</th></tr><tr><th>Period/Biomass</th><th>Sawdust (tonnes)</th><th>Açaí Pits (tonnes)</th><th>Wood Residue</th></tr><tr><td>Total Oct – Dec 2013</td><td>1,470.15</td><td>-</td><td>35.31</td></tr><tr><td>Total 2014</td><td>8,551.37</td><td>-</td><td>61.86</td></tr><tr><td>Total 2015</td><td>8,514.13</td><td>137.37</td><td>812.27</td></tr><tr><td>Total Jan – Mar 2016</td><td>2,743.37</td><td>125.80</td><td>386.96</td></tr><tr><td>Total in the period (tonnes)</td><td>21,279.01</td><td>263.17</td><td>1,296.39</td></tr></table> More detailed information (per month) is available in Appendix I.	Calculations of <i>Kamiranga</i> Ceramic - Renewable Biomass Monitored Data				Period/Biomass	Sawdust (tonnes)	Açaí Pits (tonnes)	Wood Residue	Total Oct – Dec 2013	1,470.15	-	35.31	Total 2014	8,551.37	-	61.86	Total 2015	8,514.13	137.37	812.27	Total Jan – Mar 2016	2,743.37	125.80	386.96	Total in the period (tonnes)	21,279.01	263.17	1,296.39
Calculations of <i>Kamiranga</i> Ceramic - Renewable Biomass Monitored Data																													
Period/Biomass	Sawdust (tonnes)	Açaí Pits (tonnes)	Wood Residue																										
Total Oct – Dec 2013	1,470.15	-	35.31																										
Total 2014	8,551.37	-	61.86																										
Total 2015	8,514.13	137.37	812.27																										
Total Jan – Mar 2016	2,743.37	125.80	386.96																										
Total in the period (tonnes)	21,279.01	263.17	1,296.39																										
Monitoring equipment	No monitoring equipment was used to determine this parameter																												
QA/QC procedures to be applied	Amount of biomass was checked according to receipts of purchase. The energy balance was verified according the amount of biomass applied. The thermal energy generated with the use of sawdust, açaí pits and wood residue per tonne of ceramic units produced during the current monitoring period was compared to the VCS PD. The thermal energy generated per tonne of ceramic units produced at <i>Kamiranga</i> Ceramic on the monitored period was higher than estimated on the VCS PD. More details on the assessment of this QA/QC procedure are provided on Section 4.3.																												
Purpose of the data	This parameter was used to :																												

	a. Compare the total energy produced in the current monitoring period to the thermal energy that would be necessary according to the VCS PD estimates (QA/QC table); b. Demonstrate that the Project fits in small scale category (<45MWth/year); c. To determine the occurrence of leakage emissions due to competing use of biomass.
Calculation method	The energy generated by the amount of renewable biomass during the current monitoring period was calculated based on the Net Calorific Value of each biomass, as can be seen on the VCS MR Calculation spreadsheet. The amount of biomasses was monitored in accordance to the volume measured from the truck dimensions . The values in the receipts may be described in m³, therefore it is necessary the conversion to tonnes through the specific gravity of each biomass. The specific gravity values of the renewable biomasses utilized in this project is described under the item "Description of measurement methods and procedures to be applied"..
Comments	Data was measured for each purchase/acquisition of biomass and aggregated monthly. 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	PR_y
Data unit	Tonnes of ceramic units fired per month
Description	Production of ceramic units
Source of data	Controlled by the project proponent
Description of measurement methods and procedures to be applied	The measurement is done by an internal control sheet of ceramic units burned in the kilns monitored by the project proponent, which is filled daily. The amount was acquired by counting the total production of the period considered. Data was aggregated on a monthly and yearly basis. Data from the kiln loading was used. This is considered the best source of information, since the amount of ceramic units fired have an intimate relationship with the energy required. The production is a representative sample to ensure that all appliances are still in operation.
Frequency of monitoring/recording	Monthly

