



**Verified Carbon
Standard**

KITAMBAR SWITCHING FUEL PROJECT



Document Prepared by Sustainable Carbon – Projetos Ambientais Ltda.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity was developed by Sustainable Carbon - Projetos Ambientais Ltda.

The project is applied at Kitambar Ceramic, which is a small and prototypical ceramic industry that produces structural ceramic devices like roof tiles, destined for the regional market. This project consists on utilizing renewable biomasses to feed the kilns rather than using native wood from areas without sustainable forest management, which is a pioneer practice in the region. This type of wood is considered a non-renewable biomass, once it is not originated in areas with reforestation activities.

As renewable biomasses, Kitambar Ceramic utilizes Algaroba wood¹, cashew tree residues², coconut husks, Sawdust and Native wood from forest management.

This fuel switching project is reducing the greenhouse gases (GHG) emissions through the substitution of native wood without sustainable management for renewable biomasses to generate thermal energy. The project activity will also indirectly help in reducing the Brazilian deforestation rates, the main source of greenhouse gas emissions in Brazil. Furthermore, by avoiding the anaerobic decay of these biomasses, this project will also contribute to lower greenhouse gas emissions.

In developing countries like Brazil, the deforestation rate is directly proportional to the greenhouse gases concentration in the atmosphere, which intensifies global warming.

The Caatinga is an exclusively Brazilian biome and occupies 850,000 Km², equivalent to 11% of the territory of the country³. Although being rich in natural resources, the Caatinga is one of the most threatened ecosystems on the planet. Its high calorific value causes a major cause of its decline. In a region where the shortage of rivers leads to less access to electric energy, native firewood and charcoal account for thirty percent of the total energy utilized in the industries of the region, which has intensified the local deforestation.

The Caatinga is a biome with a strong propensity to desertification and its deforestation consequently brings forward an increase in this possibility. With the loss of natural vegetation, the exposed soil becomes more susceptible to erosion and salinization. These processes are responsible for changing the system of rivers, which makes the water supply of local communities and family farming scarce.

The proposed project completed the fuel switch in December of 2006, which was defined as the Project Start Date. This monitoring period is part of the Revalidation of the project's crediting period, which started in 2017 and ends in 2026.

¹ The wood from afforestation in the northeast region of Brazil is mainly consisted of Algaroba (*Prosopis juliflora*).

² The cashew tree's pruning occurs due to its fructification, which happens more intensely in new branches.

³ Available at <<https://antigo.mma.gov.br/biomas/caatinga.html>>. Last visit on: April, 2021.

According to the PD, the emission reductions due to the switching of non-renewable fuel (native wood) to renewable biomasses is estimated to result in 355,880 tCO_{2e} during the crediting period is 10 years, i.e., from 01-Jan-2017 to 31-Dec-2026. The contribution to sustainability is monitored applying the SOCIALCARBON® Standard, which is based in six main pointers: Technology; Natural; Financial; Human; Social and Carbon Resources.

The emission reductions due to the switching of non-renewable fuel (non-renewable wood) to renewable biomasses was equal to **75,809.08 tCO_{2e}** during the monitoring period from 01-January-2017 to 31-July-2020.

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	Kitambar Artefatos de Cerâmica Ltda.
Contact person	Mr. Antônio Marcos Tavares Barbosa and Mr. Severino Francisco Torres
Title	<i>Mr. Antônio Marcos Tavares Barbosa</i>, Director and owner: Information about the ceramics, detailed information on process and production lines, environmental challenges, technological challenges, research and development history, ceramics devices market challenges. <i>Mr. Severino Francisco Torres</i>, Quality Controller, responsible for monitoring data: General data and information on inputs and outputs of the ceramic industry, detailed information on the acquisition of renewable biomasses and how this data is kept by the controller's office.
Address	Rodovia BR 232, Km 136, Distrito Industrial Caruaru - Pernambuco – Brazil Postal Code: 55.000-000
Telephone	+55 81 3722 7777
Email	financeiro.caruaru@kitambar.com.br http://www.kitambar.com.br

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

Organization name	Sustainable Carbon – Projetos Ambientais Ltda.: Project Developer, Project Participant and Project Proponent
Contact person	Marcelo Hector Sabbagh Haddad Carolina Pendl Abinajm Lyara Carolina Montone do Amaral Yara Fernandes da Silva Heloísa Dornelles
Title	Marcelo Hector Sabbagh Haddad: Technical coordinator Carolina Pendl Abinajm: Technical analyst Lyara Carolina Montone do Amaral: Technical analyst Yara Fernandes da Silva: Technical analyst Heloísa Dornelles: Technical analyst
Address	R. Doutor Bacelar. 368 – Conj. 23 – Vila Clementino São Paulo – SP. Brazil. Postal Code: 04026-001
Telephone	+55 11 2649 0036
Email	tecnica@sustainablecarbon.com

1.4 Other Entities Involved in the Project

No other entity was involved in the project activity.

1.5 Project Start Date

According to version 08 of the VCS-PD⁴, the project start date was defined as 01-December-2006. On this date, the project began reducing or removing GHG emissions, i.e., the ceramic factory started using renewable biomass as fuel.

⁴ Document available at <<https://registry.verra.org/app/projectDetail/VCS/33>>. Last visit on: April, 2021.

1.6 Project Crediting Period

The first crediting period for this project started on 01-January-2007 and ended on 31-December-2016. This is the second crediting period, which started on 01-January-2017 and ends on 31-December-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. Kitambar ceramic factory is located in Brazil, in the State of Pernambuco, which is indicated in Figure 01. The project site has the following postal address:

Kitambar Ceramic

Rodovia BR 232, Km 136, Distrito Industrial

Caruaru - Pernambuco – Brazil

Postal code: 55.000-000

Figure 1. Geographic location of the city of the project activity that has the following coordinates in Pernambuco State: Caruaru: 8° 16' 58" S and 35° 58' 33" W



1.8 Title and Reference of Methodology

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

Category AMS-I.E.: Switch from Non-Renewable Biomass for Thermal Applications by the User – Version 07, valid from 22-July-2016 until 31-October-2017⁵. 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

This project has not been registered under any other GHG programs.

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, with Brazilian Sustainable Development Criteria and the Sustainable Development Goals;
- 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 additional 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 fossil fuels.

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

⁵ This version of the methodology is available at <https://cdm.unfccc.int/UserManagement/FileStorage/J2H1I470Y38ZS6WFCEOPM5NBVRG90X>. Last visit on: April, 2021.

- SDG 4: Quality Education
- SDG 7: Affordable and Clean Energy
- SDG 8: Decent Work and Economic Growth
- SDG 13: Climate Action

2 SAFEGUARDS

2.1 No Net Harm

The only negative impact identified is that the project activity generates ashes due to the burning of the biomass, but this impact is 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.

2.2 Local Stakeholder Consultation

The formal stakeholder consultation was carried out during the validation of the project, but no complaints, suggestions and/or comment about the project was received during the present monitoring period. Currently, the company's environmental management area is available to receive any kind of suggestions and comments from the community through telephone, e-mail or even personally.

