INSTALLATION OF HIGH EFFICIENCY WOOD BURNING COOKSTOVES IN MALAWI

Document Prepared by

C-Quest Capital Stoves Asia Limited

Project Title	Installation of high efficiency wood burning cookstoves in Malawi
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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

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1 PROJECT DETAILS

1.1 Summary Description of the Project

A summary description of the technologies/ measures to be implemented by the project.

The project involves distribution of fuel-efficient improved cookstoves (ICS) in Malawi. The ICS disseminated through this project will replace the baseline cookstoves.

Through this project, the distribution and installation of approximately 500,000 ICS will be undertaken for households in Malawi. It is intended that under this project single pot, TLC-CQC Rocket Stove will be distributed. 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 Malawi but will also reduce health hazards from indoor smoke pollution and women and children will have to spend less time collecting firewood.

The end user will be informed in advance that the use of ICS generates carbon finance which in turn is used for subsidising the price of ICS and for recovering project implementation costs.

The location of the project.

The project will take place in Malawi. The details of the project location are provided in Section 1.12.

An explanation of how the project is expected to generate GHG emission reductions or removals.

The ICS will substitute the currently common cooking on open fire. The ICS burns wood more efficiently thereby improving thermal transfer to pots, hence saving fuel and lowering greenhouse gas emissions.

A brief description of the scenario existing prior to the implementation of the project.

The baseline scenario is the continued use of non-renewable wood fuel by the target population to meet similar thermal energy needs as provided by project cookstoves in absence of project activity.

A brief description of the project activity instances implemented at the time of validation.

The first project activity instance was implemented on 01 December 2020 under this grouped project activity. 54,638 project activity instances (ICS) have been implemented till submission of the validation report.

An estimate of annual average and total GHG emission reductions and removals.

The average annual GHG emission reduction from the project is expected to be 7.63 t CO_2e per Year for each project activity instance (i.e., ICS) and 1,924,569 t CO_2e for the group project activity over the entire crediting period.

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 Eligibility

The project involves energy efficient cookstove distribution which falls under the category of efficiency improvements in thermal applications, therefore it is eligible under the scope of VCS Program.

1.4 Project Design

The project is a grouped project.

Eligibility Criteria

For the inclusion of new project activity instances i.e., ICS, the project proponent shall 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) will meet the applicability conditions set out in Section 3.2 where the target of the end-user is household and the ICS deployed is at least 25% of thermal efficiency.
2	Use the technologies or measures specified in the project description.	Only TLC-CQC Rocket stoves to be 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 to be adopted in the project and it will 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 will be installed within Malawi only and subject to the same baseline scenario determined in Section 3.4.

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 will 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 will comply 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 shall exceed 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.

1.5 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

1.6 Other Entities Involved in the Project

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

1.7 Ownership

The project ownership is with C-Quest Capital Stoves Asia Limited.

1.8 Project Start Date

01 December 2020 (Date of commissioning of 1st ICS)

1.9 Project Crediting Period

01 December 2020 to 30 November 2030, ten years.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	X

Year	**Estimated GHG emission reductions or removals (tCO_2e)**
Year 1	9,53,880
Year 2	1,799,960

Year 3	2,541,108
Year 4	3,180,150
Year 5	2,765,991
Year 6	2,363,055
Year 7	1,971,176
Year 8	1,590,190
Year 9	1,219,935
Year 10	8,60,251
Total estimated ERs	**19,245,696**
Total number of crediting years	**10**
Average annual ERs	**1,924,569**

1.11 Description of the Project Activity

The project involves distribution of fuel-efficient improved cookstoves (ICS) to replace the baseline cookstoves in households.

The ICS to be 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 woodfuel consumption compared with a three-stone fire or traditional pot support.

Technology/Measure

TLC-CQC Rocket Stove uses a total of 15 bricks that will be made by the households using locally available clay. The average size of the brick would be 22.5cm x 11cm x 6.5cm. The bricks will be joined together using a mixture of 5 liters clay, 5 liters sand, 5 liters manure/cow dung and 5 liters of water. This ensures reduction in heat loss and better insulation. Metal components have been added to the design to optimize combustion and heat transfer.

TLC-CQC Rocket Stove

Stove components

Stove has a metal top that allows the pot to sit higher improving the flow of air into the combustion chamber and out through the top of the stove

An adjustable metal pot skirt ensures more effective transfer of heat from the fire into the pot, increasing efficiency and also helping to block wind

TLC-CQC stoves come with a metal stick support which is placed in front of and slightly into the opening of the stove and acts as a firewood feeding platform. This ensures adequate airflow while feeding the fuel into the combustion chamber resulting in complete combustion of wood.

According to independent stove efficiency tests performed by Aprovecho Research Centre on the TLC Rocket Stove, the WBT results yielded an average thermal efficiency of 34.5%. for boiling 5 litres of water.

Technical Specifications	
Stove Size	Depth: 35 cm Width: 35 cm Height: 28 cm
Combustion Chamber Size	Depth: 12 cm Width: 12 cm Height: 28 cm
Efficiency	34.5%

Data collection of ICS end-user

Project proponent must gather the necessary information to identify households using its ICS during the course of the project. To facilitate this process, each ICS will be assigned a unique serial number. This number will be recorded during the registration process together with the following information (as appropriate and as available):

- Name of ICS user or head of the household
- Address / GPS of ICS household
- Phone number of ICS user or household, where available.
- Stove model
- Date of distribution/installation
- ICS serial number
- Retailer/distributer information

The information collected will be stored in the electronic database which will serve as project database for project monitoring and sampling purposes.

1.12 Project Location

The project location will be the geographical boundary of Republic of Malawi. The project boundary will be the geographic borders of the Republic of Malawi.

Malawi map

Malawi (National)

Malawi, Northern Point
Latitude: - 9.366667° S
Longitude: 33.000000° E

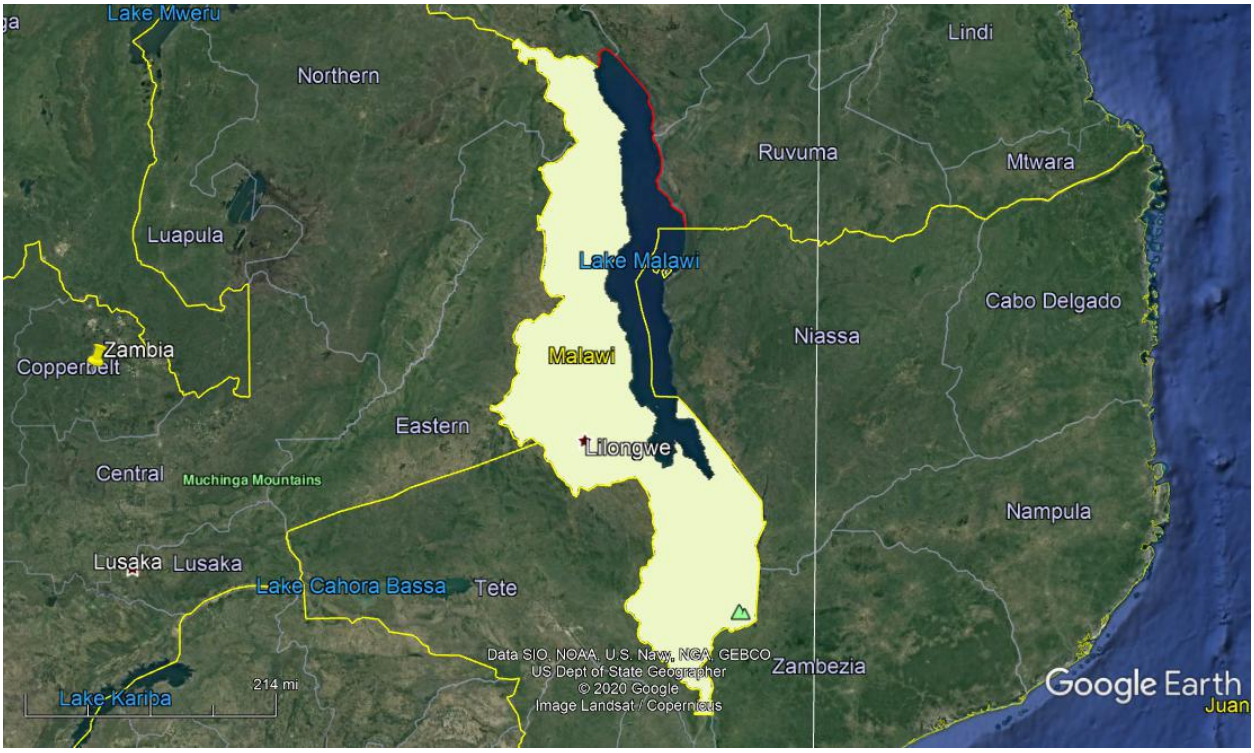
Malawi, Western Point
Latitude: - 13.600000° S
Longitude: 32.666667° E

Malawi, Eastern Point
Latitude: - 14.883333° S
Longitude: 35.916667° E

Malawi, Southern Point
Latitude: - 17.133333° S
Longitude: 35.283333° E

Map:
http://www.ephotopix.com/malawi_region_map.html

Geographical coordinates obtained from Google Earth®



Map of project area (See KML file attached)

Republic of Malawi is divided into 3 regions – Northern, Central and Southern regions. To facilitate the management, implementation, monitoring and sampling stages of the project, the project proponent divides the project boundary into 3 project regions according to the region.