Value monitored	Production of ceramic pieces	
	Period	<i>Kamiranga Ceramic</i> (tonnes of ceramic units)
	Total 2013	9,912.70
	Total 2014	45,628.50
	Total 2015	48,371.50
	Total 2016	10,558.10
	Total in the monitoring period	114,470.80
	More detailed information, please see VCS MR Calculation Kamiranga spreadsheet.	
Monitoring equipment	No monitoring equipment was used to determine this parameter. Production was counted by trained personnel on the ceramic company.	
QA/QC procedures to be applied	Data concerning PR _y measurement points are from an internal control computer used by <i>Kamiranga Ceramic</i> . Information on this computer was organized per month and daily filled according to data based on ceramic units loaded in the kilns.	
Purpose of the data	This parameter is used to calculate baseline emissions and the total energy produced in the current monitoring period in order to compare to the thermal energy necessary in the VCS PD (QA/QC table).	
Calculation method	The ceramic factory has an internal control of the quantity of ceramic units produced. It was rechecked according to the biomass employed in the ceramic kilns. As described on the VCS PD version 2.3, during the validation process the production at <i>Kamiranga Ceramic</i> encompassed two <i>Paulista</i> kiln and one Hoffman kiln. These kilns produced, together, around 2,780 tonnes of ceramic units per month. The Hoffman kiln has 30 cycles per month, producing around 78.86 tonnes of ceramic units per cycle. This totalizes 2,365.8 tonnes of ceramic units per month. The <i>Paulista</i> kilns described on the VCS PD has 4 cycles per month, one producing around 43.22 tonnes of ceramic units per cycle, and the other one producing 60 tonnes per cycle. Thus, it totalizes 412.8 tonnes of ceramic units per month. Since the third monitoring period, <i>Kamiranga ceramic</i> factory has constructed two new <i>Paulista</i> kilns that were not mentioned in the VCS PD. The kilns 3 and 4 started to operate in 02-01-2012 and 08-01-2012, respectively with capacity to burn 36 and 37 thousand pieces each. In the current monitoring period, the production process of <i>Kamiranga Ceramic</i> factory encompassed one <i>Hoffman</i> kiln and four <i>Paulista</i> kilns, which are daily fed with renewable biomass, such as: sawdust,	

	açai pits and wood residue															
	The weights of the ceramic units produced in this monitoring period were described in the table below. These values are used to convert production from units to tonnes.															
		<table><tr><th>Types of ceramic units</th><th>Weight (Tonnes per unit)</th></tr><tr><td>6 holes</td><td>0.00154</td></tr><tr><td>6 holes (1/2)</td><td>0.00082</td></tr><tr><td>8 holes (9x19x19)</td><td>0.00231</td></tr><tr><td>Maciço</td><td>0.00197</td></tr><tr><td>Combongo (6 holes)</td><td>0.00140</td></tr><tr><td>8 holes (9x19x29)</td><td>0.00288</td></tr></table>	Types of ceramic units	Weight (Tonnes per unit)	6 holes	0.00154	6 holes (1/2)	0.00082	8 holes (9x19x19)	0.00231	Maciço	0.00197	Combongo (6 holes)	0.00140	8 holes (9x19x29)	0.00288
	Types of ceramic units	Weight (Tonnes per unit)														
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	6 holes (1/2)	0.00082														
	8 holes (9x19x19)	0.00231														
	Maciço	0.00197														
Combongo (6 holes)	0.00140															
8 holes (9x19x29)	0.00288															
Bricks																
Comments	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	Controlled by the project proponent
Description of measurement methods and procedures to be applied	This information was given by the biomasses providers. Moreover, at the VCS PD v2.3 was provided a link to a website where the proponent could consult if saw mills were operating in accordance with the laws. During the period from VSC PD v2.3 and the present report, the website changed from <http://www.sectam.pa.gov.br/seiamlic> to <http://monitoramento.sema.pa.gov.br/simlam/index.htm>¹⁶. All information about the providers that are formally established as a commercial enterprise can be found at this new website.
Frequency of monitoring/recording	Each crediting period
Value monitored	Not applicable.
Monitoring equipment	No monitoring equipment was used to determine this parameter.

¹⁶ Environmental Information System of the state of Pará. According to Environmental Legislation of the State of Pará, the industries which use forested material raw have to ensure the sustainable management of their forested resources to be able to get their licenses. More information available at: <https://www.semas.pa.gov.br/1995/05/09/9741/>. Last visit on 10/06/2016.

