

GOMES DE MATTOS CERAMIC FUEL SWITCHING PROJECT



Document Prepared Sustainable Carbon – Projetos Ambientais Ltda

Project Title	Gomes de Mattos Ceramic Fuel Switching Project
Version	03
Report ID	VCS Monitoring Period 07
Date of Issue	15 - August -2018
Project ID	64
Monitoring Period	01-May-2016 to 31-October-2017
Prepared By	Sustainable Carbon – Projetos Ambientais Ltda
Contact	Rua Doutor Bacelar, 368 Conjunto 54 Vila Clementino - São Paulo, SP CEP: 04026-001 Brazil T: +55 (11) 2649-0036 F: +55 (11) 2649-0042 tecnica@sustainablecarbon.com

Table of Contents

1	Project Details	3
1.1	Summary Description of the Implementation Status of the Project	3
1.2	Sectoral Scope and Project Type.....	3
1.3	Project Proponent	3
1.4	Other Entities Involved in the Project.....	4
1.5	Project Start Date	5
1.6	Project Crediting Period	5
1.7	Project Location	5
1.8	Title and Reference of Methodology	5
1.9	Other Programs.....	6
1.10	Sustainable Development	6
2	Implementation Status.....	6
2.1	Implementation Status of the Project Activity.....	6
2.2	Deviations.....	8
2.2.1	Methodology Deviations	8
2.2.2	Project Description Deviations	8
2.3	Grouped Project	8
2.4	Safeguards	8
2.4.1	No Net Harm	8
2.4.2	Local Stakeholder Consultation	8
3	Data and Parameters	8
3.1	Data and Parameters Available at Validation	8
3.2	Data and Parameters Monitored	12
3.3	Monitoring Plan	22
4	Quantification of GHG Emission Reductions and Removals	22
4.1	Baseline Emissions	23
4.2	Project Emissions.....	23
4.3	Leakage.....	26
4.4	Net GHG Emission Reductions and Removals.....	27
APPENDIX X: <title of appendix>		Erro! Indicador não definido.

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity is *Gomes de Mattos* ceramic, which is a red ceramic factory located in *Crato* municipality, in the State of *Ceará*, northeast region of Brazil. The ceramic factory produces ceramic flagstone, tiles and bricks, destined mainly for the regional market in *Ceará*.

The objective of the implementation of this project activity in the *Gomes de Mattos* ceramic is to stop using the native firewood (without sustainable management plan), which is a non-renewable fuel, and completely substitute it with renewable biomasses to feed the ceramic kilns and fire their ceramic units, so that they can minimize environmental impacts related to the native wood deforestation and consumption.

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

Therefore, the emissions launched during the combustion of wood were not compensated by the replanting. An opposite scenario occurs with the renewable biomasses employed in this project activity, which have carbon neutral lifecycle.

In opposition to the identified baseline, the project activity generates thermal energy without stimulating deforestation and uses abundant renewable biomass.

The production process at *Gomes de Mattos* ceramic encompasses two Hoffman kilns and one Câmara kiln in order to burn the fuel and fire the ceramic units, which are mainly used in the construction sector.

The proposed project started the fuel switch in April of 2003 (which was defined as the project start date), and this was completely achieved by the end of April 2006. The project crediting period is 10 years, i.e., from 01-May-2016 to 30-April-2026.

The emission reductions due to the switching of non-renewable fuel (native wood) to renewable biomasses resulted in **60,649 tCO₂e** during the monitoring period from 01-May-2016 to 31-October-2017. The contribution to sustainability will be monitored applying the SOCIALCARBON® Standard, which is based in six main pointers: 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 GOMES DE MATTOS LTDA - ME
-------------------	------------------------------------

Contact person	Mr. Stephenson Ramalho de Lacerda
Title	Mr. <i>Stephenson Ramalho de Lacerda</i> , Manager and monitoring data responsible: General data and information on inputs and outputs of the ceramic factory, detailed information on acquisition of renewable biomasses and how this data is kept by the controller's office.
Address	Rodovia CE 55, Km 06 Crato - Ceará - Brazil Postal Code: 63105-330
Telephone	+55 (88) 3521-6580
Email	ceramicacgm@yahoo.com.br

Organization name	Sustainable Carbon – Projetos Ambientais Ltda
Contact person	Marcelo Hector Sabbagh Haddad Fernanda Alves de Almeida Fernanda Sayuri Suzuki Guilherme Lucas Medeiros Prado Livia Demier Mauri Luana Ribeiro Alves
Title	Marcelo Hector Sabbagh Haddad: Technical coordinator Fernanda Alves de Almeida: Technical analyst Fernanda Sayuri Suzuki: Technical analyst Guilherme Lucas Medeiros Prado: Technical analyst Livia Demier Mauri: Technical analyst Luana Ribeiro Alves: 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	tecnic@sustainablecarbon.com Fernanda.almeida@sustainablecarbon.com

1.4 Other Entities Involved in the Project

No other entity was involved in the project activity.

