MILENIUM CERAMIC SWITCHING NON-RENEWABLE BIOMASS PROJECT

Document Prepared by Sustainable Carbon – Projetos Ambientais Ltda

Project Title	Milenium Ceramic Switching Non-Renewable Biomass Project
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Monitoring Period	01-August-2013 to 31-August-2017
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity was developed by CantorCO2e Brasil Consultoria Comercialização de Commodities Ambientais Ltda. The project is currently being developed by Sustainable Carbon - Projetos Ambientais LTDA. CantorCO2e Brasil and Sustainable Carbon belong to the same corporate group, which has decided that Sustainable Carbon shall manage this project until the end of its crediting period.

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 is the project of Milenium Ceramic, which is a red ceramic factory located in the municipality of Paraíso do Tocantins in the state of Tocantins, north region of Brazil. The ceramic factory produces bricks, roof tiles and flagstones, destined mainly for the regional market.

The main objective of the implementation of this project activity in the ceramic factory is to stop using non-renewable native wood and completely substitute it with renewable biomass to feed the kilns and fire ceramic units, so environmental impacts related to the native wood deforestation and consumption could be minimized.

Therefore, GHG emissions from non-renewable wood burning in the baseline scenario were not compensated by vegetation growth. On the other hand, the renewable biomass employed in this project activity presents a carbon neutral lifecycle. Therefore, the project activity generates thermal energy without stimulating deforestation and uses abundant renewable biomass in the region.

Nevertheless, during the 3rd monitoring period (last monitoring period), Milenium Ceramic Industry constructed two new Round kilns, which started operating in the end of 2010. In addition, the ceramic industry acquired new automation machines, increased the drying area and the storage sheds. An additionality assessment was performed in the 3rd monitoring report in order to include the new “Round” kilns, which were not previously mentioned in the VCS PD.

During the current monitoring period, emission reductions due to the switching of non-renewable wood to renewable biomass in Milenium Ceramic Industry resulted in 69,892tCO2e from 01-August-2013 to 31-August-2017. The contribution to sustainability is being monitored through the SOCIALCARBON® Standard, which is based in 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

Organization name	Cerâmica Milenium LTDA
Contact person	Mr. Esequiel de Souza Milhomem Ms. Greice Emilia Silvestre
Title	Mr. Esequiel de Souza Milhomem: Director and owner. Ms. Greice Emilia Silvestre: owner and responsible for data monitoring.
Address	Rodovia BR 153, Km 487, Saída Sul Paraíso do Tocantins - TO, Brazil Zip Code: 77.600-000
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Organization name	Sustainable Carbon - Projetos Ambientais Ltda
Contact person	Marcelo Hector Sabbagh Haddad Guilherme Lucas Medeiros Prado
Title	Marcelo Hector Sabbagh Haddad: Technical coordinator Guilherme Lucas Medeiros Prado: Technical analyst
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 is involved in this project activity.

1.5 Project Start Date

According to version 04 of the VCS PD[1], the project start date was defined on 01/04/2006. On this date, the project began reducing or removing GHG emissions, i.e. the ceramic factory started using renewable biomass as fuel.

1.6 Project Crediting Period

The first crediting period for this project activity started on 01-September-2007 and ended on 31-August-2017.

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

1.7 Project Location

According to the applied methodology, the project boundaries are the physical geographical areas of the renewable energy generation, thus the ceramic industry limits. Milenium Ceramic Industry is located in Brazil, in the State of Tocantins, as shown in Figure 1 below.

Milenium Ceramic Industry

Rodovia BR 153, Km 487, Saída Sul

Paraíso do Tocantins - TO, Brazil

Postal Code: 77.600-000

[1] Document available at: <http://mer.markit.com/br-reg/public/project.jsp?project_id=100000000000008>. Last visit on: 10/06//2019.

Figure 1. Geographical location of the project activity that has the following coordinates: 10° 9'33"S and 48°52'29"W.

1.8 Title and Reference of Methodology

The project activity 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-February-2008 to 08-April-2010[2]. This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies.