2.3 AFOLU-Specific Safeguards

Not applicable. This is not an AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The VCS PD was validated by Designated Operational Entity Earthood Services Private Limited 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 is operating using exclusively renewable biomass, thus mitigating baseline emissions.

As described in the VCS PD version 08, the production process of Kitambar Ceramic involves eight kilns with intermittent and reversible burning system, Round kiln type, which have capacity for approximately 46,000 ceramic units per burning cycle, depending on the kind of the products that are fired. Approximately 28 burning cycles are done per month. The drying process occurs in a semi-continuous dryer which reuses the heat provided by the kilns to dry the ceramic units. In case no heat is being provided by the kilns, there is a separated furnace supplied only with renewable biomass.

The process for reducing water content in the ceramic devices is carried out through the employment of two dryer plants that utilize the heat originated in the kilns through an internal gas recirculation. Cerâmica Kitambar kilns are responsible for burning ceramic roof tiles, and it utilized 3,111.93 tonnes per year of biomass in the current monitoring period, which made possible the production of 14,014.95 tonnes of ceramic devices per year.

In the current Monitoring Period, Kitambar Ceramic Factory produced roof tiles (1.5 Kg) and bricks with 8 orifices (2.52 Kg). Thus, Cerâmica Kitambar was responsible for manufacturing 1,167.91 tonnes of ceramic devices per month. The burning cycle comprises 24 hours to load the chamber with ceramic devices, approximately 16 hours to burn, 24 hours cooling and 8 hours to remove the pieces from the kiln.

In the 6th monitoring period (01-April-2015 to 31-March-2016), Kitambar Ceramic utilized Algaroba wood, sawdust and a small amount of Coconut Husk as renewable biomass. During the 7th monitoring period (01-April-2016 to 31-December-2016) the ceramic factory used Algaroba wood and sawdust as renewable biomasses.

In the current and 8th monitoring period (01-January-2017 to 31-July-2020), Kitambar Ceramic employed only Algaroba wood and Sawdust as renewable biomasses.

3.2 Deviations

3.2.1 Methodology Deviations

There were no methodology deviations during this monitoring period.

3.2.2 Project Description Deviations

There were no project description deviations during this monitoring period.

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	tCO ₂ /TJ
Description	Emission factor for the substitution of non-renewable woody biomass by similar consumers.
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/9LFOR81TCT5FLI1AJYP46CQY802J79 >. Last visit on: April, 2021.
Value applied	81.6 tCO ₂ /TJ
Justification of choice of data or description of measurement methods and procedures applied	This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. It is assumed that the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choices), a liquid fossil fuel (represents a progression over solid fuel in the ladder of fuel use choices) and a gaseous fuel (represents a progression over liquid fuel in the ladder of fuel use choices). Thus a 50 per cent weight is assigned to coal as the alternative solid fossil fuel (96 tCO ₂ /TJ) and a 25 per cent weight is assigned to both liquid and gaseous fuels (71.5 tCO ₂ /TJ for kerosene and 63.0 tCO ₂ /TJ for liquefied petroleum gas (LPG).
Purpose of Data	The fossil fuel likely to be used by similar consumers is taken from the applied methodology. 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.

Data / Parameter	ρ_{biomass}
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. Revista da Madeira, nº 89, abril de 2005, pág. 100-106. Available at http://www.lippel.com.br/dados/download/05-05-2014-10-46poder-calorifico-da-madeira-e-de-materiais-ligno-celulosicos.pdf. Last visit on: April, 2021. IPCC: Intergovernmental Panel on Climate Change. Orientación del IPCC sobre las buenas prácticas para UTCUTS – Chapter 3 – 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: April, 2021. 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: April, 2021.
Value applied	0.88 tonne/m ³
Justification of choice of data or description of measurement methods and procedures applied	The species used to calculate the value are typical trees of <i>Caatinga</i> Biome that are usually employed as fuel in the ceramic factories of the region. The amount of wood used in the baseline was measured in volume unit. This datum was used for unit conversion.
Purpose of 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.
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	BF _y		
Data unit	Tonnes of wood per tonnes of devices		
Description	Consumption of non-renewable biomass per thousands of ceramic devices produced in year y.		
Source of data	Historical data from ceramic owner.		
Value applied	<table> <tr> <td>Ceramic factory</td><td>Kitambar</td></tr> </table>	Ceramic factory	Kitambar
Ceramic factory	Kitambar		

	BFy	1.30	
Justification of choice of data or description of measurement methods and procedures applied	The value was based on the historical situation at the site of the project activity prior to the implementation of the project. 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 parameter cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity⁶. The value was employed to calculate the real amount of wood displaced to maintain the ceramic production in the baseline scenario.		
Purpose of Data	The purpose of the data is to provide the consumption of non-renewable biomass per tonnes of ceramic units produced in a year 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.		

Data / 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	Methodological tool “Project and leakage emissions from transportation of freight”							
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.							

⁶ Methodological Tool: “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”. Available at: <<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>>. Last visit on: April, 2021.

Purpose of Data	Calculation of project emissions. The value is utilized to calculate the emissions of the biomass transportation if the distance is over 200km.
Comments	Applicable to Option B of the Methodological tool ⁷ “Project and leakage emissions from transportation of freight” – 01.1.0. Where the values of light and heavy vehicles are from the Methodological tool.

4.2 Data and Parameters Monitored

Data / Parameter	PRy		
Data unit	Tonnes of ceramic devices		
Description	Production of ceramic devices in tonnes		
Source of data	Controlled by the project proponent.		
Description of measurement methods and procedures to be applied	The amount of tonnes of ceramic pieces produced is monitored by counting the total production of one year, based on data from last crediting period and multiplying it by the weight of pieces. This parameter is monitored by the project proponent (meaning the ceramic owner). The amount is acquired by counting the total production of the ceramic factory and data is aggregated on a monthly and yearly basis.		
Frequency of monitoring/recording	Annually		
Value monitored	Period		PRy - Production (tonnes of ceramic units)
	2017	January	1,946.63
		february	1,569.80
		March	2,065.77
		April	1,311.78
		May	1,439.84
		June	1,101.92
		July	1,276.80
		August	1,466.17
		September	1,108.90
		October	1,152.95

⁷ Methodological tool “Project and leakage emissions from transportation of freight” Available at <<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-12-v1.1.0.pdf>> Last visit on: April, 2021.