No.	Project Region	Regions
1	Northern Area	Northern
2	Central Area	Central
3	Southern Area	Southern

1.13 Conditions Prior to Project Initiation

The conditions prior to project initiation is the continued use of non-renewable wood fuel (firewood) by the target population to meet similar thermal energy needs as provided by project cookstoves in absence of project activity.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

There are no laws and regulations governing the use of improved cookstoves in Malawi households.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has not been registered, nor is it seeking registration under any other GHG program.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG program.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

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

1.16.2 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit.

1.17 Additional Information Relevant to the Project

Leakage Management

Not applicable as the project adopts a net gross adjustment factor of 95% to account for leakage.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

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

a) Environmental Sustainability

- The project will help significantly reduce greenhouse gas emissions over its lifetime.
- The project will help 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 will be reduced. Less carbon dioxide, carbon monoxide and particulates will be 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 will help develop a section of the local economy, in the distribution, local assembly, maintenance and monitoring activities.
- Household expenditures on cooking fuel will be 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.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

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

2.2 Local Stakeholder Consultation

Feedback was requested from local stakeholders for the "Installation of high efficiency wood burning cookstoves in Malawi" program between October 26th, 2020 and November 25th, 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.

Stakeholders were invited to provide feedback via multiple methods including, an announcement posted on C-Quest Capital's website on October 26th, 2020 with an electronic feedback form, Project Description Presentation, and Non-Technical Summary and one-on-one meetings. Furthermore, an English advert ran in *The Nation*, a major national newspaper, on November 17th, 2020; and e-mail invitations were sent from C-Quest Capital on November 4th, 2020 to 41 people from organizations around the country including government, NGOs, stove manufacturers, project developers, academia and private and public-sector entities involved with cookstoves and/or sustainable energy. The email included a link to the CQC website announcement and feedback form which resulted in electronic commentary from seven additional stakeholders. (See Appendix 1)

Feedback was received from nine national stakeholders (Development Fund of Norway, United Purpose, Energy Africa, Total Land Care, Balaka Hospital/Tingathe Project, Balaka Civil Society Coalition, Ministry of Environmental Affairs/Department of Energy, Traditional Authority of Chiseka, USAID/Feed the Future) and female beneficiaries [see Annex VII and IX]. In summary, there was a considerable amount of positive feedback regarding the stove project. The female beneficiaries of the project greatly appreciated the lack of smoke on the CQC stove compared to open fires and that the stove has increased their time for other social/economic activities by allowing them to cook with fewer sticks. They also indicated that the pot skirt helps keep their pot cleaner and retain heat, thus allowing fast cooking. The stove releases less carbon, providing evidence that the CQC promoted stove can reduce respiratory infections if it is consistently used by households and supplemented by opening windows to allow for proper ventilation. Stakeholders agreed with these claims and further highlighted that the stove is responding to the issue of the growing scarcity of firewood. Energy Africa, indicated to be impressed with stove part production increases and subsequent increases in the installation of stoves among households.

Some of the main challenges that were raised in the discussions were, 1) the CQC promoted stove is stationary and cannot be moved like other efficient models available in Malawi. 2) Some households are still working on attitudes and behaviors to cope with using this unfamiliar model of stove and way of cooking. 3) Initial cooking takes a bit longer, mostly when using a bigger pot as many households have bigger families, a second stove for cooking would help address this issue. 4) R&D on biomass energy is not doing enough to make the technologies to be user friendly or clean.

Overall responses to feedback concluded that CQC/Malawi should continue the stove projects and work towards being visible at the national level. Attending national level cookstove steering committee meetings and supporting the organization of such meetings, could help with visibility among key stakeholders. Additionally, steps should continue to be pursued to achieve two cooking stations per household and that CQC promoted cookstove interventions should be coupled with kitchen re-construction to improve the health of beneficiaries. In considering this, maximum advocacy should be taken on the shared importance of the role an un-ventilated kitchen presents, in conducting improved cookstove implementation projects for rural communities. In conclusion, participants widely recognized the benefits of the stove programs already active in Malawi and look forward to seeing how the reach and impact will be expanded on and how the lives of the people living there will be changed in the years ahead.

PP will ensure that regular monitoring will be conducted by the field staff and/or project managers to take feedback from the local stakeholders. Stakeholders' will raise their concerns (positive or negative) during implementation of the project activity. The project proponent will take due account of the input received and will take the necessary action in terms of either updating the project design or justifying the stakeholder to resolve their queries.

2.3 Environmental Impact

No negative environmental impacts have been identified from the project and environmental impact assessment (EIA) is not required for the project.

2.4 Public Comments

Following comments were received during public commenting period:

Comment	Response
Verra is requested to kindly check the addionality which is not correctly demonstrated in the PDD. Also, since these stoves are build by the owners itself , so why carbon credits are required by the PP	Additionality for the project activity has been demonstrated as per the applied VCS methodology VMR 0006. There is no mandate for distributing fuel efficient cookstove, and the ICS will be installed free of cost to the household.
Additonality demonstration is wrong. the stove does not falls under positive list of technology as per UNFCCC guidelines	Additionality for the project activity has been demonstrated as per the applied VCS methodology VMR 0006.
These type of stoves does not yield more then 20% efficiency and are similar to baseline systems. Mere addition of burner plate and fuel feeding plate does not contribute to efficiency. project developer must suffice stoves efficiency from reputed international testing agency like clean cooking association etc to demonstrate that the actual efficiency is more then 34%	Efficiency of the TLC rocket stove has been tested and approved by Aprovecho Research Centre. Aprovecho Research Centre specializes in testing biomass cooking stoves. They test stoves to understand how they function, to compare stoves, and to improve performance. The Water Boiling Test (WBT) and the nine metrics in the ISO/IWA Tiers provide the project manager with a holistic picture of emissions, fuel use, and safety. Aprovecho Research Center (ARC) assists developing world organizations to establish high quality labs so they can test and improve their wood burning cooking stoves. It specializes in iterative experimental design of wood burning cookstoves through rapid prototyping and emissions and thermal measurements.
cook stoves deployed in the project states an efficiency of 34% which is contradicting, since stoves types depicted in the document are made of mud stoves which are just traditional stoves	Please refer the response above

the project stoves does not count as energy efficient stoves and are basically typical mud stoves with less then 20% efficiency	Please refer the response above
The cookstoves are not improved efficient cookstoves but just the traditional cook stoves with slight modification having eff less then 23%	Please refer the response above

2.5 AFOLU-Specific Safeguards

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

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Methodology for Installation of High Efficiency Firewood Cookstoves, Version 1.1[1]

3.2 Applicability of Methodology

Applicability criterion	How the project complies
Project activities shall be implemented in domestic premises or in community-based kitchen	The proposed project involves deployment of ICS only in households.
The project stove shall have specified high-power thermal efficiency of at least 25% per the manufacturer's specifications and shall exclusively use woody biomass and can be single pot or multi-pot;	TLC-CQC Rocket stoves planned to be installed under this project are single pot wood cookstoves that have an efficiency of 34.5% as per the manufacturer's specifications.
Both 'Projects' and 'Large Projects' can use the methodology	Estimated average annual emission reductions for the grouped project activity are greater than 300,000 tonnes CO2e per year. Therefore, proposed project qualifies the "Large Projects" criteria.