1.9 Participation under other GHG 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] This version of the methodology is available at: <http://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSP4VBBO5G54RXDE9KQ6FJWMGHZLHFA5>. Last visit on: 10/06/2019.

1.10 Other Forms of Credit

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

1.11 Sustainable Development

The project activity contributes to the reduction of greenhouse gas (GHG) emissions by avoiding the use of non-renewable fuels. In addition, the project activity will contribute to sustainable development of the host country, such as:

- The use of clean and efficient technologies through the use of renewable biomass as fuel. By these means, the project is in accordance to Agenda 21 and with Brazilian Sustainable Development Criteria;
- A pioneer initiative that encourages the development of new technologies throughout the country, which replaces the use of non-renewable fuels with renewable biomass which presents an efficient thermal energy generation potential as shown in the project demonstration.
- The use of renewable biomass results in GHG emission reductions. This way the project does not cause any relevant negative impacts as all generated energy is a result of the best exploitation of the natural resources available. In addition, the project improves the local environmental conditions by establishing proper treatment for the renewable.

Furthermore, the project contributes to the following UN Sustainable Development Goals (SDG), which are better described in the SOCIALCARBON Report:

- SDG 3: Good health and well-being
- SDG 7: Affordable and Clean Energy
- SDG 8: Decent Work and Economic Growth
- SDG 13: Climate Action

2 SAFEGUARDS

2.1 No Net Harm

A negative impact identified is that the project activity generates ashes due to the burning of biomass, but this impact will be mitigated by using the ashes as thermal insulator and fertilizer, due to its sources of silica (SiO2) and potassium (K). The burning of the new biomass also emits particulate material and CO2, as well as when using non-renewable native wood. However, the

project generates GHG emission reductions because the fuel utilized is renewable biomass, which has carbon neutral lifecycle.

In this way, the project does not cause any relevant negative impacts as all energy generated is a result of the best and unique exploitation of the natural resources available. Moreover, the project improves the local environmental conditions by contributing to avoid the deforestation of Cerrado biome.

2.2 Local Stakeholder Consultation

The formal stakeholder consultation was carried out during the validation of the project. Currently, the company's administrative area is available to receive any kind of suggestions and comments from the community through the telephone, e-mail or even personally. During the present monitoring period no comments were registered.

2.3 AFOLU-Specific Safeguards

Not applicable. This is not an AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

This Monitoring Report refers to the fourth monitoring period of this project activity and includes data from 01-August-2013 to 31-August-2017. The VCS PD was validated by the Designated Operational Entity TÜV Nord Cert GmbH and this present monitoring report will be verified by Earthood Services Private Limited.

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 reducing its baseline emissions.

As described in the VCS PD version 04, during the validation process the production at Milenium Ceramic factory encompassed six "Round"[3] kilns. According to the VCS PD, during the baseline scenario, Milenium Ceramic factory consumed about 2,500 m^3 of non-renewable native wood from Cerrado biome per month for producing around 1,000,000 ceramic devices per month.

Nevertheless, Milenium Ceramic Industry carried out some alterations in the productive process after the project validation, which were described in the last monitoring report (3rd monitoring period). These include a construction of two new Round kilns, which started operating in the end of 2010, producing structural bricks, roof tiles and flagstones. In addition, the ceramic industry acquired new automation machines, besides increasing the drying area and the storage sheds.

[3] *The "Round Kiln" is a kind of intermittent kiln with round shape and lateral furnaces. Its internal diameter is about 9.5 meters. It is usually employed to burn roof tiles and bricks.*

Considering that the new kilns have similar efficiencies and the ceramic company has used exclusively renewable biomass in the eight kilns, an additionality assessment was conducted during the 3º monitoring period based on the cost of renewable biomass used in the ceramic kilns, in order to include the new two "Round" kilns.

During the current monitored period, Milenium Ceramic utilized the Rice husk as renewable biomass instead of native wood. In addition, the burning process is constituted by eight "Round" kilns.

