INSTALLATION OF HIGH EFFICIENCY WOOD BURNING COOKSTOVES IN KENYA

Document Prepared by

C-Quest Capital Stoves Asia Limited

Project Title	Installation of high efficiency wood burning cookstoves in Kenya
Version	2.1
Report ID	VCS 2349 – MP01
Date of Issue	21-October-2022
Project ID	2349
Monitoring Period	06-October-2020 to 31-August-2021
Prepared By	C-Quest Capital Stoves Asia Limited
Contact	Address: C-Quest Capital Stoves Asia Limited, Brumby Centre, Lot 42, Jalan Muhibbah, 87000 Labuan F. T., Malaysia, Telephone: +1-202 247-797 Email: cqc-operations@cquestcapital.com Website: www.cquestcapital.com

CONTENTS

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 (e.g., plant, equipment, process, or management or conservation measure) included in the project.

The project involves the distribution and installation of single pot TLC Stoves for use by households in Kenya. The ICS disseminated through this project will replace the baseline cookstove. Under this project two stoves(model TLC-CQC Rocket Stoves, each with single pot) is being installed per household in Kenya..

The ICS will burn wood more efficiently thereby improving thermal transfer to pots, hence saving fuel. Not only will this halt the rapidly progressing deforestation in Kenya but will also reduce health hazards from indoor smoke pollution and women and children will be able to spend less time collecting firewood.

TLC-CQC Rocket Stove substantially reduces fuel consumption and emissions for conducting cooking and water heating tasks in homes. The ICS improve the efficiency of combustion and thermal transfer to the pot compared with a traditional pot support or three-stone fire by incorporating a number of cutting-edge components, including one or more of; a 'rocket elbow'; a highly insulated combustion chamber which provides a conducive environment for clean and efficient combustion of wood. It substantially reduces fuel wood consumption compared with a three-stone fire or traditional pot support.


The first TLC Stove was installed on 06-October-2020. Till the end of monitoring period, a total of 4,742 TLC Stoves was reported installed under the project.

All the data recorded during stove registration process was captured via hand held digital devices (smart phones and/or tablets). The information collected is then transferred to a centralized online project database.

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

Installation of ICS

Date of first ICS installed	06-October-2020
No. of ICS distributed till end of 1 MP	4,742

First Monitoring Survey

1st monitoring survey dates for parameters $N_{y,i,j}$ and $B_{y=1,new,i,survey}$	18-November-2021 to 03-December-2021

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

  The project results in a total emission reduction of 8,426 tCO2e over the monitoring period of 06-October-2020 to 31-August-2021

1.2 Sectoral Scope and Project Type

The project is categorised under type/category as below:

a) Sectoral scope: 03 - Energy demand
b) Type: II – Energy efficiency improvement projects

The project is a grouped project activity.

1.3 Project Proponent

.

Organization name	C-Quest Capital Stoves Asia Limited
Contact person	Ken Newcombe
Title	Director
Address	Brumby Centre, Lot 42, Jalan Muhibbah, 87000 Labuan, Malaysia.
Telephone	+1-202 247-797
Email	cqc-operations@cquestcapital.com

1.4 Other Entities Involved in the Project

C-Quest Capital Stoves Asia Limited is the sole entity involved in the project.

1.5 Project Start Date

The start date of this grouped project activity is 06-October-2020, which is the delivery/installation date of first TLC stove (first project activity instance).q23

1.6 Project Crediting Period

06-October-2020 to 05-October-2030 (both days included), ten years fixed crediting period.

1.7 Project Location

The project location is the geographical boundary of Republic of Kenya with coordinates 0°1'24.8" S latitude and 37°54.372' E longitude.[1]

Kenya map[2]

Republic of Kenya is divided into 8 provinces. To facilitate the management, implementation, monitoring and sampling stages of the project, the project proponent divides the project boundary into 4 project areas according to the provinces.

[1] https://www.geodatos.net/en/coordinates/kenya

[2] http://www.mapsopensource.com/kenya-provinces-map.html

No.	Project Area	Provinces
1	North-Eastern Area	North-Eastern, Coast
2	Central Area	Eastern, Central
3	Rift Valley Area	Rift Valley, Nairobi
4	Western Area	Western, Nyanza

1.8 Title and Reference of Methodology

VMR0006: Methodology for Installation of High Efficiency Firewood Cookstoves, Version 1.1[3].

1.9 Participation under other GHG Programs

Project is not registered under any other GHG programs.

1.10 Other Forms of Credit

Project has not applied for any other programme to create another form of GHG-related environment credit.

