



**Verified Carbon
Standard**

DELAGUA CLEAN COOKING GROUPED PROJECT IN SIERRA LEONE



Document Prepared by DelAgua

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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 Grouped Project activity “DelAgua Clean Cooking Grouped Project in Sierra Leone” aims at distribution of Improved Cooking Stoves (ICS) in the Least Developed Country Sierra Leone¹. Throughout this Project Description, this grouped project may be interchangeably referred as “program”

The project proponent “DelAgua Health Rwanda (Voluntary) Limited” (DelAgua) is planning to distribute a total of 480,000² ICS throughout the program’s lifetime. The ICS will be high efficiency cooking devices, leading to a reduction in the indoor smoke levels, time spent on collection of firewood used for cooking a specified quantity of meal, and reduction in the usage of firewood compared with the pre-project scenario. It is intended that under this GP two types of single pot portable stoves will be distributed, which are SSM S32 X stove and Burn Kuniokoa G2. Each household will receive 1 ICS.

The location of the project

The project activity will be implemented in the host country of Sierra Leone. The Project Activity Instances (PAIs) will occur in geographically defined regions within rural areas of Sierra Leone. Further details on the program locations may be accessed through Section 1.12 of this document.

Implementation Dates

Full details of implementation dates and numbers for the PAIs under the GP are laid out in section 4.1 of this document.

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

The program is reducing the usage of firewood as fuel used for cooking at household level, thereby, reducing the GHG emissions arising out of the burning of fossil fuels. This reduction in the firewood usage at the household level will be achieved by the usage of project ICS for cooking, as it has a higher thermal efficiency, therefore, consuming lesser amount of fuel and time in cooking a specific amount of meal.

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

The scenario existing prior to the implementation of the project activity is usage of traditional cooking devices (3 stone fire & rondereza), which have very low thermal efficiency value. Because

¹ <https://unctad.org/topic/least-developed-countries/list>

² This plan is tentative and subject to change based on actual implementation, influenced by market demand and user preferences, deemed outside the control of the PP. The number of ICS units mentioned is an approximate figure for ex-ante calculations and is non-binding.

of the low thermal efficiency, the cooking devices used prior to the project implementation consume huge amount of firewood. Due to the continuous collection of firewood from an area, the quantity of firewood that may be used as cooking fuel reduces. This reduction in firewood leads to deforestation, where the time taken to collect woody biomass increases.

The average annual and total GHG emission reduction expected from the grouped project is expected to be 2,113,488, and 16,907,902, tCO_{2e}, respectively, over the first 7-year crediting period.

The first monitoring period for the project activity is 22-February-2023 to 30-April-2023. The actual emission reduction achieved during current monitoring period is 2,078 tCO_{2e}.

The project is neither transferred nor registered in any GHG mechanism, this project is green field project and explicitly applying the VCS registration.

<u>Audit Type</u>	<u>Period</u>	<u>Program</u>	<u>VVB Name</u>	<u>Number of years</u>
Validation/ Verification	22-February-2023 to 30-April-2023	VCS	Carbon Check	0.186 year (68 days)
<u>Total</u>	1	1	1	0.186 year

1.2 Sectoral Scope and Project Type

The sectoral scope and project type is provided as below:

Sectoral Scope 03 – Energy demand

Type II – Energy efficiency improvement projects

Activity category – non AFOLU

The project activity is designed as a Grouped Project Activity and includes several Project Activity Instances (PAIs) of the same activity type into one Project Description. New instances shall be introduced to the grouped project activity at any monitoring period, with a PAI defined as: “Distribution of efficient cookstoves to a local community within a specific geographic and climatic region in the project boundary.”

1.3 Project Eligibility

The group 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. The eligibility of project under VCS Program Section 2.1 and Section 2.1 of the VCS Standard version-4.4 is demonstrated below.

Table 1: VCS Program scope

Scope	Applicability
The seven Kyoto Protocol greenhouse gases.	The program reduces GHG emissions associated with the combustion of cooking fuels. Gases included are CO ₂ , CH ₄ , N ₂ O.
Ozone-depleting substances (ODS).	The program does not involve any ODS.
Project activities supported by a methodology approved under the VCS Program through the methodology approval process.	The ICS distributed (& to be distributed) in the program uses the methodology “VMR0006 <i>Methodology for Installation of High Efficiency Firewood Cookstoves</i> ”, version 1.1.” which is a VCS approved methodology.
Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval.	Not applicable.

Table 2: Excluded project activities under the VCS Program

Excluded Activity	Applicability
Grid-connected electricity generation activities using hydroelectric power plants. The exclusion does not apply to ocean energy (e.g., wave, tidal, salinity gradient, and ocean thermal energy conversion). For hydro projects, large scale means a maximum capacity of greater than 15MW, where maximum capacity is the installed/rated capacity or authorized capacity (as determined	N/A. The GP activities are energy efficiency measures and do not generate electricity from hydro-power plants/units.

in the activity approval from the project regulator, government, or similar entity), whichever is lower. Grid-connected means >50% of total generation is exported to a national or regional grid. See the VCS Program document VCS Program Definitions for the full definition.	
Grid-connected electricity generation activities using wind, geothermal, or solar photovoltaic (PV) power plants. The exclusion does not apply to concentrated solar thermal-to-electricity, floating solar PV, or energy storage systems (e.g., batteries). Grid-connected means >50% of total generation is exported to a national or regional grid. See the VCS Program document VCS Program Definitions for the full definition.	N/A. The GP activities are energy efficiency measures and do not generate electricity from wind, geothermal, or solar power plants/units.
Activities recovering waste heat for combined cycle electricity generation, or to heat/cool via cogeneration or trigeneration. The exclusion does not apply to waste gas recovery or electricity generation using waste heat recovery outside of combined cycle applications (e.g., organic Rankine cycles).	N/A. The GP activities are energy efficiency measures and do not utilize recovered waste heat for any purposes.
Activities generating electricity and/or thermal energy for industrial use from the combustion of non-renewable biomass, agro-residue biomass, or forest residue biomass. The exclusion does not apply to gasification, pyrolysis, combusting biofuels, biogas, fractions of renewable biomass in refuse-derived fuels, agro/forest biomass residues in waste streams that are sent to landfills, CO2 capture and storage from renewable biomass combustion, or thermal efficiency improvements (e.g., cook stoves).	As the GP activities are distribution of improved cook stoves in Rwanda to improve thermal efficiency of cook stoves used for cooking purpose. The exclusion does not apply to thermal efficiency projects i.e. cook stoves, further the project activity is located in LDC.

Activities generating electricity and/or thermal energy using fossil fuels, and activities that involve switching from a higher to a lower carbon content fossil fuel. The exclusion does not apply to the use of captured flare and/or vent gas or waste containing previously used petroleum products (e.g., used plastics, oils, lubricants).	N/A. The GP activities are energy efficiency measures and do not generate electricity and/or thermal energy using fossil fuels, neither involve fossil fuel switch. The GP includes energy efficiency improvements in thermal applications, i.e. cookstoves.
Activities replacing electric lighting with more energy-efficient electric lighting, such as the replacement of incandescent electrical bulbs with compact fluorescent lights (CFLs) or light emitting diodes (LEDs). Large-scale means energy-efficient improvements with a maximum savings greater than 60 GWh/year or emission reduction greater than 60 kt CO₂e per year.	N/A. The GP activities does not include the replacement of electric lighting.
Activities installing and/or replacing electricity transmission lines and/or energy-efficient transformers. Large-scale means energy-efficient improvements with a maximum savings greater than 60 GWh/year or emission reduction greater than 60 kt CO₂e per year.	N/A. The GP activities do not include the installation and/or replacement of electricity transmission lines and/or energy efficient transformers.
Activities that reduce hydrofluorocarbon-23 (HFC-23) emissions	N/A. The GP reduces GHG emissions associated with the combustion of cooking fuels.

1.4 Project Design

The project activity is a grouped project.

Eligibility Criteria

Table 3: VCS Standard Eligibility Criteria

Eligibility criteria as per section 3.6.10 to 3.6.15 of the VCS Standard v4.4

Criterion	How the new project activity instances comply	Evidence
Grouped projects shall specify one or more clearly defined geographic areas within which project activity instances may be developed. Such geographic areas shall be specified using geodetic polygons	Each PAI will have clearly defined geographic areas and such area will be specified using geodetic polygons.	PAI 1 has been implemented in Seirra Leone. PP has submitted geodetic polygons to VVB and added details in section 1.12 of the PD MR.
Determination of baseline scenario and demonstration of additionality are based upon the initial project activity instances. The initial project activity instances are those that are included in the project description at validation and shall include all project activity instances currently implemented on the issue date of the project description.	Baseline scenario and demonstration of additionality shall be based upon the initial project activity instances	Baseline scenario and additionality has been demonstrated for PAI1 which is included at the time of validation in section 3.4 and 3.5 of the PD MR.
Where a grouped project includes multiple project activities, the project description shall designate which project activities may occur in each geographic area.	The grouped project includes only one project activity.	The PAI1 includes distribution of improved cookstoves to households that are dependent on traditional cookstoves using woody biomass for cooking.
The baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project.	Baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project	Baseline scenario has been determined for PAI1 for Seirra Leone. Details have been added in section 3.4
The additionality of the initial project activity instances shall be demonstrated for each	Additionality for a project activity instance shall be determined for each	Additionality has been determined as per the designated methodology.

designated geographic area, in accordance with the methodology applied to the project	designated geographic area, in accordance with the methodology applied to the project	Details have been added in section 3.5.
Where factors relevant to the determination of the baseline scenario or demonstration of additionality require assessment across a given area, the area shall be, at a minimum, the grouped project geographic area. Examples of such factors include, inter alia, common practice; laws, statutes, regulatory frameworks, or policies relevant to demonstration of regulatory surplus; determination of regional grid emission factors; and historical deforestation and degradation rates	All the factors relevant to the determination of baseline or demonstration of additionality shall be done for the geographical boundary of the grouped project	Assessment of baseline and demonstration of additionality for PAI-1 has been done for Seirra Leone.

Eligibility criteria as per section 3.6.16 and 3.6.17 of the VCS Standard v4.4:

S No	Criterion	How the new project activity instances comply	Evidence
1	Project Activity Instances (PAIs) must meet the applicability conditions set out in the applied methodology.	Please refer the subsections below.	Please refer the subsections below.
1a	Project activities shall be implemented in domestic premises or in community-based kitchens.	Each PAI will distribute technology that is appropriate for domestic use to household end-users	a) Manufacturer's specifications. b) Project ICS distribution database containing unique household end user information. All ICS under PAI-1 distributed to individual

			households for cooking in domestic premises. The same can be checked with distribution database.
1b	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; in case of project stove replacing fossil fuel baseline stove, it shall exclusively use renewable biomass.	ICS distributed in each PAI will have a thermal efficiency of at least 25%, and will be confirmed by the end user that they were using the firewood as the cooking fuel in the project's baseline. Each PAI will record the baseline and project fuel use to ensure that wood fuel is the sole source of energy.	1.Manufacturer's specifications. 2. Information recorded in the household visit survey will establish that the end user was exclusively using woody biomass as fuel for cooking purposes. The PAI-1 has currently distributed Kuniokoa Generation 2 with Pot Skirt having efficiency of 51.3% as per manufacturer specification. The technical specification submitted to VVB.
1c	Both 'Projects' and 'Large Projects' can use the methodology	PAIs will comply with the GP requirements	The GP is defined as a "Large Project" according to the guidelines set out in the VMR0006 methodology and can therefore apply the methodology. No further assessment required at PAI level.
1d	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.	This eligibility criteria is demonstrate at grouped project level that Non-renewable biomass has been used in the project region since 31 December 1989.	No further assessment required during inclusion of PAI.