[1] VMR0006 Methodology for Installation of High Efficiency Firewood Cookstoves - Verra

Non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics;	Non-renewable biomass has been used since 31 December 1989 in Malawi as demonstrated at below.
For the specific case of biomass residues processed as a fuel (e.g., briquettes, wood chips), it shall be demonstrated that: (a) It is produced using exclusively renewable biomass (more than one type of biomass may be used). (b) The consumption of the fuel should be monitored during the crediting period and (c) Energy use for renewable biomass processing (e.g., shredding and compacting in the case of briquetting) may be considered as equivalent to the upstream emissions associated with the processing of the displaced fossil fuel and hence disregarded.	Not applicable. The ICS is introduced as energy efficiency measure to replace baseline stoves and reduce the use of non-renewable biomass for combustion.
The project design shall explain the proposed method for distribution of project devices including the method to avoid double counting of emission reductions such as unique identifications of product and end-user locations (e.g., programme logo)	Each ICS in this project will be identified by a unique combination of customer name and geographical location, as well as a serial number. The serial number will be a unique number which will allow for a clear distinction between the stoves. No individual serial number can be repeated within the project, thus ensuring that each stove is counted only once in the proposed project. In addition, the project has been cross-checked against other CDM project activity operating in the country using the UNFCCC, the Gold Standard, and other relevant voluntary carbon schemes to ensure that the ICS is not included in any other CDM project activity or voluntary project activity.
The project design shall also explain how the proposed procedures prevent double counting of emission reductions, for example to avoid that project stove manufacturers,	The stove manufacturers/wholesale providers/end users shall sign an undertaking stating clearly that the PP or an entity

wholesale providers or others claim credit for emission reductions from the project devices	authorized by it shall be the sole owner of the VCUs arising from the project

Evidence that the non-renewable biomass has been in use since 1989

Non-renewable biomass has been in use since December 31, 1989 as evidenced by various FAO statistical data. The Global Forest Resources Assessment 2010[2] (FAO) indicates that forest areas decline yearly, and that the total forest area declined by 27% from 1973 to 2010, as summarized in the table below. It is now estimated that the fraction of non-renewable biomass in total biomass is 94 percent.

Trends in extent of forest 1973-2010 - Malawi

Area (1000 hectares)					
	1973	1990	2000	2005	2010
Forest	4456	3863	3567	3402	3237

In view of the combined evidence of declining forested areas since 1973, trend in loss in carbon stock since 1990, trend in the increased length of time spent for collecting firewood, and presently such a high fraction of non-renewable biomass, it may be deducted that the majority of fuelwood used across Malawi since December 31, 1989 was from non-renewable sources.

3.3 Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Emission from use of non-renewable biomass/Fossil fuel	CO_2	Yes	Major source
		CH_4	Yes	Major source
		N_2O	Yes	Major source
		Other	No	No other source identified
Project	Emission from use of non-renewable biomass	CO_2	Yes	Major source
		CH_4	Yes	Major source
		N_2O	Yes	Major source
		Other	No	No other source identified

[2] FAO, Global Forest Resources Assessment 2010, Country Reports, Malawi PAGE 11

3.4 Baseline Scenario

The baseline scenario is the continued use of non-renewable wood fuel (firewood) by the target population to meet similar thermal energy needs as provided by project cookstoves in absence of project activity.

3.5 Additionality

The methodology uses activity method for the demonstration of additionality.

Activity Method

Step 1: Regulatory Surplus

There is no mandated government programme or policy in host country of this project ensuring the distribution of domestic fuel-efficient cookstoves. The project is not mandated by any law, statute or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute or other regulatory framework.

Households may only participate voluntarily in this project. It is hereby confirmed that the proposed project is a voluntary coordinated action by CQC.

Step 2: Positive List

As per Section 3.2, the project meets the applicability conditions of the methodology which represent the positive list.

The project installs the ICS at zero cost to the household and has no other source of revenue other than the sale of GHG credits.

The project is not implemented as part of government schemes or supported by multilateral funds.

Conclusion: As the project fulfills the conditions above, it is deemed additional.

3.6 Methodology Deviations

The project did not apply any methodology deviations.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The methodology does not account for baseline emissions separately, but instead quantifies net emission reductions achieved by the project. Please refer to Section 4.4.

4.2 Project Emissions

The methodology does not account for project emissions separately, but instead quantifies net emission reductions achieved by the project. Please refer to Section 4.4.

4.3 Leakage

Leakage shall be considered as default 0.95 in accordance with methodology.

4.4 Net GHG Emission Reductions and Removals

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

$$ER_y = \sum_i \sum_j ER_{y,i,j}$$ 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

$$ER_{y,i,j} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times \left(EF_{wf,CO2} + EF_{wf,non\ CO2}\right) \times N_{y,i,j} \times 0.95$$ 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})[3]
$NCV_{wood\ fuel}$	=	Net calorific value of the non-renewable woody biomass that is substituted or reduced (IPCC default for wood fuel, 0.0156 TJ/tonne)[4]
$EF_{wf,CO2}$	=	CO_2 emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO_2/TJ)[5]
$EF_{wf,non\ CO2}$	=	Non-CO_2 emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO_2/TJ)[6]
$N_{y,i,j}$	=	Number of improved cookstoves of type *i* and batch *j* operating during year *y*
0.95	=	Discount factor to account for leakage

The quantify of woody biomass saved due to implementation of improved cookstoves to be estimated using equation below:

$$B_{y,savings,i,j} = B_{y=1,new,i,survey} \times \left(\frac{\eta_{new,y,i,j}}{\eta_{old}} - 1\right) \quad \text{Equation (3)}$$

where

η_{old}	=	Efficiency of baseline cookstove
$\eta_{new,y,i,j}$	=	Efficiency of the improved cookstove type *i* and batch *j* determined through water boiling test (WBT) during year *y* Alternatively, efficiency may be determined using Equation 4.
$B_{y=1,new,i,j,survey}$	=	Annual quantity of woody biomass used by improved cookstoves in tonnes per device of type *i* and batch *j*, determined in the first year of the implementation of the project through a sample survey.

$$\eta_{new,y,i,j} = \eta_p \times (DF_n)^{y-1} \times 0.94 \quad \text{Equation (4)}$$

[3] Default values endorsed by designated national authorities and approved by the Board are available at https://cdm.unfccc.int/DNA/fNRB/index.html

[4] 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 1 Introduction

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

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

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). This value may be based on actual monitoring or based on manufacturer's declaration on expected loss in efficiency or through publicly available literature on relevant industry standards. Alternatively default value of 0.99 efficiency loss per year can be considered.
0.94	=	Adjustment factor to account for uncertainty related to project cookstove efficiency test.

For ex-ante calculation purpose, the assumption below is applied.

1) The project will install up to 500,000 ICS.

2) ICS installation to be implemented in 4 years with each year comprises of 125,000 ICS.

3) The life span of ICS is 10 years. For conservative estimate of ER, the annual stove loss rate is estimated at 10%

4) $B_{y=1,new,i,j,survey}$ is assumed as 1.83 tonnes / device / year

Determination of number of ICS operating during year y

$N_{y,i,j}$ = 125,000 x [1 - (y-1) x 10%]

Example of calculation:

If y = 2,

$N_{y,i,j}$ = 125,000 x [1 - (2-1) x 10%]

= 125,000 x 90%

= 112,500

Hence, the number of ICS operating during year y is as below:

Year (y)	$N_{y,i,j}$
1	125,000
2	112,500
3	100,000

4	87,500
5	75,000
6	62,500
7	50,000
8	37,500
9	25,000
10	12,500

Determination of efficiency of ICS during year y

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

Where

η_p = 34.5%

DF_n = 0.99

Example of calculation:

If y= 2

$\eta_{new,y,i,j}$ = 34.5% X $(0.99)^{2-1}$ X 0.94

= 32.11%

Hence the efficiency of ICS during year y is as below:

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%

Determination of quantity of woody biomass that is saved in tonnes per ICS during year y

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

Example of calculation:

If y= 2,

$B_{y,savings,i,j}$= 1.83 X [(0.3211/0.1) -1]

= 4.0343 tonnes

Year (y)	$B_{y=1,new,i,survey}$	$\eta_{new,y,i,j}$	η_{old}	$B_{y,savings,i,j}$
1	1.83	32.43%	0.1	4.0935
2	1.83	32.11%	0.1	4.0343
3	1.83	31.78%	0.1	3.9757
4	1.83	31.47%	0.1	3.9177
5	1.83	31.15%	0.1	3.8603
6	1.83	30.84%	0.1	3.8034
7	1.83	30.53%	0.1	3.7471
8	1.83	30.23%	0.1	3.6914
9	1.83	29.92%	0.1	3.6362
10	1.83	29.63%	0.1	3.5816