None of the changes described above have significant effects on the project monitoring or on its capacity to mitigate baseline emissions. The construction of these new kilns doubled the ceramic's production capacity, but the project monitoring was not affected, since monitoring procedures were also implemented in the new kilns. Furthermore, the new kilns used exclusively renewable biomass, thus mitigating their baseline emissions that would be expected in the absence of the project. The monitoring data was kept according to the monitoring plan described in the project description document.

3.2 Deviations

2.3.1 Methodology Deviations

There were no methodology deviations during this monitoring period.

2.3.2 Project Description Deviations

The registered VCS PD version 04 establishes that the project proponent (meaning the ceramic owner) would measure the amount of renewable biomass used (parameter $Q_{renbiomass}$). However, during the entire monitored period this parameter was monitored through receipts and invoices from biomass providers, which were received by the ceramic factory. Therefore, the amount of renewable biomass is measured by each provider and controlled by the ceramic owner by storing receipts and invoices.

This approach was chosen considering that it is the responsibility of the provider to measure the amount of biomass since this information needs to be available in the sale invoice or receipt. As this information is used for commercial purposes (due financial compensations), it is considered that data from the suppliers are a reliable source for this parameter.

Project Proponents consider this deviation is a minor change to the project, as it has no impact on the applicability of the methodology, additionality or the appropriateness of the baseline scenario. The outcome of such deviation is solely that parameter $Q_{renbiomass}$ is being monitored with the use of reliable third-party information instead of being measured by the ceramic industry personnel.

In addition, Milenium Ceramic Industry carried out some alterations in the productive process after the project validation, which were described in the last monitoring report (3rd monitoring

period). These include a construction of two new Round kilns, which started operating in the end of 2010, producing structural bricks, roof tiles and flagstones. Considering that the new kilns have similar efficiencies and the ceramic company has used exclusively renewable biomass in the eight kilns, an additionality assessment was conducted during the 3º monitoring period based on the cost of renewable biomass used in the ceramic kilns, in order to include the new two "Round" kilns.

3.3 Grouped Projects

Not applicable. This is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{projected\ fossil\ fuel}$
Data unit	tCO2/TJ
Description	CO2 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 22/05/2019.
Value applied	77.4 tCO2/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 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	$NCV_{non\text{-}renewable\ biomass}$
Data unit	TJ/Tonne of wood
Description	Net Calorific Value
Source of data	Brazilian study carried out with Cerrado wood: Vale, A.T; Brasil, M.A.M; Leão, A.L. Quantificação e caracterização energética da madeira e casca de espécies de Cerrado. Ciência Florestal, Santa Maria; v.12, n.1, p. 71-80; 2002. Available at: http://coral.ufsm.br/cienciaflorestal/artigos/v12n1/A8V12N1.pdf. Last visit on: 22/05/2019.
Value applied	0.018
Justification of choice of data or description of measurement methods and procedures applied	This value provides the energy generated by the amount of wood that would be used in the absence of the project. It differs from the IPCC value because represents the net calorific value of the local biome.
Purpose of 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 activity.
Comments	The species used to calculate the average value are typical trees of Cerrado Biome that are usually employed as fuel in the ceramic industries of the region.

Data / Parameter	$\rho_{non\text{-}renewable\ biomass}$
Data unit	$tonne/m^3$
Description	Specific gravity of non-renewable biomass
Source of data	Brazilian study carried out with Cerrado wood: Vale, A.T; Brasil, M.A.M; Leão, A.L. Quantificação e caracterização energética da madeira e casca de espécies de Cerrado. Ciência Florestal, Santa Maria; v.12, n.1, p. 71-80; 2002. Available at: https://periodicos.ufsm.br/cienciaflorestal/article/view/1702/0. Last visit on: 22/05/2019.
Value applied	0.5702
Justification of choice of data or description of measurement methods and procedures applied	The amount of non-renewable wood used in the baseline was measured in volume unit.
Purpose of 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 Cerrado Biome that are usually utilized as fuel in the ceramic factories of the region.

