INSTALLATION OF HIGH EFFICIENCY WOOD BURNING COOKSTOVES IN ZAMBIA

Document Prepared by

C-Quest Capital Stoves Asia Limited

Project Title	Installation of high efficiency wood burning cookstoves in Zambia
Version	1.1
Report ID	VCS 2340 – MP05
Date of Issue	11-September-2023
Project ID	2340
Monitoring Period	16-September-2022 to 30-June-2023
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: +6 087 593828 Email: cqc-operations@cquestcapital.com Website: www.cquestcapital.com

CONTENTS

1 PROJECT DETAILS 3

1.1 Summary Description of the Implementation Status of the Project 3

1.2 Sectoral Scope and Project Type 5

1.3 Project Proponent 5

1.4 Other Entities Involved in the Project 6

1.5 Project Start Date 6

1.6 Project Crediting Period 6

1.7 Project Location 6

1.8 Title and Reference of Methodology 8

1.9 Participation under other GHG Programs 8

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions 8

1.11 Sustainable Development Contributions 9

2 SAFEGUARDS 12

2.1 No Net Harm 12

2.2 Local Stakeholder Consultation 12

2.3 AFOLU-Specific Safeguards 13

3 IMPLEMENTATION STATUS 13

3.1 Implementation Status of the Project Activity 13

3.2 Deviations 14

3.3 Grouped Projects 14

4 DATA AND PARAMETERS 16

4.1 Data and Parameters Available at Validation 16

4.2 Data and Parameters Monitored 18

4.3 Monitoring Plan 23

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS 27

5.1 Baseline Emissions 27

5.2 Project Emissions 29

5.3 Leakage 29

5.4 Net GHG Emission Reductions and Removals 29

APPENDIX 1: SCOPE 3 EMISSION STATEMENT 32

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 TLC Stoves for use by households in Zambia. Before the adoption of the TLC Stove, households in Zambia used inefficient, conventional open fire. 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 Zambia but will also reduce health hazards from indoor smoke pollution and women and children will have to spend less time collecting firewood.

The ICS deployed under this project is TLC-CQC Rocket Stove which 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 04-September-2020. Till the end of 5th monitoring period, a total of 89,546 TLC Stoves were installed under the project. The details of instances added for each monitoring period is depicted in the table below.

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. PP has distributed one or two improved cookstoves in the households as per the requirement of the stove users.

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

Monitoring Period

1st Monitoring Period	04-September-2020 to 15-April-2021
2nd Monitoring period	16-April-2021 to 15-October-2021
3rd Monitoring period	16-October-2021 to 28-February-2022
4th Monitoring period	01-March-2022 to 15-September-2022
5th Monitoring period	16-September-2022 to 30-June-2023

Installation of ICS

Date of first ICS installed	04-September-2020
Date of last ICS installed till 5th MP	12-January-2022
No. of instances added/ICS installed during 1st MP	22,028
No. of instances added/ICS installed during 2nd MP	40,200
No. of instances added/ICS installed during 3rd MP	27,318
No. of instances added/ICS installed during 4th MP	0
No. of instances added/ICS installed during 5th MP	0
Total no. of ICS distributed till end of 5th MP (30-06-2023)	89,546

1st Monitoring Survey

Survey dates for parameters $N_{y,i,j}$ and $B_{y=1,new,i,j,survey}$	23-June-2021 to 29-June-2021

2nd Monitoring Survey

Survey dates for parameters $N_{y,i,j}$	30-January-2022 to 26-February-2022

3rd Monitoring Survey

Survey dates for parameters $N_{y,i,j}$	12-April-2022 to 11-May-2022

5th Monitoring Survey

Survey dates for parameters $N_{y,i,j}$	05-July-2023 to 14-August-2023

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

The project results in a total emission reduction of 296,018 tCO_2e over the monitoring period of 16-September-2022 to 30-June-2023.