1e	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.	Biomass residues are not processed as a fuel to be used in the GP. End users will be asked to state their source of energy and baseline appliance at the point of distribution and during the project monitoring. Above information will be stored in the monitoring database.	1. Monitoring surveys. 2. Project ICS distribution poster specific to the end-users (sample photographs) All ICS distributed under PAI-1 replaces wood based traditional stoves, the same can be checked with distribution database and survey results as per monitoring survey submitted to VVB.
1f	The Project Design Document 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)	To avoid double counting of emission reductions through the method of distribution, each cookstove has a unique identifier number and the distribution of each stove is logged onto a database which includes unique information for each recipient	1. Project (GP) Distribution database can be checked to verify the distribution approach, along with the distribution system (includes both plan and execution steps) established by the PP. 2. The VCS GP ICS units have unique engravings or text specifically

		Each PAI will have system for avoiding double counting with data being collected via a smartphone app (where possible), or via paper forms, including: 1. Date of distribution 2. A unique serial number³ on each technology 3. Available end-user data: name, phone number, address/physical location, ID number	mentioning the unit is strictly “not for sale” along with the DelAgua logo. The PAI-1 has distributed all the ICS as per plan and details shared with VVB as distribution database.
1g	The Project Design Document shall also explain how the proposed procedures prevent double counting of emission reductions, for example to avoid that project stove manufacturers, wholesale providers or others claim credit for emission reductions from the project devices.	The End User Agreement confirms that the ownership rights of the ER/VCUs generated by the PAI reside with the PP. The signature of each end user confirming their understanding of this agreement will be collected at the point of distribution. The End User Agreement will be in English and translated into a local language where required. If necessary, it will be read out to the End User. All rights to distribute the delivered stoves and claim the resultant GHG emissions reductions belong to the PP. The GP will not include any PAI that has been rejected by	a)End users will be asked to sign the End User Agreement and this information will be stored in the monitoring database. b) Each PAI will include a statement on the uniqueness of the Project and by listing other similar activities (from other GHG programme registries) that are taking place within the project boundary to demonstrate its uniqueness. Each beneficiary has signed the agreement to confirm the GP

³ There are no similar programs running in the host country Sierra Leone where the same ICS models are distributed by another entity under different program(s). If this is found during the project ICS monitoring or verification, it shall be ensured that double counting is avoided by using distinct nomenclature for the unique ID code of the ICS compared with the different programs, and also making sure that it has a distinct color, label, or marking.

		another GP, or PA-DDs of any other GHG programs.	requirement, details shared with VVB.
2	Use the technologies or measures specified in the project description.	Only ICS that conform with the GP description are to be distributed in the project. The ICS will be chosen to deliver a level of service at least equivalent to the baseline appliance.	Manufacturer's specifications. The ICS distributed under PAI-1 complies with GP requirement, technical specification shared with VVB.
3	Apply the technologies or measures in the same manner as specified in the project description.	The ICS distributed in the PAIs will adhere to the GP description and replace biomass burned in the baseline scenario.	Manufacturer's specifications. The ICS distributed under PAI-1 are wood based and comply with GP requirement.
4	Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	All new PAIs will be implemented only in regions within the geographic borders of <i>Sierra Leone</i> subject to the same baseline scenario determined in Section 3.4 in this Project Description. The geographical location of the project ICS can be traced through the information provided in the distribution database, which includes the latitude and longitude data of the ICS distributed.	ICS Distribution database For PAI-1, records distribution (end user registration database) with clear delineation of project boundary i.e. host country of <i>Sierra Leone</i> is provided to the VVB for their reference.
5	Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.	All PAIs will use the activity method for demonstration of additionality. Step 1: Regulatory Surplus There is no government mandated programme or policy in host country of this	Step1: Regulatory Surplus There is no mandatory legal requirement for installation of cookstoves in households/ institutions of <i>Sierra Leone</i> .

		project ensuring the distribution of new project activity instances. Step 2: Positive List The inclusion of new project activity instances will comply with the positive list as it satisfies criterion 1 where it meets all the applicability conditions of the methodology. Where the project activity installs or distributes stoves at zero cost to the end-user and has no other source of revenue other than the sale of GHG credits, the project activity shall be deemed additional.	Step 2: Positive List Further, the PP distributing ICS free of cost to end users, hence there is no revenue stream than sale of VCUs, hence the project activity instances are automatically additional. The above can be checked with end user agreement and declaration from PP on the same. The PP has provided end user agreement and declaration to VVB to support free distribution of ICS.
6	Where a capacity limit applies to a project activity included in the project, no PAI shall exceed such limit. Further, no single cluster of project activity instances shall exceed the capacity limit, determined as follows: Each device that exceeds one percent of the capacity limit shall be identified. Such instances shall be divided into clusters, whereby each cluster is comprised of any system of instances such that	The GP does not have any specified capacity limits applicable, since there are no capacity limits defined within the applied methodology, VMR0006, ver. 1.1. Therefore, this eligibility criteria is not applicable.	N/A

	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. 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.		
Eligibility conditions specific to inclusion of New PAIs			
7	The new PAI must occur within one of the designated geographic areas specified in the project description	The distribution of the ICS will be within the jurisdictions of <i>Sierra Leone</i>, and therefore, the project activity will only distribute to the beneficiaries that are in agreement with the requirements of the program.	Each PAI under grouped project is within host country Sierra Leone. The same can be checked with distribution data base wherein location details of each end user is recorded. The distribution database shared with VVB, wherein each ICS under PAI-1 located within host country Sierra Leone.
8	The new PAI must comply with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial compliance with multiple sets of eligibility criteria is insufficient.	The eligibility criteria set must be complied by the PAIs at all points in time throughout the crediting period. If at any point, it is found that the PAI is not complying with the set of eligibility criteria, then it may be excluded from the	The MR acts as the documentary compliance summary. However, for each specific eligibility criteria (as laid down above), the supporting evidence has been provided by the PP.

		crediting for the duration of the monitoring period, until it is able to demonstrate the compliance of the eligibility criteria.	
9	The new PAI must be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.	The PAIs will include all the technical, financial, geographic and other relevant information related to the compliance of the applicable set of eligibility criteria & also enable sampling by the VVB.	The MR for the specific monitoring period acts as the supporting evidence for the stated condition/requirement.
10	The new PAI must be validated at the time of verification against the applicable set of eligibility criteria.	The PAI(s) shall be part of the monitoring, and therefore, will be validated against the criteria specified, by an VCS accredited/approved VVB.	The Verification Report based on the VCS template, has been issued by the approved VVB. This acts as the supporting evidence against this requirement.
11	The new PAI must have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).	The PAI related evidence on the project ownership will be in the form of a distribution end user receipt poster. This will be signed by the end user, and a photograph of him/her holding the poster along with the ICS will be saved in the PAI database.	1. A photograph of the PAI distribution first end user holding the poster along with the ICS. 2. A scan of the poster, showing the first distribution date. 3. The distribution database of the GP stating the start date
12	The new PAI must have a start date that is the same	The GP is under planning stage right now, and	This can be verified through the GP

	as or later than the grouped project start date.	therefore, the PAIs will have a start date later than the GP start date.	distribution database, wherein each PAI can be verified for its start date. The PAI-1, is first instance and start date of grouped project activity is same as start date of PAI-1. The distribution record shared with VVB to support start date of PAI-1.
13	The new PAI must be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).	The PAI will be only eligible for the crediting from its start date through to the end of the project crediting period (only).	1. The start date of the PAI can be checked through the distribution database. 2. The end date of the GP crediting shall be referenced from the VCS Project Registry webpage. 3. The overlap of monitoring periods may be checked through the previous monitoring reports (available publicly on VCS project registry webpage for those periods). The PAI-1 is eligible for crediting from the start date of the instance through to the end of the project crediting period
14	The new PAI shall adhere to clustering requirement that states the project proponent shall include in a singular project all project activity instances within ten kilometers of another instance of the	It will be ensured that PAI included within 10 kilometers of another instance of the same project activity by the same PP is in a singular project	All the project activity instances distributed by same PP within 10 kilometers has been included in the GP. There are no other project instances by the same PP distributed within 10

	same project activity and with the same project proponent		kilometers for the same project activity.
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1.5 Project Proponent

Organization name	DelAgua Health Rwanda (Voluntary) Limited
Contact person	James Beaumont
Title	Mr.
Address	DelAgua Health Rwanda (Voluntary) Limited c/o Cafferata & Co., Poinciana & West Mall Drive, Freeport, Grand Bahama, P.O. Box F-42614, Commonwealth of the Bahamas
Telephone	+250-790002992
Email	james@delagua.org

1.6 Other Entities Involved in the Project

Organization name	N/A
Role in the project	-
Contact person	-
Title	-
Address	-
Telephone	-
Email	

1.7 Ownership

DelAgua Health Rwanda (Voluntary) Limited is the owner of the VCS grouped project activity.

During the distribution of the improved cookstoves, the participating households sign an end user agreement between customer and Delagua. The end user agreement has customer information,

unique identification number, product details etc. The agreement follow the requirements of para 3.7.1 of the VCS Standard ver4.4 which states the evidence to establish project ownership should be “An enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions and/or removals which vests project ownership in the project proponent.”

The agreement confirms that the ownership rights of the VERRA project and the carbon assets generated from this project lie with the project proponent. The customer under the End User Agreement “releases all rights to the greenhouse gas reductions and carbon credits produced by the use of the clean energy product in the favour of Delagua and agree to not sell or transfer the GHG or carbon credits to any other third party or use these credits for any other purposes.

1.8 Project Start Date

The start date for this Grouped Project is 22-February-2023, which is the first date from which actual distribution of ICS started.

1.9 Project Crediting Period

The PP has chosen renewal crediting period of seven years, twice renewable, for a maximum total of 21 years.

The first crediting renewal period is from 22-February-2023 to 21-February-2030, including both the dates.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	☒

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
22 Feb 2023 – 31 Dec 2023	162,903
01 Jan 2024 – 31 Dec 2024	1,582,965

01 Jan 2025 – 31 Dec 2025	3,165,835
01 Jan 2026 – 31 Dec 2026	3,070,912
01 Jan 2027 – 31 Dec 2027	2,946,131
01 Jan 2028 – 31 Dec 2028	2,861,022
01 Jan 2029 – 31 Dec 2029	2,732,348
01 Jan 2030 – 21 Feb 2030	385,786
Total estimated ERs	16,907,902
Total number of crediting years	7
Average annual ERs	2,113,488

1.11 Description of the Project Activity

Distribution plan:

The distribution of ICS will occur at centralized distribution points, where households from surrounding villages will be educated on the proper use and maintenance of the technologies. Shortly following the initial distribution, team members will visit each household that received a technology to deliver the training again, ensuring that all members of the household are aware of proper use and maintenance.

The ICS distribution is planned in close coordination with the local government offices, e.g. District Offices, Sector Offices, and so forth. There is a structured plan through which the distribution activity is scheduled and then implemented on ground.