Determination of emission reductions by ICS installed in 1st year

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

Where

$NCV_{wood\ fuel}$ = 0.0156 TJ/tonne

$f_{NRB,y}$ = 0.91

$EF_{wf,CO2} + EF_{wf,non\ CO2}$ = 112 + 26.23 = 138.23 tCO_2/TJ

Example of calculation:

If y=2,

$ER_{y,i,j}$ = 4.0343 X 0.0156 X 0.91 x 138.23 X 112,500 X 0.95

=846,080 tCO_2

Year	$B_{y,savings,i,j}$	$NCV_{wood\ fuel}$	$f_{NRB,y}$	$EF_{wf,CO2} + EF_{wf,non\ CO2}$	$N_{y,i,j}$	$ER_{y,i,j}$
1	4.0935	0.0156	0.94	138.23	125,000	**953,880**
2	4.0343	0.0156	0.94	138.23	112,500	**846,080**
3	3.9757	0.0156	0.94	138.23	100,000	**741,148**
4	3.9177	0.0156	0.94	138.23	87,500	**639,042**
5	3.8603	0.0156	0.94	138.23	75,000	**539,721**
6	3.8034	0.0156	0.94	138.23	62,500	**443,144**
7	3.7471	0.0156	0.94	138.23	50,000	**349,269**
8	3.6914	0.0156	0.94	138.23	37,500	**258,056**
9	3.6362	0.0156	0.94	138.23	25,000	**169,466**
10	3.5816	0.0156	0.94	138.23	12,500	**83,460**

As stoves installed during year 2, 3 and 4 are using the same assumption applied on year 1, therefore the total emission reductions to be achieved by the project over 10 years of crediting period is as below:

Year	Estimated emission reductions (tCO_2)				
	Year 1	Year 2	Year 3	Year 4	Total
Year 1	953,880	0	0	0	**953,880**
Year 2	846,080	953,880	0	0	**1,799,960**
Year 3	741,148	846,080	953,880	0	**2,541,108**
Year 4	639,042	741,148	846,080	953,880	**3,180,150**
Year 5	539,721	639,042	741,148	846,080	**2,765,991**
Year 6	443,144	539,721	639,042	741,148	**2,363,055**
Year 7	349,269	443,144	539,721	639,042	**1,971,176**
Year 8	258,056	349,269	443,144	539,721	**1,590,190**
Year 9	169,466	258,056	349,269	443,144	**1,219,935**
Year 10	83,460	169,466	258,056	349,269	**860,251**
			Total		**19,245,696**
			Number of crediting period		**10**
			Average annual ERs		**1,924,569**

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1	953,880	0	0	953,880
Year 2	1,799,960	0	0	1,799,960

Year 3	2,541,108	0	0	2,541,108
Year 4	3,180,150	0	0	3,180,150
Year 5	2,765,991	0	0	2,765,991
Year 6	2,363,055	0	0	2,363,055
Year 7	1,971,176	0	0	1,971,176
Year 8	1,590,190	0	0	1,590,190
Year 9	1,219,935	0	0	1,219,935
Year 10	860,251	0	0	860,251
Total	**19,245,696**	**0**	**0**	**19,245,696**

5 MONITORING

5.1 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	0.91
Justification of choice of data or description of measurement methods and procedures applied	This parameter shall be determined ex-ante. C4 EcoSolutions (Pty) Ltd was appointed as third party to study and derive the f_{NRB} value for Malawi. The value has been calculated in accordance with Tool 30 version 3; using latest available versions of Food and Agriculture Organization (FAO) report, UN Data and other publicly available data that have been published by reliable sources.
Purpose of Data	Calculation of emission reductions

Comments	The report and calculation spreadsheet of f_{NRB} were 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	26.3
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 shall be used if 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 shall be determined ex-ante
Purpose of Data	Calculation of $\eta_{new,y,i,j}$
Comments	No comments

5.2 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 directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision according to the latest version of Standard for sampling and surveys for CDM project activities and programme of activities.
Frequency of monitoring/recording	At least once every two years
Value applied	For ex-ante emission reduction calculation, it is assumed that the project will distribute up to 500,000 ICS and the installation/ distribution of ICS to be implemented in 4 years with each year comprises of 125,000 ICS.
Monitoring equipment	Monitoring survey
QA/QC procedures to be applied	No comments
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
Comments	No comments

Data / Parameter	$\eta_{new,y,i,j}$
Data unit	Fraction
Description	Efficiency of the improved cookstove type *i* and batch *j* determined through water boiling test (WBT) 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 applied	For ex-ante calculation, the value below is applied.
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of emission reductions
Calculation method	Calculation to be performed using equation below:

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%

	$\eta_{new,y,i,j} = \eta_p \times (DF_n)^{y-1} \times 0.94$
Comments	No comments

Data / Parameter	$B_{y=1,new,i,j,survey}$
Data unit	Tonnes
Description	Annual quantity of woody biomass used by improved cookstoves in tonnes per device of type i and batch j, determined in the first year of the implementation of the project through a sample survey
Source of data	Monitoring survey
Description of measurement methods and procedures to be applied	Minimum sample size of each type i and batch j should be in line with the latest version of Standard for sampling and surveys for CDM project activities and programme of activities or guidelines provided in methodology Section 8.4 option (b). Determined in the first year of the introduction of the devices (e.g. during the first year of the crediting period, y=1) through measurement campaigns at representative households and/or sample survey. Sample surveys to estimate this parameter, that are solely based on questionnaires or interviews (i.e. that do not implement measurement campaigns) may only be used if the following conditions are satisfied. (i) Baseline cookstoves have been completely decommissioned and only improved cookstoves are exclusively used in the project households; (ii) If multiple devices are used in the project, it is possible from the results of the survey questions to clearly differentiate the quantity of firewood being used by each device. In other words, if more than one device, or another device that consumes firewood, are in use in project households, then the sample survey needs to distinguish the quantity of firewood used by the project device and the other devices that use firewood.
Frequency of monitoring/recording	Determined in the first year of project implementation
Value applied	For ex-ante calculation, the value is assumed as 5kg/device/day or equal to 1.83tonnes/device/year.
Monitoring equipment	Monitoring survey
QA/QC procedures to be applied	

Purpose of data	Calculation of emission reductions
Calculation method	
Comments	No comments

Data / Parameter	**Life Span**
Data unit	Number of years
Description	The operating lifetime of the project device. The life span should be reported if the methodology equation 5 is adopted to determine the project stove efficiency
Source of data	Manufacturer's specification
Description of measurement methods and procedures to be applied	TLC cookstoves will be manufactured to match the fixed design specification. This will be achieved using brick molds of specified dimensions to make bricks to be used for stove construction locally. This will ensure that each stove that is built at individual end user household measures exactly same as the dimensions specified by the manufacturer. Post construction, training will be provided to end users on use, care, and upkeep of these stoves. PP will conduct periodic audits and surveillance of the stoves that will be distributed under the project activity to ensure their proper functioning throughout the project lifetime. This along with spot audits and after installation maintenance services, will 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 applied	10
Monitoring equipment	-
QA/QC procedures to be applied	No comments
Purpose of data	Calculation of emission reductions

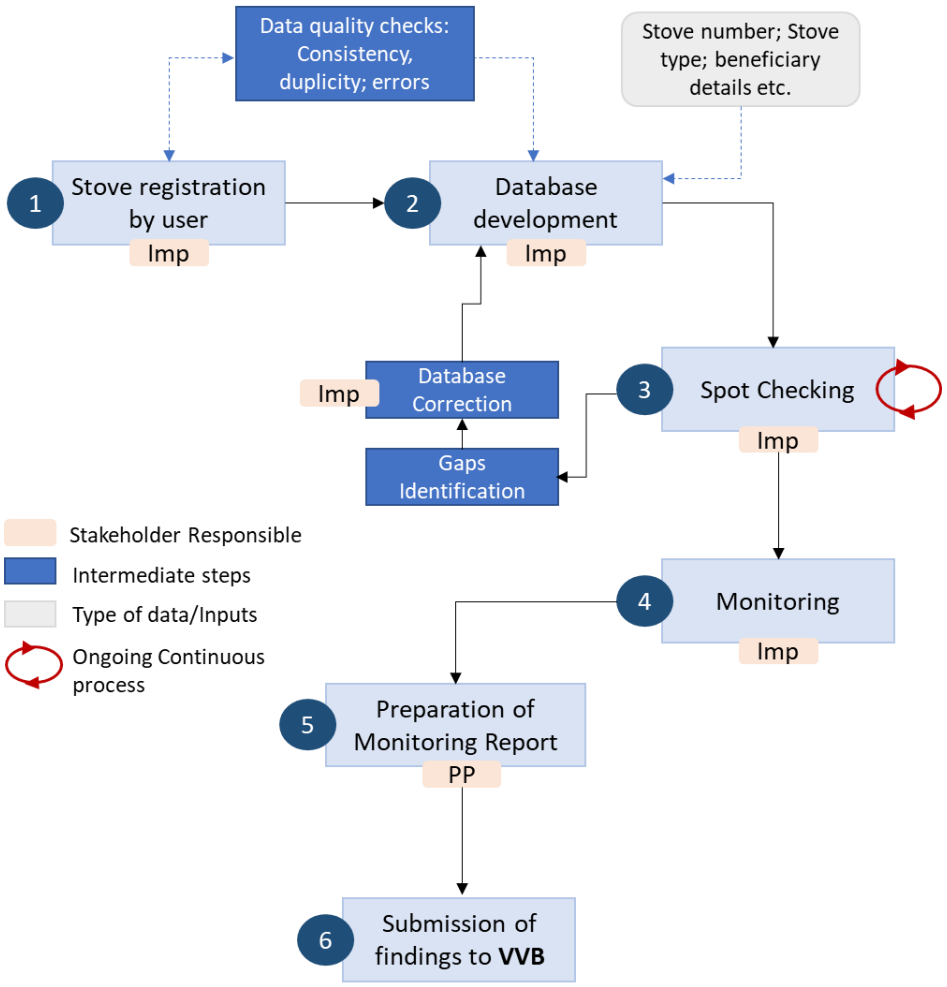
Calculation method	-
Comments	No comments