Audit Type	Period	Program	VVB Name	Number of years
Validation/ Verification	25-November-2021	VCS	Carbon Check (India) Private Limited	-
Verification	04-September-2020 to 15-April-2021	VCS	Carbon Check (India) Private Limited	0.61
Verification	16-April-2021 to 15-October-2021	VCS	Earthood Services Private Limited	0.50
Verification	16-October-2021 to 28-February-2022	VCS	Carbon Check (India) Private Limited	0.37
Verification	01-March-2022 to 15-September-2022	VCS	Carbon Check (India) Private Limited	0.55
Verification	16-September-2022 to 30-June-2023	VCS	Carbon Check (India) Private Limited	0.79

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.

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	+6 087 423828
Email	cqc-operations@cquestcapital.com

Organization name	C-Quest Capital SG Stoves Private Ltd
Contact person	Ken Newcombe
Title	Director
Address	38 Beach Road #29-11, South beach Tower, Singapore 189767
Telephone	+1202-247-7976
Email	cqc-operations@cquestcapital.com

1.4 Other Entities Involved in the Project

C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited are the only Project Proponents involved in the project. Apart from the Project Proponent(s), there are no other entities involved in the Project.

1.5 Project Start Date

The start date of this project 04-September-2020, which is the delivery/installation date of first TLC stove.

1.6 Project Crediting Period

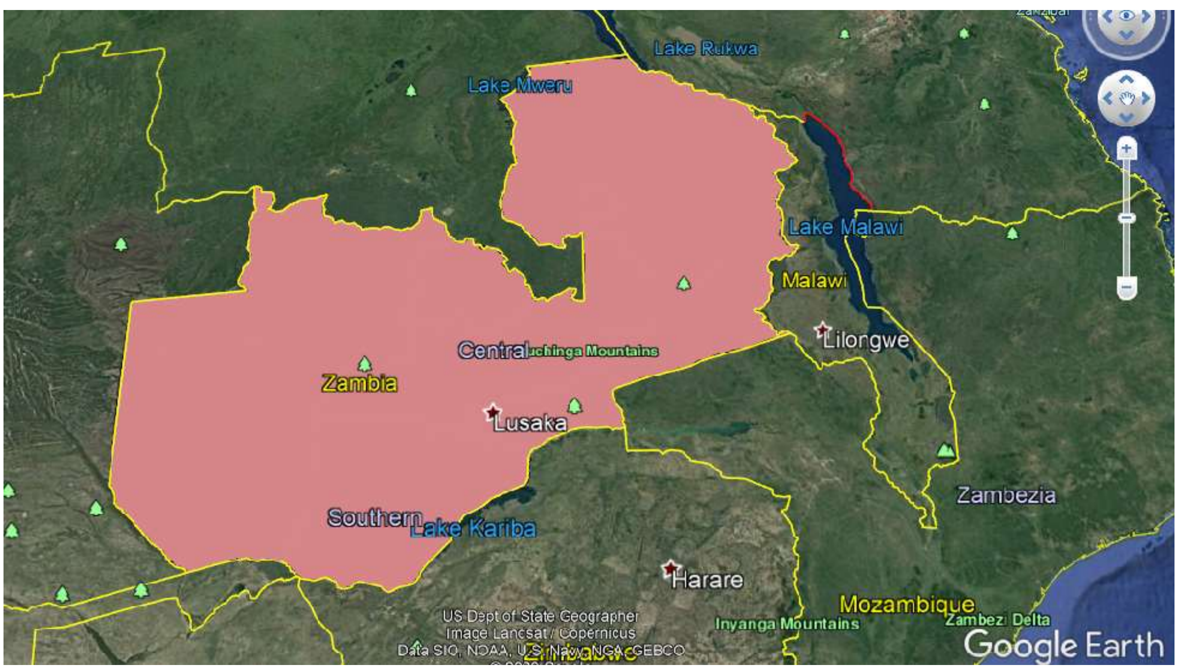
04-September-2020 to 03-September-2030 (both days included), ten years fixed crediting period.