The project involves distribution of high thermal efficiency fuel-efficient improved cookstoves (ICS) to replace the baseline cookstoves at household level in *Sierra Leone*.

The ICS units planned to be deployed under this project are Burn Kuniokoa Rocket Stove & the SSM S32-X Rocket stove, which will reduce the fuel consumption to a great extent and consequently reduce the GHG emissions from cooking activities. The project ICS will improve the efficiency of combustion and thermal transfer to the pot compared with a traditional pot support or three-stone fire. The reduction in the consumption of firewood from the usage of project ICS will result in the GHG emissions avoided compared with the pre-project scenario. This will be documented, monitored on periodic basis, and calculated for GHG emission reductions by applying

a valid version of applicable methodology. The information on the methodology applied, and its applicable eligibility criteria are provided in Sections 3.1 & 3.2 of this PD respectively.

A representative model of the ICS technology that is planned to be distributed is provided below. The program will assure that the ICS technology being distributed to households shall have minimum performance level, design specifications, and lifetime equivalent to the model represented below.

ICS technologies planned under the GP for distribution:

1. Name of the stove model – Kuniokoa Generation 2 with Pot Skirt

Stove manufacturer – Burn

Stove Type – Natural Draft

Stove Body – Stainless Steel

Stove height – 32.1 cm

Stove diameter – 28.2 cm

Thermal efficiency (with pot skirt) – 51.3%

Thermal efficiency (without pot skirt) – 43.4%

High Power Output – 2.9 KW

Stove lifetime – 10 years

Figure 1: Kuniokoa Stove Model reference picture



2. Name of the stove model – S32-X with Pot Skirt

Stove manufacturer – SSM

Stove Type – Natural Draft

Stove Body – Stainless Steel

Stove height – 27 cm

Stove diameter – 32 cm

Thermal efficiency with Pot Skirt – 50.1%

Thermal efficiency without Pot Skirt – 45.7%

Stove lifetime – 10 years



Figure 2: S32-X Stove Model reference picture

With pot skirt, the level of retention of heat surrounding the pot will be higher, giving the ICS a higher thermal efficiency than using it without the pot skirt. Since the project ICS will be distributed with the pot skirt, the stove units will have increased efficiency, thus reducing the firewood consumption to more than 50% than pre-project levels.

At the time of validation and verification 2,090 BURN Kunikoa stoves had been distributed in rural areas of Seirra Leone.

The project technology (ICS distributed under the GP) will achieve the equivalent or higher levels of performance by consuming firewood at a much lower rate than the existing cooking technologies in use, which include the 3 stone fire, and conventional stoves without any air vent, draft or chimney. The level of performance will be ensured by educating the local population on the best usage practices for cooking daily meals. All this improved cooking will be taking place at a significantly lower smoke levels, and encouragement to the people on adopting the outdoor cooking option. This will lead to improved health of the people, in terms of their respiratory health and the health of their eyes.

Data collection of ICS end-user

PP will collect the necessary information to uniquely identify households and end users, thus creating a database of users (households) registered to be using project ICS within the GP crediting period. To allow a unique registration, each ICS will be assigned a unique serial number, which can be tracked through the barcode on the ICS package box, and QR code on the stove body. This QR code label of unique serial number shall be mapped with the id of the household to which it is distributed. The distribution database will be maintained on a continuous basis, and shall be revised for any updates. The unique ICS serial number will be recorded during the registration process together with the following information (wherever appropriate and available):

- Name of ICS user or head of the household
- Address / GPS of ICS household

- Phone number of ICS user or household, where available.
- Improved Cooking Stove model
- Date of distribution/installation
- ICS serial number

The distribution database will be maintained electronically, and will be utilised towards monitoring.

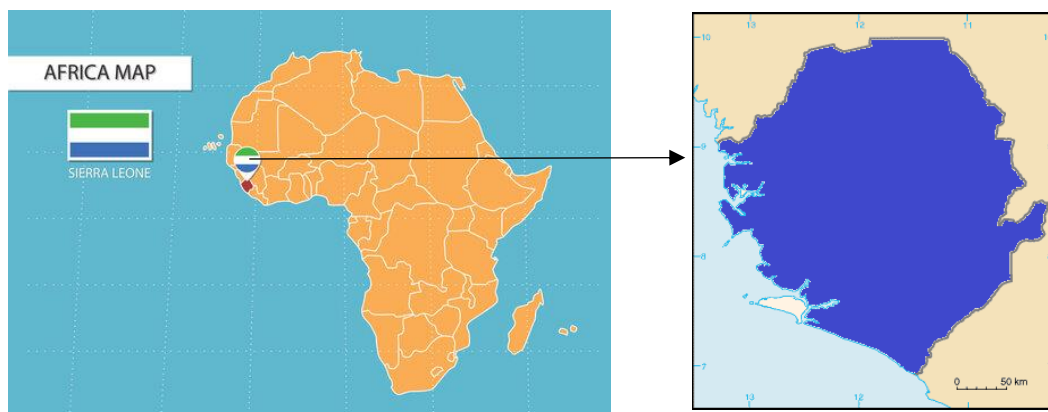
1.12 Project Location

For each PAI, the project boundary will be the geographic borders of Sierra Leone. The project boundary for each Project Activity Instance is the physical, geographical location of the ICS distributed within the geographical boundaries of Sierra Leone.

Also, each individual distribution under the project technology will record the geographical administrative boundaries of each ICS (i.e. Region, District, Chiefdom, Village etc.), which can be verified from the recorded data (monitoring surveys).

The KML file will indicate the geographical boundaries of the host country Sierra Leone.

The project boundary is defined by the following GPS coordinates: 8° 26' 58.20" N and 11° 47' 12.58" W.



1.13 Conditions Prior to Project Initiation

The baseline scenario is the same as the conditions existing prior to the Grouped Project implementation. Within the baseline scenario, majority of households use firewood⁴ as the cooking fuel, and traditional/conventional cooking technologies to meet their cooking needs. The traditional cooking technologies mainly include the 3 stone fire and the cooking structures made without chimney, grate or flue gas ventilation

⁴ Table 2.4: <https://dhsprogram.com/pubs/pdf/FR365/FR365.pdf>

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Sierra Leone government or laws do not have any regulations on the distribution of improved cookstoves to households within Sierra Leone.

1.15 Participation under Other GHG Programs

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

No. This proposed VCS Grouped Project is neither registered nor is seeking registration under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The grouped project activity has not been rejected by any other GHG Programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The grouped project does not reduce GHG emissions from activities that are included in any emissions trading program.

1.16.2 Other Forms of Environmental Credit

The VCS GP has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

1.16.3 Supply Chain (Scope 3) Emissions

Not applicable

As per VCS Standard version 4.4, this section (Scope 3 emissions inventories) is effective 1st January 2024 onwards hence this section is not applicable for the current monitoring period i.e., 22-February-2023 to 30-April-2023.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

Following sustainable contributions are expected to be associated with the distribution of ICS in Sierra Leone:

The proposed project activity will reduce the indoor air pollution levels to a significant level, thereby reducing the risks people face with the 3 stone fires or the traditional cooking devices.

The number of deaths among children per year accounted to the indoor household air pollution⁵ is high in Sierra Leone, and lack of quality health interventions at local level increase the risk further. The lower respiratory disease risk and improved indoor air quality will reduce the mortality rates caused due to it.

Women in Sierra Leone spend a significant amount of time every day to collect firewood. While using ICS, the less amount of fuel used for cooking means that they must spend less time in the field collecting wood. This time saved by the women can now be used towards better management of household, or can be used towards any livelihood or income generating activity, e.g. farming, poultry, animal products, etc.

The proposed project activity aims to distribute ICS to the *Sierra Leone* households at a discounted cost, and this will reduce their reliance on the firewood fuel usage. The project ICS models claim to reduce fuel usage by more than 50% than their baseline consumption. This will save a significant amount of firewood fuel usage per household on daily basis. The modern, improved cooking device will reduce the firewood usage of beneficiary households, which consequently will allow them to lead a healthy and less worried life.

The proposed VCS project activity will be providing indirect employment to the distribution team and provides them with the per diem for their services. These contractual workers will support the distribution, and will act as the point of program's connectivity with the households. The project activity has a permanent staff working from the office in the capital city of Freetown, and the management has an office in Kigali (Rwanda), and the contractual staff as well as permanent staff will be increased, based on the program's success. The workforce will be trained from time to time, in order to meet the requirements of the monitoring data recorded at the time of project ICS distribution.

The GHG emissions caused by the burning of firewood will get reduced by the usage of project ICS. The reduction in the firewood consumption compared with the baseline levels provide the amount of GHGs avoided, by application of VCS methodology VMR0006, ver. 1.1.

The Grouped Project will monitor the SDG impacts, and will register for SD ViSta, so that the VCUs generated from the activity can be labelled with their monitored SDG impacts.

1.17.2 Sustainable Development Contributions Activity Monitoring

Summary description of project activities implemented during the monitoring period that result in SD contributions (i.e., technologies/measures implemented, activity location):

The VCS GP involved PAIs that led to a combined Sustainable Development action through the distribution of ICS units across rural households in Sierra Leone. The distribution of ICS leads to several direct and positive impacts into the lives of these beneficiary households.

⁵ Table 2.4: <https://dhsprogram.com/pubs/pdf/FR365/FR365.pdf>

An explanation of how project activities result in the SD contributions described in Table 1 of this report.

The VCS GP impacts the lives of the households in many ways. These are then reviewed by the PP, and it was found out that these impacts from the project activity at every household level may be documented with the help of UN SDGs. Each impact is then mapped against a relevant SDG indicator, which is then planned for the monitoring. Survey questionnaire used for monitoring the project activity includes questions on the SDG impacts, and the responses from the end user acting as respondent to the monitoring survey are then recorded against those. These survey responses recorded are saved in the online survey form, and these are then analysed.

Identification of which SD contributions described in Table 1 of this report contribute to achieving any nationally stated sustainable development priorities, including any provisions for monitoring and reporting the same.

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	3.9.1 Mortality rate attributed to household and ambient air pollution	Implemented activities to decrease	Mortality rate attributed to HH and ambient pollution will decrease for those HHs using the DelAgua improved cookstove. The improved design specifications of the project ICS model(s) ensure there is very less pollution in the households. PAI-1: The survey results demonstrates that 100% households (2,090 households) confirmed reductions in the smoke level.	Total 2,090 households benefited. As this is the first monitoring period for this GP, the cumulative SDG impacts are the same as the monitored ones.
2)	12	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Implemented activities to increase	Due to grouped project the team involved in the distribution of ICS being provided training, who further educates the end user HHs about the sustainable cooking practices and awareness on climate change impacts. PAI-1: The end users have been provided with training on how usage of improved cookstove contributes to sustainable development in host country. Total 2,090 households being under current monitoring period imparted with such awareness and knowledge.	Total 2,090 households benefited during current monitoring period. As this is the first monitoring period for this GP, the cumulative SDG impacts are the same as the monitored ones.