1.5 Project Start Date

According to version 02 of the VCS PD¹, project start date was defined as 01-April-2006. On this date, the project began reducing or removing GHG emissions, i.e. the ceramic started using renewable biomass as fuel.

1.6 Project Crediting Period

The crediting period for this project started on 01-May-2006 and ends on 30-April-2016. The second crediting period started on 01-May-2016 and ends on 30-April-2026.

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. Gomes de Mattos ceramic is located in Brazil, in the State of Pernambuco, which is indicated in Figure 01. The project site has the following postal address:

GOMES DE MATTOS CERAMIC

Rodovia CE 55, Km 06

Crato – Ceará – Brazil



Postal Code: 63105-330

Figure 1. Geographic location of Gomes de Mattos Ceramic: 7°10'36.50" S; 39°24'49.23" W

¹ Document available at: < https://mer.markit.com/br-reg/public/project.jsp?project_id=100000000000032>. Last on: January, 2018.

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 07, valid from 07/11/2017 onwards. 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.

1.10 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 biomasses 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 biomasses and also by contributing to the reduction on the use of non-renewable fuels.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The VCS PD of the second crediting period and this present monitoring report will be verified by Earthood Services Private Limited.

As described on the VCS PD version 05, the production process at Gomes de Mattos ceramic encompasses two Hoffman kilns and one Câmara kiln in order to burn the fuel and fire the ceramic units, which are mainly used in the construction sector.

The ceramic units that are cooked in the kilns can be dried using two drying systems. The first one is held in a covered area which allows the ceramic units to be naturally dried. The second is an artificial dryer which, besides using biomass as fuel to supply the energy that will dry the ceramic pieces, also reuses the energy generated by the kilns.

In the current monitoring period, as renewable biomasses, the ceramic factory is employing native firewood from sustainable management plan, Algaroba wood, cashew trees and sawdust. The drying process occurs naturally at a covered site and in a semi continuous dryer, reusing the heat of the kilns.

The table below demonstrates the emission reductions verified in the last monitored periods:

Emission Reduction (tCO ₂ e)		
6° Monitoring Period	March to December of 2014	47,067
	January to December of 2015	58,614
	January to April of 2016	20,631
Total in the monitoring period		126,312
7° Monitoring Period	May to December of 2016	27,512
	January to October of 2017	33,163
Total in the monitoring period		60,675
Project Emissions		25.83
Emission Reduction		60,649

2.2 Deviations

2.2.1 Methodology Deviations

There were no methodology deviations during this monitoring period.

2.2.2 Project Description Deviations

Not applicable, since all deviations observed in the first crediting period were included in the VCS-PD for the second crediting period. Thus, for the present monitoring period, there are no deviations.

2.3 Grouped Project

Not applicable. This is not a grouped project.

2.4 Safeguards

2.4.1 No Net Harm

The only negative impact identified is that the project activity will generate ashes due to the burning of the biomass, but this impact will be mitigated by incorporating the ashes into the clay used as thermal insulator in the kilns entrance.

The burning of the new biomasses also emits particulate material and CO₂, as well as when using native wood. However, GHG emission reductions will be improved since they are renewable biomasses which have carbon neutral lifecycles.

2.4.2 Local Stakeholder Consultation

The ceramic factory cares about the disclosure of the project for the community so they promote lectures to the stakeholders about the sustainability practices carried on in the ceramic. During the lectures, the factory consults the stakeholders' opinion and answer questions about the environmental initiatives. The factory has a trained team to perform the stakeholders' consultation. The stakeholders are also interested and concerned about the sustainability practices.

There were no registration of complaints.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EF _{projected fossil fuel}
Data unit:	tCO ₂ /TJ
Description:	Emission factor for the substitution of non-renewable woody biomass by similar consumers

Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Available at: < http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf >. Page 2.18. Table 2.3. IPCC. Last visit on: 19/05/2015
Value applied:	81.6 tCO ₂ /TJ
Justification of choice of data or description of measurement methods and procedures applied	In the baseline scenario, the fossil fuel that would probably 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 substitute of wood than natural gas due to the risks involving natural gas distribution.
Purpose of the data:	The fossil fuel likely to be used by similar consumers is taken from the IPCC default value of residual fossil fuel. 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.
Any comment:	Applicable for stationary combustion in the manufacturing industries and construction.