Data / Parameter	BF_y
Data unit	Tonnes of non-renewable biomass/thousands of ceramic devices
Description	Consumption of non-renewable biomass per thousand of ceramic units produced per year y
Source of data	Historical data from project proponent (ceramic owner)
Value applied	1.4255
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 devices during the years when the ceramic industry consumed non-sustainable wood. This value is in accordance with the data acquired in other ceramic industries that employ the same type of kilns. The value is employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
Purpose of 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	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.

4.2 Data and Parameters Monitored

Data / Parameter	$Q_{renbiomass}$
Data unit	Tonnes
Description	Amount of renewable biomass
Source of data	Measured by biomass providers and controlled by the ceramic owner. The registered VCS PD version 04 establishes that the project proponent (meaning the ceramic owner) would measure this parameter; however, during the entire monitored period, this parameter was monitored through all receipts and invoices of biomass received by the ceramic factory.

Description of measurement methods and procedures to be applied

The amount of renewable biomass was monitored in accordance to the weight described in the receipts or invoices from the providers.

The VCS PD establishes that values in the receipts described in m^3 (when applicable), shall be converted into tonnes through the specific gravity of each biomass. The specific gravity values of the renewable biomass utilized in this project are:

Biomass	Specific Gravity (tonne/m^3)
Rice Husk	0.1458

Source: AMATO, G.W. Casca: agregando valor ao arroz. WAITRO - World Association and Tecnological Research Organizatrions. p.5, 2002.

Frequency of monitoring/recording

Monthly

Value monitored

Total amount during this monitoring period (tonnes):

Period/ Biomass		Rice husk
		Tonnes
2013	August	454.74
	September	908.34
	October	554.34
	November	303.29
	December	243.80
Total 2013		2,464.51
2014	January	501.83
	February	600.02
	March	96.34
	April	504.40
	May	0.00
	June	663.01
	July	551.23
	August	556.21
	September	546.43
	October	582.14
	November	700.03
	December	216.65

Total 2014		5,518.29
2015	January	800.31
	February	391.58
	March	373.86
	April	261.88
	May	632.21
	June	515.93
	July	398.85
	August	414.37
	September	567.79
	October	575.83
	November	727.70
	December	48.92
Total 2015		5,709.23
2016	January	1,319.68
	February	651.49
	March	576.44
	April	283.05
	May	0.00
	June	486.95
	July	808.22
	August	556.20
	September	394.64
	October	502.07
	November	446.51
	December	0.00
Total 2016		6,025.25
2017	January	600.00
	February	600.00
	March	600.00
	April	600.00

			May	600.00	
			June	600.00	
			July	600.00	
			August	600.00	
		Total 2017		4,800.00	
		Total period		24,517.28	
Monitoring equipment	No monitoring equipment was used to determine this parameter				
QA/QC procedures to be applied	The ceramic has spreadsheets of the quantity of biomass acquired. It was be rechecked according to the receipts of purchase. The amount of biomass was checked according to receipts of purchase. The energy balance was verified according to the amount of biomass applied. The thermal energy generated through the use of rice husks per thousands of ceramic devices produced during the current monitoring period was compared to the VCS PD version 04. The thermal energy generated per thousand of ceramic units produced at Milenium Ceramic factory on the monitored period was higher than the VCS PD.				
Purpose of the data	This parameter was used to : 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); Demonstrate that the Project fits in small scale category (<45MWth/year); To determine the occurrence of leakage emissions due to competing use of biomass.				
Calculation method	Not applicable.				
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	Unity of ceramic pieces
Description	Average of ceramic devices produced per month

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, which details the quantity of ceramic units burned in the kilns and monitored by the project proponent, which is filled daily. The amount was acquired by counting the total production of the considered period. Data was aggregated on a monthly and yearly basis. Data from the kiln loading was used. This is considered the best source of information, once the amount of ceramic units fired have a direct 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	See table below