3)	5.4	5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location	Implemented activities to decrease	Survey to be conducted to determine the reduction in time spent for collection of fuel wood. PAI-1: As per monitoring survey results 100% users confirmed that the time required for collection of fuel wood for cooking has reduced. Hence 2,090 household benefited.	2,090 household spending less time on collection of fuel wood. As this is the first monitoring period for this GP, the cumulative SDG impacts will be the same as the monitored ones.
4)	8.3	8.3.1 Proportion of informal employment in total employment, by sector and sex	Implemented activities to increase	The monitoring survey conducted with questionnaire to understand the number of employment generation due to project. Further, there are direct employment due to project activity. PAI-1: The implementation of PAI 1 has led to generation of around 20 long term employment and 10 number of short-term employment during distribution.	30 employment generation As this is the first monitoring period for this GP, the cumulative SDG impacts will be the same as the monitored ones.
5)	7.3:	7.3.1 By 2030, double the global rate of improvement in energy efficiency	Implemented activities to increase	For this GP, the baseline scenario is the households using traditional cook stoves. This project increases the adoption rate of efficient cookstoves. The outcome of SDG 7 will be measured by the number of efficient cookstoves distributed during the project. PAI1: 2,090 HHs received ICS during current monitoring period.	Number of project households predominantly using clean cooking devices such as Improved Cook Stoves. 2,090 HHs during the monitoring period. This is the first monitoring period therefore the cumulative sum is equal to the contribution during the monitoring period.

6)	8.1	8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries.	Implemented activities to increase	The survey will be undertaken to arrive the figure of monitory saving after implementing energy efficient stoves. The outcome of SDG 8 will be measured by survey. PAI1: As per survey results more than 75% beneficiaries purchase wood fuels, hence the project will result in monitory benefits.	2,090*0.75 HHs =1,567 HHs will be saving money due to less fuel required for cooking. This is the first monitoring period therefore the cumulative sum is equal to the contribution during the monitoring period.
7)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to decrease	The emission reductions will be quantified as per the methodology applied. PAI1: 2,078 tCO_{2e} saved during the current monitoring period.	GHG Emissions measured in tons CO_{2e} 2,078 tCO_{2e} saved This is the first monitoring period therefore the cumulative sum is equal to the contribution during the monitoring period.

1.18 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.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

The program will only result in positive impacts, and therefore will not lead to any harm to the host country landscape or its population.

The project involves the distribution and installation of improved cookstoves manufactured by Burn to households in Sierra Leone which currently use mostly traditional open fire for cooking. A baseline survey was also undertaken by the project participant in the region to ascertain the baseline scenario. The activities under the proposed project promote improved cook stoves that result in reduced fuel consumption and emissions due to cooking and heating water in homes. The ICS used in this project have characteristics that improve the efficiency of combustion and thermal transfer to the pot compared with three-stone fires or traditional pot support. Furthermore, traditional cooking methods involve open fires that result in the emissions of local pollutants such as carbon monoxide and particulate matter in often poorly ventilated rooms, which lead to respiratory problems. In addition, open fires are frequent causes of burns and other injuries. Switching from fireplaces to ICS reduces the incidence of such injuries and health problems. Therefore, project ICS to be installed under this project presents positive environmental impacts wherever they are applied, and no negative environmental impacts have been identified.

2.2 Local Stakeholder Consultation

A local stakeholder consultation meeting was held at **the Country Lodge Hotel, HS 51 Hillstation, Freetown**, on 24 October 2022 from 8.00AM to 10.00AM with an objective of gathering comments and concerns of the stakeholders on the grouped project level, to be implemented in various districts of Sierra Leone. Before the meeting identified stakeholders were informed by press release published in the newspaper, email to identified stakeholder dated on 26 September 2022. Also, the identified stakeholders were invited by posters and other means to join the meet. The comments were invited in an open and transparent manner in the physical meeting by facilitating with a presentation on the proposed project activity.

The agenda of the meeting was to showcase the VCS grouped project being implemented and invite local stakeholders to understand about the project, submit their grievances, and raise their concerns, wherever required. Below are the steps followed during stakeholder consultation meeting

1. The meeting started with presentation on grouped project activity and associated benefits to society, ecology and economic aspect due to use of improved cookstoves.
2. The sample cookstove unit to be distributed under VCS 3837 implementation (Burn Kuniokoa), was demonstrated to the local stakeholders present for its usage.
3. During the meeting, stakeholders were invited to raise their queries and concerns. These were duly responded to during the meeting itself.

Below are the queries raised by the attendees

Q.1. As the project activity will also be developed under VCS to claim carbon benefit, how DelAgua will ensure usage of stoves?

Ans: As project activity is planned to achieved number of sustainable development goals along with emission reduction one. The DelAgua has well established plan to ensure that ICS distributed are properly used and not transferred or sold to other user. The local team will visit the beneficiary at least twice per year for check, further the beneficiaries will also be having contact details of representative for any issue with stove or other concern. The regular interaction with end users will ensure that the project achieves envisioned goals.

Q.2. Which districts/region the project is planned under the current project activity?

Ans: The PP representative explained that the project boundary for the grouped project activity is host country Sierra Leone and all the districts will covered.

Q.3. What will be the price of ICS to the end users.

Ans: The ICS will be distributed free of cost, the beneficiary need to comply with usage norms and monitoring requirement.

Q.4. Whether only one stove per household will be provided or more?

Ans: Initially one stove per household is planned to be given, however in future the same may be assessed.

Q.5. Whether the project will be complying with local regulations?

Ans: The DelAgua has informed governemnet about the project activity, as the project will import ICS from other part of Africa, hence there will be no manufacturing unit. No negative impact identified rather all positive impact due to project to end users and host country.

Q.6. How many local employment generation due to project activity?

Ans: Except few senior personnel to supervise the project implementation, all the work force will be hired locally and the project is expected to generate around 30-40 employment during distribution and operation of the project.

There were no negative comment/concern raised by stakeholders attended the meeting.

Both the LSC meetings were recorded using digital methods (audio-visual, photographic, and pdf records of the Q&A alongwith attendance), and paper format of the meeting forms. The invites are also shared with the local stakeholders a month before the meeting date. The evidences are shared with the VVB for their validation.

Procedures for Ongoing communication with the local stakeholders:

Following are the channels through which the stakeholders can communicate with DelAgua.

1. DelAgua Call Center Phone Number: Aiding the local people in regional language Kinyarwanda, international languages English & French. This can be evidenced through the distribution poster shared with the end user. The distribution poster includes the call center phone number and is informed to the end user.
2. DelAgua email id: DelAgua email is another source of connection through which the end users can connect with them.
3. Through CHWs: The Community Health Workers are the point of contact for the end users in case they have to communicate with DelAgua. They rely on them, mainly because of the personal connect they have with them. CHWs are generally among the local villagers themselves, and therefore, it is easier for them to connect with the end users.

Apart from the mechanism available for local stakeholders connecting with the DelAgua, the follow-up visits by the DelAgua staff are also undertaken to user households.

During the current monitoring period, no feedback/grievances were raised.

2.3 Environmental Impact

Environmental Impact Assessment is not required for the project activity as per the applicable *Sierra Leone* laws⁶. There are no major impacts on the environment due to the installation of the ICS. The local ecology is not likely to get impacted by this type of activity. The group activity included under this grouped project helps in reducing the consumption of the firewood thus reducing the pressure on forest and reduces indoor air pollution, thus having overall positive environmental impacts.

2.4 Public Comments

No public comments received during the 30 days listing period on VERRA registry. The VCS PD was made available for the public comments from 16 January 2023 to 15 February 2023.

2.5 AFOLU-Specific Safeguards

This section is Not Applicable, since this a Non-AFOLU VCS Grouped Project Activity.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The methodology applied to this GP is VMR0006: Methodology for Installation of High Efficiency Firewood Cookstoves, Version 1.1 version 1.1⁷.

Other relevant CDM tools, guidelines, and standards applicable to the grouped project are provide below.

- CDM TOOL30 “Calculation of the fraction of non-renewable biomass” Version 04;
- CDM Guideline “Sampling and surveys of CDM project activities and programmes of activities” version 04;
- CDM Standard “Sampling and surveys for CDM project activities and programmes of activities” version 09.

3.2 Applicability of Methodology

Below are the methodological applicability criteria for the PAIs that are going to be included in the proposed VCS grouped Project Activity.

⁶ Please refer First Schedule (Section – 24) in the EIA Laws of Sierra Leone to access the list of project activities that require an EIA to be conducted. The URL to access the EIA Law is provided below.
URL: <http://www.sierra-leone.org/Laws/2008-11.pdf>

⁷ <https://verra.org/wp-content/uploads/2021/07/VMR0006-Methodology-for-Installation-of-High-Efficiency-Firewood-Cookstoves-v1.1.pdf>

Table 4: Fulfilment of VMR0006, ver. 1.1 Applicability criteria for PAIs to be included

No.	Applicability Condition	Justification of applicability
1	Project activities shall be implemented in domestic premises or in community-based kitchens.	Since each PAI distributes technology that is appropriate for domestic use to household end users i.e. improved cookstoves for cooking, thus this meets the applicability
2	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; in case of project stove replacing fossil fuel baseline stove, it shall exclusively use renewable biomass.	ICS distributed in each PAI has a thermal efficiency of at least 25% Baseline and project fuel for each PAI has been recorded to ensure that wood fuel is the sole source of energy.
3	Both 'Projects' and 'Large Projects' can use the methodology	The grouped project activity is falls under large projects. As such, PAIs also fall under the Large Project category.
4	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.	Proof that non-renewable biomass has been used in the project region i.e. in host country Sierra Leone since 31 December 1989 is available through widespread documentation of more biomass being consumed than is sustainably harvested, and is specifically outlined in an information note for the CDM which estimates fraction of non-renewable biomass for Least Developed Countries ⁸ , wherein fraction of non-renewable biomass usage in Sierra Leone is established as 97%. The wood fuel being main source for households cooking need and for other sectors as well even before 1989 ⁹ . There is no change in source of energy, however in urban areas the consumption of charcoal has increased significantly. The total dependence of wood biomass energy by over 90% of the population has impacted Sierra Leone negatively. According to reports,

⁸ CDM SSC WG 35th Meeting Report, Annex 20

⁹ <https://www.jstor.org/stable/1159894>

		Sierra Leone's forest area is declining as the demand for forest products and wood fuel increases¹⁰. Also report warned that the current high deforestation rate, due to harvesting of traditional fuels, can lead to environmental, health and social impacts on the 65 % of the population living in rural areas. The FAO survey reveals that between 1990 and 2010, Sierra Leone lost an average of 20,000 hectares per year. In total, between 1990 and 2010, Sierra Leone lost 14% of its forest cover. The recent survey shows the deforestation rate is further increasing. Deforestation continues to rise in Sierra Leone with primary forest losses increased, the report reveals that total primary forest losses averaged around 12.2% from 2001 to 2020, wherein around 50% losses occur between 2016 to 2020¹¹. Further, the tree cover losses between 2001 to 2020 averaged around 30%, wherein more than 50% tree cover lost between 2016 to 2020. The demand of fuel wood will further increase with increasing population as no alternatives in near future. The above clearly shows that the rural areas in the host country are dependent on biomass since and before 1989 with not much change in the trend which clearly depicts the dependence of the people of the host country on woody biomass as fuel for meeting thermal energy requirement for cooking at households.
5	For the specific case of biomass residues processed as a fuel (e.g. briquettes, wood chips), it shall be demonstrated that:	Not Applicable. Biomass residues are not processed as a fuel to be used in the GP. The PAIs uses non-renewable biomass (firewood) as source of fuel for the improved cookstove. No processed biomass residue is used.

