



# Verified Carbon Standard

## ONIL STOVES —GUATEMALA — USPANTÁN

Document Prepared by

C-Quest Capital Malaysia Limited

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<b>Project ID</b>	1721
<b>Monitoring Period</b>	20-December-2020 to 30-September-2021
<b>Prepared By</b>	C-Quest Capital Malaysia Limited
<b>Contact</b>	Address: C-Quest Capital Malaysia Limited, Brumby Centre, Lot 42, Jalan Muhibbah, 87000 Labuan F. T., Malaysia, Telephone: +6 087 593828 Email: <a href="mailto:vgarg@cquestcapital.com">vgarg@cquestcapital.com</a> Website: <a href="http://www.cquestcapital.com">www.cquestcapital.com</a>

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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Implementation Status of the Project

- **A summary description of the implementation status of the technologies/ measures (eg, plant, equipment, process, or management or conservation measure) included in the project.**

The project involves the distribution and installation of ONIL Stoves for use by households in Guatemala. Before the adoption of the ONIL Stove, households in Guatemala used inefficient, conventional open fire. The ONIL Stove is a fuel-efficient stove that reduces the amount of firewood required by households by up to 58%, compared to the baseline, and results in lower emissions based on its construction. A single ONIL Stove will save 3.837 tons of CO<sub>2e</sub> per year.

The project was included as the first CPA under CDM PoA entitled “ONIL Stoves –Guatemala – Uspantán” (CDM PoA reference number - 8480, CPA reference number – 8480-0001).<sup>1</sup>

- 1) The first ONIL Stove was installed on 11-January-2010. Till the end of monitoring period, a total of 11,132 ONIL Stoves was reported installed under the project.

All the data recorded during stove registration process was captured via hard copy of registration card. The information collected is then transferred to a project database.

- **The relevant implementation dates (eg, dates of construction, commissioning, and continued operation periods).**

### CDM CPA inclusion

Date of CPA inclusion into PoA	19-December-2012
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### Installation of ICS

Date of first ICS installed	11-January-2010
Date of last ICS installed in the database	11-August-2012

### First Monitoring Survey

Survey dates for parameters $n_y$ and $SS_y$	01-February-2017 to 28-March-2017
Survey dates for parameter $\eta_{new,y,i}$	28-February-2017 to 16-March-2017

<sup>1</sup> <https://cdm.unfccc.int/UserManagement/FileStorage/6M3UGFJRC8TBWP4DKQA2Y9ZXS0IH1L>

**Second Monitoring Survey**

Survey dates for parameters $n_y$ and $SS_y$	08-June-2018 to 11-June-2018
Survey dates for parameter $\eta_{new,y,i}$	15-June-2018 to 28-June-2018

**Third Monitoring Survey**

Survey dates for parameters $n_y$ and $\mu_y$	01-October-2020 to 31-October-2020
Survey dates for parameter $\eta_{new,y,i}$	29-September-2020 to 03-November-2020

- **The total GHG emission reductions or removals generated in this monitoring period.**

The project results in a total emission reduction of 70,983 tCO<sub>2</sub>e over the monitoring period of 20-December-2020 to 30-September-2021.

## 1.2 Sectoral Scope and Project Type

The project is categorized under type/category as below:

- Sectoral scope:** 03 - Energy demand
- Type:** I – Energy efficiency improvement projects

The project is not a grouped project.

## 1.3 Project Proponent

<b>Organization name</b>	HELPS International Incorporated
<b>Contact person</b>	Mr. Richard Grinnell
<b>Title</b>	Director of Stove Project and Vice President of International Development
<b>Address</b>	Calzada Atanasio Tzul 21-00 Zona 12, Complejo Empresarial El Cortijo II, Bodega 517, Guatemala.
<b>Telephone</b>	011(502) 2428-6600
<b>Email</b>	<a href="mailto:richardgrinnell@helpsinternational.com">richardgrinnell@helpsinternational.com</a>

<b>Organization name</b>	C-Quest Capital LLC
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Contact person	Isabel Alegre
Title	Managing Director
Address	1015 18 <sup>th</sup> Street NW Suite 730 Washington, DC 20036 United States of America
Telephone	+1 (202) 416-2400
Email	<a href="mailto:ialegre@cquestcapital.com">ialegre@cquestcapital.com</a>

## 1.4 Other Entities Involved in the Project

Other entities are not involved in the development of the project.

## 1.5 Project Start Date

The start date of this project is 11-January-2010, which is the date when ONIL stoves were first delivered (implementation) after the POA and its first CPA were published for Global Stakeholder Consultation at the UNFCCC website.<sup>2</sup>

## 1.6 Project Crediting Period

First Crediting Period: 20-December-2010 to 19-December-2020, ten years, renewable twice, but not extending beyond 13-December-2034 when the maximum CDM crediting period expires<sup>3</sup>

Second Crediting Period: 20-December-2020 to 19-December-2030

<sup>2</sup> As per paragraph 3.19.7 of VCS Standard Version 4.0, “for projects registered under the CDM as a Program of Activities (PoA), each Component Project Activity (CPA) shall be registered with the VCS Program as a separate project accompanied by its associated Program of Activities Design Document... The project start date for such projects is the date on which the first activity under the Program of Activities began reducing or removing GHG emissions. Where the project start date is before 8 March 2011, validation shall be completed within four years of the project start date; (in this case, validation refers to validation of the first CPA under the associated PoA)”.