1.11 Sustainable Development Contributions

The project contributes to sustainable development in a number of ways:

a) Environmental Sustainability

- The project helped significantly reduce greenhouse gas emissions over the monitoring period.
- The project helped reduce the use of non-renewable biomass from forests, thus assist in conserving existing forest stock and the protection of natural forest eco-systems and wildlife habitats.

b) Social Sustainability

- Considerably less time need to be spent collecting wood fuel for the family home thereby reducing the work burden on rural families and presenting alternative opportunities for economic development.
- The amount of indoor pollutants from the burning of biomass in the family home reduced. Less carbon dioxide, carbon monoxide and particulates emitted due to the decrease in total biomass burned and an increase in the temperature of combustion.
- The stove provides a safer method for combusting biomass for cooking, helping to reduce burn injuries, especially for children, in the family home.

c) Economic Sustainability

[3] https://verra.org/methodology/vmr0006-methodology-for-installation-of-high-efficiency-firewood-cookstoves/

- The project helped develop a section of the local economy, in the distribution, local assembly, maintenance and monitoring activities.
- Household expenditures on cooking fuel reduced through the use of the ICS.
- Saved household labour can be diverted to more productive economic activities.

The project will create local employment opportunities in operational and management roles, as well as future assembly and/or manufacturing initiatives.

Project will be perused for SD Vista labeling, so detail of SDG achieved by the project activity will be provided in the SD Vista MR.

2 SAFEGUARDS

2.1 No Net Harm

There are no potential negative environmental or socio-economic impacts for this project activity based on the following facts:

- The project does not coerce the population into any practice or habit which they are not willing to take up as the cooking practice or habit on the project stove is similar to what was practiced before implementing this project activity, i.e., on the baseline stove.
- The project activity promotes gender equality as it intends to reduce the burden on women in the most vulnerable communities by reducing the fuel wood consumption. The amount of time spent collecting fuel wood and cooking will be reduced. Women will have more time for other pursuits. The risk of being exposed to gender-based violence will also reduce.
- The project is neither involved in any activity that would bring environmental deterioration nor will lead to any emission of toxic substances. The project stoves will rather reduce emissions due to the increased thermal efficiency compared to the baseline stoves.
- The amount that was charged from HH for 2000 ICS, is a very small amount and has not affected the end user much since it is also a onetime payment. PP has also replaced the IP that charged the amount with another IP ensuring that distribution/installation will remains free of cost.
- There are no threats anticipated in terms of negative effects on the local economy. Moreover, the locals will also be employed as a result of this project activity. Thereby improving the economic growth in the region where the project activity has been implemented.

2.2 Local Stakeholder Consultation

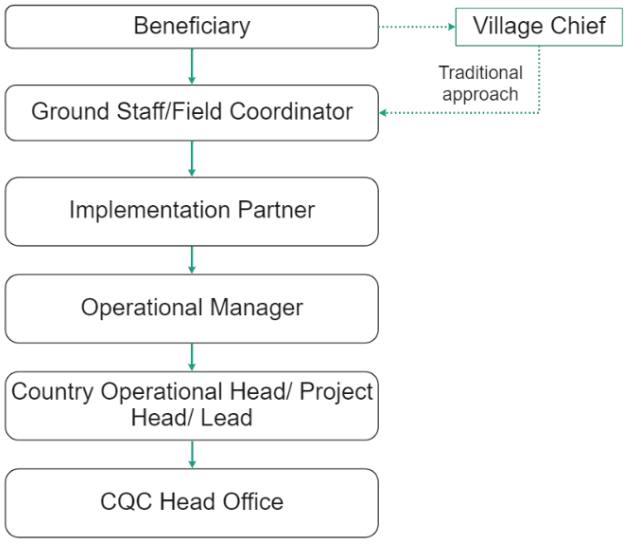
Feedback was requested from local stakeholders for the “Installation of high efficiency wood burning cookstoves in Kenya” program between 26-October-2020 and 25-November-2020. Necessary precautions were taken place in light of the COVID-19 pandemic, with feedback having been conducted electronically when possible, minimizing large groups and socially distancing during in person meetings. The outcomes from the local stakeholder consultation are available in Section 2.2 of the PD

On-going Communication mechanismStove owner can contact the local implementation partner in case any support or replacement of any stove part is required. The local support staff address the end users’ query by providing the necessary support. In case of replacement of stove part is needed, local staff

coordinates with the management team to arrange the replacement of the part. At the time of monitoring survey also, field staff takes feedback from the local stakeholders. All stakeholders' concerns (positive or negative) during implementation of the project activity, have been compiled in the survey results spreadsheet. Necessary action has been taken by the PP (if required) to address the concerns raised by stakeholders during ongoing communication.

Grievance Redressal mechanism.

PP follows a proper Feedback and Grievance Redress Policy and Procedure, which ensures that project-affected communities and individual stakeholders' grievances are properly prioritized and addressed. These measures are taken to enhance PP's accountability and transparency and to support the project initiatives that can help the communities to identify adverse effects to them, or their environment which had not previously been identified and mitigated by PP.



Flow of information/complaint/grievances from stakeholder to PP

The Grievance Policy and Procedure is accessible as a phone number of the PP/implementing partner office in Kenya is available on the TLC brochure provided to each household, which is the most accessible manner to provide feedback. PP policy and procedure outline the process to evaluate and respond to complaints; the procedure details when a serious level complaint should be communicated to PP country teams and when it would be best addressed by the implementing partner.