1.7 Project Location

The project location is the geographical boundary of Republic of Zambia with coordinates- 13°08'02.0"S latitude and 27°50'57.6"E longitude[1].

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

Zambia map



Map of project area

Till the end of 5th monitoring period, the project activity instances/ICS implemented under this grouped project are shown in the table below.

Project Province/Regions	Districts
Central, Eastern, Western, Northern, North-Western, Lusaka, Copperbelt, Southern, Muchinga	Chasefu, Chavuma, Chibombo, Chikankanta, Chilanga, Chingola, Chisamba, Chongwe, Gwembe, Ikelenge, Itezhi-tezhi, Kabompo, Kafue, Kalumbila, Kaoma, Kapiri Mposhi, Kasempa, Katete, Kitwe, Luampa, Luano, Luanshya, Lufwanyama, Lukulu, Lumezi, Lundazi, Mafinga, Mambwe, Manyinga, Mitete, Mkushi, Monze, Mpongwe, Mufumbwe, Mumbwa, Mungwi, Mwinilunga, Ndola, Nkeyema, Senga Hill, Shibuyunji, Sinazongwe, Sinda, Solwezi, Zambezi.

1.8 Title and Reference of Methodology

- VMR0006: Methodology for Installation of High Efficiency Firewood Cookstoves, Version 1.1[2].
- Tool 30: Calculation of the fraction of non-renewable biomass, Version 3.0[3]
- Standard: Sampling and Surveys for CDM project activities and programmes of activities, Version 09.0[4]

1.9 Participation under other GHG Programs

Project is not registered under any other GHG programs.

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions

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

Further in line with section 3.23.9 of the VCS Standard, version 4.4, the "producer(s) or retailer(s) of the impacted good or service are known but not involved in the project or do not have a website".

PP will inform the manufacturers of the project stoves and the implementation partner that the Verified Carbon Units (VCUs) may be issued for the greenhouse gas emission reductions and removals under this grouped project. For these VCUs, the PP will be claiming carbon credits under VERRA. PP will further apprise that the ownership of these credits lies exclusively with C-Quest

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

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-30-v3.0.pdf

[4] https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20210531160756223/Meth_Stan05.pdf

Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited to avoid any potential risk of double claiming of Scope 3 emissions.

Copies of the emails will be submitted to the VVB during verification of the project.

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

- 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 created local employment opportunities in operational and management roles, as well as future assembly and/or manufacturing initiatives.

The details of the project activity's contribution to the Sustainable Development Goals have been provided in the Table below:

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1	3.9	Project specific indicator: Reduction in $PM_{2.5}$ emissions	Implemented activities to decrease	Annual emission of PM2.5 is reduced by 47% in 44,773 project households. The same is evidenced from survey results which show that ~96% of the respondents felt reduction in smoke, ~31% reduction in soot levels near the cooking area and ~65% of respondents experienced reduced levels of itchiness of eye associated with cooking on open fire.	Contribute to improved health and well-being brought about by reduced levels of fine particulate matter (PM2.5) emissions within 0.25 million households by approximately 47% below baseline emission level of 3.9 g/kg fuel.
2	4.3	Project specific indicator: Number of individuals who received any informal training	Increase	Vocational training and project related training with respect to successful implementation of a programme, appropriate methods of conducting surveys, carrying out maintenance activities etc. in addition to issues related to climate change was provided to 5 individuals associated with the project.	Contribute to increasing vocational and relevant skills of at least 50 local individuals (with a focus on targeting women and youth) by providing non-formal education and training on issues related to climate change, with specific skill building in operations and surveying activities related to stove distribution and its monitoring under VCS
3	5.4	Project specific indicator: Proportion of women/female population reporting reduction in time spent in collecting	Implemented activities to decrease	Contribute to reducing drudgery and reducing gender inequality, especially for women and children by saving time spent in collecting fuel wood and cooking, in all 44,773 households translating to equal number of women as they are primary cooks and fuel wood collectors in most of the households. The women can	100% of the primary fuelwood collectors/cooks in households receiving improved cookstoves under the project activity are expected to report reduction in time spent in collecting fuelwood and cooking