		November	1,220.68		
		December	1,090.54		
		Total 2017	16,751.79		
	2018	January	1,315.34		
		february	1,039.26		
		March	1,122.50		
		April	1,239.52		
		May	1,171.87		
		June	1,292.93		
		July	1,294.43		
		August	1,273.20		
		September	994.24		
		October	1,107.22		
		November	1,227.01		
		December	1,030.14		
		Total 2018	14,107.65		
	2019	January	1,300.31		
		february	1,086.29		
		March	1,113.19		
		April	1,160.21		
		May	1,250.57		
		June	919.06		
		July	1,136.23		
		August	1,040.69		
		September	1,120.04		
		October	1,207.85		
		November	967.82		
		December	1,062.21		
		Total 2019	13,364.47		
	2020	January	1,004.06		
		february	869.34		
		March	858.90		
		April	416.03		
		May	904.48		

	June	919.57
	July	1,023.96
	Total 2020	5,996.34
	Total in the monitoring period	50,220.24
	For more detailed information, please see the VCS-MR Calculation Kitambar spreadsheet.	
Monitoring equipment	No monitoring equipment is used to determine this parameter. Production is counted by trained personnel on Kitambar ceramic industry.	
QA/QC procedures to be applied	The ceramic has an internal control of the quantity of pieces produced. It will be rechecked according to the biomass employed and the kiln consumption of renewable biomass.	
Purpose of the 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 will be 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 / Parameter	$Q_{renbiomass}$						
Data unit	Tonnes per year						
Description	Amount of renewable biomass utilized						
Source of data	Data is 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 m^3 to tonnes, the specific gravity values of some renewable biomasses are available below: <table> <tr> <th>Biomass</th><th>Specific gravity (tonnes/m^3)</th></tr> <tr> <td>Coconut husk</td><td>0.500</td></tr> <tr> <td>Residues from cashew trees</td><td>0.420</td></tr> </table>	Biomass	Specific gravity (tonnes/ m^3)	Coconut husk	0.500	Residues from cashew trees	0.420
Biomass	Specific gravity (tonnes/ m^3)						
Coconut husk	0.500						
Residues from cashew trees	0.420						

Native wood from forest management	0.807
Sawdust	0.245
Algaroba wood	0.760

Source of data:

Coconut husk:

PINHEIRO, G. F.; RENDEIRO, G.; PINHO J. T. **Densidade Energética de Resíduos Vegetais**. Biomassa & Energia, v. 2, n. 2, p. 113-123, 2005. Available at <http://www.lippel.com.br/dados/download/02-05-2014-15-30Densidade-Energetica-de-Residuos-Vegetais.pdf>. Last visit on: April, 2021.

Cashew tree residues:

LORENZI, H. **Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil**, vol.1. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002.

LORENZI, H. **Árvores Brasileiras: Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil**, vol.2. 4.ed. Nova Odessa, SP: Instituto Plantarum, 2002.

Native wood from forest management

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://www.asabrazil.org.br/images/UserFiles/File/Avaliao_dos_impactos_ambientais_gerados_por_uma_industria_cramica_tpic_a_da_regio_do_Serid-RN_dissert_2007.pdf. Last visit on: April, 2021.

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: Instituto Plantarum, 2002.

	Algaroba wood PEREIRA, J. C. D.; LIMA, P. C. F. Comparação da Qualidade da Madeira de seis Espécies de Algarobeira para a Produção de Energia. Colombo: Embrapa Florestas, 2002. p. 99-107. Cashew tree wood (conversion factor): FERRAZ, Douglas Galvão. Inventário Florestal de Três Fragmentos com Candeia (<i>Eremanthus erythropappus</i>) no Município de Itajubá - MG. 2008. 26 f. Monografia (Conclusão de Curso) - Curso de Gestão Ambiental, Escola Agrotécnica Federal, Inconfidentes-mg, 2008.																																																																																																																				
Frequency of monitoring/recording	Monthly																																																																																																																				
Value monitored	Total amount of biomasses consumed during all months of this monitoring period (tonnes): <table><tr><th></th><th colspan="4">Renewable biomass (tonnes)</th></tr><tr><th></th><th>Period</th><th>Algaroba</th><th>Sawdust</th><th>Total</th></tr><tr><td rowspan="13">2017</td><td>January</td><td>535.59</td><td>33.33</td><td>568.92</td></tr><tr><td>February</td><td>301.55</td><td>40.40</td><td>341.95</td></tr><tr><td>March</td><td>357.67</td><td>52.92</td><td>410.59</td></tr><tr><td>April</td><td>336.46</td><td>34.20</td><td>370.66</td></tr><tr><td>May</td><td>197.74</td><td>86.98</td><td>284.72</td></tr><tr><td>June</td><td>151.05</td><td>49.50</td><td>200.55</td></tr><tr><td>July</td><td>285.20</td><td>28.58</td><td>313.78</td></tr><tr><td>August</td><td>345.42</td><td>63.54</td><td>408.96</td></tr><tr><td>September</td><td>281.19</td><td>38.67</td><td>319.86</td></tr><tr><td>October</td><td>241.77</td><td>48.76</td><td>290.53</td></tr><tr><td>November</td><td>247.10</td><td>93.00</td><td>340.10</td></tr><tr><td>December</td><td>193.08</td><td>117.43</td><td>310.51</td></tr><tr><td>Total 2017</td><td>3,473.82</td><td>687.31</td><td>4,161.13</td></tr><tr><td rowspan="13">2018</td><td>January</td><td>162.87</td><td>59.06</td><td>221.93</td></tr><tr><td>February</td><td>399.25</td><td>40.59</td><td>439.84</td></tr><tr><td>March</td><td>273.44</td><td>35.69</td><td>309.13</td></tr><tr><td>April</td><td>161.70</td><td>69.61</td><td>231.31</td></tr><tr><td>May</td><td>194.13</td><td>56.67</td><td>250.80</td></tr><tr><td>June</td><td>244.50</td><td>36.05</td><td>280.55</td></tr><tr><td>July</td><td>170.75</td><td>40.78</td><td>211.53</td></tr><tr><td>August</td><td>187.88</td><td>47.28</td><td>235.16</td></tr><tr><td>September</td><td>167.79</td><td>78.83</td><td>246.62</td></tr><tr><td>October</td><td>45.61</td><td>48.40</td><td>94.01</td></tr><tr><td>November</td><td>129.51</td><td>19.84</td><td>149.35</td></tr><tr><td>December</td><td>203.90</td><td>41.31</td><td>245.21</td></tr><tr><td>Total 2018</td><td>2,341.33</td><td>574.11</td><td>2,915.44</td></tr></table>		Renewable biomass (tonnes)					Period	Algaroba	Sawdust	Total	2017	January	535.59	33.33	568.92	February	301.55	40.40	341.95	March	357.67	52.92	410.59	April	336.46	34.20	370.66	May	197.74	86.98	284.72	June	151.05	49.50	200.55	July	285.20	28.58	313.78	August	345.42	63.54	408.96	September	281.19	38.67	319.86	October	241.77	48.76	290.53	November	247.10	93.00	340.10	December	193.08	117.43	310.51	Total 2017	3,473.82	687.31	4,161.13	2018	January	162.87	59.06	221.93	February	399.25	40.59	439.84	March	273.44	35.69	309.13	April	161.70	69.61	231.31	May	194.13	56.67	250.80	June	244.50	36.05	280.55	July	170.75	40.78	211.53	August	187.88	47.28	235.16	September	167.79	78.83	246.62	October	45.61	48.40	94.01	November	129.51	19.84	149.35	December	203.90	41.31	245.21	Total 2018	2,341.33	574.11	2,915.44
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	2019	January	178.55	74.98	253.53
		February	42.22	143.39	185.61
		March	142.18	159.91	302.09
		April	171.37	60.06	231.43
		May	197.71	69.96	267.67
		June	193.66	47.33	240.99
		July	178.98	24.36	203.34
		August	155.16	4.00	159.16
		September	277.79	0.00	277.79
		October	107.49	48.91	156.40
		November	202.53	0.00	202.53
		December	219.34	0.00	219.34
		Total 2019	2,066.98	632.90	2,699.88
	2020	January	362.82	4.84	367.66
		February	198.67	1.54	200.21
		March	150.80	5.48	156.28
		April	53.50	16.82	70.32
		May	113.48	1.40	114.88
		June	178.32	21.52	199.84
		July	226.91	38.55	265.46
		Total 2020	1,284.50	90.15	1,374.65
	Total in the monitoring period		9,166.63	1,984.47	11,151.10
More detailed information is available in the VCS-MR Calculation Kitambar spreadsheet.					
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 was rechecked according to the receipts of purchase.				
Purpose of the data	This parameter is 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 is calculated based on the Net Calorific Value of each biomass, as can be seen on the VCS-MR Calculation Kitambar spreadsheet.				