Production of ceramic pieces		
Period		Milenium Ceramic Industry (thousands of ceramic units)
2013	August	1,114
	September	1,010
	October	1,092
	November	869
	December	815
Total 2013		4,900
2014	January	936
	February	898
	March	934
	April	857
	May	977
	June	912
	July	1,044
	August	953
	September	1,128
	October	1,017
	November	918
	December	729
Total 2014		11,303

	2015	January	860
		February	402
		March	834
		April	642
		May	706
		June	788
		July	869
		August	882
		September	836
		October	798
		November	770
		December	628
	Total 2015		9,016
	2016	January	781
		February	514
		March	841
		April	761
		May	802
		June	902
		July	824
		August	830
		September	638
		October	587
		November	366
		December	271
	Total 2016		8,115
	2017	January	744
		February	452
		March	0
		April	0
		May	446

	<table><tr><td></td><td>June</td><td>811</td></tr><tr><td></td><td>July</td><td>766</td></tr><tr><td></td><td>August</td><td>754</td></tr><tr><td colspan="2">Total 2017</td><td>3,973</td></tr><tr><td colspan="2">Total in the monitoring period</td><td>37,307</td></tr></table> More detailed information, please see VCS MR Calculation spreadsheet.
Monitoring equipment	No monitoring equipment was used to determine this parameter. Production is counted by trained personnel from Milenium ceramic industry.
QA/QC procedures to be applied	PRy measurement data were obtained from internal control documents used by Milenium Ceramic factory. These documents are organized per month and daily filled according to data based on ceramic devices that are loaded in the kilns.
Purpose of the data	This parameter was 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 industry has an internal control of the quantity of ceramic units produced. It was rechecked according to the biomass utilized in the ceramic industry kilns.
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 biomass providers. The biomass (rice husk) is considered renewable as fulfilling the options described in the methodology applied.
Frequency of monitoring/recording	Each monitoring period
Value monitored	Not applicable.
Monitoring equipment	No monitoring equipment was used to determine this parameter

QA/QC procedures to be applied	The biomass was considered renewable because it is in accordance with the definition given by the Annex 18, EB 23 of UNFCCC definition[4].
Purpose of the data	This parameter is used to guarantee that the 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	All the renewable biomass utilized in the monitoring period have already been described in the VCS PD and are in accordance with definitions of renewable biomass set in the applied methodology. 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	**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	Data from The Brazilian Institute of Geography and Statistics (IBGE)[5] and from Brazilian Agricultural Research Corporation (EMBRAPA)[6] were used to calculate leakage emissions from the utilization of renewable biomass. The sources of leakages predicted in the applied methodology were monitored. The measurement of leakage was based in national and international articles and database. The sources provide information about the biomass availability in the project activity's region.
Frequency of monitoring/recording	Annually
Value monitored	

[4] CDM – Executive Board. Annex 18 definition of renewable biomass. EB 23. Available at: <http://cdm.unfccc.int/EB/023/eb23_repan18.pdf>. Last visit on: 10/06/2019.

[5] The Brazilian Institute of Geography and Statistics (IBGE). Produção agrícola - Cereais, Leguminosas e Oleaginosas. Available at: <https://cidades.ibge.gov.br/>. Last visit on 22/05/2019.

[6] EMBRAPA. Available at: <https://ainfo.cnptia.embrapa.br/digital/bitstream/CNPAF-2009-09/27693/1/doc_227.pdf>. Visited in: 10/06/2019.

	<table><tr><th>Biomass surplus</th><th>Surplus</th></tr><tr><td>Rice Husk (tonnes)</td><td>74,470</td></tr></table> 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 industry fuel consumption was utilized 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. Thus, the value described above 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	tCO2e
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 be applied	Data available regarding the ceramic industries fuel consumption 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 sustainable forest management was offered with low prices to the ceramic owner. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. However, according to MMA[7], Cerrado Biome has only 5.56% of its total area with sustainable use, thus, 94.44% of its forest resources can be considered non-renewable. Also, the amount of wood saved by similar projects that have been developed by Sustainable Carbon – Projetos Ambientais Ltda within the Cerrado biome using the same methodology was also included in the calculation of this parameter[8], which corresponds to an additional of 0.07%.
Frequency of monitoring/recording	Annually
Value monitored	94.36%
Monitoring equipment	No monitoring equipment was used to determine this parameter.