5.3 Monitoring Plan

The Monitoring Plan applied in this project involves several key elements that ensure that the PP and/or CPA-Implementer have 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 VMR 0006 version 1.1 on the basis of the amount of non-renewable biomass saved by the ICS in the project activity. The key elements are the following:

- Data collection procedures
- Distribution and Monitoring Database
- Spot Checking of ICS (ongoing)
- Sample Plan for the Monitoring Survey
- Data Quality, Consistency and Duplication Checks
- Monitoring Reporting

The below flow-chart illustrates the roles and responsibilities of the parties during the implementation of the monitoring plan for the project. In the below flowchart, the project implementer is abbreviated to “Imp” and can be the PP or another party authorized by the PP.



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

1. **Imp: User registers stove:** Project implementer will collect/receive the necessary information requested in the Registration process from the user. Means of collecting this information may be through a physical Registration Card filled by project Imp staff, retailers, end-users, or partner organization's staff, or through the use of ICTs or SMS. Project Implementers' staff shall double check the accuracy of information provided, and request for field staff additional clarifications if needed.

2. **Imp: Data logged into database:** Project implementer trained staff will input the data in the database either manually (if data collected from physical Registration Card) or this will be automatically input if data was collected using ICTs or SMS. Project implementer staff shall double check the information included on the database and check for duplications. Any duplicate information shall be investigated, and errors corrected or excluded from the database if it is a true duplicate entry.

3. **Imp: Spot- checking (ongoing):** Project implementer field staff will 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) will be updated on the database, and in the case, ICS are found to be no longer in use, they will be clearly marked as such and excluded from emission reductions calculations.

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

5. **PP: Preparation of monitoring report:** the project implementers or the PP will prepare the final monitoring report to be provided to the VVB for verification of emission reductions. A copy of the monitoring report will remain with the PP

The PP will coordinate and manage each project Implementer and assist them in implementing each element of the monitoring plan. The monitoring plan shall be elaborated in accordance with the Sampling Plan below. Also, regular audits conducted throughout the project lifetime ensures proper functioning of stoves and determination of the lifespan of the same.

Sampling Plan

As per *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities; version 09.0,* the sampling plan is the following:

(a) Sampling Design

Due to the large number of ICS envisioned to be distributed as part of the project activity, it is not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling will be undertaken as part of a Sampling Plan that is designed in line with the requirements of the "Standard for sampling and surveys for CDM project activities and programme of activities".

(i) Objective and Reliability Requirements:

The objective is to obtain an unbiased and reliable estimate of the proportion or mean value of the following key variables over the course of the crediting period, and with 90/10 confidence/prevision (as per applied methodology VMR 0006; version 1.1).

Monitored Parameters:

Sr. no	Parameter	Description of Parameter	Frequency
1	$N_{y,i,j}$	Number of project devices of type *i* and batch *j* operating during year *y*	Annual/biennial

2	$B_{y=1,new,i,\ survey}$	Quantity of woody biomass used by project devices in tonnes per device of type *i*. and batch j	Determined in the first year of project implementation

(ii) Target Populations:

The target population are all households in the project database which are using fuelwood in ICS distributed under the project for cooking.

(iii) Sampling Frame

It is expected that the geographical locations do not have influence on the parameters of interest that is $Ny_{,i,\ j,}$ & $B_{y=1,new,i,\ survey}$. Therefore, these parameters can be assumed to be highly homogeneous regardless of how the end user group and distribution/installation location is defined since the end users shall always be households and geographical location is restricted to the project boundary. The Sampling Frame for individual parameters have been defined in the following paragraphs

The sample frame refers to all the information sources on the Database. The SMS/ICT system is the primary mechanism for data collection for newly distributed ICS and the Monitoring Survey (which includes a household questionnaire and visual inspection of ICSs) that will be used throughout the lifetime of the project. The SMS/ICT data is used to populate the stoves Database and the Monitoring Survey follows the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities"; version 09.

All the TLC rocket stoves distributed under this project shall be grouped together to create a Primary Sampling Unit which is homogenous. The procedure to determine the sample of households will ensure that they adequately represent the broader project population, minimizing sampling error. Using, a 90 per cent confidence level, and a 10 per cent margin of error, a random sample will be selected from the target population.

1) Sampling frame for proportion of ICS still in operation ($N_{y,j}$)

The first step is to identify the Primary Sampling Units.

Factors such as model of the ICS do not effect parameter $N_{y,j}$. Therefore Primary sampling unit in case of parameters $N_{y,j}$ is independent of model of stove.

2) Quantity of woody biomass used by project devices in tonnes per device ($B_{y=1,new,i,\ survey}$)

The Parameter $B_{y=1,new,i,\ survey}$ shall vary in accordance with its model. Hence for this parameter, the Primary Sampling Unit shall be defined as the group of ICSs of the same model. If two different ICS models being implemented in the same project – this will form two Primary Sampling Units.

(iv) Sampling Method

The sampling method for the monitored parameters $Ny_{,i,j,}$ and $B_{y=1,new,i,\ survey}$ is Simple Random Sampling and samples will be randomly selected from the primary sampling units as illustrated above. To ensure a random selection of ICS, random number generators shall be applied. Each ICS in the target population is uniquely identifiable by its unique ID number. Each ICS can thus be allocated a Sample Selection Number in each monitoring period, starting at 1 and increasing up to the total number of ICS in the Database for that pre-defined sampling frame. Applying the random number generators, the ICS can then be randomly chosen from the defined population up to the required sample size as calculated by the project proponent.

To determine the parameters, sampling will involve the following approaches (outcome in brackets):

$N_{y,i,j}$:	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)
$B_{y=1,new,i,\ survey}$	Interview with end user for determining average quantity of fire wood used in the project stove per day. Measurement campaigns for estimation of consumption of wood in project households. (Wood fuel quantity)

Using the formulas below, the CME will randomly sample the required number of ICS from the primary sampling units.

(v) Sample Size

For the estimation of the proportion or mean value of the parameters investigated, the minimum sample size for each sample frame has to achieve the 90/10 confidence/precision.

The procedure to determine the sample of households will ensure that they adequately represent the broader project population, minimizing sampling error. Using a 90 per cent confidence level, and a 10 per cent margin of error, random samples will be selected from each Primary Sampling Unit. The parameter number of stoves still in operation during the monitoring period as determined by the monitoring survey ($Ny_{,j}$) will be estimated through sampling annually/biennially and the parameter Quantity of woody biomass used by project devices in tonnes per device $B_{y=1,new,i,\ survey}$ shall be estimated through sampling within the first year of project installation. $B_{y=1,new,i,\ survey}$ can be coupled with $Ny_{,j\ j}$ for the first year. Of the two parameters to be monitored, $N_{y,i,j}$ is proportion/percentage parameter and $B_{y=1,new,i,\ survey}$ is a mean value parameter.

In order to calculate the required sample size estimates, values for the proportions and the mean values are required. Furthermore, the standard deviation needs to be assumed in case of sampling for a mean value. As per Guidelines for Sampling and surveys for CDM project activities and programmes of activities, there are different ways available to obtain the estimates of the parameter of interest:

(a) Refer to the result of previous studies and use these results.