	Values in the receipts from biomass providers may be described in m ³ , 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”. Values in the receipts from biomass providers may be described in “sacos” (bags), therefore it is necessary the conversion to tonnes through multiplying the amount of bags by its weight (20kg = 0.02t).
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 is given by the biomass’ providers. The biomasses (Sawdust, Native wood from forest management, coconut husk, cashew tree residues, and Algaroba firewood) are 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 is used to determine this parameter.
QA/QC procedures to be applied	The biomasses are considered renewable as they were in accordance with the definition given by the Annex 18 of the 23 rd meeting of the Executive Board from the Clean Development Mechanism ⁸ .
Purpose of the data	The objective of this data is monitoring the origin of the different types of biomasses utilized in the project.
Calculation method	Not applicable.

⁸ CDM – Executive Board. Annex 18 definition of renewable biomass. EB 23. Available at http://cdm.unfccc.int/EB/023/eb23_repan18.pdf. Last visited on: April, 2021.

Comments	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.
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Data / Parameter	Leakage of non-renewable biomass
Data unit	tCO ₂ e
Description	Leakage resulted from the non-renewable biomass
Source of data	Monitored
Description of measurement methods and procedures to be applied	The sources of leakages predicted in the applied methodology are monitored. Scientific articles, official statistical data, regional and national surveys are assessed in order to ensure that there was no leakage from non-renewable biomass (or to estimate the leakage). Please see Section 5.3: "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 will be used to monitor the leakage.
Purpose of the data	Calculation of leakage emissions. This parameter is used to quantify source of indirect emission related to non-renewable biomass. The adjustment factor is 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 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.

Source of data:

Calculations according to Annex 20 of the 35th meeting of the Small-Scale Working Group of the Clean Development Mechanism:

CDM - SSC WG. **Information note - Default values of fNRB for LDCs and SIDs.** Thirty-fifth meeting Report, Annex 20. Available at <http://cdm.unfccc.int/Panels/ssc_wg/meetings/035/ssc_035_an20.pdf>.

Fnatural forests - extent of natural forests

SNIF – Sistema Nacional de Informações Florestais. **Florestas Naturais.** Available at <<https://snif.florestal.gov.br/pt-br/os-biomas-e-suas-florestas>>.

GRnatural forests - annual growth rate of biomass in natural forests

BRASIL. Ministério da Ciência, Tecnologia e Inovação. Secretaria de Políticas e Programas de Pesquisa e Desenvolvimento. Coordenação-Geral de Mudanças Globais de Clima. **Terceira Comunicação Nacional do Brasil à Convenção-Quadro das Nações Unidas sobre Mudança do Clima – Volume III/Ministério da Ciência, Tecnologia e Inovação.** 2016. Available at <https://sirene.mctic.gov.br/porta1/export/sites/sirene/backen d/galeria/arquivos/2018/10/11/TCN_Volume_3.pdf>

Information taken from Section 1.1.5 page 294 of the report: 0.6 tC/ha is the value for annual growth of forests in the Caatinga biome. This parameter was divided by 0.47 tC/ha to convert tonne of carbon to tonne of biomass.

PA - protected area extent of forest

BRASIL. Ministério do Meio Ambiente. Departamento de Áreas Protegidas. **Painel Unidades de Conservação Brasileiras.** Available at <[### GR - annual growth rate of biomass in natural forests](https://app.powerbi.com/view?r=eyJrIjo1YjBiYzFiMWMtZTNkMS00ODk0LWI1OGltMDQ0NmUzNTQ4NzE4liwidCI6IjM5NTdhMzY3LTZkMzgtNGMxZi1hNGJhLTMzZThmM2M1NTBINyJ9>></p>
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BRASIL. Ministério da Ciência, Tecnologia e Inovação. Secretaria de Políticas e Programas de Pesquisa e Desenvolvimento. Coordenação-Geral de Mudanças Globais de Clima. **Terceira Comunicação Nacional do Brasil à Convenção-Quadro das Nações**

	Unidas sobre Mudança do Clima – Volume III/Ministério da Ciência, Tecnologia e Inovação. 2016. Available at <https://sirene.mctic.gov.br/portal/export/sites/sirene/backen d/galeria/arquivos/2018/10/11/TCN_Volume_3.pdf>. Information taken from Section 1.1.5 page 294 of the report: 0.6 tC/ha is the value for annual growth of forests in the Caatinga biome. This parameter was divided by 0.47 tC/ha to convert tonne of carbon to tonne of biomass. <u>Caatinga deforestation rate</u> INPE – Instituto Nacional de Pesquisas Espaciais. TerraBrasilis. Máscara de área acumulada de supressão da vegetação nativa – Shapefile. Available at <http://terrabrasilis.dpi.inpe.br/downloads/> <u>Total above ground biomass of the Caatinga Biome</u> SNIF – Sistema Nacional de Informações Florestais. Estoques das Florestas. Available at <https://snif.florestal.gov.br/pt-br/estoques-das-florestas> <u>Planted forests in States inside Caatinga (hectares)</u> SNIF – Sistema Nacional de Informações Florestais. Florestas Plantadas. Available at <https://snif.florestal.gov.br/pt-br/florestas-plantadas>. Information on Planted Forests Only Eucalyptus and Pinus forests are considered, as the contribution of other species to planted forests is not significant in the states belonging to the Caatinga biome. <u>Growth rate - Eucalyptus and Pinus</u> BRASIL. Ministério da Ciência, Tecnologia e Inovação. Secretaria de Políticas e Programas de Pesquisa e Desenvolvimento. Coordenação-Geral de Mudanças Globais de Clima. Terceira Comunicação Nacional do Brasil à Convenção-Quadro das Nações Unidas sobre Mudança do Clima – Volume III/Ministério da Ciência, Tecnologia e Inovação. 2016. Available at <https://sirene.mctic.gov.br/portal/export/sites/sirene/backen d/galeria/arquivos/2018/10/11/TCN_Volume_3.pdf>, pages 295-296.
Description of measurement methods and procedures to be applied	The monitoring of this parameter is based on national and international articles, databases and data monitored by the project developer such as project activities at the same region. The sources provide information about the availability of woody biomass in the Caatinga biome.