[7] Biome conservation units. http://www.mma.gov.br/areas-protegidas/cadastro-nacional-de-ucs Last visit on 22/05/2019.

[8] Considering projects that were validated or are under validation process by an accredited DOE in UNFCCC. Values of non-renewable biomass consumption were obtained from VCS PDs or equivalent documents of these projects. Available at: <https://mer.markit.com/br-reg/public/index.jsp?name=sustainable&entity=project&entity_domain=Markit,GoldStandard>. Last visit on 10/06/2019.

QA/QC procedures to be applied	The monitoring of this parameter was based in national and international articles and database at each monitoring period. The sources will provide information about the sustainable use of Cerrado biome. Wood saved from projects developed by Sustainable Carbon - Projetos Ambientais LTDA. within the same biome and that applied the same methodology was considered in this calculation. CDM or VCS registered projects were also be included in this fraction if placed in the same region and used the same methodology.
Purpose of the data	This parameter is used to calculate baseline emissions. The $f_{NRB,y}$ parameter determines the fraction of biomass (wood) used in the absence of the project activity that can be established as non-renewable biomass.
Calculation method	Calculation methods are described under the description of the measurement methods and procedures to be applied.
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.

4.3 Monitoring Plan

The monitoring report was done with the aim of determining the most approximate quantity of non-renewable wood that, in the absence of the project, would be used in the ceramic industry's 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 industry employees are responsible to monitor the operating conditions in the factory, including the amount of renewable biomass consumed and the monthly production of ceramic devices (parameters $Q_{renbiomass}$ and PR_y). Furthermore, they are also responsible to store invoices, receipts of sales and other documents related to purchase or acquisition of biomass.

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 $f_{NRB,y}$. During the current monitoring period, Sustainable Carbon performed an analysis to verify if biomass and production data were 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 through 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 for registering Biomass and Production data, in order to minimize errors, including assisting the ceramic industry in case the person in charge of the project monitoring is replaced.

The responsible for the monitoring plan are Mr. Esequiel de Souza Milhomem and Ms. Greice Emilia Silvestre from Milenium ceramic industry. Sustainable Carbon technical team (including those members described on Section 1.3) was also involved in the project monitoring.

Sustainable Carbon personnel involved in this monitoring report (as described on Section 1.3) includes Environmental Managers and Environmental Engineers. All members of Sustainable Carbon technical team have significant experience with similar projects and have developed many monitoring reports in the past years.

Milenium ceramic personnel involved on this monitoring report have significant experience with management of the ceramic production. Ms. Greice Emilia Silvestre is involved with the emission reduction project for the past ten years and was involved on all previous monitoring reports.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 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 08/04/2010[9]. During the current monitoring period (49 months), this project activity generated 87.34 TJ per year. Converting this number to MWh, a total of 24,259.86 MWh per year were generated, which corresponds to the use of 2.77 MWthermal during the monitored period. This is less than the limits of 45 MWthermal for Type I Small scale project activities.

Baseline emissions were calculated according to equations below.

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

Where:

ER_y: Emission reductions during the year y in tCO2e

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

[9] Available at: < https://cdm.unfccc.int/methodologies/DB/IO5FJLJFWT91R6B8SO5BC7TXSK27I2>. Last visit on: 10/06/2019.

$fNRB_{,y}$: 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/TJ[10].

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

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

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

Where:

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

η_{old}: Efficiency of the system being replaced

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

Where:

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

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

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

Where:

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

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

Where:

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

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

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

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

The exact production (PR_y) was monitored by the project proponent based on data of ceramic units that are loaded in the kilns. Data is aggregated on a monthly and yearly basis. Measurements are done by an internal control sheet monitored by the ceramic owner.

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 of non-renewable wood at the baseline from the monthly production of ceramic devices at the baseline, in tonnes of ceramic devices.