		fuelwood and cooking.		use the time saved for doing more productive activities or personal care.	activities, thereby freeing up time for more productive activities.
4	7.1	7.1.2 Proportion of population with primary reliance on clean fuels and technology	Increase	Increasing access to clean cooking technology by distributing a set of project stoves in 44,773 households.	Increase access to clean cooking technology with project stoves installations in approximately 250,000 households under the project lifecycle
5	8.3	8.3.1 Proportion of informal employment in non-agriculture employment, by sex	Increase	A total of 5 individuals were directly and indirectly employed under the project activity during the current monitoring period in Country for various activities related to project implementation, maintenance, and monitoring.	Contribute to generation of employment in informal sector (total economy, agriculture, and non-agriculture) by contracting locals with a target employment of 50 employees for varying lengths of time over the project lifetime with a focus on hiring females. Employment comprises all persons of working age who, during a short reference period (minimum one week), or full time will be engaged in any activity to produce goods or provide services for pay or profit
6	13.0	Project Specific indicator: Reduction in emissions as compared to baseline scenario (open fire)	Increase	Total emission reduction in the current monitoring period is 296,018 tCO_2 eq.	Contribute to GHG reduction through an estimated reduction of ~50.75 tCO_2e per stove for the ten-year period owing to the replacement of baseline stoves with project stoves.
7	15.3	15.2.1 Progress towards sustainable forest management by increasing above ground biomass in forests	Implemented activities to decrease	The project has resulted in saving ~1.97 tons of non-renewable biomass per stove during this MP.	Contribute an estimated reduction of deforestation of ~4.0343 t tons of woody biomass, per stove, per year, from forests surrounding the communities and reducing pressure on forest reserves

2 SAFEGUARDS

2.1 No Net Harm

No potential negative environmental or socio-economic impacts have been identified for the project.

- 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.
- 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 Zambia" 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 is available in Section 2.2 of the PD.

As a part of the ongoing communication, the Stove users can contact the local implementation partner in case any support or replacement of any stove part is required. The contact details of the local implementation partner have been shared with the end users during the stove installation. 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.

PP has a robust feedback and grievance redress policy and procedure in order to ensure that grievances of project-affected communities and individual stakeholders are properly handled and addressed. These procedures are implemented to enhance PP's accountability and transparency, as well as to promote project activities that can help communities in identifying adverse effects to them or their environment that PP had not previously identified and mitigated.

During the current monitoring period, PP has received nine grievances from the end users related to stove maintenance, lost metal parts, stove usage, etc. All the grievances which were received have been addressed by the PP. The grievance register records have been shared with VVB.

All the grievances received, and actions being taken during the current monitoring period are shown in the table below.

Grievance(s) Received	Action Taken
Lost stove serial QR card	Six of the end user has reported to field staff that she lost her QR card for their stove serial number. Stove Champions (SC) went and re-issued the QR card to the beneficiary within 2 days of reporting the issue.
Missing Stickshelve	An end user has reported to Stove Champion (SC) that she lost her stickshelve. Field coordinator visited the household and provided a new stickshelve to the end user.
Lost pot rest (stove metal part)	Couple of end user has reported to Field Coordinator (FC) that she lost her pot rest. Field coordinator (FC) visited the household and issued a new pot rest to the beneficiary.

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

No new ICS or project activity instances (PAIs) were installed during the current monitoring period. However, by the end of the monitoring period, the project has installed 89,546 stoves. Only one stove model (TLC-CQC Rocket Stove) was distributed in the project.