¹⁰

https://www.researchgate.net/publication/331413817_Status_and_challenges_of_wood_biomass_as_the_principal_energy_in_Sierra_Leone#pf6

¹¹ https://rainforests.mongabay.com/deforestation/archive/Sierra_Leone.htm

	(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.	
6	The Project Design Document 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)	In order to avoid double counting of emission reductions through the method of distribution, each cookstove has a unique identifier number and the distribution of each stove is logged onto a database which includes unique information for each recipient Each PAI has a system for avoiding double counting with data being collected via a smartphone app (where possible), or via paper forms, including: 4. Date of distribution 5. A unique serial number on each technology Available end-user data: name, phone number, address/physical location, ID number
7	The CDM-PDD or CDM-PoA-DD/CPA-DD shall also explain how the proposed procedures prevent double counting of emission reductions, for example to avoid that project stove manufacturers, wholesale providers or others claim credit for emission reductions from the project devices.	The End User Agreement confirms that the ownership rights of the ER/VCUs generated by the PAI reside with the PP. The signature of each end user confirming their understanding of this agreement will be collected at the point of distribution. The End User Agreement will be in English and translated into a local language where required.

		If necessary, it will be read out to the End User. All rights to distribute the delivered stoves and claim the resultant emissions reductions belong to the PP. The GP does not include any PAI that has been rejected by another GP, or CPA/VPA-DDs of any other GHG programs.
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Tool 30 - Calculation of the fraction of non-renewable biomass

Applicability criterion	How the project complies
This tool may be used by: (a) DNAs to submit region- or country-specific default f_{NRB} values, following the procedures for development, revision, clarification and update of standardized baselines (SB procedures); or (b) project participants to calculate project- or PoA-specific f_{NRB} values.	Option (b) applied to calculate the project specific f_{NRB} value as described under in the separate f_{NRB} spreadsheet submitted to VVB.
Project participants and DNAs shall identify and clearly delineate the applicable area for which f_{NRB} is determined. For project- or PoA-specific f_{NRB} values, project participants shall assess and use the area from which woody biomass is sourced for end-users included in the project activity and justify the selection of the area in CDM project design documents. For region- or country-specific f_{NRB} values, DNAs shall specify the applicable area.	The PP has chosen host country Sierra Leone as region for the grouped project activity.
Project participants and DNAs may choose between the following two options to determine the value of f_{NRB}: (a) Use the default value as provided in TOOL33; or (b) Calculate f_{NRB} by determining the share of renewable and non-renewable woody biomass in the total quantity of woody biomass consumption for the country/region	The PP has chosen option b), wherein a third-party consultant has established the f_{NRB} for host country. Please refer Appendix for calculation details and comparison with literature.

or the project area (hereinafter referred as the applicable area) following the procedure and requirements in the paragraphs below. The project participants shall compare and analyse the calculated values against the values for fNRB reported in relevant scientific literature and justify any differences. This analysis shall be included in the appropriate section of the PDD. The relevant scientific literature should include at least: (i) Bailis, R.; Drigo, R.; Ghilardi, A. & Masera, O. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change, 5(3), pp. 266–272.	
If the fNRB value is estimated at the national level, as a cross check, project proponent shall compare the value of estimated NRB with the product of: i) total average above ground biomass tonnage of the area of forest areas deforested in recent past (tonnes/ha), and ii) most recent available observed annual rate of deforestation (ha/yr). If the estimated NRB value is more than 10% above the value calculated as per the product of biomass and deforestation rate, justification shall be provided for the higher value for NRB	Please refer Appendix for cross check.

3.3 Project Boundary

The Grouped Project boundary is defined as per the applied methodologies VMR-0006, ver. 1.1.

Table 5: The GHG sources & sinks within the project boundary

Source	Gas	Included?	Justification/Explanation
Baseline	CO ₂	Yes	Major source
	CH ₄	Yes	Major source
	N ₂ O	Yes	Major source
	Other	No	No other source identified
Project	CO ₂	Yes	Major source
	CH ₄	Yes	Major source

Source	Gas	Included?	Justification/Explanation
Biomass for household cooking requirements	N ₂ O	Yes	Major source
	Other	No	Not applicable

Figure 2: Project boundary map¹² showing polygon of two districts where implementation has started

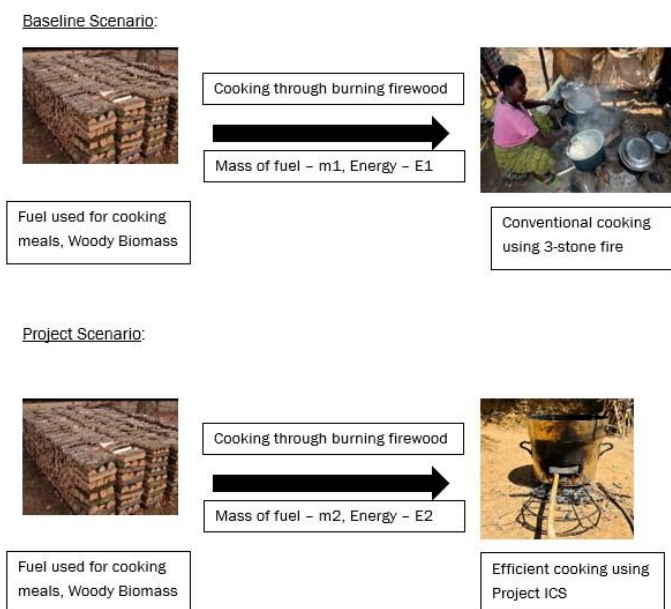


As per the VCS PD template requirements, the diagram of the equipments distributed under the grouped project is provided in Section 1.

The systems that were applied for the distribution activity to take place, are described in the Section 1.11 of this document.

Flow of mass and energy in the project activity:

¹² Source: NATIONS ONLINE PROJECT; URL: https://www.nationsonline.org/oneworld/map/sierra_leone_map2.htm



Here, the change in mass of firewood between baseline and project scenario is $m1 > m2$.

The change in energy consumed for cooking between baseline and project scenario is $E1 < E2$.

3.4 Baseline Scenario

The grouped project activity baseline is the usage of inefficient, conventional cooking devices by majority of the population of Sierra Leone. The existing traditional stoves used in the baseline are simple structures made from clay or having stone or metal tripods with poor combustion air supply or flue gas ventilation system i.e. without a grate or a chimney. These stoves use non-renewable biomass (firewood). A baseline survey was undertaken to confirm the baseline technology, it was confirmed that three stone and other traditional stoves prevalently used along with few metal pot conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney. According to the applied methodology on page 19 “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”. The baseline three-stone cookstove has an efficiency of 10%¹³.

PP conducted baseline survey and baseline KPTs between October to November 2022, to assess the type & quantity of fuels consumed and the cooking technologies in use in pre-project scenario. The PP initially conducted a desk-research to identify regions (districts) where use of traditional cookstoves and wood fuel is predominant. This was followed by designing a survey questionnaire to validate the baseline scenario in the selected regions. The baseline scenario

¹³ <https://verra.org/wp-content/uploads/imported/methodologies/VMR0006-Methodology-for-Installation-of-High-Efficiency-Firewood-Cookstoves-v1.1.pdf>

was identified as the continued use of traditional cookstove (e.g. Rondereza) without chimney or grate or three-stone fired for preparation of meal.

The survey focused on a total of 6 districts of Sierra Leone. Samples were randomly selected for conducting the baseline survey and baseline KPTs. Enumerators were given adequate training in relation to data collection and quality checks by the PP.

PP used guidance provided in para 8.4-b of VMRO006 version 1.1. to conduct the baseline survey. Sample size was determined using CDM Guideline: Sampling and Survey for CDM PA and PoA version 4.0. Sample size for as per CDM Guideline on 95/10 precision confidence was 30 across Northern, Southern and Eastern Provinces of Sierra Leone for the baseline survey. PP used simple random sampling to select 43 samples from Northern, 41 samples from Southern and 51 samples from Eastern province. Samples were randomly picked from 6 districts across these provinces totalling to 139 households.

Province	Sample Covered	Sample Requirement
Eastern	51	30
Northern	43	30
Southern	41	30
Total	139	90

As per the baseline survey, 100% of the households were found using simple wood stove (i.e. either 3-stone fired or Rondereza) as their primary cooking device.

Baseline Survey Results	
Local improved wood stove	0%
Traditional metal stove	0%
Simple wood stove	100%
Local improved charcoal stove	0%
LPG Stove	0%
Imported Improved wood stove	0%
Imported Improved charcoal stove	0%
Other	0%

Samples for baseline KPTs were picked from the baseline survey. Total households who participated in the baseline KPT were 137 households. PP followed the KPT protocol to conduct the baseline KPTs¹⁴. The project KPT was conducted in-house by trained enumerators. Sampled households were visited for 4 consecutive days to collect the data on the fuel consumption for cooking. The average fuel consumption per household per year was derived based on KPT result from 137 households. The result of the KPT conducted for 137 households was 22.80 kg/HH/day i.e. **8.321 tonnes/HH/year**. The baseline fuel consumption value was within the 95/10 confidence/precision. PP has submitted the KPT sheet to VVB which contained the list of households and the KPT results. The summary of the results is provided below:

Mean Consumption (kg/HH/day)	22.80 (8.321 tonnes/HH/Year)
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¹⁴ <https://cleancooking.org/binary-data/DOCUMENT/file/000/000/83-1.pdf>

Standard deviation	7.82
CoV (Standard Error)	34%
Precision (95/10)	5.94%
Result	Ok Acceptable

Since the grouped project activity provides improved cookstoves to households where there was only firewood was used as the cooking fuel, and the cooking device was a traditional cooking device such as three-stone fired, traditional stove without chimney etc., it is considering the burning of firewood, and usage of unimproved cooking devices as the baseline. Also, PP verifies this for every individual household where distribution of project ICS is taking place, that they were using unimproved cooking device using firewood as fuel prior to receiving it. This is acknowledged by the end-user in the form of a signed ICS usage practices poster where the information is written down. This information can be checked through the sample posters. The poster is in local language Kinyarwanda, which makes it clearly understandable for the end user

3.5 Additionality

The applied methodology provides the two options to choose from, within the activity method, to demonstration additionality. This is elaborated below.

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 DeIAgua.

Step 2: Positive List

Requirement:

The applicability conditions of this methodology represent the positive list. The project must demonstrate that it meets all of the applicability conditions of the methodology as well as the below condition. In so doing, the project is deemed as complying with the positive list.

The project meets all the applicability conditions as demonstrated in section 3.3 above.

1. Where the project activity installs or distributes stoves at zero cost to the end-user and has no other source of revenue other than the sale of GHG credits, the project activity shall be deemed additional.

2. Project activities that are implemented as part of government schemes or are supported by multilateral funds cannot be considered additional even if the stoves are distributed free of cost or at a highly subsidized rate and hence are not eligible to use this methodology.

Justification:

1. The ICSs under the project are to be distributed at zero cost to the end users and therefore the project fulfils the criteria for positive list. The project has no other source of revenue other than the carbon credits. Carbon revenue will only make viable the project activity.

2. The project activity is voluntary activity and not supported by any government scheme.

Based on the above substantiation no further demonstration required for additionality.

Therefore, the GP is considered as additional.