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

Table 1. Baseline emissions for Milenium Ceramic Industry.

Period		Baseline Emissions (tCO2e)
2013	August	2,088
	September	1,892
	October	2,046
	November	1,627
	December	1,527
Total 2013		9,180
2014	January	1,754
	February	1,682
	March	1,750
	April	1,606
	May	1,830
	June	1,709
	July	1,956
	August	1,786

	September	2,112
	October	1,905
	November	1,719
	December	1,366
Total 2014		**21,175**
2015	January	1,612
	February	752
	March	1,563
	April	1,203
	May	1,323
	June	1,477
	July	1,628
	August	1,652
	September	1,566
	October	1,496
	November	1,442
	December	1,177
Total 2015		**16,891**
2016	January	1,463
	February	963
	March	1,575
	April	1,425
	May	1,503
	June	1,689
	July	1,544
	August	1,555
	September	1,194

	October	1,099
	November	685
	December	508
Total 2016		**15,203**
2017	January	1,395
	February	846
	March	0
	April	0
	May	835
	June	1,519
	July	1,435
	August	1,413
Total 2017		**7,443**
Total in the monitored period		**69,892**

5.2 Project Emissions

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

5.3 Leakage

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

The Category AMS-I.E v.1 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.

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

Table 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

According to table above, the possible sources of leakage of the present project activity is the competing use of rice husk. There is enough availability of such biomass in the project region, as showed below, thus demonstrating the non-occurrence of leakage for this biomass.

Rice Husk

The project activity utilizes rice husk, which is an abundant biomass in the region. The state of Tocantins is a large producer of rice in Brazil, with 338.5 thousand tonnes registered in 2006[11], and consequently a great supplier of rice husk.

Considering that each tonne of rice generates 0.22 tonne of rice husk[12], table below shows the amount of rice husk generated.

Table 3. Rice and rice husk production in 2007.

Harvest	Rice produced (tonnes)	Rice husk availability (t)
2005/2006	338,500	74,470

[11] The Brazilian Institute of Geography and Statistics (IBGE). Produção agrícola - Cereais, Leguminosas e Oleaginosas. Available at: <https://cidades.ibge.gov.br/>. Last visit on 22/05/2019.

[12] Source: EMBRAPA. Available in: <https://ainfo.cnptia.embrapa.br/digital/bitstream/CNPAF-2009-09/27693/1/doc_227.pdf>. Visited in: 22/05/2019.

The project activity utilized approximately 24,517.28 tonnes of biomass during the monitoring period (49 months), which corresponds to 6,004 tonnes of rice husk per year. Therefore, Milenium Ceramic Industry utilized around 8% of the total availability of this kind of biomass in the region. Thus, it can be concluded that the biomass availability is largely superior than the amount required by this project activity, i.e. leakage emissions from the competing use of rice husk can be neglected.

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

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

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

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

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

It is expected that carbon credit revenues will stimulate the use of renewable biomass by other ceramic facilities promoting sustainable development in the region. The project activity did 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 carried out by the project activity is not expected to affect biomass prices, since the project consumption represents a small fraction of total biomass available in the market. Therefore, the present project activity does not have any impact on the fuel choice of non-project users.

The non-renewable biomass previously used by Milenium Ceramic Industry, which is the baseline for this project activity, was not saved by other project activities, since other ceramic facilities have already been consuming non-renewable biomass, which is a common practice in the region. In addition, other projects involving the use of non-renewable biomass in the baseline scenario by industries 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 baseline scenarios 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 as there was no transference of equipment, despite new equipment had to be acquired.

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

5.4 Net GHG Emission Reductions and Removals

Table below summarizes the emission reductions for this monitoring period:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2013*	9,180	0	0	9,180
2014	21,175	0	0	21,175
2015	16,891	0	0	16,891
2016	15,203	0	0	15,203
2017**	7,443	0	0	7,443
Total	**69,892**	**0**	**0**	**69,892**

* From August to December

** From January to August