VCS methodology VMR0006, version 1.1 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. PP during the current MP, has conservatively considered the average usage rate of ICS (6.6250 days/week) being captured during the current monitoring survey from representative samples and the same has been applied in apportioning of emission reductions. The same can be verified from the ER calculation excel spreadsheet.

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

This project did not apply any deviations related to Project Description.

3.3 Grouped Projects

New project activity instances 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 34.5% of thermal efficiency (Please refer the efficiency report attached).
2	Use the technologies or measures specified in the project description.	Only TLC-CQC Rocket stoves have been adopted in the project,
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
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 Zambia only and subject to the same baseline scenario determined in Section 3.4 of PD.

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 mandated government programme or policy in host country of this project ensuring the distribution of new project activity instances. **Step 2: Positive List** The inclusion of new project activity instances complies with positive list as it satisfies criterion 1 where it meets all the applicability conditions of the methodology.
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. 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.	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.

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	0.81
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 Zambia.
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 was 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	Measured based on a representative sample.

and procedures to be applied	
Frequency of monitoring/recording	At least once every two years
Value monitored	89,546
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% * 89,546 = 89,546
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 values mentioned below are applied -

Year (y)	$\eta_{new,y,i,j}$
1	32.43%
2	32.11%
3	31.78%
4	31.47%
5	31.15%
6	30.84%
7	30.53%
8	30.23%
9	29.92%
10	29.63%

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: $$\eta_{new,y,i,j} = \eta_p \times (DF_n)^{y-1} \times 0.94$$ For vintage 1 stoves: $\eta_{new,1,i,j}$ = 0.345 x $(0.99)^{1-1}$ x 0.94 = 0.3243 For vintage 2 stoves: $\eta_{new,2,i,j}$ = 0.345 x $(0.99)^{2-1}$ x 0.94 = 0.3211 For vintage 3 stoves: $\eta_{new,3,i,j}$ = 0.345 x $(0.99)^{3-1}$ x 0.94 = 0.3178 For vintage 4 stoves: $\eta_{new,4,i,j}$ = 0.345 x $(0.99)^{4-1}$ x 0.94 = 0.3147 For vintage 5 stoves: $\eta_{new,5,i,j}$ = 0.345 x $(0.99)^{5-1}$ x 0.94 = 0.3115 For vintage 6 stoves: $\eta_{new,6,i,j}$ = 0.345 x $(0.99)^{6-1}$ x 0.94 = 0.3084

	For vintage 7 stoves: $\eta_{new,7,i,j}$ = 0.345 x $(0.99)^{7-1}$ x 0.94 = 0.3053 For vintage 8 stoves: $\eta_{new,8,i,j}$ = 0.345 x $(0.99)^{8-1}$ x 0.94 = 0.3023 For vintage 9 stoves: $\eta_{new,9,i,j}$ = 0.345 x $(0.99)^{9-1}$ x 0.94 = 0.2992 For vintage 10 stoves: $\eta_{new,10,i,j}$ = 0.345 x $(0.99)^{10-1}$ x 0.94 = 0.2963
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
Description of measurement methods and 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 This value was determined within the first year of the introduction of the devices through sample surveys.
Frequency of monitoring/recording	In the first year of project implementation
Value monitored	1.2082
Monitoring equipment	Weighing scale
QA/QC procedures to be applied	Calibration of weighing scales used for measuring the fuel wood was done in house before start using on site.
Purpose of data	Calculation of emission reductions
Calculation method	This is monitored value
Comments	At the time of first monitoring survey, the surveyor enquired for firewood consumption for each stove installed in the household. PP during the current MP, has conservatively considered the

	average usage rate of ICS i.e., 6.6250 days/week being captured during the current monitoring survey from representative samples and the same has been applied in apportioning of emission reductions. The same can be verified from the ER calculation excel spreadsheet.