Grievance received for the monitoring period.

Grievance Received	Action Taken
Difficult to prepare fuel	End user has been cutting tree to make wood logs for preparing firewood. Field officer visited the household and sensitized to use small twigs and branches collected from the fields and nearby areas instead of cutting tree.

Difficult to start	Insufficiently dried wood logs were being used by the end user to produce food, which caused the stove to burn wood very slowly. Field officer visited the household and sensitized not to use wood logs and wet firewood.

2.3 AFOLU-Specific Safeguards

This section is not applicable as the project is a non-AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Till the end of the monitoring period, the project installed 4,742 stoves. Only one stove model (TLC-CQC Rocket Stove) was distributed in the project.

VCS methodology VMR0006 allows the use of a correction factor of 0.95 applied to the overall emissions reductions to account for any possible leakage. This factor has been applied to the emissions reductions presented in this report.

During the current monitoring period, no incident or event occurred, that could affect GHG emissions reduction and approved monitoring plan.

3.2 Deviations

3.2.1 Methodology Deviations

This project did not apply any methodology deviations.

3.2.2 Project Description Deviations

In the section 3.5 of registered VCS-PD, other than the regulatory surplus and positive list, another step called project method has been added. NPV analysis steps are being added in the revised VCS-PD to confirm the additionality of each project activity instances, where PP has other sources of revenue except carbon credit sales.

In certain villages of Kenya, Implementing Partner has charged a nominal amount for the readymade bricks used for building the stove(for around 2000 ICS). This happened due to the shortage of raw materials like clay and cow dung in that village/ HH vicinity. These raw materials had to be arranged from other locations by implementing partners at additional cost. Other than these 2000 stoves, project Implementer/Project Proponent installs all the stove at zero cost and PP does not plan on charging the end users any amount. PP has replaced the IP that charged the amount with another IP ensuring that distribution/installation will remains free of cost.

PP has calculated NPV of the project and provided detailed investment analysis spread sheet sheets to VVB. Also, Implementation cost and project revenue are mentioned in detail in the section 3.5 of the VCS PD.

The proposed changes does not have any impact on applicability of methodology, appropriateness of the baseline scenario and estimation of emission reductions.

3.3 Grouped Projects

New project activity instances (each ICS) included under this grouped project ensure that it meets the eligibility criteria below.

No.	Criterion	How the new project activity instances to comply
1	Meet the applicability conditions set out in the methodology applied to the project	New project activity instances (TLC-CQC Rocket Stoves) meet the applicability conditions set out in Section 3.2 of the PD, where the end-user is household and the ICS deployed is at least 25% of thermal efficiency. Thermal efficiency of TLC-CQC Rocket Stove is 34.5% as per manufacturer specification.
2	Use the technologies or measures specified in the project description.	Only single pot TLC-CQC Rocket stoves have been adopted in the project. Project database confirms to the same
3	Apply the technologies or measures in the same manner as specified in the project description.	Only TLC-CQC Rocket stoves have been adopted in the project and it replace traditional cookstoves in household. Project database confirms the same.
4	Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	The new project activity instances were installed within Kenya only and subject to the same baseline scenario determined in Section 3.4 of VCS-PD. Confirmed through the monitoring survey and project database.
5	Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.	All new project activity instances use the activity method for demonstration of additionality. **Step 1: Regulatory Surplus**

		There is no law, statute or government programme or policy in Kenya mandating the project activity nor is there any systematically enforced law, statute or other regulatory framework for such projects hence this requirement is satisfied for all project activity instances to be included in the current grouped project. **Step 2: Positive List** PP adopted the project method to prove additionality, since for some of the ICS, implementing partners have charged a nominal amount for readymade mud bricks provided to households **Step 3: Project Method** The financial indicator against which the project activity instances will demonstrate investment barrier, shall be Net present value (NPV). A specific project activity instance for which NPV is negative without VER revenue shall be deemed additional Evidence of all costs/revenue in case the implementation has started, else reference of expected costs/revenue from earlier investment in similar projects. NPV analysis sheet for individual ICS (project activity instance) has been submitted to VVB for reference.
6	Where a capacity limit applies to a project activity included in the project, no project activity instance shall exceed such limit. Further, no single cluster of project activity instances shall exceed the capacity limit, determined as follows: 1) Each project activity instance that exceeds one percent of the capacity limit shall be identified.	No project activity instance exceeds the applicable limit, which is 180 GWh_{th}/y. The expected annual energy saving for each project activity instance is approximately 0.02 GWh_{th}/y or 0.01% of the limit. As the annual energy saving is below 1% of the limit, therefore no project activity instance is identified and divided into clusters.

	2) Such instances shall be divided into clusters, whereby each cluster is comprised of any system of instances such that each instance is within one kilometer of at least one other instance in the cluster. Instances that are not within one kilometer of any other instance shall not be assigned to clusters. 3) None of the clusters shall exceed the capacity limit and no further project activity instances shall be added to the project that would cause any of the clusters to exceed the capacity limit.	