Frequency of monitoring/recording	Annually.
Value monitored	95.03%
Monitoring equipment	No monitoring equipment is used to determine this parameter.
QA/QC procedures to be applied	The monitoring of this parameter is based in national and international articles and database every monitoring period. The sources provided information about the sustainable use of <i>Caatinga</i> biome.
Purpose of the data	The purpose of the data is to determine the fraction of woody biomass that would be used in the absence of the project activity in year y.
Calculation method	More detailed information in the VCS-MR Calculation Kitambar spreadsheet.
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	Renewable biomass surplus
Data unit	tonnes or m ³
Description	Amount of renewable biomass available
Source of data	Monitored
Description of measurement methods and procedures to be applied	It is used to calculate the leakage of renewable biomass. The sources of leakages predicted in methodology applied are monitored. The measurement of the leakage is based in national and international articles and databases every monitoring period. These sources provide information about the biomass availability in the project activity's region. The bibliographic references are described on the section 5.3 "Leakage".
Frequency of monitoring/recording	Annually

Value monitored	Biomass surplus	Surplus	Year
	Native wood from forest management (m ³)	1,800,022.5	2012
	Cashew tree residues (tonnes)	176,316	2017
	Sawdust (m ³)	248,419	2016
	Coconut Husks (tonnes)	2,335,091.5	2017
	Algaroba wood (m ³)	1,900,000	2007
Detailed information in section 5.3 – 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 is 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 the total biomass available, which was calculated ex ante, according to CDM's "General guidance on leakage in biomass project activities - Version 03" ⁹ .		
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	NCV _{biomass}		
Data unit	TJ/tonne of wood		
Description	Net Calorific Value of non-renewable woody biomass that is substituted.		

⁹ General guidance on leakage in biomass project activities - Version 03. Available at <https://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf>, paragraph 18. Last visited on: June 2021.

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/S0800GYGWHMXXM287RBNKEYAMN9EUNO >. Last visit on: April, 2021. The value informed in the applied methodology is based on IPCC default for wood fuel.
Description of measurement methods and procedures to be applied	IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is "air-dried".
Frequency of monitoring/recording	Annually
Value monitored	0.015
Monitoring equipment	No monitoring equipment is used to determine this parameter
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions. This value provides the energy generated by the amount of wood that would be used in the absence of 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	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 recorded by the ceramic in a sheet with the distance between the ceramic and the furnisher. Information in section 5.2 – Project Emissions			
Frequency of monitoring/recording	Annually			
Value monitored	Provider	Origin	Destiny	Return trip distance (in kilometers) D _{f,m}

	Airon Jorge Vieira Da Silva	Rua Ozorio Ferreira dos Santos - Cumaru - PE - Postal Code 55.650-000	Rodovia BR 232, Km 136, Distrito Industrial, Caruaru - PE - Postal Code 55.000-000	120.60
	Edpaz Ind E Com De Moveis	Rua Alfredo Alves da Cunha, 276, Galpão 01, Caruaru - PE - Postal Code 55.045-025		4.20
	Erivonaldo Alves	Rua do Sol, 150, Centro, Barra de Guabiraba - PE		128.00
	Etelvino Alves	-		572.00
	Herval Nordeste Ind	Rod BR 232, KM 109, Lote 01, Polo Industrial de Bezerros, Bezerros - PE - Postal Code 55.660-000		49.40
	Jose Manoel Arruda	Sítio Lagoa do Algodão, Zona Rural, Riacho das Almas - PE - Postal Code 55.120-000		82.40
	Jw Estofados	Rod BR 232, KM 162, Galpão 02 Zona Urbana, Tacaimbó - PE - Postal Code 55.140-000		62.60
	Leodorio Pereira Da Silva	Fazenda Cachoeirinha, Zona Rural, Sertânia - PE		442.00
	Lucinaldo Soares Da Silva	Rua Esdras de Farias, 729, Salgado, Caruaru - PE - Postal Code 55.018-630		20.80
	Mademaster Ind De Moveis	Avenida Liezid Interaminense, 376, Distrito Industrial - Alto Do Moura Caruaru - PE - Postal Code 55.045-060		4.20
	Moveis São Carlos Ltda	Rua Rosa Barros de Brito Costa, 104, Afogados da Ingazeira - PE - Postal Code 56.800-000		572.00
	Movel Paz Industria	Rua Alfredo Alves da Cimja, 276, Distrito Industrial, Caruaru - PE - Postal Code 55.045-025		4.20
	Posto Molas Gerencial	Rod BR 232, KM 150, São Caitano - PE - Postal Code 55.130-000		33.40
	Vicente Nery	Sítio Peixe, S/N, Zona Rural, Ouro Velho - PB		506.00
	W L Da Silva Pereira	Rua Joaquim Moita, 42, Centro, Tacaimbó - PE - Postal Code 55.140-000		69.20

More detailed information available in the VCS-MR Calculation Kitambar spreadsheet and in the Appendix I.

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 5.2 – Project Emissions
Comments	-

Data / 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 recorded by the ceramic in a sheet with the distance between the ceramic and the furnisher. Information in section 5.2 – Project Emissions							
Frequency of monitoring/recording	Annually							
Value monitored	FR _{f,m} in tonnes							
	2017		2018		2019		2020	
	Algaroba	Sawdust	Algaroba	Sawdust	Algaroba	Sawdust	Algaroba	Sawdust
	3,473.82	687.31	2,341.34	574.11	2,066.98	632.90	1,284.50	90.15
	4,161.13		2,915.45		2,699.88		1,374.65	
	11,151.11							
	More detailed information available at Appendix I.							
	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 5.2 - Project Emissions							
Comments	Values were monitored at Monitoring Report.							

4.3 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 performs an analysis to verify if biomass and production data are being correctly filled in the monitoring spreadsheets. Analysis on production data are 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 are 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 are monitored. Scientific articles, official statistical data and 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 also assists the Ceramic personnel to double check the monitored data on biomass consumption and ceramic devices production.

Non-conformities identified in the double check procedures are clarified between Sustainable Carbon's 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. Francisco from Kitambar Ceramic Company. Sustainable Carbon's technical team (including those members described on Section 1.3) are also involved in the project monitoring.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

It is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs. The project activity in this monitoring period (43 months) generated 61.07 TJ per year. Converting this number to MWh, it was generated 16,963.08 MWh per year, which corresponds to the use of 1.94 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.