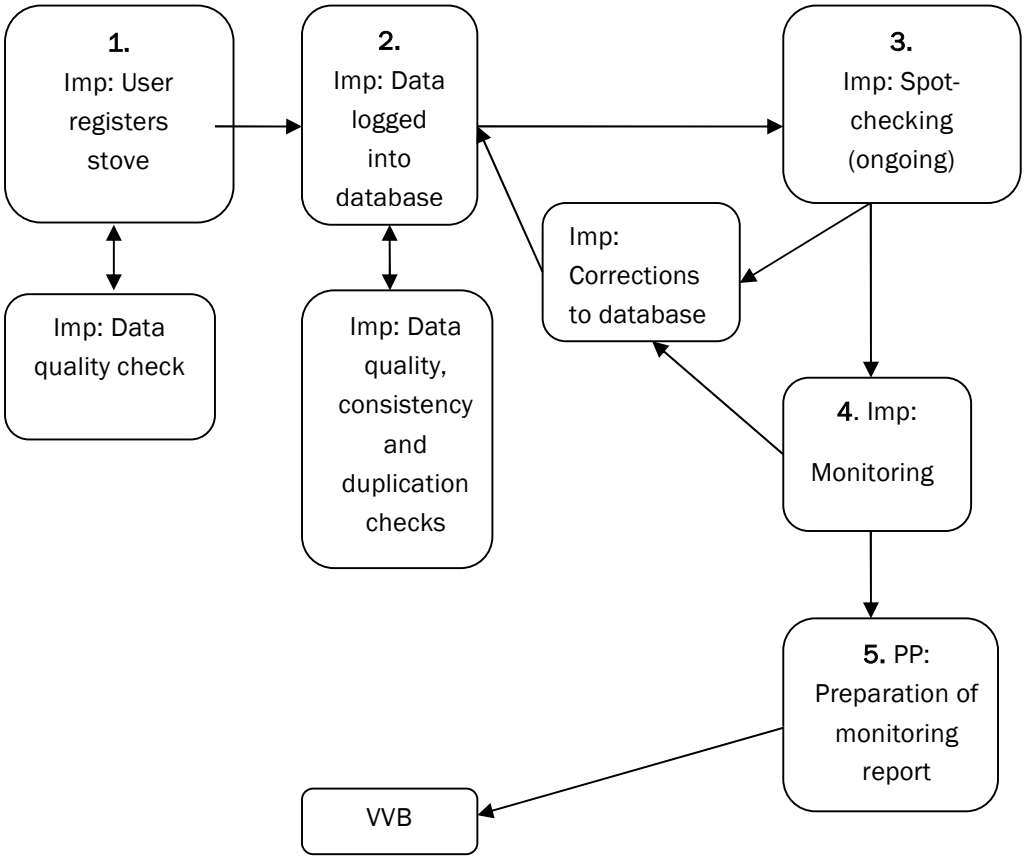
Data / Parameter	Life Span
Data unit	Number of years
Description	The operating lifetime of the project device.
Source of data	Manufacturer's specification
Description of measurement methods and procedures to be applied	TLC cookstoves manufactured under the project activity match the fixed design specification. 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 will conduct 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.

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", while the project proponent by "PP".



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

1. **Imp: User registers stove:** Project implementer collected/received the necessary information required for the Registration process from the user. 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. **Imp: 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. **PP: Spot- checking (ongoing):** Project implementer field staff randomly select units included in the database and visit or contact the stove users 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 got clearly marked as such and excluded from emission reductions calculations.

4. **Imp: Monitoring:** Project implementer follows the requirements as per VCS-PD to collect the necessary information for a monitoring report.

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

The Project Proponent (PP) is comprised of Project Manager, Chief Operating officer, Country Directors and field staffs/enumerators to support the team. The roles and responsibilities of the PP and the team are described 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 Directors

- Oversees the execution of training, which includes all aspects of stove design, construction, use & maintenance of the field staffs 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

The 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 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 ($N_{y,j,j}$).

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]

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.