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$f_{NRB,y}$
Data unit	Fraction
Description	Fraction of woody biomass saved by the project activity during year *y* that can be established as non-renewable biomass
Source of data	IPCC 2019 refinement, UNData & FAO reports.
Value applied	0.94
Justification of choice of data or description of measurement methods and procedures applied	This parameter has determined ex-ante. C4 EcoSolutions (Pty) Ltd was appointed as third party to study and derive the f_{NRB} value for Kenya.
Purpose of Data	Calculation of emission reductions
Comments	The report of f_{NRB} was made available to VVB during the validation.

Data / Parameter	$NCV_{wood\ fuel}$
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted or reduced
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 1 Introduction
Value applied	0.0156
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of emission reductions
Comments	No comments

Data / Parameter	$EF_{wf,CO2}$
Data unit	tCO_2/TJ
Description	CO_2 emission factor for the use of wood fuel in baseline scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion
Value applied	112
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of emission reductions
Comments	No comments

Data / Parameter	$EF_{wf,non\ CO2}$
Data unit	tCO_2/TJ
Description	Non-CO_2 emission factor for the use of wood fuel in baseline scenario

Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion
Value applied	26.23
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of emission reductions
Comments	No comments

Data / Parameter	η_{old}
Data unit	Fraction
Description	Efficiency of baseline cookstove
Source of data	Methodological default value
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	A default value of 0.1 has used, as baseline device is a three-stone fire using firewood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney
Purpose of Data	Calculation of emission reductions
Comments	No comments

Data / Parameter	η_p
Data unit	Fraction
Description	Efficiency of project stove at the start of project activity.
Source of data	Manufacturer's specification
Value applied	0.345
Justification of choice of data or description of measurement methods and procedures applied	This parameter was determined ex-ante

Purpose of Data	Calculation of $\eta_{new,y,i,j}$
Comments	No comments

4.2 Data and Parameters Monitored

Data / Parameter	$N_{y,i,j}$
Data unit	Number
Description	Number of project devices of type i and batch j operating during year y
Source of data	Monitoring
Description of measurement methods and procedures to be applied	Measured based on a representative sample.
Frequency of monitoring/recording	At least once every two years
Value monitored	4,742
Monitoring equipment	No equipment was used to monitor this parameter
QA/QC procedures to be applied	Sampling standard "sampling and surveys for CDM project activities and programme of activities" version 9 was used for determining the sample size to achieve 90/10 confidence precision.
Purpose of data	Calculation of emission reductions
Calculation method	Proportion of operational stoves obtained from the survey is multiplied by the total commissioned stoves to arrive at this value. Proportion of operational stoves: 100% $N_{y,i,j}$ = 100% * 4,742 = 4,742
Comments	No comments

Data / Parameter	$\eta_{new,y,i,j}$
Data unit	Fraction

Description	Efficiency of the improved cookstove type *i* and batch *j* during year *y*
Source of data	Calculation
Description of measurement methods and procedures to be applied	To adopt Option V given in the methodology: "Efficiency of the improved cookstoves to be estimated using equation 5 above where loss in efficiency per year is calculated, and therefore this parameter does not need to be monitored"
Frequency of monitoring/recording	Annually
Value monitored	the value below is applied. Year (y): 1 — $\eta_{new,y,i,j}$: 32.43%
Monitoring equipment	Calculated value
QA/QC procedures to be applied	This parameter has been calculated using equation 5 of the applied methodology
Purpose of data	Calculation of emission reductions
Calculation method	Calculation was performed using equation below: For Vintage 1 Stoves - $\eta_{new,y,i,j} = \eta_p \times (DF_n)^{y-1} \times 0.94$ = 0.345 x $(0.99)^{1-1}$ x 0.94 = 0.3243
Comments	No comments

Data / Parameter	$B_{y=1,new,i,j,survey}$
Data unit	Tonnes per device per year
Description	Annual quantity of woody biomass used by improved cookstoves in tonnes per device of type i and batch j
Source of data	Monitoring survey

<table>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Sampling standard “sampling and surveys for CDM project activities and programme of activities” version 9 was used for determining the sample size

This value was determined within the first year of the introduction of the devices through sample surveys.