QA/QC procedures to be applied	The biomasses were considered renewable as they were in accordance with the definition given by the Annex 18. EB 23 of UNFCCC ¹⁷ .
Purpose of the data	This parameter is used to guarantee that the amount of biomass acquired by the project proponent has a renewable origin. It is also necessary to comply with procedures required by the methodology AMS-I.E, Version 01.
Calculation method	Not applicable.
Comments	The sawmills consulted on the website < http://www.sectam.pa.gov.br/seiamlic >, that provided 80% of total sawdust utilized during the current monitoring report, did not present any legal pending issues, providing indirectly the source of biomass. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter:	Renewable biomass surplus			
Data unit	Tonnes or m ³			
Description	Amount of renewable biomass available			
Source of data	Monitored			
Description of measurement methods and procedures to be applied	It is used to calculate the leakage of renewable biomass. The sources of leakages predicted in “General guidance on leakage in biomass project activities” of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories were monitored. The measurement of the leakage was based in national and international articles and database every monitoring period. The sources provided information about the biomass availability in the project activity's region. The bibliographic references are described on the section 4.3 “Leakage”.			
Frequency of monitoring/recording	Annually			
Value monitored		Biomass	Surplus	Year
		Açaí pits in tonnes	79,715.5	2007
		Forest residue m ³	1,999,833	2007

¹⁷ CDM – Executive Board. Annex 18 definition of renewable biomass. EB 23. Available at: <http://cdm.unfccc.int/EB/023/eb23_repan18.pdf>. Last visited on 07/04/2016.

	Detailed information in Section 4.3.: “Leakage”.
Monitoring equipment	No monitoring equipment is used to determine this parameter.
QA/QC procedures to be applied	Data available regarding the ceramic industries fuel consumption was employed to monitor the leakage
Purpose of the data	This parameter is used to determine if leakage emissions due to competing use of biomass should be calculated.
Calculation method	The amount of biomass used by the project activity in each year of the crediting period is compared to total biomass available, as estimated on the VCS PD.
Comments	According to the guidance applied, the project participant shall evaluate ex ante if there is a surplus of the biomass in the region of the project activity, which is not utilized. If it is demonstrated (e.g., using published literature, official reports, surveys etc.) at the beginning of each crediting period that the quantity of available biomass in the region (e.g., 50 km radius), is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions. Value monitored, hence, represents the value determined ex ante at the beginning of the current crediting period. Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter	Leakage of non-renewable biomass
Data unit	tCO ₂ e
Description	Leakage resulted from the non-renewable biomass
Source of data	Monitored
Description of measurement methods and procedures to be applied	The three sources of leakages predicted in the applied methodology were monitored. Scientific articles official statistical data regional and national surveys were provided in order to ensure that there was no leakage from non-renewable biomass (or to estimate the leakage). Please see Section 4.3: “Leakage”.
Frequency of monitoring/recording	Annually
Value monitored	0
Monitoring equipment	No monitoring equipment is used to determine this parameter.
QA/QC procedures to	Data available regarding the ceramic industries fuel consumption

be applied	were utilized to monitor the leakage.
Purpose of the data	This parameter is used to evaluate if there is any source of indirect emission related to non-renewable biomass. If applicable, leakage emissions are used to adjust emission reductions resulting from the project.
Calculation method	Not applicable.
Comments	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter	$f_{NRB,y}$
Data unit	Percentage
Description	Fraction of biomass (wood) used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods.
Source of data	Survey methods
Description of measurement methods and procedures to be applied	Before the project activity, wood from areas without forest management was offered with low prices and high viability to the ceramic facilities owners. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, according to Brazilian environmental agency (MMA) (2016)¹⁸, Amazonian Biome has only 17.14% of its total area with sustainable use. According to a research made by Brazilian Environmental Ministry, there are around 60m³ of wood per hectare in Amazonia biome¹⁹. Thus, the amount of non-renewable woody biomass (NRB) available at Amazonia biome is around 20,873,070,000m³. The amount of demonstrably renewable woody biomass (DRB) is around 4,318,236,000 m³. So, according to the equation presented in the methodology applied, the fraction of non-renewable biomass is around 0.8284. Two sheets were made in order to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the <i>Amazonia</i> biome. The other sheet calculates the amount of wood consumed regarding only Kamiranga Ceramic. Dividing these values by the total of wood available, it was achieved the amount of renewable biomass that has been saved by all the

¹⁸ Source: Brazilian Environment Ministry, 2016 Unidades de Conservação por Bioma Available at: <http://www.mma.gov.br/images/arquivo/80112/CNUC_PorBiomaFev16.pdf>. Last visit on: 12/04/2016