3.6 Methodology Deviations

The project activity has not taken any deviation in applied approved methodology VMR0006, version 1.1.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

The grouped project planned to distribute the 480,000 improved cookstoves in host country. The first project activity instance (PAI1) has distributed 2,090 ICS and more numbers will be added onwards. The first ICS under the grouped project has started distribution from 22 February 2023 and till the end of monitoring period i.e. 30 April 2023. 2,090 stoves (wood based Kuniokoa Generation 2 with pot skirt manufactured and supplied by Burn) distributed and operating successfully. Distribution schedules has been provided below:

Month-Year	Number of stoves distributed
February-2023	1,987
March-2023	103
Total	2,090

The operation of stoves was confirmed by a survey undertaken as part of monitoring requirements of VCS PD. The results of the survey are demonstrated in the ER spreadsheet and has been furnished to VVB for verification. The first cookstove under this grouped project

distributed on 22 February 2023, the cookstoves were distributed in the targeted area for the project, location was selected in consultation with the distribution partner. The first monitoring survey was undertaken between 18th April and 26th April 2023 by visiting the sampled households. Sample size was selected by using the latest version 4 of CDM guideline, “Sampling and surveys for CDM project activities and programmes of activities” version 04. The surveyors visited the houses and completed the survey.

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Methodology VMR0006, ver. 1.1 does not account for baseline emissions separately, but instead quantifies emission reductions as a function of the reduction in the amount of non- renewable biomass fuel consumption in the efficient project stoves as compared to baseline stoves. Please refer section 5.4 below.

5.2 Project Emissions

Methodology VMR0006, ver. 1.1 does not account for project emissions separately, but instead quantifies emission reductions as a function of the reduction in the amount of non- renewable biomass fuel consumption in the efficient project stoves as compared to baseline stoves. Please refer section 5.4 below.

5.3 Leakage

Leakage shall be considered as default 0.95 in accordance with section 8.3 of VMR0006 ver. 1.1.

5.4 Estimated Net GHG Emission Reductions and Removals

Equation for Improved Cookstove as per VMR0006

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

Where:

i = Indices for the situation where more than one type/model of improved cook stove is introduced to replace three-stone fire

j = Indices for the situation where there is more than one batch of improved cook stove of type i

ER_y = Emission reductions during year y in t CO₂e

$ER_{y,i,j}$ = Emission reductions by improved cook stove of type i and batch j during year y in t CO₂e

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

Where:

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

$f_{NRB,y}$ = Fraction of woody biomass that can be established as non-renewable biomass (fNRB)

$N_{woodfuel}$ = Net calorific value of the non-renewable woody biomass that is substituted or reduced (IPCC default for wood fuel, 0.0156 TJ/tonne)

$EF_{wf\ CO_2}$ = CO₂ emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO₂/TJ)

$EF_{wf\ non-CO_2}$ = Non-CO₂ emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO₂/TJ)

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

0.95 = Discount factor to account for leakage

The quantify of woody biomass saved $B_{y,savings,i,j}$ due to implementation of improved cook stoves will be estimated as follows:

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

Where:

B_{old} = Annual quantity of woody biomass that would have been used in the absence of the project activity (in tonnes per device) to generate useful thermal energy equivalent to that provided by the improved cook stove. The value of B old has been sourced from baseline field surveys.

η_{old} = Efficiency of baseline cookstove

$\eta_{new,i,j}$ = Efficiency of the improved cook stove type i and batch j determined through water boiling test (WBT).

Efficiency of the improved cookstove will be updated as per equation below:

$$\eta_{new,i,y} = \eta_p \times (DF_n)^{y-1} \times 0.94 \quad \text{Equation (5)}$$

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.

If project households continue to use baseline cookstoves along with improved cookstoves, B_{old} shall be adjusted ex-post based on the percentage of project households found to continue such practice according to Equation 6 below. For such cases, the quantity of woody biomass saved $B_{y,savings,i,j}$ due to implementation of improved cook stoves shall be calculated using an adjusted value to account for ex-post use of baseline stoves in addition to improved cookstove.

$$B_{old,adjusted} = B_{old} \times (1 - \mu_y) \quad \text{Equation (6)}$$

Where:

$B_{old,adjusted}$ = Adjusted B_{old} to account the ex-post usage of firewood in baseline cookstove(s) by project households in addition to improved cookstove (in tonnes per device)

μ_y = Baseline stove usage factor to account for use of baseline cookstoves along with improved cookstoves.

Sample VCU estimates (based on the calculation for third year of ICS monitoring estimates):

For the estimation of emission reduction, μ_y has been considered as 0.23. This is a monitored parameter and the value will be updated based on ex-post monitoring during ex-post calculation...

And based on that,

$$B_{old,adjusted} = 8.321 - (1 - 0.23) \text{ tonnes/year}$$

$$\text{Or } B_{old,adjusted} = 6.41 \text{ tonnes/year}$$

The project stove efficiency as per manufacturer taken as 51.3% and 43.4% for usage with pot skirt and without respectively for Burn Kuniokoa stove. For estimation of ERs, it is assumed that 5% user may not use pot skirt due to various reasons/occasions, hence weighted average efficiency for year 1 is calculated as below.

Year 1 efficiency of project stove with pot skirt- 48.22%

Year 1 efficiency of project stove without pot skirt- 40.80%

Hence, effective efficiency is calculated as

$$\text{Project stove efficiency in year 1} = 48.22\% \times 0.86 + 40.80\% \times 0.14 = 46.24\%$$

$$B_{y,savings,i,j} = 6.41 \times (1 - (0.113/0.4624)) \text{ ton firewood/household/annum}$$

$$\text{Or } B_{y,savings,i,j} = 4.842 \text{ ton firewood/household/annum}$$

Further, it is assumed that 2% project stove might not be operational by end of Year-2023. Total stoves planned to be distributed is 250,000

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

$$ER_{y,i,j} = 4.842 \times 0.68^{15} \times 0.0156 \times (112+26.23) \times (250,000 \times 98\%) \times 0.95$$

$$ER_{y,i,j} = 1,652,545 \text{ ton CO}_2/\text{annum}^{16}.$$

Detailed calculations on the VCU, for both (i) estimates throughout the crediting period, and (ii) actual VCUs obtained in the first monitoring period, are provided in the ER Sheet.

Emission Reduction Estimate for Improved Cookstove¹⁷

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
22 Feb 2023 – 31 Dec 2023	162,903	-	-	162,903
01 Jan 2024 – 31 Dec 2024	1,582,965	-	-	1,582,965
01 Jan 2025 – 31 Dec 2025	3,165,835	-	-	3,165,835
01 Jan 2026 – 31 Dec 2026	3,070,912	-	-	3,070,912
01 Jan 2027 – 31 Dec 2027	2,946,131	-	-	2,946,131
01 Jan 2028 – 31 Dec 2028	2,861,022	-	-	2,861,022
01 Jan 2029 – 31 Dec 2029	2,732,348	-	-	2,732,348
01 Jan 2030 – 21 Feb 2030	385,786			385,786
Total	16,907,902	-	-	16,907,902

¹⁵f_{NRB} value is established as per third party report for host country.

¹⁶ The sample calculations are for Kuniokoa ICS distribution plan, and ER estimates are made for its third year of operations.

¹⁷ For the crediting period estimates, due consideration was given to the discount factors, thus using realistic figures for the project scenario.

The VCS methodology, VMR0006 is applicable to both ‘Projects’ and ‘Large Projects’. Hence there are no limits on volume of credits from Improved Cookstove component that can be certified per annum.

6 MONITORING

6.1 Data and Parameters Available at Validation

Data/parameter fixed ex-ante for Improved Cookstove instances

Data / Parameter	<i>Bold</i>
Data unit	tons/annum
Description	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data	Sourced from KPT survey in host country ¹⁸ .
Value applied:	8.321
Justification of choice of data or description of measurement methods and procedures applied	This parameter has been fixed ex-ante. The survey revealed that the average wood consumption in the Seirra Leone 8.321 tonnes/device/year. The sampling was done in line with para 8.4-b of applied methodology using CDM guideline: Sampling and Survey for CDM project activity and programme of activity, version 4.0. Quantitative measurement of fuel wood which is the primary fuel, done with a weighing scale and moisture meter and its consumption was measured for 3 consecutive days in the sampled households, visiting those households on 4 consecutive days. The details of the baseline KPTs including target population, sample size, sampling method, precision/confidence achieved has been added in section 3.4.
Purpose of Data	Calculation of emission reductions
Comments	<i>Bold</i> will remain fixed for the entire crediting period. The PP conducted a baseline KPT in the months of October to November 2022, to assess quantity of fuels consumed and the cooking technologies in use in pre-project scenario. The survey focused on

¹⁸ KPT Survey

	6 districts in Seirra Leone. Baseline KPTs were done in 139 households to determine fuel consumption per day. The PP compared the results from the surveys with peer-reviewed publications and found values to be comparable/conservative.
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Data / Parameter	η_p
Data unit	Fraction
Description	Efficiency of project stove at the start of project activity
Source of data	Manufacturer's Specifications
Value applied:	Kuniokoa¹⁹ Generation 3: 0.434 for project stove without skirting 0.513 for project stove with pot skirting S32-X²⁰: 0.457 for project stove without skirting 0.5010 for project stove with pot skirting
Justification of choice of data or description of measurement methods and procedures applied	This data is fixed ex-ante as per applied methodology VMR0006 ver. 1.1.
Purpose of Data	Calculation of emission reductions
Comments	A pot-skirt is distributed along with the project stove. If at the time of monitoring, the pot skirt is identified as not being used, then the parameter will be calculated as a weighted average of the efficiency of a skirted stove and a non-skirt stove for the number of ICS with (and without) skirt.

Data / Parameter	$NCV_{biomass}$
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¹⁹ CREEC lab Certification reports provided to the VVB.

²⁰ CREEC lab Certification reports provided to the VVB.

Data unit	TJ/ton
Description	Net calorific value of the non-renewable woody biomass
Source of data	IPCC
Value applied:	0.0156 TJ/tonne
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of emission reductions
Comments	-

Data / Parameter	$EF_{wf\ CO_2}$
Data unit	ton CO ₂ /TJ
Description	CO ₂ emission factor for woody biomass
Source of data	IPCC
Value applied:	112 tCO ₂ /TJ
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of emission reductions
Comments	-

Data / Parameter	$EF_{wf\ non-CO_2}$
Data unit	ton CO ₂ /TJ

Description	Non-CO2 emission factor for woody biomass
Source of data	IPCC
Value applied:	26.23 tCO2/TJ
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of emission reductions
Comments	-

Data / Parameter	Leakage Factor
Data unit	Fraction
Description	net to gross adjustment factor to account for the leakage
Source of data	Default as per VMR0006, ver. 1.1, Section 8.3
Value applied:	0.95
Justification of choice of data or description of measurement methods and procedures applied	In-line with the applied methodology VMR0006, ver. 1.1 Section 8.3.
Purpose of Data	Calculation of emission reductions
Comments	-

Data / Parameter	$f_{NR,y}$
Data unit	Fraction
Description	Fraction of woody biomass that can be established as non-renewable biomass

Source of data	Third party report in line with TOOL 30 Version-04
Value applied	0.68
Justification of choice of data or description of measurement methods and procedures applied	The value is sourced from third party report by C4 EcoSolutions for host country Sierra Leone, is prepared in line with TOOL30 version-04.
Purpose of Data	Calculation of emission reductions
Comments	-

6.2 Data and Parameters Monitored

Data/parameter monitored for Improved Cookstove instances

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 surveys
Description of measurement methods and procedures applied	Measured directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 95/10 confidence precision according to the latest version of Standard for sampling and surveys for CDM project activities and program of activities
Frequency of monitoring/recording	At least once every two years
Value applied	480,000 (total distribution planned)
Monitoring equipment	Surveys
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions

Calculation method	N/A
Comments	1. This parameter only accounts for the number of project ICS that are identified as operating in the monitoring period. 2. The numbers provided for this parameter are only indications based on the distribution plan, and do not mean the exact numbers that will be obtained at the time of monitoring. 3. Here, the batch j is not segregated in a PAI. Every distribution under a PAI may be considered as a separate batch. 4. The current numbers provided for the parameter are meant for ex-ante ER calculation, and are based on the distribution plan, which may change at the time of actual implementation.