The calculation of emission reductions is described below.

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

(Equation 01)

Where:

BE_y:	Baseline emissions during the year y in tCO ₂ e
B_y:	Quantity of biomass that is substituted or displaced in tonnes
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_{projected fossil fuel}:	Emission factor for the projected fossil fuel consumption in the baseline in tCO ₂ e/TJ ¹⁰ .

B_y is determined using the following option:

¹⁰ Value obtained on the AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user - Version 7.0.

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

$$B_y = \sum_i^n HG_{p,y} \div (NCV_{biomass} \times \eta_{old,i})$$

(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,i} : Efficiency of pre-project device per type of device i.

$$HG_{p,y} = SGE \times PR_y$$

(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

$$\eta_{old} = \frac{SGE}{SFE}$$

(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

$$SFE = BF_y \times NCV_{biomass}$$

(Equation 05)

Where:

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

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

$$B_y = PR_y \times BF_y$$

(Equation 06)

As shown in the calculations above, the η_{old} is not required to calculate the Emission Reductions, thus it was excluded.

As shown in the calculations above, the η_{old} is not required to calculate the Baseline Emissions, thus it was excluded.

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 tonnes of ceramic devices.

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

Table 1. Baseline Emissions for Kitambar Ceramic

	Period	BE _y (tCO ₂ e)
2017	January	2,943.00
	february	2,373.00
	March	3,123.00
	April	1,983.00
	May	2,177.00
	June	1,666.00
	July	1,930.00
	August	2,217.00
	September	1,676.00
	October	1,743.00
	November	1,845.00
	December	1,649.00
	Total 2017	25,325.00
2018	January	1,988.00
	february	1,571.00
	March	1,697.00
	April	1,874.00
	May	1,771.00

	June	1,955.00
	July	1,957.00
	August	1,925.00
	September	1,503.00
	October	1,674.00
	November	1,855.00
	December	1,557.00
	Total 2018	21,327.00
2019	January	1,966.00
	february	1,642.00
	March	1,683.00
	April	1,754.00
	May	1,891.00
	June	1,389.00
	July	1,718.00
	August	1,573.00
	September	1,693.00
	October	1,826.00
	November	1,463.00
	December	1,606.00
	Total 2019	20,204.00
2020	January	1,518.00
	february	1,314.00
	March	1,298.00
	April	629.00
	May	1,367.00
	June	1,390.00
	July	1,548.00
	Total 2020	9,064.00
Total in the monitoring period		75,920.00

5.2 Project Emissions

According to applied Methodology¹¹, 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 using the Methodological tool “Project and leakage emissions from transportation of freight” – 0.1.1.0 where the option B “using conservative default values” will be used. The emissions caused by transportation were 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:

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

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

Table 2. Project Emissions for Kitambar Ceramic

Period	PE _y
2017	75.00
2018	20.00
2019	15.00
2020 (Until July)	5.00
Total	115.00

The detailed calculation can be found in the VCS-MR Calculation Kitambar spreadsheet.

¹¹ Available at <<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v4.pdf>> Last visit on: April, 2021.

5.3 Leakage

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

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

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

The leakage from biomass projects, like this project activity, should also be estimated according to the “General guidance on leakage in biomass project activities” (attachment C of appendix B)¹² 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 3. Different emission sources based for each type of biomass

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

Observing the Table above, the possible sources of leakage of the present project activity are the competing use of *Algaroba wood, Cashew tree, Sawdust, Native wood from forest management and Coconut husks*. All of these biomasses have enough availability as shown below demonstrating the lack of leakage for each biomass.

¹² Document available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_AttachmentC.pdf>. Last visit on: April, 2021.

Cashew tree wood

Cashew cultivation is very significant to Brazilian economy, generating an important income of around 150 million US dollars per year. It is especially important in the northeast region, where represents about 95% of Brazilian's cashew production. The Brazilian production achieved 134,580 tonnes of cashew-nuts in 2017 spread in an area of around 565,000 hectares¹³.

The pruning of cashew trees is necessary in order to allow an appropriate formation of the tree and maintaining favorable conditions for the next harvest time. This way, cashew cultivation should prune undesirable branches of the cashew trees¹⁴. Moreover, dry branches on the ground compound a considerable amount of residues from cashew trees cultivation.

There is no estimated amount of residues from cashew trees generation per year, however its abundant availability is well-known all over the country.

Cashew trees cultivation presents a density of 125 trees per hectare¹⁵, and the production of firewood residues from each tree is 2.5 kg per year¹⁶. The cultivation of cashew in the Northeast region of Brazil occupies in an area of 564,212 hectares in 2017¹⁷. This way, the production of residues from cashew trees within the Brazilian Northeast region is around 176,316 tonnes per year. The project activity estimated consumption of residues from cashew trees residues would be around 820 tonnes per year, which represents less than 1% of the total production of residues from cashew trees within the Northeast region.

During the current monitoring period there was no use of cashew tree wood, therefore, avoiding the possibility of leakage.

¹³ According to IBGE. Available at: <<https://sidra.ibge.gov.br/home/lspa/brasil>>. Last visited on: April, 2021.

¹⁴ SÁ, Filadelfio Tavares et al. **Plantando Caju**. EMBRAPA, 2000. Available at: <https://www.agencia.cnptia.embrapa.br/Repositorio/Plantando_caju_000g0591zi302wx5ok0q43a0rzirgez3.pdf>. Last visited on: April, 2021.

¹⁵ According to SEBRAE, CE. "Estudo Setorial Cajucultura". According to the study, the spacing of planting cashew tree is around 10m by 8m, which means one hectare has around 125 trees. Available at: <http://www.iac.sp.gov.br/areasdepesquisa/frutas/frutiferas_cont.php?nome=Caju>. Last visited on: April, 2021.

¹⁶ CEPEL. Manual de Aplicação de sistemas descentralizados de Geração de Energia elétrica para projetos de Eletrificação rural. Eletrobrás, Rio de Janeiro RJ, 2000. 41 p.

¹⁷ According to IBGE. Available at: <<https://sidra.ibge.gov.br/home/lspa/nordeste>>. Last visited on: April, 2021.

Algaroba wood

According to Silva (2007)¹⁸, *Algaroba*¹⁹ (*Prosopis juliflora* (Sw.) D.C.) is a tropical legume tree fairly common in the semi-arid region of Brazil, which thrives in dry environments where other plants would hardly survive. A research made by EMBRAPA²⁰, which encompass the States of Pernambuco and Bahia, affirmed that *Algaroba* is characterized as an invasive exotic plant due to its fast expansion, which causes many environmental impacts²¹. This source stated that there were several centers of *Algaroba* operation highlighting the San Francisco Water Basin, which is comprised for many municipalities from the states of Bahia and Pernambuco, including this project region. Besides, *Algaroba* presents a considerable capacity of regeneration and dispersal²² which means that the plant does not die, it sprouts again instead.