¹⁹ Source: Brazilian Environment Ministry, Normative Instruction nº 6 of 2006. Available at: <http://www.carvaomineral.com.br/abcm/meioambiente/legislacoes/bd_carboniferas/geral/in_06-2006_mma_n.pdf>. Last visit on: 12/04/2016

	project activities, or only by Kamiranga Ceramic project, respectively.²⁰ Finally, each value was subtracted from the fraction of non-renewable biomass to achieve the $f_{NRB,y}$, in order to be ensured that the proposed project activity is not saving the non-renewable biomass accounted for by the already registered project activities. Therefore, the smaller value was selected in order to be more conservative. These sheets are available at the VCU Estimates spreadsheet.
Frequency of monitoring/recording	Annually
Value monitored:	82.84%
Monitoring equipment	No monitoring equipment was used to determine this parameter.
QA/QC procedures to be applied	The monitoring of this parameter was based in national and international articles and database every monitoring period. The sources provided information about the sustainable use of Amazonian biome. Wood saved from projects developed by Sustainable Carbon in the same biome and that have applied the same methodology was considered in this fraction²¹. CDM or VCS registered projects were also included in this fraction if placed in the same region and using the same methodology. Moreover the amount of non-renewable biomass applied in the project activity were monitored monthly and were considered in the value of $f_{NRB,y}$ parameter.
Purpose of the data	This parameter is used to calculate Baseline emissions. The $f_{NRB,y}$ determines the fraction of biomass (wood) used in the absence of the project activity that can be established as non-renewable biomass.
Calculation method	The values from wood residues should be determined <i>ex ante</i> ²² . Detailed information in Section 4.3 - Leakage.
Comments	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.

²⁰ According to data from project activities at Sustainable Carbon Company.

²¹ Document available at: < http://mer.markit.com/br-reg/public/index.jsp?entity=project&sort=project_name&dir=ASC&start=0&acronym=&limit=15&name=sustainable+carbon&standardId> Last visit on: 12/04/2016.

²² According to CDM General guidance on leakage in biomass project activities, version 3. Available at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved/history/c_leak_biomass/guid_biomass_v03.pdf>. Last visited on: 12/04/2016.

3.3 Monitoring Plan

The monitoring is done with the aim of determining the most approximate quantity of non-renewable wood that in the absence of the project would be used in the ceramics' kilns and consequently the amount of GHG that would be emitted in tonnes of CO₂e. Section 3.2 describes data and parameters monitored, as well as the procedures involved on the monitoring plan.

Ceramic personnel are responsible to monitor the operating conditions on the factory, including the amount of renewable biomass consumed and the monthly production of ceramic devices (parameters $Q_{\text{renbiomass}}$ and PR_y). Ceramic personnel are also responsible to store invoices, receipts of sales and other documents related to purchase or acquisition of biomass.

Based on this information, Sustainable Carbon is responsible to assess if the biomasses are from renewable origin, to evaluate if there is a surplus of renewable biomass and to calculate emission reductions, including an assessment of leakage emissions and the determination of parameter $f_{\text{NRB},y}$. Sustainable Carbon also assists the Ceramic personnel to double check the monitored data on biomass consumption and ceramic units production.

In the current monitoring period Sustainable Carbon performed an analysis to verify if biomass and production data are being correctly filled in the monitoring spreadsheets.

Analysis on production data is performed by a series of comparisons between different measurement points of production (molding machine, kiln loading and kiln unloading) to detect inconsistencies or suspicious data. Analysis on biomass data is performed by a series of comparisons between the amount of biomass and the cost over months to identify inconsistencies or unexpected variations in these parameters.

Sustainable Carbon is responsible for providing the required guidance to the ceramic factory, to register Biomass and Production data, in order to minimize errors, including assisting the ceramic in case the person in charge of the project monitoring is replaced.

The responsible for the monitoring plan are *Mr. Raimundo Nonato Fernandes and Mr. Sigifério Alves de Oliveira*, from *Kamiranga* ceramic. Sustainable Carbon technical team (including those members described on Section 1.3) was also involved in the project monitoring.

Sustainable Carbon personnel involved on this monitoring report (as described on Section 1.3) includes holders of undergraduate degrees on Environmental Management, Environmental Engineering and Biological Sciences. All member of Sustainable Carbon technical team have significant experience with similar projects, having developed many monitoring reports for many years.

Kamiranga ceramic personnel involved on this monitoring report have significant experience with management of the ceramic production. Mr. Raimundo Nonato Fernandes was involved with the emission reduction project on previous monitoring reports.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are estimated following procedures of the applied methodology: AMS-I.E.: Switch from Non-Renewable Biomass for Thermal Applications by the User – Version 01, valid from 01/02/2008 to 08/04/2010²³. The project activity in the current monitoring period (30 months) generated 134 TJ per year. Converting this number to MWh it was generated 37,222.19 MWh per year, which corresponds to the use of 4.25 MWthermal. This is less than the limits of 45 MWthermal for Type I Small scale project activities.