Under this project two TLC-CQC Rocket Stoves have been installed in each household, which are classified as Project stove 1 and project stove 2.At the time of survey field staff asked the user to make a pile of the firewood[4] used in all the project stoves available with the household. In addition, stove wise firewood consumption is also weighed by the field staff separately by asking the end user to make piles of firewood used in project stove 1 and project stove 2 separately. This data captured (stove specific firewood consumption/day/household) for both the project stoves separately is then recorded in survey form, which clearly distinguishes firewood consumption of the both project stoves distributed in the same household.
Proper training has been provided to the monitoring personnel before conducting the onsite monitoring survey.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>In the first year of project implementation</td></tr>
<tr><td>Value monitored</td><td>1.1352</td></tr>
<tr><td>Monitoring equipment</td><td>Weighing scale

<table>
<tr><th>Weighing Scale Model</th><th>Other details</th></tr>
<tr><td>H-110</td><td>Manufactured by American Weigh Scales

<table>
<tr><td>Date of Calibration</td><td>18-November -2021</td></tr>
<tr><td>Acceptable tolerance</td><td>0.15lb/60g</td></tr>
<tr><td>Accuracy Class</td><td>OIML M2</td></tr>
<tr><td>Maximum Capacity</td><td>110 lb</td></tr>
<tr><td>Readability</td><td>0.05lb</td></tr>
<tr><td>Minimum capacity</td><td>0.25 lb</td></tr>
<tr><td>Dimensions</td><td>1.0x2.5x5.2</td></tr>
</table>
</td></tr>
</table>
</td></tr>
</table>

[4] Firewood available at the end user’s premises.

QA/QC procedures to be applied	Calibration of weighing scales used for measuring the fuel wood was done in-house before the start of monitoring survey.
Purpose of data	Calculation of emission reductions
Calculation method	This is monitored value
Comments	No comments

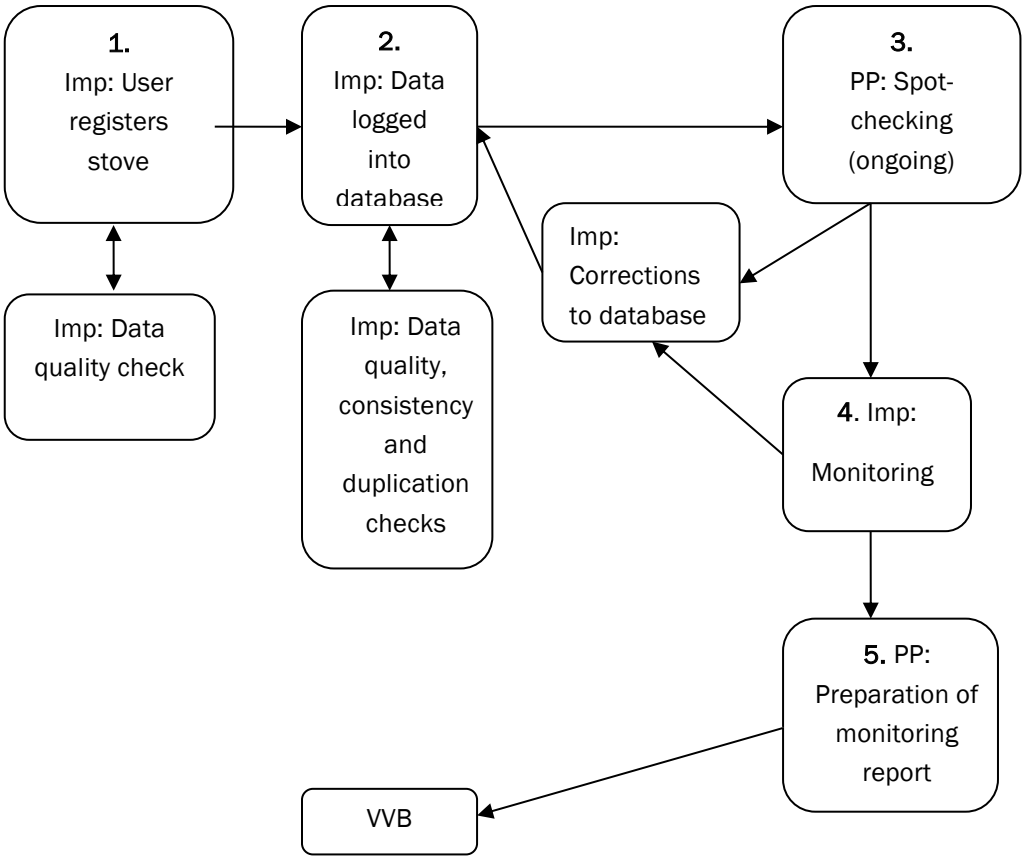
Data / Parameter	**Life Span**
Data unit	Number of years
Description	The operating lifetime of the project device.
Source of data	Manufacturer's specification
Description of measurement methods and procedures to be applied	TLC cookstoves manufactured under the project activity match the fixed design specification. This has achieved by using brick molds of specified dimensions to make bricks used for stove construction locally. This ensured, that each stove that is built at individual end user household measures exactly same as the dimensions specified by the manufacturer. Post construction, training has been provided to end users on use, care, and upkeep of these stoves. PP conducted periodic audits and surveillance of the stoves distributed under the project activity to ensure their proper functioning throughout the project lifetime. This along with spot audits and after installation maintenance services, ensure that the project stoves continue to work at efficiencies as specified by the manufacturer.
Frequency of monitoring/recording	Once at the time of project stove installation
Value monitored	10
Monitoring equipment	No equipment was used to monitor this parameter
QA/QC procedures to be applied	This parameter is referred from the Manufacturer's specification
Purpose of data	Calculation of emission reductions
Calculation method	No calculation used for this parameter
Comments	No comments

4.3 Monitoring Plan

The project's monitoring system follows the monitoring plan described in section 5.3 of the VCS-PD.