To estimate the sample size for the parameter Ny,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

Sample size calculation:

The calculation of the required sample size for $N_{y,i,j}$ parameter in this monitoring period is illustrated below. During 4th MP verification, 100% of ICS were found to be in operation although expected proportion (p) was considered as 0.85. However, for this monitoring period also, PP has considered value of expected proportion (p) as 0.85, so that PP covers ample samples from the population to gain required confidence and to achieve better precision level.

The resulting sampling size is calculated as:

$$n \geq \frac{1.645^2 \text{ x } 89{,}546 \text{ x } 0.85\ (1-0.85)}{(89{,}546-1) \text{ x } 0.1^2 \text{ x } 0.85^2 + 1.645^2 \text{ x } 0.85\ (1-0.85)} = 47.73$$

Therefore, using simple random sampling formula, 48 ICS were calculated to be surveyed. Sample stoves were selected using the random number generator technique. Under this project activity two stoves were also distributed in one household. Survey team also surveyed the second stove, if distributed in the sample household. Therefore, during this survey total 96 stoves were surveyed.

Step 5 involved 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 parameter was obtained though sampling:

1. $N_{y,i,j}$: Number of stoves in operation

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 VMR0006 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 ($N_{y,i,j}$)	96	1.00	0.00%

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 are 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.

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

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

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

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]

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

$EF_{wf,CO2}$	=	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.
$\eta_{new,I,j}$	Efficiency of the improved cook stove determined using Equation 5 of the methodology.

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

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 stove efficiency test

[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 VMR0006, version 1.1

The full set of emission reductions calculation for single stove as well as double stove per HH is provided in separate Excel spread sheets.

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

PP has calculated the emission reduction for each ICS installed under the project activity separately. In this section example of ER calculation of one ICS (stove serial number **CQCSSAZT184987**) is provided:

Date of installation: **04-September-2020**

Vintage for the stove: Vintage 3

No. of days for vintage 3: 288 (from 16-September-2022 to 30-June-2023)

Year fraction: 288/365 = 0.7890

$B_{y=1,new,i,survey}$ = 1.2082

Conservatively, after considering the actual usage rate of ICS (6.6250 days/week),

$B_{y=1,new,i,survey}$ = 1.2082 x (6.6250/7) = 1.1434

$\eta_{new,i,j}$ = 0.3178

$B_{y,savings,i,j}$ = 1.1434 x ((0.3178/0.1) - 1)

= 2.4909

$ER_{y,i,j}$ = 2.4909 x 0.0156 x 0.81 x (112 + 26.23) x 1 x 0.95 x 0.7890

= 3.2613

Emission Reductions claimed before this monitoring period

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2020 (04-September-2020 to 31-December-2020)	175	0	0	175
2021 (01-January-2021 to 15-April-2021)	11,688	0	0	11,688
2021 (16-April-2021 to 15-October-2021)	116,544	0	0	116,544
2021 (16-October-2021 to 31-December-2021)	72,777	0	0	72,777
2022 (01-January-2022 to 28-February-2022)	65,041	0	0	65,041
2022 (01-March-2022 to 15-September-2022)	218,038	0	0	218,038
Total	**484,263**	**0**	**0**	**484,263**

Emission Reductions claimed during this monitoring period

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2022	110,401	0	0	110,401

(16-September-2022 to 31-December-2022)				
2023 (01-January-2023 to 30-June-2023)	185,617	0	0	185,617
Total	**296,018**	**0**	**0**	**296,018**

Comparison of Ex-Ante and Ex-Post Emission Reductions and Removals (ERR) values

Monitoring Period days: 16-Sept-2022 to 30-June-2023

No. of Days: 288

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
242,076	296,018	22.28%	Actual emission reductions achieved are higher than the value estimated in ex-ante calculation due to 100% ICS were found operating during the monitoring survey as compared to the 10% annual loss rate assumed in VCS-PD.

A detailed comparison of ERs (Ex-ante vs Actual ER) along with justification is provided in the ER calculation excel spreadsheet as well as in a separate ERR comparison sheet for reference.