<sup>3</sup> At the time of registration of this project under VCS, the applicable version of VCS standard was version 3.7 and in accordance with the VCS standard version 3.7 paragraph 3.8.1 that states “For non-AFOLU projects and ALM projects focusing exclusively on reducing N<sub>2</sub>O, CH<sub>4</sub> and/or fossil-derived CO<sub>2</sub> emissions, the project crediting period shall be a maximum of ten years which may be renewed at most twice.” Paragraph 3.8.3 of the standard mentions “Projects registered under other GHG programs are not eligible for VCU issuance beyond the end of the total project crediting period under those programs. For example, a CDM project with a seven year twice renewable project crediting period is not eligible for VCU issuance beyond the end of those 21 years”.

## 1.7 Project Location

Each SSC-CPA will contain a delineated set of households in which ONIL Stoves have been installed within Guatemala. (CPA Implementer) will record names of end-users and the exact location in the SSC-CPA in the program database. End-user names and locations and stove identification numbers will be collected on stove purchase contracts. The sum of the location of these households as within Guatemala, will define the spatial boundary of the SSC-CPA.

The key geographic location of the applied measure (improved cook stoves) is determined using the database of unique stove IDs, the household addresses, GPS coordinates and owners' names and national ID card numbers. These parameters uniquely identify the household. The CPA boundaries equal Guatemala's borders. The geographic coordinates for Guatemala, the CPA boundary, are: Northernmost point N 17° 48.744894' W 89° 9.902344' (*Reserva de la Biosfera Calakmul*), Westernmost point: N 14° 32.202449' W 92° 13.483887; Southernmost point: N 13° 45.280865' W 90° 7.910156 (*Carretera del Litoral*); Easternmost point: N 15° 43.469738' W 88° 13.872070 (*Carretera 13*).

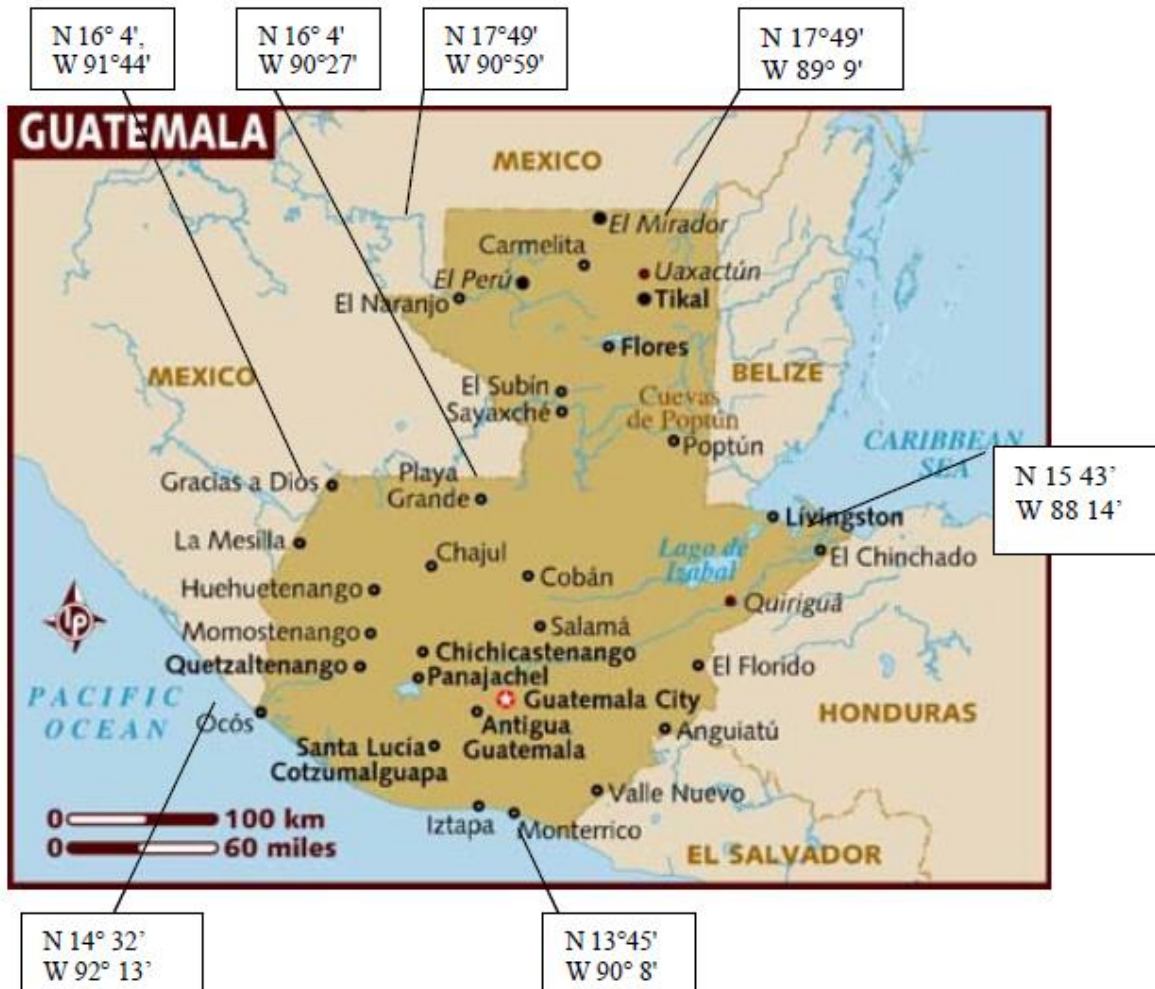


Figure 1. Map of Guatemala, Uspantán CPA<sup>4</sup>

## 1.8 Title and Reference of Methodology

VMR0006: Methodology for Installation of High Efficiency Firewood Cookstoves, Version 1.1<sup>5</sup>

## 1.9 Participation under other GHG Programs

“ONIL Stoves –Guatemala – Uspantán” is registered as a Small-Scale Component Project Activity under the Clean Development Mechanism (CDM) and under the Programme of Activities “Distribution of ONIL Stoves – Guatemala” (Ref. PoA 8480).<sup>6</sup>

## 1.10 Other Forms of Credit

The project is not included in an emissions trading program or any other mechanism that includes GHG allowance trading.