Data Unit / Parameter:	ρ_{wood}
Data unit:	tonne/m ³
Description:	Specific gravity of non-renewable wood
Source of data:	Brazilian studies carried out with <i>Caatinga</i> wood: - 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. - 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: 19/05/2016. - IPCC: Intergovernmental Panel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS - chapter3 – Table 3A.1.9-2. - OLIVEIRA, E. et al. Estrutura anatômica da madeira e qualidade do carvão de Mimosa tenuiflora (Willd.) Poir. Revista Árvore, Viçosa-MG, v.30, n.2, p.311-318, 2006. Available at:

	<http://www.scielo.br/pdf/rarv/v30n2/a18v30n2.pdf>. Last visit on: 19/05/2016 - IBAMA – Madeiras Brasileiras. <https://web.archive.org/web/20091226033704/http://www.ibama.gov.br/lpf/madeira/caracteristicas.php?ID=195&caracteristica=139>. Last visit on: 19/05/2016
Justification of choice of data or description of measurement methods and procedures applied	The amount of wood used in the baseline was measured in volume unit. This datum was used for unit conversion.
Value applied:	0.88
Purpose of the data:	Calculation of baseline emissions. The amount of wood used in the baseline was measured by volume units, so this data was used to the unity conversion.
Any comment:	The species used to calculate the average value are typical trees of <i>Caatinga</i> Biome that are usually utilized as fuel in the ceramic industries of the region.

Data Unit / Parameter:	BF_y
Data unit:	tonnes/tonnes of ceramic devices
Description:	Consumption of non-renewable biomass per thousand of ceramic devices produced In year y
Source of data:	Historical data from ceramic owner
Value applied:	0.563
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 used to consume non sustainable wood. This value is in accordance with the data acquired in other ceramics that employ the same type of kilns. The value is employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.
Purpose of the data:	Calculation of baseline emissions. The value is utilized to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario. This value is in accordance with the data acquired in other ceramics

	that employ the same type of kilns.
Any comment:	The value was acquired through the average consumption and production of ceramic devices during the years when the ceramic used to consume non-renewable wood.

Data Unit / Parameter:	EF _{co2,f}								
Data unit:	g CO ₂ /t km								
Description:	Default CO ₂ emission factor for freight transportation activity <i>f</i>								
Source of data:	Historical data from ceramic owner								
Value applied:		<table><tr><th>Vehicle class</th><th>Emission factor (g CO₂/t km)</th></tr><tr><td>Light vehicles</td><td>245</td></tr><tr><td>Heavy vehicles</td><td>129</td></tr></table>	Vehicle class	Emission factor (g CO ₂ /t km)	Light vehicles	245	Heavy vehicles	129	
Vehicle class	Emission factor (g CO ₂ /t km)								
Light vehicles	245								
Heavy vehicles	129								
Justification of choice of data or description of measurement methods and procedures applied	The value is calculated by the multiplication of distance between the origin and destination, total mass of freight transported, emission factor and freight transportation activities. The value is employed to calculate the project emission by transportation of biomass over a distance of 200km.								
Purpose of the data:	Calculation of project emissions. The value is utilized to calculate the emissions of the biomass transportation if the distance is over 200km.								
Any comment:	Applicable to Option B. The default CO ₂ emission factors take into account emissions generated by loaded outbound trips and empty return trips. The default emission factors have been obtained from two sources. For light vehicles, the emission factor was obtained from empirical data from European vehicles. For heavy vehicles, the emission factor has been derived based on custom design transient speed-time-gradient drive cycle (adapted from the international FIGE cycle), vehicle dimensional data, mathematical analysis of loading scenarios, and dynamic modelling based on engine power profiles, which, in turn, are a function of gross vehicle mass (GVM), load factor, speed/acceleration profiles and road gradient. The following								

	assumptions on key parameters have been made: an average driving speed of 30 km/h, an average gradient of 1%, and a load factor attained when biomass is transported were assumed.
--	--