APPENDIX 1: SCOPE 3 EMISSION STATEMENT

From: Brent Moser
Sent: Wednesday, February 22, 2023 7:09 PM
To: Dale,Lewis(COMACO)
Cc: Chrispine Mbewe; Myles Nussbaum
Subject: Installation of High Efficiency Wood Burning Cookstoves in Zambia – (VCS 2340)

Dear Dale,

This is to bring to your kind notice that C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited is implementing a grouped project titled, "Installation of High Efficiency Wood Burning Cookstoves in Zambia" (VCS ID 2340). It involves distribution of improved cook stoves (ICS) to households in Republic of Zambia. For this purpose, we have involved your organization for distribution of project stoves in Republic of Zambia.

Verified Carbon Units (VCUs) may be issued for the greenhouse gas emission reductions and removals for which C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited will be claiming carbon credits under VERRA. The ownership of these credits lies exclusively with C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited.

This mail intends to apprise you about the project, to avoid any potential risk of double claiming of Scope 3 emissions under the grouped project.

Best,

Brent Moser
Director of Operations – Africa Region
Phone *+1 407.491.0368*
E-mail *bmoser@cquestcapital.com*
Website *www.cquestcapital.com*
CQuestCapital

E-mail sent to implementation partner (Community Marketing Cooperation-COMACO)

From: Brent Moser
Sent: Wednesday, February 22, 2023 7:09 PM
To: Jacob Eubanks
Cc: Chrispine Mbewe; Myles Nussbaum
Subject: Installation of High Efficiency Wood Burning Cookstoves in Zambia – (VCS 2340)

Dear Jacob,

This is to bring to your kind notice that C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited is implementing a grouped project titled, "Installation of High Efficiency Wood Burning Cookstoves in Zambia" (VCS ID 2340). It involves distribution of improved cook stoves (ICS) to households in Republic of Zambia. For this purpose, we have involved your organization for distribution of project stoves in Republic of Zambia.

Verified Carbon Units (VCUs) may be issued for the greenhouse gas emission reductions and removals for which C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited will be claiming carbon credits under VERRA. The ownership of these credits lies exclusively with C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited.

This mail intends to apprise you about the project, to avoid any potential risk of double claiming of Scope 3 emissions under the grouped project.

Best,

Brent Moser
Director of Operations – Africa Region
Phone *+1 407.491.0368*
E-mail *bmoser@cquestcapital.com*
Website *www.cquestcapital.com*
CQuestCapital

E-mail sent to implementation partner (Choose Water)

From: Brent Moser
Sent: Wednesday, February 22, 2023 7:09 PM
To: Umair Zaveri
Cc: Herbert Kakono; Chrispine Mbewe; Myles Nussbaum
Subject: Installation of High Efficiency Wood Burning Cookstoves in Zambia – (VCS 2340)

Dear Umair,

This is to bring to your kind notice that C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited is implementing a grouped project titled, "Installation of High Efficiency Wood Burning Cookstoves in Zambia" (VCS ID 2340). It involves distribution of improved cook stoves (ICS) to households in Republic of Zambia. For this purpose, we have involved your organization for distribution of project stoves in Republic of Zambia.

Verified Carbon Units (VCUs) may be issued for the greenhouse gas emission reductions and removals for which C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited will be claiming carbon credits under VERRA. The ownership of these credits lies exclusively with C-Quest Capital SG Stoves Private Ltd and C-Quest Capital Stoves Asia Limited.

This mail intends to apprise you about the project, to avoid any potential risk of double claiming of Scope 3 emissions under the grouped project.

Best,

Brent Moser
Director of Operations – Africa Region
Phone *+1 407.491.0368*
E-mail *bmoser@cquestcapital.com*
Website *www.cquestcapital.com*
CQuestCapital

E-mail sent to implementation partner (Alliance Ginneries)