(b) In a situation where information from previous studies is not available, a preliminary sample as a pilot could be conducted and use that sample is used to provide the estimates.

(c) Use best guesses based on the researcher's own experiences.

For the registration purpose of project, option (c) as stated above shall be applied. For the following monitoring periods, the estimates can be adjusted taken the results of the previous monitoring period(s) into account or the result from recent pilot study which is conducted after the previous monitoring periods.

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 following assumptions are made to exemplify the sample size calculation for the parameters.

1. An overview of the estimated sample sizes for a hypothetical population of 100,000 ICS units applying a level of 90/10 is provided below. It is likely that all the sample frames for each parameter will include fewer than 100,000 ICS in the first monitoring period, so this is a conservative approach. Hence, population size, N, is taken as 100,000 households/ICS (Assuming one ICS for one household).
2. It is expected at least 80% of ICS still in operation, hence the expected proportion *p* is taken as 0.8.

Sample size calculation:

The calculation of the required sample size for each parameter in the first monitoring period is illustrated below. In all cases a conservative approach is taken, however if for any parameter the required confidence/precision is not met then the CME will randomly select an additional sample and collect further data from this sample to ensure the pooled data meet or exceed the required thresholds.

Based on the above assumptions, the resulting sampling size is calculated as:

$$n \geq \frac{1.645^2 \times 100{,}000 \times 0.8(1-0.8)}{(100{,}000-1) \times 0.1^2 \times 0.8^2 + 1.645^2 \times 0.8(1-0.8)} = 67.61$$

Therefore, in this case a sample size of 68 is to be sampled from each primary sampling unit.

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

For the purposes of determining sample size in the first monitoring period, the performance of ICS is characterized by the range of likely mean wood consumption and the likely values of SD relative to the mean, according to the type of ICS. The ICS models that are manufactured in modern factories tend to be very highly efficient (30-50% thermal efficiency) and have been designed to meet stringent efficiency specifications, so the standard deviation is expected to be relatively low.

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

Based on the above assumptions, the sample size calculation would be

$$n \geq \frac{1.645^2 \times 100{,}000 \times \left(\frac{0.076}{0.38}\right)^2}{(100{,}000-1) \times 0.1^2 + 1.645^2 \times \left(\frac{0.076}{0.38}\right)^2} = 10.82$$

The resulting sample size based on the above equation is smaller than 30, since $B_{y=1,new,i,\ survey}$ is a numeric mean value (i.e. not a proportion or percentage) the Student's t-distribution shall be used as per paragraph 14 of "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities, version 09.0.

The sample size for parameter $B_{y=1,new,i,\ survey}$ under t-distribution is referred to the equation below:

$$n = \left(\frac{t_{n-1} \times SD}{0.1 \times mean} \right)^2$$

Where t_{n-1} is the value of the t-distribution for 90% confidence when the sample size is n. Since the sample size is not known yet, the first step is to use the value for 90[7]% confidence when the sample is large, i.e., 1.645 and then redefine the calculation.

$$n = \left(\frac{1.645 \times 0.076}{0.1 \times 0.38}\right)^2 = 10.82$$

Thus n is rounded up to 11.

The calculation now needs to repeat using t-value for 90% confidence and n = 11

$$n = \left(\frac{2.228 \times 0.076}{0.1 \times 0.38}\right)^2 = 19.86$$

And n is rounded to 20.

The calculation now need to repeat using t_{n-1} value for n = 20. The process should be iterated until there is no change to the value of n.

[7] For CPAs not qualifying the conditions under paragraph 12 of Tool 19, the requirements of the applied methodology shall apply.

$t_{19\text{-}1}$	2.093
n=	17.52
Round up	18

$t_{18\text{-}1}$	2.110
n=	17.81
Round up	18

The repeated calculation shows that n = 18. Thus, the sample size to be sampled from each sampling unit is 18.

Since parameters $N_{y,j,j}$, and $B_{y=1,new,i,\ survey}$ share the same sampling units, CME may choose to have one common survey for these two parameters with largest number of sample size between these two parameters being chosen. Sampling more than one parameter within the same sample (household) helps reduce travel needs for monitoring and the associated costs. At the same time this approach ensures the random selection of samples for every parameter.

Oversampling is strongly encouraged, not only to compensate for any attrition, outliers or non-response associated with the sample, but also to prevent a situation at the analysis stage where the required reliability is not achieved, and additional sampling efforts would be required. The sample size shown above will be adjusted upwards to account for non-responses, CME shall determine the appropriate non-responses rate based on previous experience.

(b) Data:

(i) Field Measurements:

To monitor the number of stoves that continue to be in use ($N_{y,i,j}$), the data collected will be a representative number of stoves in the database that are in use for the monitoring period. The method of collecting data will be field surveys of required sample size of ICS users in the database. Data will be collected from the field surveys, entered in the database and included in the monitoring report.

For monitoring $B_{y=1,new,i,\ survey}$, the data collected will be representative number of stoves in the database that were distributed within one year of start date of CPA implementation. The method of collecting data will be field survey and frequency will be once during the entire crediting period.

The table below summarizes field measurement data requirements

Parameter	Timing (indicative)	Frequency (required by AMS II.G –Version 11.1)	Methods to be applied	Comments on seasonal fluctuation
$N_{y,i,j}$	Monitoring will likely occur every 12 months	annual/biennial	Visits to the premises, visual inspection and interview with ICS end-user	Unlikely to be due to any seasonal fluctuation.
$B_{y=1,new,i,survey}$	Within 1st year from the starting date of CPA implementation for CPAs applying equation 8 of applied methodology.	Once. The value will be fixed for entire crediting period	Visits to the premises, visual inspection, measurement and interview with ICS end-user.	unlikely

(ii) Quality Assurance/Quality Control

The CME will apply measures to ensure the required confidence/precision for each sampled parameter is met, allowing for non-response and the possible removal of outliers from the sample, as part of a Quality Control/Quality Assurance system. The choice of measure applied to each parameter will depend on the cost of each data collection approach and logistics required. The CME will determine the most effective measure for each parameter from the following list (illustrated using a required sample size of 20 and an effect of non-response of 2 to 4 ICS):

- Oversampling: Randomly draw a sample of minimum 24 ICS and collect data from each
- Buffer Group: Randomly draw a sample of at minimum 24 ICS and collect data from only 22 ICS. If this would not result in the required sample size data would be collected from the additional 2 ICS that were selected in the sample.
- Draw an additional sample: Randomly draw a sample of 22 ICS and collect data from these. If the required sample size is not achieved, an additional sample of 2 elements will be drawn and included in the sample.
- Use lower confidence bound (of $Ny_{,i,j,}$, $B_{y=1,new,i,survey}$) or, with a conservative approach according to the parameter definitions,

The CME may choose to stop monitoring a particular parameter once the required level of confidence/precision has been reached, as long as the calculated minimum number of samples has been achieved. As an example, the following steps could logically be followed for the case of applying a 30% buffer:

1. Visit first 10% of premises required for the 30% buffer. If the number of responses is sufficient to achieve the required reliability level, then stop sampling.

2. If step 1 is not sufficient to achieve the required reliability level, then visit the next 10% of premises (increases the additional sampling to 20% of the 30% buffer). If this additional sampling is sufficient, then stop sampling.

3. If step 2 is not sufficient to achieve the required reliability level, then complete the final 10% of the additional sampling buffer (bringing the total to 30%).

The sampling plan has the following procedures in place to ensure good quality data. The CME will ensure that field personnel have reviewed, understand and have signed the monitoring plan, including provisions for maximizing response rates, documenting out-of-population cases, refusals and other sources of non-response. A quality control and assurance strategy will be documented. Quality control and assurance strategies include addressing non-sampling errors, such as non-response or bias from interviewer. The monitoring plan will explain how to properly survey households to prevent bias from interviewer. In the case a household refuses to participate, another household will be chosen at random. To reduce interviewer bias, good questionnaire design and well-tested questionnaires will be used.

The calculation of the sample size will be carried out using estimates for parameter proportions, mean values and standard deviations, as the actual characteristics of the population/sampling frame are unknown. In order to ensure the quality of the sampling results, the CME can draw on the provisions for reliability calculations as provided by the *Guidelines for Sampling and Surveys in CDM Project Activities and Programme of Activities* (version 04). In the event that the sampling results do not fulfil the required level of confidence and precision, the CME can undertake additional samples. If the reliability is still not sufficient after additional samples or other measures, the sampling may be repeated with an increased sample size. Alternatively, the CME may choose to apply the lower bound or higher bound according to the more conservative approach.