3.2 Data and Parameters Monitored

Data Unit / Parameter:	NCVbiomass
Data unit:	TJ/tonne of wood
Description:	Net Calorific Value of non-renewable woody biomass that is substituted.
Source of data:	AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user - Version 7.0. Available at: https://cdm.unfccc.int/methodologies/DB/9LFOR81TCT5FLI1AJYP46CQY8O2J79 Last visit on: July 17th, 2017. The value informed in the applied methodology is based on IPCC default for wood fuel.
Description of measurement methods and procedures to be applied:	This parameter is record by the ceramic in a sheets with the distance between the ceramic and the furnisher. Information in section 3.2 – Project Emissions
Frequency of monitoring/recording:	Annually
Value applied:	0.015 TJ/Tonne
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Purpose of the data	This value provides the energy generated by the amount of wood that would be used in the absence of the project.
Calculation method:	-
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data / Parameter	Qrenbiomass								
Data unit	Tonnes per year								
Description	Amount of renewable biomass utilized								
Source of data	Data will be monitored through all the receipts and invoices of biomass received by the ceramic company.								
Description of measurement methods and procedures to be applied	In order to convert m³ to tonnes, the specific gravity values of some renewable biomasses are available below: <table border="1"> <thead> <tr> <th>Biomass</th><th>Specific gravity (tonnes/m³)</th></tr> </thead> <tbody> <tr> <td>Native wood from forest management</td><td>0.880</td></tr> <tr> <td>Sawdust</td><td>0.245</td></tr> <tr> <td>Residues from tree pruning</td><td>0.613</td></tr> </tbody> </table> Source of data: - Renewable native wood Brazilian study carried out with Caatinga and Atlantic Forest wood utilized at the ceramic sector: NASCIMENTO, W. S. A. Avaliação dos Impactos Ambientais Gerados Por Uma Indústria Cerâmica Típica da Região do Seridó/RN; Dissertação (Mestrado em Engenharia Mecânica), Universidade Federal do Rio Grande do Norte, Natal, 2007. Available at: http://bdtd.bczm.ufrn.br/tedesimplificado//tde_busca/arquivo.php?codArquivo=1239. Last visit on: July 04th, 2009. 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.1. 4.ed. Nova Odessa, SP:	Biomass	Specific gravity (tonnes/m ³)	Native wood from forest management	0.880	Sawdust	0.245	Residues from tree pruning	0.613
Biomass	Specific gravity (tonnes/m ³)								
Native wood from forest management	0.880								
Sawdust	0.245								
Residues from tree pruning	0.613								

	Instituto Plantarum, 2002. Associação de Plantas do Nordeste. Projeto Madeira. Available at: <http://www.plantasdonordeste.org/madeiras.pdf>. - Municipal wood residues This value was obtained by the average value between the specific gravity of each type of tree pruning (mango, jaca fruit and sabia wood), BARROSO, et. al. Consumption of firewood and production of waste of wood in Federal District, 2009. VALADARES, L.B. Propriedades da madeira e do carvão vegetal de <i>Artocarpus heterophyllus</i> Lamk, 2013. ALVES et al. Estudo de aproveitamento energético da espécie vegetal <i>Sabiá</i> (<i>Mimosacaesalpiniaefolia</i> Benth), 2012.										
Frequency of monitoring/recording	Annual										
Value applied	The applied value was based on the last monitoring period: <table border="1"> <thead> <tr> <th colspan="2">Gomes de Mattos Ceramic</th> </tr> <tr> <th>Biomass</th><th>Q_{renbiomass}</th> </tr> </thead> <tbody> <tr> <td>Native wood from forest management</td><td>7,183.18</td> </tr> <tr> <td>Sawdust</td><td>84.00</td> </tr> <tr> <td>Residues from tree pruning</td><td>650.25</td> </tr> </tbody> </table>	Gomes de Mattos Ceramic		Biomass	Q _{renbiomass}	Native wood from forest management	7,183.18	Sawdust	84.00	Residues from tree pruning	650.25
Gomes de Mattos Ceramic											
Biomass	Q _{renbiomass}										
Native wood from forest management	7,183.18										
Sawdust	84.00										
Residues from tree pruning	650.25										
Monitoring equipment	No monitoring equipment is used to determine this parameter.										
QA/QC procedures to be applied	The ceramic has monthly records of the quantity of biomass acquired. It will be rechecked according to the receipts of purchase.										
Purpose of data	This parameter will be 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 for biomass renewable energy projects (capacity <45MWth); Calculation of leakage emissions due to competing use of biomass.
Calculation method	The energy generated by the amount of renewable biomass will be calculated based on the Net Calorific Value of each biomass, as can be seen on the VCS MR Calculation spreadsheet. Values in the receipts from biomass providers 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 under the item "Description of 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.