The monitoring system applied involves a number of key elements to ensure that the PP has high-quality, unbiased and reliable information regarding the performance of the project in terms of implementation and outcomes, and for the purposes of calculating Verified Carbon Units (VCUs) following VCS methodology VMR0006 version 1.1 on the basis of the amount of non-renewable biomass saved by the ICS in the project activity.

Roles and Responsibilities The below flow-chart illustrates the roles and responsibilities of the parties during the implementation of the monitoring plan for the project activity. In the below flowchart, the project implementer is abbreviated to "Imp", and can be the project proponent by the PP.



Below is the description of the above steps on the flow-chart.

1. **Implementer: User registers stove:** Project implementer collected/received the necessary information required for the Registration process from the user. The Means of collecting this information were through the use of ICTs. Project Implementers' staff double checks the accuracy of information provided, and request for field staff additional clarifications if needed.

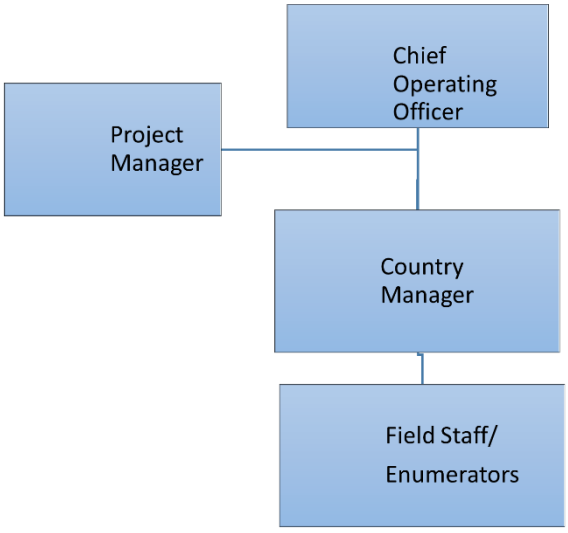
2. **Implementer: Data logged into database:** Registered data by the staff of the project implementer uploads in the database automatically. PP shall double check the information included on the database and check for duplications. Any duplicate information if investigated, checked for the errors, gets corrected or excluded from the database if it is a true duplicate entry.

3. **Project Proponent: Spot- checking (ongoing):** Project Proponent has a procedure for internal auditing called spot-checking, where field staff randomly selects households to ensure proper functioning of the project stoves throughout the project lifetime and to ensure that the project stoves continue to work as efficient as specified by the manufacturer.Field staff of project proponent randomly select units included in the database and visit or contact the stove owners to cross-check the information on the database with the factual evidence in the field. Any inconsistencies found (e.g., change in the address of a user) gets updated on the database, and in the case, ICS are found to be no longer in use, they get clearly marked as such and is excluded from emission reductions calculations.

   During the spot check, if any of the project stoves was found to be in poor working condition like cracked/damaged or with missing metal parts, the stove owner repairs the stove as they have been trained during installation. If the stove owners are unsuccessful in repairing, the field staff informs the implementer to provide the necessary assistance and the missing metal parts are reported to the management of implementer who then either provides the parts from their existing stocks or request the same to project proponent who procured those from their suppliers. Implementing partner then provides those parts to the stove owners. This is a continuous process.4. **Implementer: Monitoring:** Project implementer follows the requirements as per VCS-PD to collect the necessary information for a monitoring report.

5. **Project Proponent: Preparation of monitoring report:** The project proponent prepare the final monitoring report to be provided to the VVB for verification of emission reductions.

The Project Proponent is comprised of Project Manager, Chief Operating officer, Country manager and field staffs/enumerators to support the Team. The organizational chart can show as below:



Roles and responsibilities

Project Manager

- Ensures compliance of the technology with project requirements.
- Follows up of registration of any project and issuance of VCUs.
- Oversees the proper implementation of project.
- Communicate with Verra and VVB.

Chief Operating Officer

- Maintain record of issued serial numbers.
- Authenticates any changes/replacements of serial numbers during the life span of the ICS.

Country managers

- oversees the execution of training, which includes all aspects of stove design, construction, use & maintenance, of the field staff of project proponent and project implementer.
- Periodically checks and confirms that the installed ICS conform to the standards detailed in the project description.
- Procurement and delivery of stove parts, posters, brochures, and stove ID cards(QR cards).
- Checks and keeps control of all issued serial numbers.

Field staff/Enumerator

- Execute installation and registration of stoves with the implementation partner in the selected households.
- Assist the team in conducting the monitoring survey.
- Conducts spot checking of the installed stoves.