The research's author reported that wood from *Algaroba* exploration on San Francisco Basin is mainly commercialized as fuel for industries of vegetable oil, leather, ceramic and bakeries. The factors which contribute most to the expansion of *Algaroba* uses, as firewood in these industries sectors, were its wide availability in the region and its legal release extraction from IBAMA²³.

The same research estimated that in the Northeast semi-arid region there were about 500 thousands hectares spread through every typs region land. Moreover, according to EMBRAPA (1992)²⁴, wood's production by *Algaroba* is at least 5 m³/ha/year, i.e. the production in the project's region is about 2,500 thousands of m³ per year, which corresponds to 1,900,000 tonnes per year. As Kitambar Ceramic would consume approximately 6,578.3 tonnes of *Algaroba* wood per year, it represented just 0.35% of the total of *Algaroba* wood produced in the region.

In this monitoring period, Kitambar Ceramic consumed approximately 2,558.13 tonnes of *Algaroba* wood per year, which represents around 0.13% of the total of *Algaroba* wood produced in the region. Thus, the amount of residues from *Algaroba* wood necessary to provide thermal energy at the ceramic kilns is not significant, avoiding the possibility of leakage.

¹⁸ Silva, C. G. M, Melo Filho, A. B., Pires, E. F., Stamford M. Physicochemical and microbiological characterization of mesquite flour (*Prosopis juliflora* (Sw.) DC). Ciênc. Tecnol. Aliment., Campinas, 27(4): 733-736, out.-dez. 2007.

¹⁹ *Algaroba* may also be known as mesquite.

²⁰ EMBRAPA is the Brazilian Agricultural Research Corporation's which its mission is to provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer.

²¹ ARAUJO, J. L. P., CORREIA, R. C., ARAUJO, E. P., LIMA, P. C. F. Cadeia Produtiva da *Algaroba* no Pólo de Produção da Bacia do Submédio São Francisco. EMBRAPA. Petrolina - PE - Brazil

²² EMBRAPA, Projeto vai definir manejo para evitar invasão da *Algaroba* no ambiente semi-árido. Avaliable at <http://www.cpatia.embrapa.br:8080/noticias/bkp_noticiasantigas/noticia17.html>. Last visit on: April, 2021.

²³ IBAMA (Brazilian Institute for Environment and the Renewable Natural Resource) is the environmental agency of Brazil affiliated with Ministry of Environment. The main missions of IBAMA are Environmental Protection, Environmental Licensing, Environmental Quality and Sustainable Use of Forest Management and Animal Resources. More information about IBAMA is available at <<https://www.gov.br/ibama/pt-br>>. Last visit on April, 2021.

²⁴ EMBRAPA, Comunicado Técnico N°, Nov/92, p.1-2. Available at: <http://www.cpatia.embrapa.br/public_eletronica/downloads/COT51.pdf>. Last visit on: April, 2021.

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 5975/06²⁵.

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.year²⁶, 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 biome²⁷.

Considering that the exploration is in blocks (in order to sustainable forest exploitation annually)²⁸, 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 consumption presented in this project activity is about 89.8 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.

During the current monitoring period there was no use of Native wood from forest management, therefore, avoiding the possibility of leakage.

Coconut husks

The coconut has diverse uses, such as food, water, fiber among others. In the northeast region of Brazil, the production of coconuts was around 1,334,338 thousands of units in 2017²⁹. Each

²⁵ BRASIL. Lei n°. 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: April, 2021.

²⁶ BRASIL. Estatística Florestal da Caatinga/MMA. Ano 2. Vol. 2 (ago. 2015). Natal, RN: APNE, 2015. Available at <<https://www.terrabrasil.org.br/ecotecadigital/index.php/estantes/pesquisa/3415-estatistica-florestal-da-caatinga-ano-2-vol-2>>. Last visit on: April, 2021.

²⁷ CNIP, 2012. Available at <http://www.cnip.org.br/planos_manejo.html>. Last visit on: April, 2021.

²⁸ 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.

²⁹ According to IBGE Available at <<https://sidra.ibge.gov.br/home/lspa/nordeste>> Last visit on: April, 2021.

unit produces around 1.75 Kg³⁰ of residues, thus 2,335,091.5 tonnes of coconut husks were generated in 2017. The project activity will employ around 350 tonnes of coconut husk per year, representing less than 1% of the coconut husk available at the region.

During the current monitoring period there was no use of coconut husk, therefore, avoiding the possibility of leakage.

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 m³³¹ in 2016. Considering that around 22% of the wood produced will generate sawdust³². Thus, it can be assumed that around 248,835.2 m³ of sawdust was generated. The average use of sawdust in this project activity is 586.2 tonnes, which means 2,284.53 m³ per year, That represents 0.92% of the production. This way, this renewable biomass did not have potential to generate leakage emissions.

In this monitoring period, the project activity was responsible for the consumption of around 553.81 tonnes per year, which means around 2,260.43m³ per year and represents around 0.90% of the total production of residues from sawdust. Thus, the amount of residues from sawdust necessary to provide thermal energy at the ceramic kilns is not significant, avoiding the possibility of leakage.

Eucalyptus wood (reforestation wood)

The area destined for afforestation in Brazil corresponds to 5.6 millions of hectares, where the *Eucalyptus* genus corresponds to 3.5 millions of this area, and can generate 23 to 25 tonnes of biomass per hectare³³. The grand majority of these cultivations were established in the middle of 1970 to 1980.

In addition, sustainable management afforestation practices in Brazil (i.e. the techniques of preparation, fertilization, control of weeds, improved seeds, cloning and reform) were introduced and constantly improved in order to increase its productivity³⁴. As a consequence, Brazil withholds the best productivity rates (in m³/ha/year) over the world due to the adaptation of these species

³⁰ According to BBC Available at http://www.bbc.com/portuguese/noticias/2014/02/140207_coco_sub_reciclagem_cidades_pai Last visit on: April, 2021.

³¹ According to IBGE. Available at <https://cidades.ibge.gov.br/> Last visit on: April, 2021

³² 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.

³³ Brazilian Society of Forestry. Available at <http://sbs.org.br/atualidades.php>. Last visit on: April, 2021

³⁴ MCT/IPEF. **Silvicultura e Manejo**

to the Brazilian territory and the success of the experiments of genetic improvement³⁵. The total area of Eucalyptus wood cultivation in the Northeast Region of Brazil is 901,218 ha. Eucalyptus can generate around 25 tonnes of biomass per hectare³⁶. The total production of Eucalyptus wood is the amount of 22,530,450.00 tonnes per year. Considering that the factory uses just this biomass for one year to generate 159.62 TJ, it was estimated the average of annual consumption of this kind of fuel as around 10,232.05 tonnes representing 0.045% of the total of *Eucalyptus* wood produced.

During the current monitoring period there was no use of Eucalyptus wood from reforestation, therefore, avoiding the possibility of leakage.