## 1.11 Sustainable Development

The following are contributions of the project to sustainable development:

### **Environmental sustainability**

(i) The project reduces the use of non-renewable biomass:

By adopting the higher efficiency ONIL Stove, households reduce the quantity of fuel wood they must consume for daily cooking needs. When compared to firewood consumption of conventional open fires, the ONIL Stove on average reduces firewood consumption by 58 percent. Since a very high proportion of fuel wood comes from non-renewable sources, this translates directly into reduced emission reductions from non-renewable extraction of wood.

(ii) The project also supports the objectives of national climate change policies and programs.

The Programa Nacional de Cambio Climatico (PNCC) within the Environment Ministry of Guatemala is charged with assessing the risks of climate change and recommending policies to reduce the country’s vulnerabilities. The project is in line with the PNCC aim of generating projects within Guatemala that promote forest management, a critical and vulnerable sector identified by the Program. By installing improved cook stoves, households reduce firewood consumption, thus helping maintain forest stocks within the country.

<sup>4</sup> [www.lonelyplanet.com/maps/central-america/guatemala/map\\_of\\_guatemala.jpg](http://www.lonelyplanet.com/maps/central-america/guatemala/map_of_guatemala.jpg)

<sup>5</sup> <https://verra.org/methodology/vmr0006-methodology-for-installation-of-high-efficiency-firewood-cookstoves/>

<sup>6</sup> CDM document can be accessed through:  
[https://cdm.unfccc.int/ProgrammeOfActivities/poa\\_db/NOIZR3S1J58FLTHUKMB2X6PY07CE49/view](https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/NOIZR3S1J58FLTHUKMB2X6PY07CE49/view) (PoA) and  
[https://cdm.unfccc.int/ProgrammeOfActivities/cpa\\_db/Q158GU3XA9MFE0H2Z6OI4JTNDL7WRP/view](https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/Q158GU3XA9MFE0H2Z6OI4JTNDL7WRP/view) (CPA 001)

### **Economic Sustainability**

(i) The project reduces household expenditures:

The PoA will contribute significantly to Guatemala economic sustainability through the more efficient use of firewood. Energy savings at both individual household and national levels make important contributions to their economic efficiency and sustainability. The use of the ONIL Stoves will reduce firewood consumption by approximately 58 percent from baseline consumption, significantly reducing household expenditures. By installing improved cook stoves, these households would save significantly on household expenditures related to firewood purchases along with saving time spent gathering firewood, which would free up time for households for other income generating activities. These savings would help improve living conditions for households in Guatemala.

(ii) The project results in creation of new jobs and development of new skill sets:

The ONIL Stove distribution program, which all CPAs will follow, relies on community organizers to facilitate demonstrations and organize training sessions. As these community organizers increase their knowledge about stoves, they often become professional installers and help maintain the stoves in their community. As uptake of stove technologies spreads, it will allow for expansion of manufacturing facilities to meet increased demand, thus generating more employment opportunities within the country.

### **Social Sustainability**

(iii) The project helps to improve health conditions:

There are very tangible and significant health benefits associated with the switch in technology from conventional open fires to improved cook stoves. Traditional cooking methods involve conventional open fires that result in the emissions of local pollutants such as carbon monoxide and particulate matter in often poorly ventilated rooms, which lead to respiratory problems. In addition, conventional open fires are frequent causes of burns and other injuries. Switching from conventional open fires to ONIL Stoves reduces the incidence of such injuries and health problems.

## **2 SAFEGUARDS**

### **2.1 No Net Harm**

The PoA involves the distribution and installation of ONIL certified improved cook stoves to households in Guatemala which currently use mostly traditional open fire for cooking. The activities under the proposed SSC-PoA promote improved cook stoves that result in reduced fuel consumption and emissions due to cooking and heating water in homes. The ICS used in this SSC-PoA have characteristics that improve the efficiency of combustion and thermal transfer to the pot compared with three-stone fires or traditional pot support. Furthermore, traditional

cooking methods involve open fires that result in the emissions of local pollutants such as carbon monoxide and particulate matter in often poorly ventilated rooms, which lead to respiratory problems. In addition, open fires are frequent causes of burns and other injuries. Switching from fireplaces to ICS reduces the incidence of such injuries and health problems. Therefore, the ONIL Stove installed under this project presents positive environmental impacts wherever they are applied, and no negative environmental impacts have been identified.

## 2.2 Local Stakeholder Consultation

The local stakeholder consultation was done at PoA level, prior to the registration of the PoA. The first stakeholder meeting for the POA was conducted in Agua Blanca, Quetzaltenango on 15 December 2009. A series of similar meetings followed this.

The outcomes from the local stakeholder consultation is available in Section F of the PoA-DD<sup>7</sup>.

PP conducted regular spot checks to observe that project ICS were being used properly and to get feedback from stakeholders on ICS usage and its benefits. Also, registration card contains contact details of local PP representative through which ICS users can contact PP for any concerns /comments on the project or project ICS. If any stove part is damaged or missing, then PP representatives immediately arrange for replacement of missing/damaged parts.

No negative comment received during the ongoing communications with stakeholders during this monitoring period.

## 2.3 AFOLU-Specific Safeguards

This project is non-AFOLU project.

# 3 IMPLEMENTATION STATUS

## 3.1 Implementation Status of the Project Activity

Implementation status of the project activity has already been described under section 1.1.

## 3.2 Deviations

### 2.3.1 Methodology Deviations

This project did not apply any methodology deviations.