Data / Parameter	PRy						
Data unit	Tonnes						
Description	Production of ceramic units						
Source of data	Controlled by the project proponent.						
Description of measurement methods and procedures to be applied	The amount of ceramic pieces produced is monitored by counting the total production of one year, based on data from last crediting period. This parameter will be monitored by the project proponent (meaning the ceramic owner). The amount will be acquired by counting the total production of the period considered for each ceramic factory and data will be aggregated on a monthly and yearly basis.						
Frequency of monitoring/recording	Annual						
Value applied		<table><tr><td>Ceramic factory</td><td>Gomes de Mattos</td></tr><tr><td>PRy</td><td>95,142</td></tr></table>	Ceramic factory	Gomes de Mattos	PRy	95,142	
Ceramic factory	Gomes de Mattos						
PRy	95,142						
Monitoring equipment	No monitoring equipment is used to determine this parameter. Production is counted by trained personnel on Gomes de Mattos ceramic industry.						
QA/QC procedures to be	The ceramic has an internal control of the quantity of pieces						

applied	produced. It will be rechecked according to the biomass employed and the kiln consumption of renewable biomass.
Purpose of data	This parameter is used to calculate baseline emissions and the total energy produced 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 employed in the ceramic 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 Unit / Parameter:	Origin of renewable biomass
Data unit:	Not applicable
Description:	Renewable origin of the biomass
Source of data:	Controlled by the project developer
Description of measurement methods and procedures to be applied:	This information was given by the biomasses providers. The guarantee of acquiring renewable wood was achieved by invoices from the providers. As stated in the section 2.2, the biomasses (Algaroba wood and forest residues) are considered renewable as fulfilling the options described in the methodology applied. Compared with the last monitoring period, few of biomass suppliers were modified and most of them provided evidences on the origin of each type of biomass consumed by Gomes de Mattos Ceramic, through receipts and invoices. Aiming to assess if biomass are renewable, interviews were made by Sustainable Carbon with biomass suppliers. Such procedures were applied in the last monitoring period.
Frequency of monitoring/recording:	Annually
Value monitored:	Not applicable.
Monitoring equipment:	No monitoring equipment was used to determine this parameter.

QA/QC procedures to be applied:	The biomass is considered renewable as it is according to the definition given by the applied methodology.
Purpose of the data	Not directly applied for the calculation. 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
Any comment:	All the renewable biomasses utilized 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 for this project activity, whichever occurs later.

Data Unit / 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:	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:	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	Calculation of leakage emissions due to competing use of biomass.
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.
Any comment:	Data will be kept for two years after the end of the crediting period or the

	last issuance of carbon credits for this project activity, whichever occurs later.
--	--

Data Unit / 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 be applied:	Data available regarding the ceramic industries fuel consumption were utilized to monitor the leakage.
Purpose of the data	Calculation of leakage emissions. 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.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data Unit / Parameter:	$f_{NRB,y}$
Data unit:	Percentage
Description:	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods or government data or approved default country specific fraction of non-renewable biomass (f_{NRB}) values available on the CDM website.

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 ceramics owner. Thus, the totality of fuel employed in the baseline scenario is from non-renewable origin. According to Associação Plantas do Nordeste (APNE, 2016), the approximated area of the Caatinga biome with sustainable use corresponds to 393,995 ha². Besides that, according to the same source, the approximate area of Caatinga biome is 850,000 km², which means 85,000,000 ha. Therefore, the percentage of wood with sustainable use in Caatinga Biome is around 0.46%. Two sheets were made to calculate the amount of wood consumed. The first one encompasses the amount of wood consumed by the ceramics located at the Caatinga biome. The other sheet calculates the amount of wood consumed regarding only Gomes de Mattos Ceramic. Dividing these values by the total of wood available, the amount of renewable biomass that has been saved by all the project activities or only by Gomes de Mattos project was achieved³. Afterwards, summing each value with the sustainable use areas defined by APNE (2016), two fractions of renewable biomass were acquired. Finally, each value was subtracted from 100% to achieve the $f_{NRB,y}$. Therefore, the smaller value was considered in order to be more conservative. These sheets are available at the VCU Estimates spreadsheet.
Frequency of monitoring/recording:	Annually
Value monitored:	92.53%
Monitoring equipment:	No monitoring equipment is 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 Caatinga biome. Wood saved from projects developed by Sustainable Carbon in the same biome and that have applied the same methodology was considered in this fraction⁴. 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

² According to Associação Plantas do Nordeste 2016. Available at: <http://www.cnip.org.br/planos_manejo.html>. Last visited on: 27/07/2016.

³ According to data from project activities elaborated by Sustainable Carbon – Projetos Ambientais LTDA.

⁴ 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: 12/05/2016.

	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:	Values from wood residues should be determined ex ante ⁵ . Detailed information in Section 4.3 - Leakage.
Any comment:	Data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later.