Baseline

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

Where:

ER_y : Emission reductions during the year y in tCO₂e

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

$f_{NRB,y}$: Fraction of biomass (wood) used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods

$NCV_{biomass}$: Net calorific value of non-renewable biomass that is substituted in TJ/tonne

$EF_{projected_fossil\ fuel}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO₂/TJ²⁴.

B_y is determined using option (b) of the applied methodology, as follows:

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

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

Where:

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

η_{old} : Efficiency of the system being replaced

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

Where:

SGE : Specific energy which has to be generated in the process to produce a certain amount of ceramic pieces in TJ/tonne of ceramic units.

PR_y : Amount of product produced in year y in tonne of ceramic units fired

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

²³ Available at: This version of the methodology is available at: http://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSP4VBBO5G54RXDE9KQ6FJWMGHZLHFA5. Last visited on 08/04/2016.

²⁴ The fossil fuel likely to be used by similar consumers is taken the IPCC default value of residual fossil fuel.

Where:

SFE: Specific fuel energy needed for the process to produce a certain amount of ceramic pieces in TJ/ tonne of ceramic units.

$\text{SFE} = \text{BF}_y \times \text{NCV}_{\text{biomass}}$	(Equation 05)
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Where:

BF_y: Consumption of non-renewable biomass per tonne of ceramic units fired in year y

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

$\text{B}_y = \text{PR}_y \times \text{BF}_y$	(Equation 06)
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As shown in the calculations above, the η_{old} is not required to calculate the Emission Reductions, thus it was excluded.

The value of BF_y was determined through historical consumption of non-renewable biomass by the ceramic. It was calculated by dividing the monthly consumption at the baseline from the monthly production at the baseline.

Baseline emissions during the monitored period are summarized in the following table:

Table 1. Baseline emissions for *Kamiranga Ceramic*

Period		Baseline Emission (tCO ₂ e)
2013	October	3,159
	November	2,749
	December	3,461
Total 2013		9,369
2014	January	3,467
	February	2,807
	March	2,940
	April	2,754
	May	3,335
	June	3,610
	July	3,932
	August	3,797
	September	4,006
	October	4,179
	November	3,877
	December	4,420
Total 2014		43,124
2015	January	4,097
	February	3,891
	March	3,955
	April	3,505
	May	3,288
	June	3,462
	July	4,028
	August	3,963
	September	4,065
	October	3,975
	November	3,661
	December	3,826
Total 2015		45,716
2016	January	3,845
	February	2,737
	March	3,396
Total 2016		9,978
Total in the monitored period		108,187

4.2 Project Emissions

The applied methodology does not include any source of project emissions.

4.3 Leakage

Leakage is estimated as 0 (zero) tCO₂e during the entire monitoring period.

The Category AMS-I.E predicts the following possible three sources of leakage:

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

The leakage from biomass projects, like this project activity, should also be estimated according to the “General guidance on leakage in biomass project activities²⁵” (attachment C of appendix B) of Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories, which identifies different emission sources based on the type of biomass considered (described in the table below).

Table 2. Sources of leakage according to the type of the biomass

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

Observing table 2 the possible sources of leakage of the present project activity is the competing use of biomass residues, such as sawdust, açai pits and wood residue. All of these biomasses have enough availability as showed below, demonstrating the lack of leakage for each biomass.

²⁵ Document available at:

<http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf>. Last visited on 07/4/2016.

Forest Residues (Sawdust, Wood residue)

Forest Residues are used for the ceramic devices burning. The production of wood generates a large amount of residues, which can be reused to generate thermal energy. As can be observed in the Figure 2, the potential of energy generation in the State of Pará is high, which means that there is an enormous availability of this kind of fuel to be employed in the project activity. This way, this biomass does not have potential to generate leakage emissions due to its high availability.