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<sup>7</sup> CDM: Distribution of ONIL Stoves—Guatemala (unfccc.int)

### 2.3.2 Project Description Deviations

**Sampling method:** The sampling method applied in the registered monitoring plan is multi-stage sampling. Multi-stage sampling is a sophisticated method which is not easy to be implemented and the data analysis is difficult. Given that the population being studied is relatively homogeneous with respect to the parameter being studied, therefore simple random sampling was chosen to replace the existing sampling method from first VCS verification.

**Applied Methodology:** applied methodology in the registered project activity is AMS II.G, version 3. VCS methodology VMR0006 “Methodology for Installation of High Efficiency Firewood Cookstoves” Version 01 has now approved under VERRA for this type of projects. PP has switched from the registered methodology AMS II.G to VCS methodology VMR0006. There is no negative impact on conservativeness of quantification of GHG emission reduction as a result of deviation.

### 3.3 Grouped Projects

The project is not grouped project.

## 4 DATA AND PARAMETERS

### 4.1 Data and Parameters Available at Validation

<b>Data / Parameter</b>	<b>Bold</b>
<b>Data unit</b>	Tonnes/year
<b>Description</b>	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
<b>Source of data</b>	Baseline surveys, ex-ante
<b>Value applied:</b>	8.05
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	The baseline survey assessed the average biomass usage per household per annum amongst users of traditional 3-stone fires or traditional pot support, according to interviews in Guatemala.
<b>Purpose of the data</b>	Calculation of baseline and project emissions
<b>Comments</b>	See CDM PoA-DD for more details on the baseline measurement

<b>Data / Parameter</b>	<b>L</b>
<b>Data unit</b>	Fraction
<b>Description</b>	Net to gross adjustment factor to account for leakage
<b>Source of data</b>	Paragraph 8.3 of the VMR 0006 methodology, version 1.1
<b>Value applied:</b>	0.95
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	A net to gross adjustment factor (0.95 default) is applied in order to adjust $B_{old}$ to account for leakages as per paragraph 8.3 of the VMR 0006, version 1.1 methodology.
<b>Purpose of the data</b>	Calculation of leakage
<b>Comments</b>	-

<b>Data / Parameter</b>	$\eta_{old}$
<b>Data unit</b>	Fraction
<b>Description</b>	Efficiency of baseline stove
<b>Source of data</b>	Paragraph 9.2, of the VMR 0006 methodology, version 1.1, default
<b>Value applied:</b>	0.10 (default for conventional open fires, as stated in the methodology)
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Provided as default value since replaced system is conventional open fire.
<b>Purpose of the data</b>	Calculation of baseline and project emissions
<b>Comments</b>	-

<b>Data / Parameter</b>	$f_{NRB,y}$
<b>Data unit</b>	Fraction
<b>Description</b>	Fraction of non-renewable biomass saved by the project activity
<b>Source of data</b>	FAO, ex-ante, calculated
<b>Value applied:</b>	0.7982
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	For biomass savings to be calculated, the portion of biomass used that is renewable must be accounted for based on the methodology. The Guatemalan Institute of Forest publications give the number of hectares of reforested area. This area was multiplied by an expected growth volume of different types of forest ( $m^3/ha/yr$ ) and multiplied by an average density of wood, which

	<p>give the total demonstrably renewable biomass of all the reforested land.</p> <p><math>B_{old}</math> is taken from the baseline survey and adjusted (<math>B_{old}</math>) to account for the quantity of fuel wood used by baseline stoves households that have ONIL and baseline stoves. <math>B_{old}</math>, is then multiplied by the estimated number of homes in Guatemala (1.746 million) that still use open fires to obtain an estimate of the total amount of fuel wood used in Guatemala (<math>B_{oldGuatemala}</math>).</p> <p>NRB is <math>B_{old\_Guatemala}</math> (excluding fuel wood used in baseline stoves) minus the DRB component . Then, <math>fNRB = NRB/(NRB + DRB)</math></p>
Purpose of the data	Calculation of baseline and project emissions
Comments	-

Data / Parameter	$NCV_{biomass}$
Data unit	TJ/t
Description	Net calorific value of non-renewable biomass that is substituted
Source of data	IPCC default value for fuel wood, ex-ante, VMR 0006 methodology, version 1.1.
Value applied:	0.0156 TJ/tonne
Justification of choice of data or description of measurement methods and procedures applied	Default value that is provided in VMR 0006, version 1.1
Purpose of the data	Calculation of baseline and project emissions
Comments	-

Data / Parameter	$EF_{wf,CO2}$
Data unit	$tCO_2/TJ$
Description	CO2 emission factor for the use of wood fuel in baseline scenario
Source of data	IPCC default value, ex-ante, VMR 0006 methodology, version 1.1.
Value applied:	112 $tCO_2/TJ$
Justification of choice of data or description of measurement methods and procedures applied	Default value that is provided in VMR 0006, version 1.1
Purpose of the data	Calculation of baseline and project emissions

<b>Comments</b>	-
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<b>Data / Parameter</b>	EF <sub>wf,non CO2</sub>
<b>Data unit</b>	tCO <sub>2</sub> /TJ
<b>Description</b>	Non-CO <sub>2</sub> emission factor for the use of wood fuel in baseline scenario
<b>Source of data</b>	IPCC default value, ex-ante, VMR 0006 methodology, version 1.1.
<b>Value applied:</b>	26.23 tCO <sub>2</sub> /TJ
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Default value that is provided in VMR 0006, version 1.1
<b>Purpose of the data</b>	Calculation of baseline and project emissions
<b>Comments</b>	-