Data Unit / Parameter:	$D_{f,m}$		
Data unit:	Kilometre		
Description:	Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m		
Source of data:	Records of vehicle operator or records by project participants		
Description of measurement methods and procedures to be applied:	This parameter is record by the ceramic in a sheets with the distance between the ceramic and the furnisher. Information in section 4.2 – Project Emissions		
Frequency of monitoring/recording:	Annually		
Value monitored:	Distance between project and furnisher		
	Origen of the Material	Origen of Municipality	Distance (km)
	Josafá Fernandes de Oliveira Filho	Cratéus	280
	Josafá Fernandes de Oliveira Filho	Tamboril	320
	Josafá Fernandes de Oliveira Filho	Cratéus	280

⁵ 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: 13/05/2016.

	Josafá Fernandes de Oliveira Filho	Cratéus	280
	Josafá Fernandes de Oliveira Filho	Cratéus	280
	Josafá Fernandes de Oliveira Filho	Cratéus	280
	Cícero Jailson de Sousa	Picos	290
Monitoring equipment:	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources).		
QA/QC procedures to be applied:	-		
Purpose of the data	This parameter is used to calculate project emissions.		
Calculation method:	Information in section 4.2 – Project Emissions		
Any comment:	Applicable to Option B		

Data Unit / Parameter:	FR_{f,m}			
Data unit:	tonnes			
Description:	Total mass of freight transported in freight transportation activity f in monitoring period m			
Source of data:	Records by project participants or records by truck operators			
Description of measurement methods and procedures to be applied:	This parameter is record by the ceramic in a sheets with the distance between the ceramic and the furnisher. Information in section 4.2 – Project Emissions			
Frequency of monitoring/recording:	Annually			
Value monitored:	Furnisher	Distance (km)	Quantity of Biomass (Tonnes)	
	Josafá Fernandes de Oliveira Filho	280	17.8	

	Josafá Fernandes de Oliveira Filho	320	131.1
	Josafá Fernandes de Oliveira Filho	280	143.1
	Josafá Fernandes de Oliveira Filho	280	201.2
	Josafá Fernandes de Oliveira Filho	280	0.29
	Josafá Fernandes de Oliveira Filho	280	107.3
	Cícero Jailson de Sousa	290	92.1
Monitoring equipment:	Through a scale to know the weight of biomass.		
QA/QC procedures to be applied:	-		
Purpose of the data	This parameter is used to calculate project emissions.		
Calculation method:	Information in section 4.2 – Project Emissions		
Any comment:	Applicable to Option B		

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 4.2 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 Qrenbiomass and PRy). Ceramic personnel are also responsible to store invoices, receipts of sales and other documents related to purchase or acquisition of biomass.

Ceramic personnel register monitoring data regarding parameters Qrenbiomas and PRy on electronic spreadsheets, which are shared with Sustainable Carbon team using an internet cloud service (dropbox). This gives Sustainable Carbon real time access to monitoring data.

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 $f_{NRB.y}$.

Periodically, Sustainable Carbon will perform an analysis to verify if biomass and production data are being correctly filled in the monitoring spreadsheets. Analysis on production data will be performed by a series of comparisons between different measurement points of production (molding machine, kiln loading and kiln unloading or sales) to detect inconsistencies or suspicious data.

Analysis on biomass data will be 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 evaluate 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 sources of leakages predicted in the applied methodology will be monitored. Scientific articles official statistical data regional and national surveys are provided in order to ensure that there is no leakage from non-renewable biomass (or to estimate the leakage). 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 $f_{NRB,y}$. Sustainable Carbon shall also assist the Ceramic personnel to double check the monitored data on biomass consumption and ceramic devices production.

Non-conformities identified in the double check procedures will be clarified between Sustainable Carbon technical team and the monitoring responsible on the ceramic during site visits for data collection, by reassessing existing documents and sources of information.

The responsible for the monitoring plan is Mr. Stephenson from *Gomes de Mattos Ceramic Company*. Sustainable Carbon technical team (including those members described on Section 1.3) was also involved in the project monitoring.

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 08/04/2010⁶. The project activity in this monitoring period (18 months) generated 88 TJ per year. Converting this number to MWh, it was generated 11,336.30 MWh per year, which corresponds to the use of 1.29 MW_{thermal} on average of the kilns capacity during the monitored period, which is less than the limits of 45 MW_{thermal} for Type I Small scale project activities.

Baseline emissions

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel} \quad (\text{Equation 1})$$

Where:

BE_y: Baseline emissions during the year y in tCO_{2e}

⁶ Available at: <

http://web.archive.org/web/20090304141849/http://cdm.unfccc.int/UserManagement/FileStorage/CDM_AMSP4VBBO5G54RXDE9KQ6FJWMGHZLHFA5 >. Last visit on: 06/12/2017.