Data / Parameter	η_{old}
Data unit	Fraction
Description	Efficiency of baseline stove
Source of data	Calculated using the Default value as specified in VMR0006 methodology and the data obtained through during first monitoring surveys,
Description of measurement methods and procedures applied	If the 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, a default value of 0.1 is used as per the applied methodology; for other types of devices, a default value of 0.2 is used.
Frequency of monitoring/recording	Fixed for each individual household at the time of project implementation
Value applied:	0.1130
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions.
Calculation method	During the ICS distribution, the PP ensures that ICS are distributed only to users whose primary cookstove was a 3-stone fire or

	traditional wood stove by signing a poster agreement (carbon rights agreement). Some households might also have charcoal stoves alongside the 3-stone fire stove or traditional wood stove, but their primary stove remains the 3-stone fire stove or traditional wood stove. After receiving the ICS, these households might stop using the 3-stone fire and use the improved wood stove (DelAgua stove) but may occasionally use the traditional charcoal stove. Given that the DelAgua ICS only replaces 3-stone fire stoves or traditional wood stoves in the household, the use of an efficiency value of 0.1 for η_{old} is appropriate. However, as a conservative measure, the PP has decided to incorporate the 12% usage of traditional charcoal stoves and 1% of other type of stoves into the η_{old} calculation by applying a value of 0.2 for these 13% and calculating the weighted average values as follows: Weighted average value of η_{old} $= (2090 * 0.87 * 0.1 + 2090 * 0.13 * 0.2) / 2090$ $= 0.1130$
Comments	The value is recorded at the time of distribution, through the distribution survey. If the baseline cooking device is traditional device (e.g. Rondereza) or a 3 stone fire, without any grate or chimney, then as per VMR0006, ver. 1.1, the applied value will be 0.1. In case there is any other unimproved cooking device identified as baseline cooking device, then the applied value for the parameter will be 0.2. As per the methodology, this value has been fixed for each household that receives project ICS, during the project crediting period. To be updated at renewal of crediting period.

Data / Parameter	$\eta_{new,i,j}$
Data unit	Fraction
Description	Efficiency of the device of each type i and batch j
Source of data	Calculated as per the equation 5 of the applied methodology
Description of measurement methods and procedures applied	Efficiency of the improved cookstoves will be estimated each year using equation (5) above where loss in efficiency per year is calculated, and therefore no direct measurement is involved.

Frequency of monitoring/recording	Annually				
Value applied:	Crediting Period Year	Kuniokoa Efficiency value		SSM S-32 X	
		With pot skirt	Without pot skirt	With pot skirt	Without pot skirt
	Year-1	0.4822	0.4080	0.4709	0.4296
	Year-2	0.4774	0.4039	0.4662	0.4253
	Year-3	0.4726	0.3998	0.4616	0.4210
	Year-4	0.4679	0.3958	0.4570	0.4168
	Year-5	0.4632	0.3919	0.4524	0.4127
	Year-6	0.4586	0.3880	0.4479	0.4085
	Year-7	0.4540	0.3841	0.4434	0.4044
	Year-8	0.4495	0.3802	0.4389	0.4004
Monitoring equipment	N/A				
QA/QC procedures applied	N/A				
Purpose of data	Calculation of emission reductions				
Calculation method	As per equation (6) above				
Comments	The parameter will be calculated as a weighted average of the efficiency of a skirted stove and a non-skirted stove, taking into consideration the usage of pot skirt. Surveys shall be conducted to determine the number of cooking events that occur with and without a pot skirt. Here, the batch j is not segregated in a PAI. Every distribution under a PAI may be considered as a separate batch.				
Data / Parameter	μ_y				
Data unit	Fraction				

Description	Adjustment to account for any continued use of pre-project devices during the year y
Source of data	Monitoring
Description of measurement methods and procedures applied	This parameter should be monitored using one of the following methods: If the baseline cookstoves are decommissioned and no longer used, as determined by the monitoring survey its value is 0 and $B_{old, adjusted}$ is equal to B_{old} . If both the improved cookstove and baseline cookstoves are used together then surveys shall be conducted to record the average continued operation of baseline cookstoves in a sample of households. The surveys should be designed to capture the cooking habits and stove usage of households in the region, including quantification of use of baseline cookstoves, by formulating questions and/or collecting evidences to determine the frequency of usage of both the improved cookstoves and baseline cookstoves.
Frequency of monitoring/recording	At least once every two years
Value applied:	0.19 (for ex-ante estimation) ²¹
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions
Calculation method	N/A
Comments	The applied values are assumptions (to calculate the VCU estimates for the first crediting period), and the actual value of pre-project device usage will be identified using the monitoring surveys, and shall be appropriately applied.

Data / Parameter	Date of commissioning of batch j
Data unit	Date

²¹ Applied as assumption for year-1 estimations.

Description	To establish the date of commissioning, the Project Participant may opt to group the devices in “batches” and the latest date of commissioning of a device within the batch shall be used as the date of commissioning for the entire batch.
Source of data	Distribution database
Description of measurement methods and procedures applied	To be recorded once at the time of distribution for each project activity instance
Frequency of monitoring/recording	Once
Value applied:	22-February-2023 (date when the first ICS under the PAI-1 is commissioned)
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions
Calculation method	N/A
Comments	N/A

Data / Parameter	Life span
Data unit	Years
Description	State the operating lifetime of project device for projects opting Equation 6 (above) for updating project stove efficiency during project crediting period.
Source of data	Manufacturer’s specifications
Description of measurement methods and procedures applied	The operational life of cookstove is sourced from manufacturer specification.
Frequency of monitoring/recording	Yearly

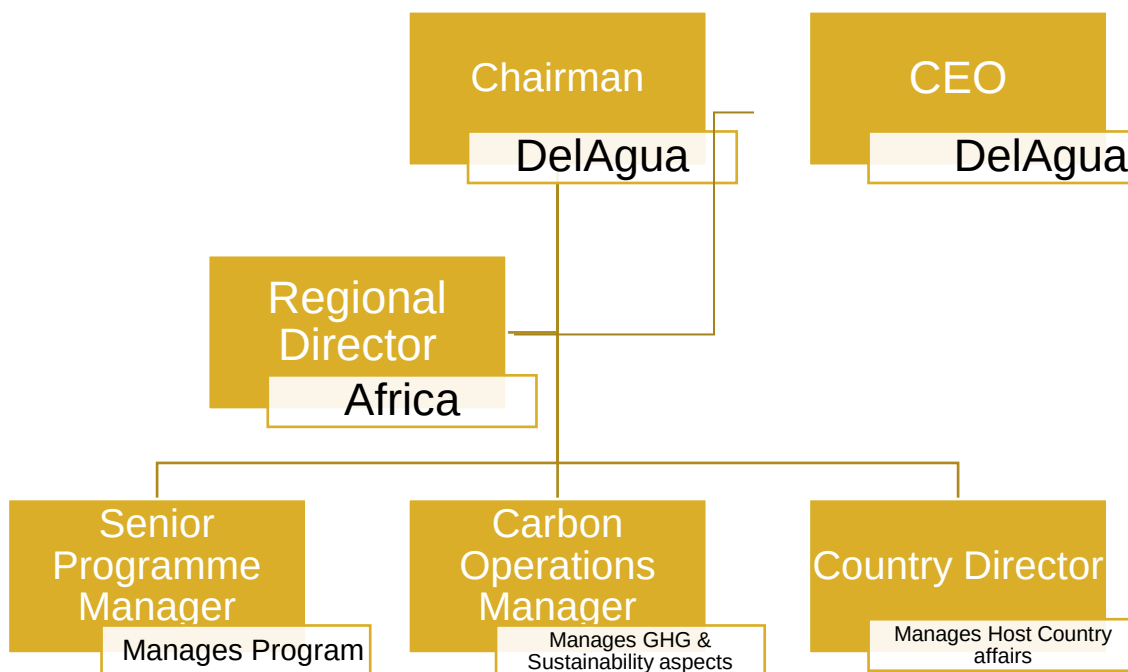
Value applied:	1) Burn Kuniokoa Generation 2 = 10 years 2) SSM S32X = 10 years
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions
Calculation method	N/A
Comments	The emission reduction from each project stove can be claimed till 10 years operational lifetime of the project stove from date of commissioning. For onward if PP willing to claim emission reduction PP may replace project stove with new improved cookstoves subject to baseline applicability at the time of replacement.

6.3 Monitoring Plan

The VCS Grouped Project in Sierra Leone will be following VCS standard requirements applicable, along with the methodological requirements on monitoring a grouped non-AFOLU large project activity. The Monitoring Plan is elaborated in multiple sub-sections for the sake of clarity.

- 1) Team Involved: The DelAgua team involved in the GHG operations management is the local staff based in *Sierra Leone* along with the senior management.

The key responsibilities are shared by the team as follows:



2) Roles and Responsibility:

Chairman – Supervises the overall programme at strategy and financial side.

CEO – Acts as central point of strategy, programme management, finance, and technical domains of the programme.

Regional Director – Responsible for the regional level programme implementation and expansion planning and implementation.

Senior Programme Manager – Manages the programme at implementation level, and acts as an internal technical reviewer for the programme documents and procedures.

Carbon Operations Manager – Manages the operations for GHG emission mitigation programme, from planning to implementation stage. Additionally manages the Sustainability aspects of the programme.

Country Director – Supports programme in the operations and management at the host country level, and acting as point of communication between DelAgua and government of *Sierra Leone*.

The collective responsibilities of DelAgua as the Project Participant will be the following:

- Acts as the project managing entity
- Development of PD
- Registration of the project with VERRA
- Inclusion of new PAIs upon satisfaction of the eligibility criteria stipulated in the PD

- Authorized entity for any official communication with the VERRA and VVB
- Manage and archive the database for all appliances
- QA/QC of database during distribution & data collection
- Maintain local repair/replacement facilities
- Education and public awareness raising during initial distribution as well as periodic education campaigns.
- Data collection during distribution & delivery of data to database
- QA/QC of data collection

3) Quality Assurance and Quality Control:

The quality assurance and quality control of the programme is managed by the quality management standard of DelAgua. The following points summarize the DelAgua view on quality:

- i) Wherever any instrument is used in the program for meeting any of the objectives, it is ensured that the team involved is competent and trained for the operation, handling, and maintenance of the same.
- ii) The teams involved in the programme operations are trained on a periodic basis, to cater for any of the improvements/updates introduced to the programme.
- iii) Refresher trainings are conducted whenever there is an activity resuming after a brief period of time.
- iv) The documents drafted for the programme are reviewed internally as well as in line with the requirements of the VCS ver. 4.2 (i.e. Validated and Verified by VCS approved third party auditors, VVB).
- v) The quality of programme is maintained throughout its operation period, and the feedback is recorded from the end-users on continuous basis.
- vi) There are safeguards defined to maintain the degree of reliability and conservativeness prior to stating any claims on the performance of the programme in its operations. These safeguards are defined in-line with the requirements of the VCS Standard.