## 4.2 Data and Parameters Monitored

<b>Data / Parameter</b>	N <sub>y,i,j</sub>
<b>Data unit</b>	Quantity
<b>Description</b>	Number of ONIL Stoves in operation during the monitoring period as determined by the monitoring survey. This includes total number of stoves distributed/installed in the entire CPA.
<b>Source of data</b>	ONIL Stove registration data and data from monitoring surveys
<b>Description of measurement methods and procedures applied</b>	The percentage of stoves found to be still in operation based on the sampling plan in this monitoring period is applied to the total number of stoves distributed/installed in each CPA included in the sample (according to the ICS registration records in the monitoring database and the applicable sample frame). The proportion of sampled ICS found in operation in this monitoring period was applied to the total number of stoves for each CPA when calculating emission reductions.
<b>Frequency of monitoring/recording</b>	Data from Registration Cards was uploaded to database continuously to come up with the overall number of stoves installed under the CPA. Monitoring surveys captured the fraction of operational ONIL stoves.
<b>Value applied:</b>	10,868
<b>Monitoring equipment</b>	Monitoring surveys and registration card records loaded into CPA database

<b>QA/QC procedures applied</b>	<p>Staff was trained to obtain unbiased and reliable survey data. Monitoring database was checked for errors. There were four cases in which the stoves were not considered in use despite users affirming using stoves:</p> <ol style="list-style-type: none"> <li>1. When surveyors discovered, based on visual inspections or their observations that a stove was not in use.</li> <li>2. When users had another type of improved cookstove along with the ONIL stove. The measure was taken to prevent double counting with other programs and to accurately estimate emissions reductions (as the presence of another improved cookstove may affect the baseline).</li> <li>3. In cases where there was no prior use of three stone fires. In these cases, the firewood baseline would not be applicable.</li> <li>4. When stoves were modified to operate as three stone fires (e.g., when insulating material and combustion chamber were removed).</li> </ol>
<b>Purpose of data</b>	Calculation of baseline and project emissions
<b>Calculation method</b>	<p>10,868 = 0.9763 multiplied by 11,132 stoves eligible in the database.</p> <p>Note: The percentage of ONIL stove was found in operation from the survey is 97.63%.</p>
<b>Comments</b>	<p>Stoves that that were used along other types of improved cookstoves, or where the baseline was not applicable (because households were not using three-stone fires prior to the ONIL stove installation or because they were already using another type of improved cookstove) were considered as non-operational and discounted from the fraction of stoves that remain in operation. The removal of these stoves resulted in more conservative emissions reductions estimates.</p>

<b>Data / Parameter</b>	$t_{y,j}$
<b>Data unit</b>	Fraction
<b>Description</b>	Fraction of project's monitoring period the stove is in operation (weeks in operation/total weeks in monitoring period)
<b>Source of data</b>	ONIL Stove registration data in monitoring database and length of monitoring period
<b>Description of measurement methods and procedures applied</b>	Calculated from database records
<b>Frequency of monitoring/recording</b>	Calculated value
<b>Value applied:</b>	1.00 [average]
<b>Monitoring equipment</b>	--

QA/QC procedures applied	Cross checks and spot checks in the database to ensure installation/registration dates are correctly captured
Purpose of data	Calculation of baseline and project emissions
Calculation method	Days in operation during monitoring period divided by total number of days in monitoring period. This calculation is applied to every ONIL stove in the database.
Comments	-

Data / Parameter	$\eta_{new,i,j}$																				
Data unit	Fraction																				
Description	Efficiency of the ICS																				
Source of data	Efficiency tests conducted in monitoring period																				
Description of measurement methods and procedures applied	<p>The Water Boiling Test (WBT) protocol used was the WBT version 4.2.4 published by the Global Alliance for Clean Cookstoves. The WBTs were conducted by trained staff. Stoves were tested at the place of installation (i.e., in stove user households) using firewood available in the same households. Each sampled stove was tested once for the cold start phase, hot start phase and simmer phase. The staff ensured the stoves were at room temperature before applying cold start tests. Each test used two aluminium pots with 2.5 litres of water in each. Testers supplied clean water to the households where tests were conducted. Pots were put in direct contact with fire by removing the metal rings around the stove burners. Boiling point temperatures used in calculations were adjusted based on altitude that was taken with GPS instruments. The calorific value of the different species of wood was taken from the literature, where available. When not available in the literature, a broader distinction was made between softwoods and hardwoods and average values of these types of woods were applied accordingly to the species of wood for which data was unavailable.</p>																				
Frequency of monitoring/recording	Annually																				
Value applied:	<table border="1"> <thead> <tr> <th>Vintage</th> <th>Efficiency</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>0.2805</td> </tr> <tr> <td>5</td> <td>0.2794</td> </tr> <tr> <td>6</td> <td>0.2777</td> </tr> <tr> <td>7</td> <td>0.2789</td> </tr> <tr> <td>8</td> <td>0.2830</td> </tr> <tr> <td>9</td> <td>0.2817</td> </tr> <tr> <td>10</td> <td>0.2865</td> </tr> <tr> <td>11</td> <td>0.2849</td> </tr> <tr> <td>12</td> <td>0.2780</td> </tr> </tbody> </table>	Vintage	Efficiency	4	0.2805	5	0.2794	6	0.2777	7	0.2789	8	0.2830	9	0.2817	10	0.2865	11	0.2849	12	0.2780
Vintage	Efficiency																				
4	0.2805																				
5	0.2794																				
6	0.2777																				
7	0.2789																				
8	0.2830																				
9	0.2817																				
10	0.2865																				
11	0.2849																				
12	0.2780																				
Monitoring equipment	<ul style="list-style-type: none"> <li>Digital scales</li> <li>Firewood moisture meters</li> </ul>																				