(i) Data archiving

Hard copies of the surveys will be kept and the registration database will have back up. Original stove purchase contracts or other means of acceptance by the users will be stored in the main office for the coordinating entity. A back-up of the registration database will also be stored on an electronic medium by the PP. All data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of VCUs for the project activity, whichever is later.

(ii) Analysis

The PP will manage a project database that includes the following data that can be directly attributable to the project activity, thereby allowing unambiguous determination of the emission reductions attributable the project:

- A list of households participating in project activity, including name, community/location, distribution date and unique serial number;
- Where replacements are made, assurance that the efficiency of the new ICS is similar to the specified.

Data obtained from the samples will be used to estimate proportions and mean values for the parameters described above. The values will then be factored into the emissions reduction calculations and result in the request for issuance of VCUs. The stoves that are not in use will be excluded from emissions reductions calculations and will not be counted towards the total number of ICS in operation during the monitoring period.

(c) Implementation

Sampling for the purpose of emission reduction calculation and elaboration of the monitoring report will occur at the end of each monitoring period. This sampling will be conducted by trained personal either part of the CPA Implementer or CME team, or an experienced third-party entity. The maximum length of one monitoring period will be two years (duration, not calendar years). The CPA Implementer will be responsible for managing household data collection and entry into the project database. Field personnel will receive training on how to properly deal with surveying techniques and reduce errors and sign a document certifying that there is no conflict of interest of those involved in data collection and analysis. If there is conflict of interest, the personnel will not be allowed to participate in data collection and analysis. The project database will record the start and end dates of each monitoring period and record the emission reductions attributable to each monitoring period. Appropriate record keeping procedures will be implemented to ensure that each monitoring period data set can be transparently attributed to its corresponding CPA, preventing any occurrences of double counting. An internal review of the project database will be able to determine the status of project—the duration of previous monitoring periods, the households delivering monitoring data, and current verification activities.

Assessment for Leakage

According to methodology VMR 0006, version 1.1, section 8.3; Leakage shall be considered as default 0.95 in accordance with Section 5.4 of AMS-II.G. therefore default value of leakage as 0.95 will be applied.

Monitoring Reporting

The PP will assess all monitoring data and produce one or two monitoring reports for the project for the VVB to verify corresponding to the preceding monitoring period the project. This report will

present the data relating to the emission reductions generated by the project at the time of the monitoring period.

APPENDIX

CQC Website Announcement and Feedback Submission Form [Posted on October 26th, 2020]

October 26, 2020

Local Stakeholder Feedback Requested for Sub-Saharan African Improved Cookstove Projects

C-Quest Capital is developing improved cookstove projects in Angola, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe under VERRA/Voluntary Carbon Standard (VCS) and seeks to obtain Voluntary Carbon Units (VCUs). Through the distribution and installation of our energy-efficient cookstoves, we aim to reduce the use of non-renewable biomass for cooking and water boiling for households, particularly in rural areas. To better design these projects, C-Quest Capital is seeking feedback through an online stakeholder consultation process that seeks to gather comments and suggestions.

Feedback on the proposed projects will be collected from **26 October to 25 November 2020**.

Detailed information on the projects is below. Please provide feedback in the form below.

Non-Technical Summaries: Angola, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe.

Project Presentations: Angola, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe.

Select *
Country
Malawi

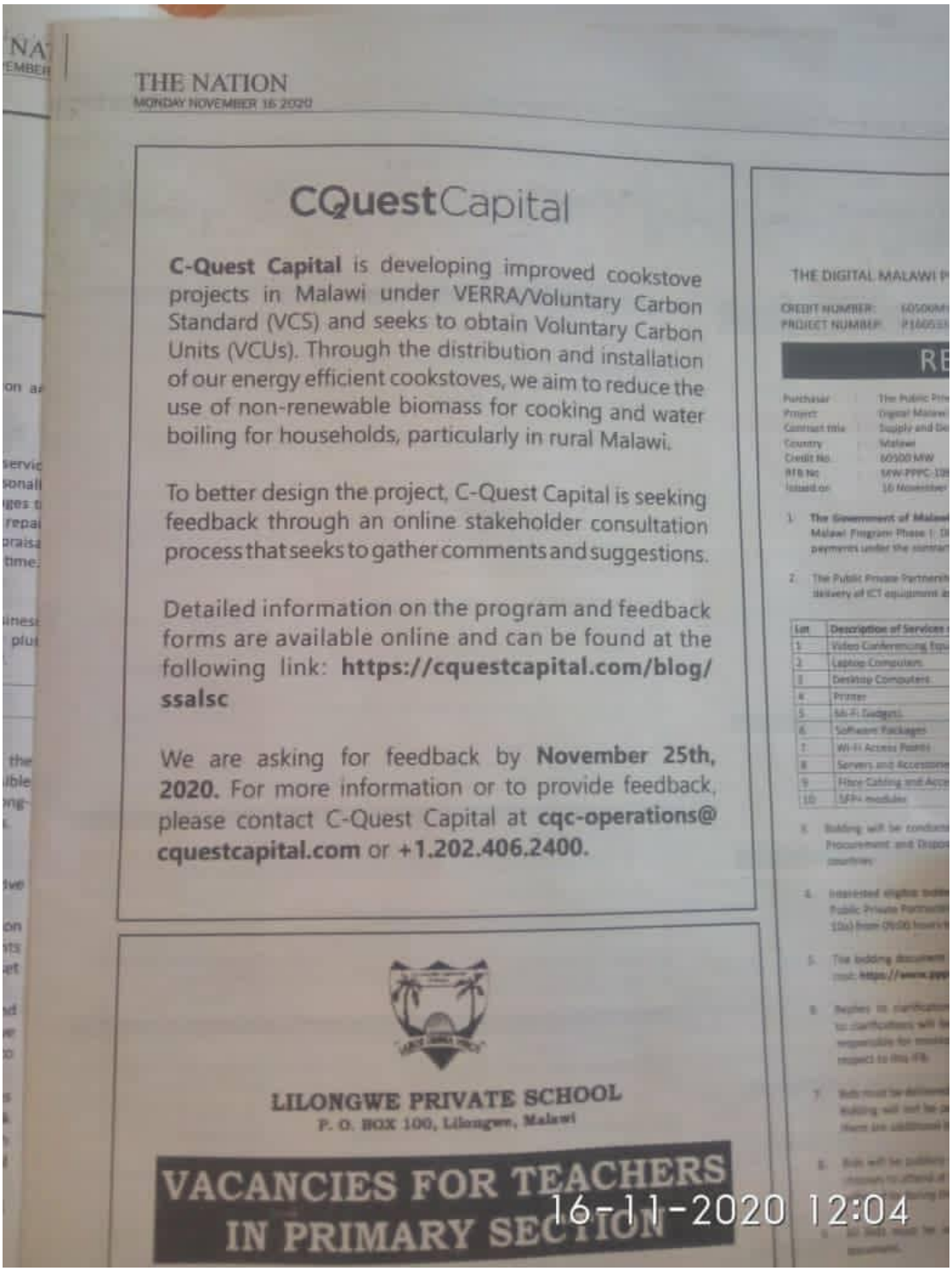
Name *
First Name
Last Name

Job Title

Organization Name

Email *

Newspaper Advert, *The Nation*, Monday, November 16th, 2020 [English]



THE NATION
MONDAY NOVEMBER 16 2020

CQuestCapital

C-Quest Capital is developing improved cookstove projects in Malawi under VERRA/Voluntary Carbon Standard (VCS) and seeks to obtain Voluntary Carbon Units (VCUs). Through the distribution and installation of our energy efficient cookstoves, we aim to reduce the use of non-renewable biomass for cooking and water boiling for households, particularly in rural Malawi.

To better design the project, C-Quest Capital is seeking feedback through an online stakeholder consultation process that seeks to gather comments and suggestions.

Detailed information on the program and feedback forms are available online and can be found at the following link: **https://cquestcapital.com/blog/ssalsc**

We are asking for feedback by **November 25th, 2020.** For more information or to provide feedback, please contact C-Quest Capital at **cqc-operations@cquestcapital.com** or **+1.202.406.2400.**

LILONGWE PRIVATE SCHOOL
P. O. BOX 100, Lilongwe, Malawi

VACANCIES FOR TEACHERS IN PRIMARY SECTION

16-11-2020 12:04

Invitation Email sent from CQC on 4 November 2020

Local Stakeholder Consultation Feedback Requested - Improved Cookstoves (Malawi)

BM Brent Moser (bmoser@CquestCapital.com)
To Brent Moser (bmoser@CquestCapital.com)
Cc Jason Steele (jsteele@CquestCapital.com)

Reply | Reply All | Forward | ...