Thus PP coordinates and manages the implementation of each element of the monitoring plan.

Data measuring, recording Method and Implementation of Sampling Approaches

Steps 1, 2 and 3 – Involves 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 number of project devices operating during year y ($N_{y,j,j}$) and quantity of woody biomass used by improved cookstoves ($B_{y=1,new,i,j,survey}$) as described in the table below.

Parameter	Description of Parameter	Sampling approach (outcome in brackets)
$N_{y,j,j}$	Number of project devices operating during year y	Visual inspection of the premises to see if ICS is operational and in use. Interview with end user if required to verify that ICS is still in use [Yes/No]
$B_{y=1,new,i,j,survey}$	Quantity of woody biomass used by improved cookstoves	Interview with end user and measurement of wood fuel used for project stove [Weight of fuel wood]

Due to the large number of ICS envisioned to be distributed in the project activity, it is not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling was undertaken that is designed in line with the requirements of the Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities version 09.0.

Sample size calculation:

(i) Parameter $N_{y,i,j}$:

To estimate the sample size for the parameter $N_{y,i,j}$ the following equation is used:

$$n \geq \frac{1.645^2 N \times p \times (1-p)}{(N-1) \times 0.1^2 \times p^2 + 1.645^2 p \times (1-p)}$$

Where:

n = Sample size

N = Population size (Total number of households/ICS)

p = Expected proportion

1.645 = Represents the 90% confidence required

0.1 = Represents the 10% relative precision

The sample size is calculated as follows:

Definition	Value	Justification
The population size N is	4,742	Number of stoves registered in database
The expected proportion p for ny,i is	0.85	A conservative assumption of 85% is applied for sample size calculation.
Sample size	47.29	Calculated
Sample size (Rounded up)	48	Calculated

$$n \geq \frac{1.645^2 \times 4742 \times 0.85(1-0.85)}{(4742-1) \times 0.1^2 \times 0.85^2 + 1.645^2 \times 0.85(1-0.85)} = 47.29$$

(ii) Parameter $B_{y=1,new,i,\ survey}$:

To estimate the sample size for parameter $B_{y=1,new,i,\ survey}$ the following equation is used:

$$n \geq \frac{1.645^2\, NV}{(N-1) \times 0.1^2 + 1.645^2 V}$$

Where:

$$V = \left(\frac{SD}{mean} \right)^2$$

n = Sample size

N = Population size (Total number of households/ICS)

mean = Expected mean of ICS thermal efficiency

SD = Expected standard deviation

1.645 = Represents the 90% confidence required

0.1 = Represents the 10% relative precision

The sample size is calculated as follows:

Definition	Value	Justification
The population size *N* is	4,742	Number of stoves registered in database
The expected mean is	2.00	Assumption
The expected SD is	1.000	Assumption
Sample size	66.71	Calculated
Sample size (rounded up)	67.00	Calculated

$$n \geq \frac{1.645^2 \times 4742 \times \left(\frac{1}{2}\right)^2}{(4{,}742 - 1) \times 0.1^2 + 1.645^2 \times \left(\frac{1}{2}\right)^2} = 66.71$$

Since parameters $N_{y,j,j}$, and $B_{y=1,new,i,\ survey}$ share the same sampling units, it is decided to have one common survey for these two parameters with the highest number of sample size between these two parameters being chosen.To compensate for any attrition, outliers or non-response associated with the sample, 20% extra samples have been additionally selected.

The sample size for parameters $N_{y,i,j}$: and $B_{y=1,new,i,\ survey}$ calculated for the monitoring survey is 85 and surveyed 73 households.

Step 5- Involves monitoring analyses and accuracy and precision checks. The project proponent 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 though sampling:

1. $N_{y,i,j}$: Number of stoves in operation
2. $B_{y=1,new,i,j,survey}$: Quantity of woody biomass used by improved cookstoves

Simple random sampling was used for all monitoring parameters in accordance with the Sampling Plan of section 5.3 of the VCS-PD. The objective was to obtain reliable and unbiased estimates of the monitoring parameters. Reliability levels were set at 90% confidence and 10% precision as per VMR 0006 version 1.1.

A single homogeneous population (Primary Sampling Unit, as per VCS-PD) was considered for both parameters.

The following table summarizes the sample sizes and results.