	<ul style="list-style-type: none"> <li>Digital thermometers</li> <li>Thermocouples</li> </ul>
QA/QC procedures applied	WBT version 4.2.4 A check was performed for outliers, but none were found (defined as those thermal efficiency values 3 standard deviations above or below the vintage sample mean, as per the CDM PoA-DD section I.7.2).
Purpose of data	Calculation of project emissions
Calculation method	WBT version 4.2.4 calculation methods.
Comments	-

Data / Parameter	$\mu_y$
Data unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices during the year $y$
Source of data	ONIL Stove registration data and data from monitoring surveys.
Description of measurement methods and procedures applied	A survey asked for usage of baseline stoves as per the monitoring plan outlined in Section I.7.2 of the PoA-DD. $\mu_y$ was calculated in each monitoring period as follows: the number of sampled households with distributed ICS that also continue to use a baseline stove divided by the total number of surveyed samples.
Frequency of monitoring/recording	At least once every two years
Value applied:	2.37%
Monitoring equipment	Surveys
QA/QC procedures applied	Data for this parameter was collected using the same survey for the fraction of $n_{y,j}$ (appliances in operation) conducted by trained project staff members.
Purpose of data	Calculation of baseline and project emissions
Calculation method	The number of households with operational ONIL stoves and continuing to use baseline stoves divided by the total number of surveyed households.
Comments	-

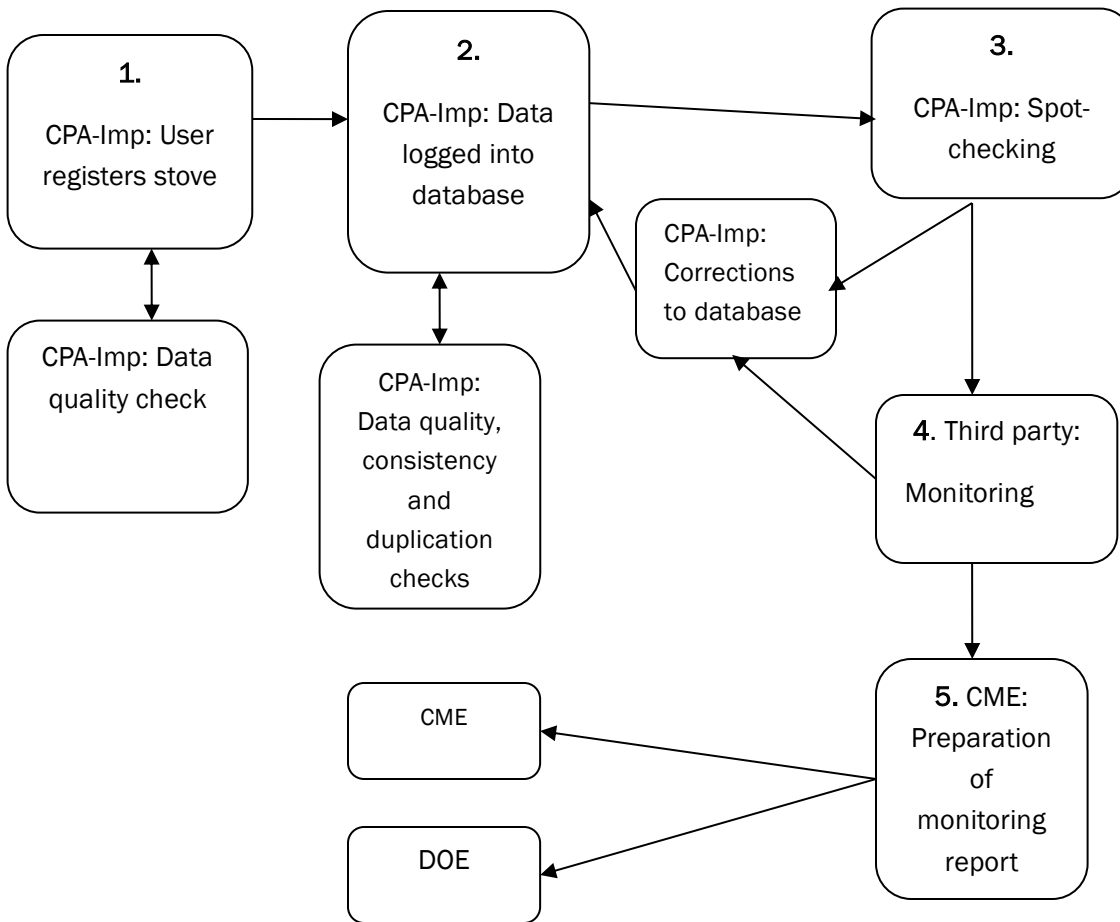
Data / Parameter	<b>B<sub>old</sub> adjusted</b>
Data unit	Tonnes/year
Description	If baseline stoves continue to be used, adjustment ensures that fuel wood consumption of those stoves is excluded from <b>B<sub>old</sub></b> .
Source of data	Baseline survey, ex-ante; monitoring survey ex-post

Description of measurement methods and procedures applied	According to VMR0006 version 1.1, Where the project households continue to use baseline cookstoves along with improved cookstoves, $B_{old}$ shall be adjusted ex-post based on the percentage of project households found to continue such practice. For such cases, the quantity of woody biomass saved due to implementation of improved cook stoves shall be calculated using an adjusted value to account for ex-post use of baseline stoves in addition to improved cookstove.
Frequency of monitoring/recording	At least once every two years
Value applied:	7.8592
Monitoring equipment	-
QA/QC procedures applied	Data for this parameter was collected using the same survey for the fraction of $\mu_y$ conducted by trained project staff members.
Purpose of data	Calculation of baseline and project emissions
Calculation method	To be calculated using the formula below: $B_{old\_adjusted} = B_{old} \times (1 - \mu_y)$ $= 8.05 \times (1 - 0.0237)$ $= 7.8592$
Comments	-

### 4.3 Monitoring Plan

The project's monitoring system follows the monitoring plan described in section I.7.2 of the PoA-DD.