Wed 11/4/2020 11:10 AM

Dear Madam / Sir:

As the Project Participant, C-Quest Capital would like to request local stakeholders in Malawi to provide feedback on their proposed improved cookstove projects for Malawi. The projects have been developed under VERRA/Voluntary Carbon Standard (VCS) and seeks to obtain Voluntary Carbon Units (VCUs). This program plans to disseminate and install high efficiency firewood cookstoves to poorer households in Malawi that cook with open-fires with the goal to significantly reduce the dependency on Malawi's remaining natural resources, reduce greenhouse gas emissions related to cooking, and contribute to improved health outcomes for the end-user. Carbon finance will be the primary source of funding for this program.

All program information including non-technical summary and project presentation is located on our website: https://cquestcapital.com/blog/ssalsc

You can provide feedback by replying to this email or through the feedback form on our website via the link above.

Please provide any feedback by **25 November 2020**.

Brent Moser
Director of Operations – Africa Region
C-Quest Capital LLC
1015 18th Street NW Suite 730
Washington, DC 20036
Phone *+1 407.491.0368*
Skype *moser.brent*
E-mail *bmoser@cquestcapital.com*
Website *www.cquestcapital.com*

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Invitation List

No.	Organization	Name of Invitee	Title	Email Address
1	Peace Corps	Lughano Munthali	Program Manager Environment	lmunthali@peacecorps.gov
2	Peace Corps	Eliza Kaziya	Programming and Training Assistant Health	ekaziya@peacecorps.gov
3	Peace Corps	Cornelius Msanyama	Program Manager Health	cmsanyama@peacecorps.gov
4	Peace Corps	Amber Lucero-Dwyer	Country Director	alucerodwyer@peacecorps.gov
5	LICO (Life Concern)	Peter Gondwe	Executive Director	pethogondwe@yahoo.com
6	United Purpose	Kate Hartley-Louis	Country Director	uplilongwe@united-purpose.org
7	Mulanje Mountain Conservation Trust	Carl Bruessow	Executive Director	carl@mountmulanje.org.mw
8	Malawi Environmental Affairs Department	Robert Mugabe Crescent	The Director of Environmental Affairs	ead@ead.gov.mw
9	Malawi Department of Forestry	Teddie Kamoto	Deputy Director East Zone	teddiekamoto@yahoo.co.uk
10	Malawi Department of Forestry	Stella Gama	Director of Forestry	stellagama@ifmslp.org
11	Christian Aid	Boniface Thawapo	Senior Project Manager	bthawapo@christian-aid.org
12	CIP International Potato Center	Wells Kumwendo	Outreach Coordinator	wells.khuwanyakumwenda@gmail.com
13	Concern Worldwide	Thokozani Kalanje	Food and Nutrition Security Advisor	thokozani.kalanje@concern.net
14	Hope 4 Relief	Richard Mwanjasi	Executive Director	rmwanjasi08@gmail.com

15	Yellow Africa	Rhoda Luhana	Program Officer	rhodaluhana@gmail.com
16	Youth Action in Malawi (YAMA)	Bright Mfune	Director of Programs	brightmfune@yahoo.com
17	Baylor College of Medicine Children's Foundation Malawi	David Stobbelaar	Deputy Director, Tingathe Outreach Program	dstobbelaar@tingathe.org
18	Baylor College of Medicine Children's Foundation Malawi	Elijah Kavuta	Program Coordinator	ekavuta@tingathe.org
19	Baylor College of Medicine Children's Foundation Malawi	Teferi Beyene		tbeyene@tingathe.org
20	Baylor College of Medicine Children's Foundation Malawi	Saeed Ahmed	Director, Tingathe Outreach Program	sahmed@tingathe.org
21	Total Land Care	Trent Bunderson	Executive Director	tbunderson@tlcmw.org
22	Total Land Care	Zwide Jere	Co-Founder/Managing Director	zjere@tlcmw.org
23	Moringa Miracles Ltd.	Ian Lockington	Managing Director	ian.lockington@yara.com
24	Ener-g-Africa	Andre Moolman	Managing Director	andre@ener-g-africa.com
25	Ener-g-Africa	Richard Bunderson	Director	rich@ener-g-africa.com
26	Ener-g-Africa	Catherine Almeida		catherine@ener-g-africa.com
27	Mzuzu University	Thokozani Kamoto	Physics Lecturer	thokokamoto2@gmail.com
28	Mzuzu University	Michael Zimba	Senior Lecturer, Information and Communication Tech	mgmzimba@gmail.com

29	Mzuzu University	Kondwani Gondwe	Energy Studies Senior Lecturer	kondwanithapasila@yahoo.com
30	Oxfam	Chiyambi Mataya	Food Security and Livlihoods	cmataya@oxfam.org.uk
31	TerraCarbon	Scott Settelmyer	Managing Director	scott.settelmyer@terracarbon.com
32	TerraCarbon	David Shoch	Director, Forestry and Technical Services	david.shoch@terracarbon.com
33	Rumphi District Hospital	Lotti Nyama	Clinician	lottienyama@gmail.com
34	United Purpose	Rueban Kainga		Reuben.Kainga@united-purpose.org
35	USAID AgriDiv	Afshan Omar		affyoam@gmail.com
36	Africare	Grace Kamba	Officer in Charge Malawi	gkamba@africare.org
37	Bluwave Malawi	Susan Flynn	Malawi Officer	sflynn@waitrose.com
38	Elderly People Association	Helen Chasowa	Director	epamalawi@yahoo.com
39	Eva Demaya Centre	Brian Smyser	Director	smyser@umich.edu
40	ENERGIA	Sheila Oparaocha	Program Director	soparaocha@hivos.org
41	Tetra Tech	Ramzy Kanaan	Chief of Party	Ramzy.Kanaan@tetratech.com

List of Attendees

C-QUEST CAPITAL (CQC)

ATTENDANCE SHEET — CONSULTATION MEETING FOR STAKEHOLDS - 19/11/2020

NO.	NAME	POSITION	CONTACT NO.	SIGNATURE
1	T-A · Chizeka	TA	0998676331	
2	Efrida Sintrawo	Stove user	0991587205	E. Sintrawo
3	Malita Chiseka	Stove user	0995672166	M. Chiseka
4	Lonisa Makanga	Stove user	0999477639	LMakanga
5	Ikela maumbo	stove user	0995719316	Ik. maumbo
6	JESE BONIFESI	STOVE USER	0990327814	J BONIFESI
7	Gibeta msondodzi	Stove user	0997358871	G. Msondodzi
8				
9				

NO.	NAME	POSITION	CONTACT NO.	SIGNATURE
1	Thokozani Malunga	Principal Energy Officer	0884445136	
2	Zwide Jere	Director TLC	0999822420	
3	Mahara Ngwenda	DFM	0999710211	
4	Merina Mtonga	FYF - Direct	0888891865	
5	Mayamiko Minofu	UP	0999867464	
6	Charles Sinetre	Director-CSO	0995668871	
7	Eugene Kaunda	DHO-Blk	0994088911	
8	Desmond McAdam	En-Africa	0998792671	

ATTENDANCE SHEET — STAKEHOLDER CONSULTATIVE MEETING 24/11/20

NO.	NAME	POSITION	CONTACT NO.	SIGNATURE
1	Afsham Omar	NUTRITION ADVISOR	0993437625	AFLLC

List of Electronic Feedback Providers

No.	Organization	Name	Title	Email Address	Date Received
1	Individual	Deepak Hathiramani	Promotor	deepakmalawi@hotmail.com	16-Nov-20
2	Moringa Miracles Ltd.	Ian Lockington	Managing Director	Ian.lockington@yara.com	4-Nov-20
3	HELPS Africa	Amakhosi Jere	Executive Director	amakosijere@outlook.com	19-Nov-20
4	National Bank Malawi	Golden Sanyila	IT Support Team Leader	gsanyila@natbankmw.com	11-Nov-20
5	Tetra Tech	Ramzy Kanaan	Chief of Party	Ramzy.kanaan@tetratech.com	9-Nov-20
6	Potential Partner	Alex Kaiwe	-	alexkaiwe81@gmail.com	19-Nov-20
7	Baylor Tingathe Program	Teferi Beyene	Medical Manager	tbeyene@tingathe.org	5-Nov-20