Monitored Parameter	Sample size	Survey Results	Precision achieved

Number of stoves in operation ($N_{y,i,j}$)	73	1.00	0.00%
Quantity of woody biomass used by improved cookstoves ($B_{y=1,new,i,j,survey}$)	73	3.11 Kg/day/stove	6.52%

Implementation and quality assurance and control and procedures used for handling any internal auditing performed and any non-conformities identified:

Project proponent 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 have applied to calculate the net GHG emission reductions.

$$ER_y = \sum_i \sum_j ER_{y,i,j}$$ 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_2e
$ER_{y,i,j}$	=	Emission reductions by improved cookstove of type i and batch j during year y in t CO_2e

$$ER_{y,i,j} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times \left(EF_{wf,CO2} + EF_{wf,non\ CO2}\right) \times N_{y,i,j} \times 0.95 \quad \text{Equation (2)}$$

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})
$NCV_{wood\ fuel}$	=	Net calorific value of the non-renewable woody biomass that is substituted or reduced (IPCC default for wood fuel, 0.0156 TJ/tonne)[5]
$EF_{wf,CO2}$	=	CO_2 emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO_2/TJ)[6]
$EF_{wf,non\ CO2}$	=	Non-CO_2 emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO_2/TJ)[7]
$N_{y,i,j}$	=	Number of improved cookstoves of type i and batch j operating during year y
0.95	=	Discount factor to account for leakage

To calculate $B_{y,savingsi,j}$, we use equation 4 of the applied methodology[8]

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

Where:

$B_{y=1,new,i,survey}$	Annual quantity of woody biomass used by improved cook stoves in tonnes, determined in the first year of the implementation of the project through a sample survey
η_{old}	Efficiency of baseline cookstove. A default value of 0.10 has been used as 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.
$\eta_{new,l,j}$	Efficiency of the improved cook stove determined using Equation 5 of the methodology.

[5] 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 1 Introduction

[6] 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion

[7] 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion

[8] Equation 3 of methodology VMR 0006

$$\eta_{new,y,i,j} = \eta_p \times (DF_n)^{y-1} \times 0.94$$

Where:

η_p	Efficiency of project stove (fraction) at the start of project activity
$(DF_n)^{y-1}$	Discount factor to account for efficiency loss of project cookstove per year of operation (fraction). default value of 0.99 efficiency loss per year has considered for the project activity
0.94	Adjustment factor to account for uncertainty related to project cookstove efficiency test

The full set of emission reductions calculation for two stoves per HH is provided in emission reduction 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

Calculation of GHG Emission Reductions

$$ER_{y,i,j} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times \left(EF_{wf,CO2} + EF_{wf,non\ CO2}\right) \times N_{y,i,j} \times 0.95$$

Where:

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

Parameter	Description	Unit	Source	Value
By,savings, 1	Total biomass that is saved in tonnes during the monitoring period of vintage 1	tonnes	Calculated	2.5461
fNRB,y	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass	Fraction	National value obtained from local study	0.94

NCVwood fuel	Net Calorific Value of biomass	TJ/tonne	IPCC default for wood fuel	0.0156
$EF_{wf,CO2}$	CO2 emission factor for the use of wood fuel in baseline scenario	tCO2e/TJ	IPCC default for wood fuel	112
$EF_{wf,non\ CO2}$	Non-CO2 emission factor for the use of wood fuel in baseline scenario	tCO2e/TJ	IPCC default for wood fuel	26.23
0.95	Discount factor to account for leakage	Fraction	Default from VMR0006 version 1.1	0.95
ηold	Efficiency of the system being replaced	Fraction	Default from VMR0006 version 1.1	0.10
ηnew,1	Efficiency of the system being deployed as part of the project activity (Vintage 1)	Fraction	Calculated	0.3243
Ny,i,j	Number of stoves still in operation during the monitoring period	Quantity	Stove registration/Installation database	4,742
By=1,new,I ,survey	Quantity of woody biomass used in the absence of the project activity	Tonnes / household/ year	Monitoring Survey	1.1352

Sample calculations are as follows:

PP has calculated the emission reduction for each ICS installed under the project activity separately. In this section example for ER calculation of one ICS (stove serial number CQCVKE0045621) is provided:

For year 2020

Date of installation: 06-October-2020

Vintage for the stove: Vintage 1

No. of days for year 2020: 87 (from 06-October-2020 to 31-December-2020)

$B_{y=1,new,i,survey}$ = 1.1352

$\eta_{new,i,j}$ = 0.3243

η_{old} = 0.10

= 1.1352 x ((0.3243/0.1) - 1)

$B_{y,savings,i,j}$ = 2.5461

$ER_{y,i,j}$ = 2.5461 X 0.0156 x 0.94 x (112 + 26.23) x 1 x 0.95 x 0.24 x 87/365

= 1.17

For year 2021

Date of installation: 06-October-2020

For year 2021, vintage for the stove: Vintage 1

No. of days for year 2021: 243 (from 01-January-2021 to 31-August-2021)

Year fraction: 243/365 = 0.67

$B_{y=1,new,i,survey}$ = 1.1352

$\eta_{new,i,j}$ = 0.3243

η_{old} = 0.10

= 1.1352 x ((0.3243/0.1) - 1)

$B_{y,savings,i,j}$ = 2.5461

$ER_{y,i,j}$ = 2.5461 X 0.0156 x 0.94 x (112 + 26.23) x 1 x 0.95 x 0.67

= 3.26

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
06-October-2020 to 31-December-2020	106	0	0	106
01-January-2021 to 31-August-2021	8,320	0	0	8,320
Total	**8,426**	**0**	**0**	**8,426**