Sugar Cane Bagasse

According to CGEE, one tonne of sugar cane produces about 140 kilograms of sugar cane bagasse and finally 90% of this amount can be used to energy production. According to UNICA³⁷, Alagoas, Bahia and Pernambuco produced 31,590,000 tonnes of Sugar Cane in 2016. Thus the production of sugar cane bagasse that can be used to energy was around 3,980,340 tonnes. Considering that the factory uses just this type of biomass for one year for the generation of 159.62 TJ, it was estimated the average of annual consumption of this kind of fuel as around 21,184.37 which represents 0.53% of the total Sugar Cane Bagasse produced in the region.

During the current monitoring period there was no use of sugar cane bagasse, therefore, avoiding the possibility of leakage.

Aveloz wood

Euphorbia tirucalli, most known as Aveloz, is a juicy plant and medium size tree, widespread occurrence in the continents. The plant is usually used in popular, folk medicine. The specie has origin in Africa, grows and develops well at tropical weather and also became a very successful intruder in Caatinga biome. The branch leaves are usually used for cancer treatment by popular medicine in Brazilian Northeast. This fact has been subject of many medicine studies of pharmacy in Brazil. Aveloz is a shrub that grows over a limit of 3m, and is used as quickset. This specie forms dense shrubs, which are cut to avoid the invasion to the property. It is important lay emphasis on the fact that the Aveloz would be extracted even without the project activity, and would not have another sustainable destination. According to IBGE (Instituto Brasileiro de Geografia Estatística) in 2008 the State of Pernambuco produced approximately 1.8 million per m³ of firewood³⁸, which represents 1,008,000 tonnes. Considering that the factory uses just this type of biomass for one year for the generation of 159.62 TJ, it was estimated the average of

³⁵ JUVENAL, T. L.; MATTOS, R. L. G. **O setor florestal no Brasil e a importância do reflorestamento**. BNDES Setorial, Rio de Janeiro, n. 16, p. 3-30, set. 2002.

³⁶ Source: IBGE. Available at <<http://www.imaflorestal.com/noticias/producao-de-biomassa-um-novo-uso-para-o-eucalipto>> Last visit on: April, 2021.

³⁷ Source: Unica. Available at <<http://www.unicadata.com.br/historico-de-producao-e-moagem.php?idMn=32&tipoHistorico=4&acao=visualizar&idTabela=1803&safr=2015%2F2016&estado=BA%2CAL%2CPE>> Last visit on: April, 2021.

³⁸ IBGE – Instituto Brasileiro de Geografia e Estatística. Pernambuco: Extração vegetal e silvicultura 2008. Available at: <<http://www.sidra.ibge.gov.br/bda/extveg/default.asp?t=2&z=t&o=18&u1=23&u3=1&u2=23>>. Last visit on: April, 2021.

annual consumption of this kind of fuel as around 10,232.05 tonnes which represents 1.01% of the total Aveloz wood produced in the region.

During the current monitoring period there was no use of Aveloz wood, therefore, avoiding the possibility of leakage.

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

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 equipment had to be acquired.

Table 4. Production – Qrenbiomass – QA/QC Procedure

		VCS PD	Monitoring period
Period total production of ceramic at Kitambar Ceramic (tonnes of ceramic units)		86,432.15	50,220.24
Qrenbiomass (tonnes)	Algaroba wood	23,572.17	9,166.63
	Sawdust	2,100.55	1,984.47
Thermal Energy (TJ) generated at the ceramic industry		518.72	218.82
Thermal energy per tonnes pieces produced (TJ/tonnes of pieces)		0.0060	0.0044

As can be verified on Table 4, the thermal energy generated with the use of Algaroba wood and Sawdust per tonne of ceramic devices produced, during the current monitoring period, was lower when comparing to the projections on the VCS-PD - Version 08, as was the amount of renewable biomass utilized.

Although, when it is calculated how many tonnes of ceramic units were produced with the corresponding tonnes of renewable biomass, it is possible to conclude that more tonnes of ceramic units were produced with a lesser amount of renewable biomass in the Monitoring Period (4.50 tonnes of ceramic units per tonne of renewable biomass) than in the VCS-PD's estimates (3.37 tonnes of ceramic units per tonne of renewable biomass).

Therefore, based on Category AMS-I.E.: Switch from Non-Renewable Biomass for Thermal Applications by the User - Version 7.0, valid from 22-July-2016 to 31-October-2017, this project activity contributes to Sustainable Development, once the ceramic company is using renewable biomass and applying the SOCIALCARBON methodology.

5.4 Net GHG Emission Reductions and Removals

This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy technologies. The project's emissions from the combustion of native wood are accounted in the same way as fossil fuel combustion, once it is non-renewable and emits CO₂.

Emissions reductions are to be estimated based on the equation below:

$$ER_y = BE_y - PE_y - LE_y \quad (\text{Equation 8})$$

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

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)
2017	25,325.00	75.00	0.00	25,250.00
2018	21,327.00	20.00	0.00	21,307.00
2019	20,204.00	15.00	0.00	20,189.00
2020	9,064.00	5.00	0.00	9,059.00
Total	75,920.00	115.00	0.00	75,805.00

APPENDIX I

Table 5. Total mass of freight transported in freight transportation activity f in monitoring period m

Provider	FRf,m in tonnes							
	2017		2018		2019		2020	
	Algaroba	Sawdust	Algaroba	Sawdust	Algaroba	Sawdust	Algaroba	Sawdust
Airon Jorge Vieira Da Silva	2,490.46	0.00	1,828.86	0.00	2,044.38	0.00	1,004.29	0.00
Edpaz Ind E Com De Moveis	0.00	5.92	0.00	0.00	0.00	0.00	0.00	0.00
Erivonaldo Alves	0.00	0.00	0.00	0.00	0.00	0.00	10.31	0.00
Etelvino Alves	0.00	0.00	47.52	0.00	0.00	0.00	0.00	0.00
Herval Nordeste Ind	0.00	344.93	4.19	361.65	0.00	358.48	0.00	0.00
Jose Manoel Arruda	0.00	0.00	0.00	0.00	22.60	0.00	269.90	0.00
Jw Estofados	0.00	29.78	0.00	80.90	0.00	25.20	0.00	0.00
Leodorio Pereira Da Silva	960.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lucinaldo Soares Da Silva	0.00	0.00	336.43	0.00	0.00	0.00	0.00	0.00
Mademaster Ind De Moveis	0.00	42.90	0.00	0.00	0.00	0.00	0.00	0.00
Moveis São Carlos Ltda	23.12	244.50	47.43	78.04	0.00	196.72	0.00	55.81
Movel Paz Industria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48
Posto Molas Gerencial	0.00	19.28	0.00	53.52	0.00	52.50	0.00	0.00
Vicente Nery	0.00	0.00	76.91	0.00	0.00	0.00	0.00	0.00
W L Da Silva Pereira	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.86
otal	3,473.82	687.31	2,341.34	574.11	2,066.98	632.90	1,284.50	90.15
	4,161.13		2,915.45		2,699.88		1,374.65	
	11,151.11							