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

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

$EF_{fossil\ fuel}^{projected}$: Emission factor for the projected fossil fuel consumption in the baseline in tCO₂e/TJ⁷.

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

B_y is determined using the following option:

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

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

Where:

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

η_{old} : Efficiency of the system being replaced

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

Where:

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

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

⁷ Value obtained on the AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user - Version 7.0.

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

Where:

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

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

Where:

BF_y: Consumption of non-renewable biomass per tonne of ceramic units fired in year y (tonnes/tonnes of pieces)

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

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

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

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 each kiln at the baseline from the monthly production of each kiln at the baseline, in thousands of pieces.

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

Table 1. BE_y in tCO₂e for *Gomes de Mattos* ceramic

Year	Month	By (Tonnes)	PR _y (Tonnes)	BE _y (tCO ₂ e)
2016	May	3,063	5,438.8	3,469
	June	3,205	5,691.4	3,630
	July	3,329	5,911.1	3,770
	August	2,983	5,296.6	3,378
	September	2,908	5,163.9	3,293
	October	2,830	5,024.8	3,204
	November	3,031	5,381.3	3,432

	December	2,947	5,231.7	3,336
2017	January	2,884	5,121.1	3,266
	February	2,912	5,170.1	3,297
	March	2,914	5,174.8	3,300
	April	3,065	5,441.8	3,470
	May	2,915	5,176.6	3,301
	June	2,916	5,178.4	3,302
	July	2,774	4,925.8	3,141
	August	2,878	5,109.6	3,259
	September	2,843	5,047.1	3,219
	October	3,186	5,657.4	3,608
Total in the monitoring period		53,584	95,142	60,675

4.2 Project Emissions

According to Methodological tool⁸ the project emissions could be a result of biomass transportation of a distance over 200Km or emissions from energy consumption associated with processing of biomass residue. Since it is a small scale project, may neglect emissions from energy consumption associated with cultivation of biomass. If the biomass providers are located over a distance of 200 Km of the Ceramic factory, it will be calculated the emissions caused by transportation It will be monitored during the verification to ensure the distance is less than 200Km and if it is over than 200km calculate the emissions by the following equation:

⁸ Available at < <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf> > Last visit: March, 2018.

$$PE_{TR,m} = \sum_f D_{f,m} \cdot FR_{f,m} \cdot EF_{CO_2,f} \cdot 10^{-6}$$

Equation 07

Where:

- $PE_{TR,m}$ = Project emissions from road transportation of freight monitoring period m (t CO₂)
 $D_{f,m}$ = Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m (km)
 $FR_{f,m}$ = Total mass of freight transported in freight transportation activity f in monitoring period m (t)
 $EF_{CO_2,f}$ = Default CO₂ emission factor for freight transportation activity f (g CO₂ / t km)
 f = Freight transportation activities conducted in the project activity in monitoring period m

Project Emissions (Distances over 200 km)			
Furnisher	Distance (km)	Quantity of Biomass (Tonnes)	Project Emissions
Josafá Fernandes de Oliveira Filho	280	17.8	0.646
Josafá Fernandes de Oliveira Filho	320	131.1	5.415
Josafá Fernandes de Oliveira Filho	280	143.1	5.169
Josafá Fernandes de Oliveira Filho	280	201.2	7.269
Josafá Fernandes de Oliveira Filho	280	0.29	0.0107
Josafá Fernandes de Oliveira Filho	280	107.3	3.876
Cícero Jailson de Sousa	290	92.1	3.447
Total	-	693.2	25.8

4.3 Leakage

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

The Methodology 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.

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

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 above, the possible sources of leakage of the present project activity is the competing use of *Sawdust, Eucalyptus wood, Cashew tree, Residues from tree pruning, Algaroba firewood, Renewable native wood, Babaçu coconut husk, and Sugar cane bagasse*. All of these biomasses have enough availability as shown below demonstrating the lack of leakage for each biomass.

Native wood from forest management

The sustainable forest management plan can be organized into three stages: firstly, the division of the property in exploitable areas and areas of permanent preservation that are inaccessible to exploitation. The second stage is the planning of roads that connect the area with the primary roads. In the third stage, the allocated area is divided for exploration in blocks in order to sustain forest exploitation annually. Furthermore, the minimum requirements of the management plan are defined by Article 19 of Brazilian Forest Code, and are regulated by Decree 5975/06⁹.