Organizational structure, responsibilities and competencies: To obtain the monitoring variables, the CPA implementer follows the steps, organizational structure and responsibilities in the flow chart below. Appendix 1 contains description of monitoring personnel competencies.



The CME coordinated, managed and assisted HELPS international A.C. and monitoring third parties with each element of the monitoring plan. Details of the monitoring steps on the flowchart are the following:

1. **HELPS international A.C.: User registered stove.** HELPS International A.C. field personnel collected the information in the Registration Card from the users. Information was collected via a Registration Card filled by HELPS International A.C. staff and partner organizations. HELPS International A.C. staff double-checked the accuracy of the information and requested clarifications if needed.
2. **HELPS international A.C.: Data logged into database.** HELPS International A.C.'s trained staff inputted the information from the Registration Card into the database. HELPS International A.C. and CQC checked the database records and removed duplicates (this included completing the serial number, checking for name duplicates, etc...).
3. **HELPS international A.C.: Spot-checks (ongoing).** HELPS International A.C. visited locations in the field and reported updates to office either via telephone or forms. HELPS International A.C. personnel corrected the database and clearly marked stoves that were not installed, were given away, the end user died or left town, or had any other issues that made the stove no longer

- eligible to participate in the CPA. These stoves were excluded from the emission reduction calculations.
4. **Third Parties: Monitoring.** Third Parties followed the sampling plan outlined in the PoA-DD (Section I.7.2) and reported in section D.2 below.
  5. **CME Preparation of monitoring report.** CQC prepared the final monitoring report and retained copies of the document.

#### Data measuring, recording Method and Implementation of Sampling Approaches

Steps 1, 2 and 3 captured end user information and populated the database, as well as provided database quality control.

Step 4 involves creating sampling surveys to capture data on continuous use of stove ( $n_{y,j}$ ) and use of baseline systems along with ICS ( $SS_y$ ) as well as stove thermal efficiency ( $\eta_{new,i}$ ) as described in the table below.

Parameter	Description of Parameter	Sampling approach (outcome in brackets)
$n_{y,j}$	Proportion of ONIL Stoves still in operation	Visual inspection of the premises to see if ONIL stove is operational and in use. Interview with end user if required to verify that ONIL stove is still in use [Yes/No]
$\mu_y$	Percentage of continued baseline stove use among ONIL stove households in the database	Interview with end user and visual inspection to determine if a baseline (replaced) stove is still being used in addition to ONIL stove [Yes/No]
$\eta_{new,i}$	Thermal Efficiency of operational ONIL Stoves	ONIL Stoves were tested using WBTs [ONIL stove thermal efficiency]

Sampling captured information on monitoring variables with required confidence/precision<sup>8</sup> and used simple random sampling (as per of EB 69 Annex 5 Section E). The method involved the grouping of ONIL stoves by implementer and model and randomly selecting villages to sample. further the stoves within the selected municipalities were also randomly selected. Since all stoves were of the same model and managed by the same CPA Implementer, no further stratification was needed to capture parameter  $n_{y,i}$  and  $\mu_y$  data. Stoves were divided into three Primary Sampling Units for  $\eta_{new,i}$  (stoves managed by same CPA Implementer, of the same model and vintage) given that multiple stove vintages were present. Each stove vintage was sampled separately using the simple random sampling method described below.

<sup>8</sup> According to paragraph 22 of Methodology AMS-II.G version 03, 95/10 confidence/precision for annual and 95/5 for biennial sampling across CPAs. In case a single CPA is sampled, 90/10 confidence/precision for annual and 95/5 confidence/precision shall be required for biennial sampling.

Step 5 involved monitoring analyses and accuracy and precision checks. The CPA implementer and CME scrutinized the monitoring data to confirm accuracy of results, analyzed the data, and estimated the resulting emissions reductions outlined in this monitoring report.

The following parameters were obtained through sampling:

1.  $n_{y,i}$ : proportion of stoves in operation
2.  $\mu_y$ : fraction of households that continue to use baseline systems (3-stone fires) along with ONIL stoves
3.  $\eta_{new,i}$ : thermal efficiency of ONIL Stoves

simple random sampling was used for all monitoring parameters in accordance with the Sampling Plan of section I.7.2 of the PoA-DD. The objective was to obtain reliable and unbiased estimates of the monitoring parameters. Reliability levels were set at 95% confidence and 5% precision as per AMS II.G version 3, paragraph 22 for biennial sampling.

A single homogeneous population (Primary Sampling Unit, as per PoA-DD) was considered for  $n_{y,i}$  and  $\mu_y$  (proportion parameters) since the CPA Implementer and stove model (HELPS International A.C. and ONIL Stove respectively) were the same throughout the CPA. The sampling was carried out at PoA level which comprises of CPA 001 and CPA 002. Eight sampling populations (Primary Sampling Units) were considered for parameter  $\eta_{new,i}$ : stoves from Vintages 4 to 11. No other vintages were included in the PoA since these eight populations comprise the entire PoA.

For the stoves those age was under vintage 12 at the end of monitoring period, WBT was conducted in accordance with the guidelines of applied methodology VMR0006. 3 stoves were selected randomly and 3 WBT were conducted for each of the stove.

The following table summarizes the sample sizes and results.