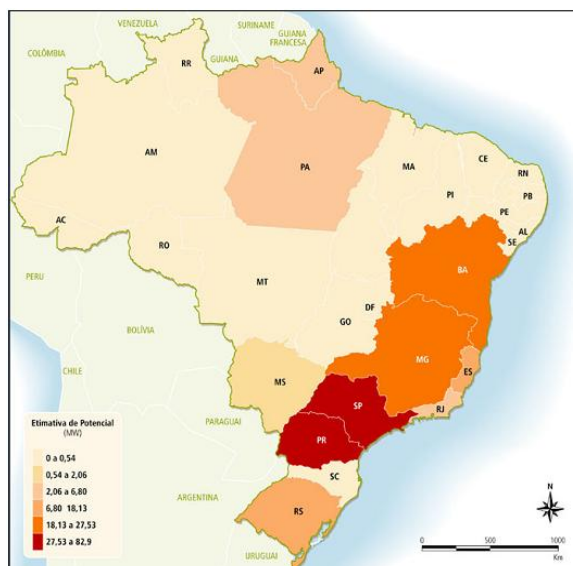


Figure 2. Forest Residues Potential for Energy Generation²⁶

Considering that around 22% of the wood produced generates forest residue²⁷. The production of wood in the State of Pará (PA) was of 9,090,150 m³²⁸ in 2007. Thus, the production of forest residue was around 1,999,833 m³ per year.

During the current monitoring period, the project activity employed around 25,003.43 m³ of residue per year representing 1.25% of the total of these residues generated in the State of Pará. This way this renewable biomass did not have potential to generate leakage emissions due to its high availability.

Açaí pits

In terms of açaí pits, the State of Pará is the largest producer of açaí (*Euterpe oleraceae*) in Brazil. The pits are easily found, especially in Belém, which is the major consumer of açaí in the State of

²⁶ CENTRO NACIONAL DE REFERÊNCIA EM BIOMASSA - CENBIO. Panorama do potencial de biomassa no Brasil. Brasília; Dupligráfica, 2003. 80 p. Available at: <[www.aneel.gov.br/aplicacoes/atlas/pdf/05-Biomassa\(2\).pdf](http://www.aneel.gov.br/aplicacoes/atlas/pdf/05-Biomassa(2).pdf)>. Last visit on 19/04/2016.

²⁷ BRITO EO. Estimativa da produção de Resíduos na Indústria Brasileira de Serraria e Laminação de Madeira. Rev. da Madeira. v.4. n.26. 1995, pp. 34-39.

²⁸ According to IBGE (Geographic and Statistic Brazilian Institute). Available at: <<http://www.sidra.ibge.gov.br/bda/extveg/default.asp?t=2&z=t&o=18&u1=1&u3=1&u2=15>>. Last visited on 19/04/2016.

Pará. The *açaí* is the basis of the daily diet of the population in this state, where is widely cultivated. Nevertheless, its residues are still without adequate economic destination²⁹.

The production of *açaí* in the State of Pará in the year of 2007 was 93,783 tonnes³⁰. The pit corresponds to 85% of the weight of *açaí*³¹; therefore the *açaí* pit production was around 79,715.5 tonnes in the year of 2007.

Kamiranga ceramic employed approximately 105.27 tonnes of *açaí* pits per year representing around 0.13% of the total of the amount produced. Therefore, the project activity did not disturb in any aspects the availability of this biomass, once there is plenty of it available.

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

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

- Use/diversion of non-renewable biomass saved under the project activity by non-project households/users who previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable biomass used by the non-project households/users attributable to the project activity then baseline is adjusted to account for the quantified leakage.
- Use of non-renewable biomass saved under the project activity to justify the baseline of other project activities can also be potential source of leakage. If this leakage assessment quantifies a portion of non-renewable biomass saved under the project activity that is used as the baseline of other project activity then baseline is adjusted to account for the quantified leakage.
- Increase in the use of non-renewable biomass outside the project boundary to create non-renewable biomass baselines can also be potential source of leakage. If this leakage assessment quantifies an increase in use of non-renewable biomass outside the project boundary then baseline is adjusted to account for the quantified leakage.

It is expected that the carbon credit revenues will stimulate the use of renewable biomass by other ceramic factories promoting sustainable development in the region. It is expected that the project activity will not displace the use of renewable biomass of a non-project user, since both renewable and non-renewable biomasses are widely available in the region. The fuel switch performed by the project is not expected to affect biomass prices, since the project consumption represents a small fraction of total biomass available in the market. Therefore, the project will have no impact on the fuel choice of non-project users.

²⁹ SILVA, I. T. et al. Uso do caroço de *açaí* como possibilidade de desenvolvimento sustentável do meio rural, da agricultura familiar e de eletrificação rural no estado do Pará. 2004. Available at: <http://www.proceedings.scielo.br/scielo.php?script=sci_arttext&pid=MSC0000000022004000200063>. Last visit on 19/04/2016.

³⁰ IBGE. *Extração vegetal e silvicultura 2007*. Available at: <<http://www.ibge.gov.br/estadosat/temas.php?sigla=pa&tema=extracaovegetal2007>>. Last visited on 19/04/2016.