Considering that the rotation cycle is defined between 12 and 15 years, the period used to estimate the production of wood with sustainable forest management plan in *Caatinga* biome was 13.5 years, medium value. Another important parameter is the MAI (mean annual increment), that according to MMA (2015) is around 15 m³/ha.year¹⁰, which leads to 4.5 m³/ha.year.

The total area properly regularized with sustainable forest management plan in the *Caatinga* biome corresponds to around 400,000 hectares. There are around 588 sustainable forest management plans operating in this biome¹¹.

Considering that the exploration is in blocks (in order to sustainable forest exploitation annually)¹², the area available for exploration is around 29,630 ha/year in *Caatinga* biome. In addition, it was considered the productivity of wood in *Caatinga* biome as 60.75 m³/ha.

Therefore, the production of wood with sustainable forest management plan in *Caatinga* biome was around 1,800,022.5 m³ in 2012. As the ceramic average consumption presented in this project activity is about 5,755.22 m³ per year, the consumption of this kind of fuel represents less than 1% of the total of wood with sustainable forest management plan produced in the region.

Residues from tree pruning

Urban gardens residues are very usual residue over Brazilian's countries where around 70% of the amount of this kind of biomass is left in open dumps or landfills. This way the urban garden residue does not have any kind of utilization turning out in an residue which may originate

⁹ BRASIL. Lei nº. 4.771, de 15 de setembro de 1965. Código Florestal. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 16 de set. 1965. Available at: <http://www.planalto.gov.br/ccivil_03/LEIS/L4771.htm>. Last visit on: January, 2018.

¹⁰ BRASIL. Estatística Florestal da Caatinga/MMA. Ano 2. Vol. 2 (ago. 2015). Natal, RN: APNE, 2015. Available at: <<https://goo.gl/DEiSiq>>. Last visit on: January, 2018.

¹¹ CNIP, 2012. Available at: <http://www.cnip.org.br/planos_manejo.html>. Last visit on: January, 2018.

¹² BRASIL. Manejo sustentável dos recursos florestais da Caatinga/MMA. Secretaria de Biodiversidade e Florestas. Departamento de Florestas. Programa Nacional de Florestas. Unidade de Apoio do PNF no Nordeste. Natal: MMA, 2008. 28p. Last visit on: January, 2018.

problems such as high costs for its correct disposal or treatment or result in negative environmental effects when not disposed correctly¹³.

For all these reasons the utilization of Urban gardens residues as fuel turn out to be a considerable destination for these kind of residue, and would provide an abundant source of renewable biomass if utilized in the proposed project activity.

Sawdust

Sawdust is a probable fuel to be used for the ceramic devices burning. The production of wood generates a large amount of residues, which can be reused to generate thermal energy.

The production of timber in the Northeast Region of Brazil was of 1,129,176 m³¹⁴ in 2016. Considering that around 22% of the wood produced will generate sawdust¹⁵, thus, it can be assumed that around 248,419 m³ of sawdust was generated. The average use of sawdust is 453 m³ in this monitoring period, that represents less than 1% of the production.

This way, this renewable biomass did not have potential to generate leakage emissions.

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

¹³ Available at: <http://cenbio.iee.usp.br/download/documentos/notatecnica_ix.pdf>. Last visit: February, 2018

¹⁴ According to IBGE < <https://cidades.ibge.gov.br/> > Last visit: February, 2018

¹⁵ 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.

The carbon credits incomes stimulate the use of renewable biomass to other ceramic companies presenting a huge possibility for sustainable development in the region. Therefore, the sources of leakages mentioned above are not applicable as the project activity does not displace the use of renewable biomass of a non-project user, due to the likely decrease in the use of non-renewable biomass in the region and there is current great amount of renewable biomasses available locally as described before. The non-renewable biomass employed which would be employed in this project activity is not being saved for other project activity, since other ceramics were already consuming wood from non sustainable forest management (common practice).

The project will contribute to reduce the use of non-renewable biomass, especially due to the incentive of carbon credits. Therefore, it can be concluded that this source of leakage, until the date of this monitoring report, is not considered for this project activity. This leakage was monitored in order to guarantee the project conservativeness.

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

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

4.4 Net GHG Emission Reductions and Removals

$$ER_y = BE_y - PE_y - LE_y$$

Equation 08

Where:

ER_y: Emission Reductions in year y in tCO₂e

PE_y: Project Emissions in year y in tCO₂e

LE_y: Leakage Emissions in year y in tCO₂e

Table 5. Emission reductions for the monitoring period.

Year	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)

2016	27,512	17.85	0	27,494
2017	33,163	7.98	0	33,155
Total	60,675	25.83	0	60,649