Monitored Parameter	Sample size	Survey Results	Precision achieved
Proportion of stoves in operation ( $n_{y,i}$ )	253	0.9763	1.91%
Stoves in operation ( $\mu_y$ )	253	0.0237	1.91%

Monitored Parameter	Sample size	Test results	Precision achieved
Efficiency of Vintage 4 ONIL Stove vintage	18	0.2805	1.65%
Efficiency of Vintage 5 ONIL Stove vintage	18	0.2794	2.18%
Efficiency of Vintage 6 ONIL Stove vintage	18	0.2777	1.68%
Efficiency of Vintage 7 ONIL Stove vintage	18	0.2789	1.70%
Efficiency of Vintage 8 ONIL Stove vintage	18	0.2830	1.83%

Efficiency of Vintage 9 ONIL Stove vintage	18	0.2817	1.63%
Efficiency of Vintage 10 ONIL Stove vintage	18	0.2865	1.97%
Efficiency of Vintage 11 ONIL Stove vintage	18	0.2849	1.62%
Efficiency of Vintage 12 ONIL Stove vintage	3	0.2780	-

Implementation and quality assurance and control and procedures used for handling any internal auditing performed and any non-conformities identified: CME trained monitoring personnel on monitoring procedures, including provisions for maximizing response rates, documenting out-of-population cases, refusals and other sources of non-response. The monitoring survey included several questions to support the information on the key monitoring parameters. These included visual inspections to confirm stove use and presence of baseline stoves, comments by surveyors, check of randomly selected households against actual household information, and refusal tracking. These strategies aimed at minimizing surveyor or non-response biases. The questionnaire was piloted in the field prior to implementation.

## 5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 5.1 Baseline Emissions

The improved cookstove is introduced as energy efficiency measure in the project, therefore equations 1 and 2 of the methodology will be applied to calculate the net GHG emission reductions.

$$ER_y = \sum_i \sum_j ER_{y,i,j} \quad \text{Equation (1)}$$

Where:

- $i$  = Indices for the situation where more than one type/model of improved cookstove is introduced to replace three-stone fire
- $J$  = Indices for the situation where there is more than one batch of improved cookstove of type  $i$
- $ER_y$  = Emission reductions during year  $y$  in t CO<sub>2</sub>e

$ER_{y,i,j}$  = Emission reductions by improved cookstove of type  $i$  and batch  $j$  during year  $y$  in t CO<sub>2e</sub>

$$ER_{y,i,j} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times (EF_{wf,CO_2} + EF_{wf,non\ CO_2}) \times N_{y,i,j} \times 0.95 \quad \text{Equation (2)}$$

Where:

$B_{y,savings,i,j}$  = Quantity of woody biomass that is saved in tonnes per improved cookstove of type  $i$  and batch  $j$  during year  $y$

$f_{NRB,y}$  = Fraction of woody biomass that can be established as non-renewable biomass ( $f_{NRB}$ )<sup>9</sup>

$NCV_{wood\ fuel}$  = Net calorific value of the non-renewable woody biomass that is substituted or reduced (IPCC default for wood fuel, 0.0156 TJ/tonne)<sup>10</sup>

$EF_{wf,CO_2}$  = CO<sub>2</sub> emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO<sub>2</sub>/TJ)<sup>11</sup>

$EF_{wf,non\ CO_2}$  = Non-CO<sub>2</sub> emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO<sub>2</sub>/TJ)<sup>12</sup>

$N_{y,i,j}$  = Number of improved cookstoves of type  $i$  and batch  $j$  operating during year  $y$

0.95 = Discount factor to account for leakage

To calculate  $B_{y,savings}$ , we use Option 1 of the applied methodology<sup>13</sup>

$$B_{y,savings,i,j} = B_{old} \times \left( 1 - \frac{\eta_{old}}{\eta_{new,i,j}} \right)$$

Where:

<sup>9</sup> Default values endorsed by designated national authorities and approved by the Board are available at <https://cdm.unfccc.int/DNA/fNRB/index.html>

<sup>10</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 1 Introduction

<sup>11</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion

<sup>12</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion

<sup>13</sup> Equation 3 of methodology VMR 0006

$B_{old}$	Quantity of wood fuel used in the absence of the project activity in tonnes
$\eta_{old}$	A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air supply or flue gas ventilation system, i.e., without a grate or a chimney.
$\eta_{new,i,j}$	Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol.

As some of the project households continue to use baseline cookstoves along with improved cookstoves,  $B_{old}$  has been adjusted *ex-post* based on the percentage of project households found to continue such practice according to the Equation 6 of applied methodology as follows:

$$B_{old,adjusted} = B_{old} \times (1 - \mu_y)$$

Where:

$B_{old,adjusted}$	= Adjusted $B_{old}$ to account the ex-post usage of firewood in baseline cookstove(s) by project households in addition to improved cookstove (in tonnes per device)
$\mu_y$	= Baseline stove usage factor to account for use of baseline cookstoves along with improved cookstoves.

$$\eta_{old} = 0.10$$

$$\eta_{new,4} = 0.2805$$

$$\eta_{new,5} = 0.2794$$

$$\eta_{new,6} = 0.2777$$

$$\eta_{new,7} = 0.2789$$

$$\eta_{new,8} = 0.2830$$

$$\eta_{new,9} = 0.2817$$

$$\eta_{new,10} = 0.2865$$

$$\eta_{new,11} = 0.2849$$

$$\eta_{new,12} = 0.2780$$

The full set of emission reductions calculation is provided in Excel spread sheet.

## 5.2 Project Emissions

The methodology does not account for project emissions separately, but instead quantifies net emission reductions achieved by the project.

## 5.3 Leakage

Leakage is considered as default 0.95 in accordance with methodology.

## 5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
20-Dec-2020 to 31-Dec-2020	2,980	0	0	2,980
01-Jan-2021 to 30-Sep-2021	68,003	0	0	68,003
<b>Total</b>	<b>70,983</b>	<b>0</b>	<b>0</b>	<b>70,983</b>