³¹ Source: <<http://minhasfrutas.blogspot.com/2008/12/importancia-economica-do-aai.html>>. Last Visit on: 19/04/2016.

The non-renewable biomass which is employed in this project activity will not be saved for other project activities, since other ceramic factories were already consuming non-renewable biomass, which is a common practice in the region. Also, other projects involving the use of non-renewable biomass in the baseline scenario by users different than ceramic factories are not being developed in the project region. Hence, there is no need to use the non-renewable biomass saved by the project activity to create baselines for future projects.

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

The leakage is not applicable for this project activity in *Kamiranga Ceramic* as there is no transference of equipment.

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

Table 3. Production – $Q_{\text{renbiomass}}$ - QA/QC Procedure

	VCS PD	Monitoring Period
Production (tonnes of ceramics units)	83,400	114,471
Sawdust Consumption (tonnes)	10,020.00	21,279.01
Açaí Pits Consumption (tonnes)	0.00	263.17
Wood Residue (tonnes)	0.00	1,296.39
Thermal Energy generated (TJ)	146.80	335.00
Thermal energy per tonne of pieces produced (TJ/tonnes of pieces)	0.00176	0.00293

As can be verified on Table 3, the thermal energy generated with the use of renewable biomass per tonne of ceramic units produced during the current monitoring period was higher than estimated on the VCS PD version 2.3.

This difference probably indicates that parameters on the VCS PD do not provide accurate criteria for comparison of the current operating conditions of *Kamiranga Ceramic*. It is important to notice that the data on the VCS PD did not consider the use of *Açaí* pits and wood residues. The different calorific properties of biomass considered in this assessment are likely one of the causes of the difference observed on energy levels.

In addition during the third monitoring period *Kamiranga Ceramic* built a shed to store sawdust, as evidenced in the Appendix II, which interfere on energy levels calculations since it allows the Ceramic to increase the amount of biomass stocked. As energy levels are calculated based on the amount of biomass purchased (and not directly based on the amount of biomass fed to the kilns), the increase of stock also affects the analysis causing an increase of energy generation as can be seen at the table 4.

Table 4. Energy generated per tonne of ceramic units fired – MR to MR analysis.

MR	TJ/Tonne of ceramic units fired	% relative to baseline	% relative to last MR
Baseline	0.00176	100%	-
1	0.00198	113%	113%
2	0.00275	157%	139%
3	0.00322	183%	117%
4	0.00343	195%	106%
5	0.00315	179%	92%
6	0.00293	166%	93%

The table 4 shows the variation of the relations between energy generated per tonne of ceramic units fired. As described before, the construction of the shed during the third monitoring period caused an increase of this value. Since third monitoring period the quantity of energy generated has been over estimated once the value considers the total quantity of biomass purchased. Even so, historical data demonstrates this variation is decreasing since the 5th monitoring period .

Therefore, based on Category AMS-I.E: Switch from Non – Renewable Biomass for Thermal Application by the User (Version 01. valid from February 01st. 2008 to April 08th. 2010) this project activity contributes to sustainable development once the ceramic company is using renewable biomass and applying the SOCIALCARBON methodology.

4.4 Net GHG Emission Reductions and Removals

Table below summarizes the emission reductions for this monitoring period³².

³² Emission reductions are equal to the baseline emissions, since there are no project emissions according to the applied methodology and since leakage emissions are estimated at zero tCO₂e.

Table 5. Emission reductions for the monitoring period.

Period		PR _y (tonnes of ceramic units)	B _y (tonne)	ER _y (tCO ₂ e)
2013	October	3,343	2,708	3,159
	November	2,908	2,356	2,749
	December	3,662	2,966	3,461
Total 2013		9,913	8,029	9,369
2014	January	3,668	2,971	3,467
	February	2,970	2,406	2,807
	March	3,111	2,520	2,940
	April	2,915	2,361	2,754
	May	3,529	2,858	3,335
	June	3,819	3,094	3,610
	July	4,160	3,370	3,932
	August	4,018	3,254	3,797
	September	4,239	3,433	4,006
	October	4,421	3,581	4,179
	November	4,103	3,323	3,877
	December	4,677	3,788	4,420
Total 2014		45,629	36,959	43,124
2015	January	4,335	3,511	4,097
	February	4,117	3,334	3,891
	March	4,185	3,390	3,955
	April	3,708	3,004	3,505
	May	3,479	2,818	3,288
	June	3,663	2,967	3,462
	July	4,262	3,452	4,028
	August	4,193	3,396	3,963
	September	4,301	3,484	4,065
	October	4,206	3,407	3,975
	November	3,874	3,138	3,661
	December	4,049	3,279	3,826
Total 2015		48,372	39,181	45,716
2016	January	4,069	3,296	3,845
	February	2,896	2,346	2,737
	March	3,594	2,911	3,396
Total 2016		10,558	8,552	9,978
Total in the monitored period		114,471	92,721	108,187

Table 6. Emission reductions for the monitoring period.

Year Month	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2013 (October to December)	9,369	0	0	9,369
2014	43,124	0	0	43,124
2015	45,716	0	0	45,716
2016 (January to March)	9,978	0	0	9,978
Total	108,187	0	0	108,187

The annual average emission reductions observed on the years of the current monitoring report (43,274.80 tCO₂e), is higher than the annual average estimated in VCS PD v.2.5, (35,125 tCO₂e). This situation can be explained if considered that during the elaboration of VCS PD v.2.3 it was not taken in consideration the increase on local market demand for ceramic pieces, which directly interferes in the ERY calculation. Moreover, as observed in the table below, if considered the relation from quantity of ceramic pieces produced by emission reduction achieved, there is a consistency during the monitored period.

Table 7. Emission reductions for the project activity.

MR	Month	Year	PRy	ERY (tCO ₂ e)	ERY per tonnes
1	Jan/2008 - Dec/2008	2008	29,603.98	31,156.00	1.05
	Jan/2009 - Jun/2009	2009	33,218.00	34,966.00	1.05
2	Jul/2009 - Dec/2009				
	Jan/10	2010	31,313.00	31,974.00	1.02
3	Feb/2010 - Dec/2010	2011	24,376.00	24,813.00	1.02
	Jan/2011 - Feb/2011				
4	Mar/2011 - Dec/2011	2012	42,178.00	42,940.00	1.02
	Jan/2012 - Apr/2012				
5	May/2012 - Dec/2012	2013	38,238.00	38,209.00	1.00
	Jan/2013 - Sep/2013				
6	Oct/2013 - Dec/2013	2014	45,629.00	43,124.00	0.95
	Jan/2014 - Dec/2014				
	Jan/2015 - Dec/2015				
	Jan/2016 - Mar/2016				

APPENDIX I: AMOUNT OF RENEWABLE BIOMASS CONSUMED PER MONTH ON KAMIRANGA CERAMIC

Table 8. Amount of renewable biomass used by Kamiranga Ceramic.

Calculations of Kamiranga Ceramic - Renewable Biomass Monitored Data					
Period/ Biomass		Açaí Pits	Sawdust	Wood Residue	Total
2013	October	-	488.75	-	488.75
	November	-	536.43	-	536.43
	December	-	444.97	35.31	480.28
Total Oct - Dec 2013		-	1,470.15	35.31	1,505.46
2014	January	-	801.62	25.86	827.48
	February	-	612.76	17.26	630.02
	March	-	929.82	-	929.82
	April	-	668.55	-	668.55
	May	-	780.62	-	780.62
	June	-	616.07	-	616.07
	July	-	730.52	-	730.52
	August	-	617.82	-	617.82
	September	-	707.00	-	707.00
	October	-	703.73	18.73	722.46
	November	-	626.73	-	626.73
	December	-	756.12	-	756.12
Total 2014		-	8,551.37	61.86	8,613.22
2015	January	86.76	807.04	8.57	902.37
	February	50.61	268.97	-	319.58
	March	-	457.56	-	457.56
	April	-	428.54	-	428.54
	May	-	409.52	197.01	606.54
	June	-	827.58	177.26	1,004.83
	July	-	787.33	106.35	893.68
	August	-	799.40	-	799.40
	September	-	840.70	170.44	1,011.14
	October	-	1,012.20	17.04	1,029.24
	November	-	831.60	53.40	885.00
	December	-	1,043.70	82.19	1,125.89
Total 2015		137.37	8,514.13	812.27	9,463.77
2016	January	50.61	1,104.60	106.81	1,262.02
	February	28.92	827.19	84.99	941.10
	March	46.27	811.58	195.16	1,053.01
Total Jan - Mar 2016		125.80	2,743.37	386.96	3,256.13
Total in the monitoring period		263.17	21,279.01	1,296.39	22,838.57

APPENDIX II: PHOTOS OF THE CONSTRUCTION OF THE SHED TO SAWDUST STORAGE



Figure 3: Photo of the construction of the shed.



Figure 4: Photo of the shed built. (2011)