4) Training and Maintenance Procedures:

- i) The training of teams involved in various procedures related to the project activity implementation and monitoring will be conducted through modules defined for those procedures.
- ii) The modules for training of resources will be revised on a periodic basis, accounting for the need-based improvements in the training programs or the procedural requirements.
- iii) The data that is recorded in the monitoring surveys is collected and stored electronically, and then uploaded to the central database management system, where it is maintained online on a subscription-based server host.

- iv) The data is also stored offline, within the hard disk drives. The data collection procedures do not involve any paper records, to reduce the environmental footprint of the programme.
- v) The project related data will be stored for two years after the implementation period is over for the project activity.

5) Calculation of Emission Reductions:

Emission reductions will be calculated using the results of the most recent survey data. The updated parameters adjust all emission reduction results for the year monitored.

6) Sampling Plan:

The sampling plan is intended to enable the discovery of unbiased and reliable estimates of monitored parameter values used in the GHG emission reduction calculations. The sampling plan design is based on the CDM Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 4.

STEP 1: Monitoring Objectives

The objective was to obtain an unbiased and reliable estimate of the proportion or mean value of the following key variables over the course of monitoring period.

- a) *$N_{y,i,j}$ Number of project devices of type i and batch j operating during year y (Annual/biennial)*
- b) *μ_y Adjustment to account for any continued use of pre-project devices during the year y*

As per Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities version 9.0, 95/10 confidence/precision has been adopted as this is a large-scale project for both the parameters.

STEP 2: Target Population

Total 2,090 households are part of the PAI-1.

STEP 3: Sampling Frame

The sampling frame referred to all the information sources on the database. PP collected all the information sources on monitoring data through physical visit. The monitoring survey data was collected primarily through physical survey which is the primary mechanism in place for the data collection of the newly distributed ICS and the Monitoring Survey (which includes a household questionnaire and visual inspection of ICSs) which is used in the current monitoring period.

Following information were recorded during the monitoring survey.

- a. Product based Unique Identification number.
- b. Contact information, geographical location or other relevant information of the end user

c. Sampling frame was representative of the entire population

d. No elements from outside the population of interest is present for the current monitoring period. Wherever information miss-match is observed, it is corrected in the database and conservative assumptions is applied.

STEP 4: Sample Method

The sampling method for the monitored parameters $N_{y,i,j}$, and μ_y is Simple Random Sampling and samples were randomly selected from the primary sampling units as illustrated above.

To ensure a random selection of ICS, random number generators was 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 was 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 involves the following approaches

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

$\mu_{y,i,j}$: Pre project device only is in use then fraction to be used to calculate total number, however if pre project device is used along with project ICS, proportion of usage of each was determined by cooking habits evaluated by survey questionnaire during the monitoring period. Using the formulas below, the project proponent randomly sampled the required number of ICS from the primary sampling units

STEP 5: Desired Precision / Expected Variance and Sample Size

To estimate the number of premises to be surveyed with a 10% margin of error at desired confidence level of 95%, the optimal sample size n is given by:

1. For proportional parameter i.e. number of operational project cookstoves

$$n \geq \frac{1.96^2 N \times p(1-p)}{(N-1) \times 0.1^2 \times p^2 + 1.96^2 p(1-p)}$$

Here,

Parameter	Description
n	Sample Size
N	Total number of cookstoves (ICS) distributed

p	Expected proportion
1.96	Represents the 95% confidence required
0.1	Represent the 10% relative precision

2. For mean-based parameter i.e adjustment factor

$$n \geq \frac{1.96^2 NV}{(N-1) \times 0.1^2 + 1.96^2 V}$$

Here,

Parameter	Description
n	Sample Size
N	Total number of cookstoves (ICS) distributed
SD	Standard deviation
V	(SD/mean) ²
1.96	Represents the 95% confidence required
0.1	Represent the 10% relative precision

Requirements of Guideline for Sampling and surveys for CDM project activities and program of activities, version 4.0 has been followed.

STEP 6: Minimum Sample Size²²

- **Proportion based parameter ($N_{y,i,j}$)**

As per the CDM guideline for Sampling and survey²³, if the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 shall be chosen. The sample size calculation for PAI-1 has been shown below:

Sampling Constants	Values
Monitoring period start	22-02-2023
Monitoring period end	30-04-2023
Level of Sampling	Single vintage
Confidence (%) (90 or 95)	95%
Margin of Error (%)	10%
Z value	1.960

²² Detailed sample size calculation of PAI-1 can be found in the ER Calculation sheet

²³ https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20151023152925068/Meth_GC48_%28ver04.0%29.pdf

Usage Rate ($N_{y,i,j}$)				
Year	Stove Model (Sampling Frame)	Stove Population (sampling frame size)	Usage Rate ($N_{y,i,j}$) (%)	Calculated Sample Size (n)
2023	Kuniokoa	2,090	90%	50
Sample size determination				
Estimated $N_{y,i,j}$ (p)				90.00%
$V_{ny,i,j} = p(1-p)$				0.090
Sample Size required ($N_{y,i,j}$)				42
Monitoring Results				
Year	Stove Model (Sampling Frame)	Sampling frame size	Monitored Sample Size	Monitored Usage
2023	Kuniokoa	2,090	108	88%
Reliability Check				
Samples Monitored				108
Monitored $N_{y,i,j}$ (p)				88.00%
Standard Error of $N_{y,i,j}$				3.05%
Relative precision (Margin of error)				6.79%
Result				Ok, acceptable
Lower Bound confidence value				not applicable

As per the sample size calculation, 42 samples were calculated to be surveyed, However, 108 samples were considered to compensate for any outliers or non-responses associated with samples and to get accurate results. The parameter was within the 95/10 confidence/precision.

- Mean based parameter (μ_y)

If the parameter of interest is a numeric mean value (i.e. not a proportion or percentage) the Student's t-distribution shall be used if the resulting sample size is less than 30. As per the CDM: Sampling and Surveys for project activities and programme of activities, PP used t-distribution to calculate the sample size.

Use of baseline stove (μ_y)					
Year	Stove Model (Sampling Frame)	Stove Population (sampling frame size)	Expected Mean value (tonnes per year)	Expected SD	Calculated Sample Size (n)
2023	Kuniokoa	2,090	0.19	0.02	7
Sample size determination					
Estimated (p)					0.19
Estimated Standard Deviation (SD)					0.02
$V_{mean} = (SD/p)^2$					0.01
Minimum Sample Size required					4
tDistribution sample size adjustment				Iteration 1	11
				Iteration 2	5
				Iteration 3	8
				Iteration 4	6
				Iteration 5	7

				Iteration 6	6
Monitoring Results					
Year	Stove Model (Sampling Frame)	Sampling frame size	Monitored Sample Size	Monitored Mean Value of use of baseline stove Monitored Standard Deviation	
2023	Kuniokoa	2,090	108	0.27	
Reliability Check					
Samples Monitored(p)				108	
Standard error of μ_y				4.15%	
Relative precision (Margin of error) (%)				0.28%	
Result				ok acceptable	
Applicable Value				not applicable	

As per the sample size calculation, 7 samples were calculated to be surveyed, However, 108 samples were considered as per CDM sampling standard. There were two reasons- firstly, common survey was conducted for $N_{y,i,j}$ and μ_y and secondly, to compensate for any outliers or non-responses associated with samples. The parameter was within the 95/10 confidence/precision.

6. Quality Assurance/Quality Control

The project proponent applied a confidence/precision of 95/10 for each monitored parameter 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 both parameters i.e. number of operational cookstoves, and adjustment factors. The project proponent monitored a particular parameter till the required level of confidence/precision has been reached, as long as the calculated minimum number of samples has been achieved.

The monitoring plan followed procedures in place to ensure good quality data. The project proponent ensured that field personnel have reviewed, understood and have agreed to follow the monitoring plan procedures, including provisions for maximizing response rates, documenting out-of-population cases, refusals and other sources of non-response. A quality control and assurance strategy were audited and documented. The monitoring plan explained how to properly survey households to prevent bias from interviewer. In the case a household refuses to participate, another household is chosen at random. To reduce interviewer bias, good questionnaire design and well-tested questionnaires was developed. The calculation of the sample size was carried out using values from pilot study for parameter proportions (for number of operational cookstoves), mean values (for adjustment factor) and standard deviations, as the actual characteristics of the population/sampling frame are unknown..

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

The parameters obtained during the first monitoring period, along with the actual VCUs obtained shall be provided in the PD&MR document at the time of validation.

Data / Parameter	$N_{y,i,j}$
Data unit	Number
Description	Number of project devices of type i and batch j operating during year y
Value applied:	PAI1: 2,090 * 88% = 1,838
Comments	The project implementor maintains a database for distribution record to calculate this parameter. The sampling was undertaken by complying the 95/10 confidence precession, which is conservative. The required precision level achieved with sample size determined. All the ICS units distributed during M.P.-1 are considered for the VCU calculation, as the monitoring surveys conducted from 18 April 2023 to 26 April 2023 provide a 88% operational rate.

Data / Parameter	η_{old}
Data unit	Fraction
Description	Efficiency of baseline stove
Value applied:	0.1130
Comments	This value has been fixed for each household that receives project ICS, during the project crediting period. To be updated at renewal of crediting period.

Data / Parameter	$\eta_{new,i,j}$												
Data unit	Fraction												
Description	Efficiency of the device of each type i and batch j												
Value applied:	<table border="1"> <thead> <tr> <th rowspan="2">Crediting Period Year</th><th colspan="2">Kuniokoa Efficiency value</th><th rowspan="2">Weighted Average</th></tr> <tr> <th>With pot skirt</th><th>Without pot skirt</th></tr> </thead> <tbody> <tr> <td>Year-1</td><td>0.4822</td><td>0.4080</td><td>0.4707</td></tr> </tbody> </table> 0.51 at start of operation. The pot skirt usage rate was 84.55%. Hence weighted average value was calculated = $(0.4822 * 84.55\%) + (0.4080 * (1 - 84.55\%)) = 0.4707$			Crediting Period Year	Kuniokoa Efficiency value		Weighted Average	With pot skirt	Without pot skirt	Year-1	0.4822	0.4080	0.4707
Crediting Period Year	Kuniokoa Efficiency value		Weighted Average										
	With pot skirt	Without pot skirt											
Year-1	0.4822	0.4080	0.4707										
Comments	Since M.P.-1 accounts for year-1 only, the applied values indicate values for Kuniokoa ICS model as no other ICS model distributed. For capturing the pot-skirt usage, project survey was conducted.												

Data / Parameter	Life span
Data unit	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
Value applied:	10
Comments	The operational lifetime of the ICS considered as per manufacturer specification. Other models of firewood stoves in future instances shall use the manufacturer's life time for respective models.

Data / Parameter	Date of commissioning of batch j
Data unit	Date

Description	To establish the date of commissioning, the Project Participant may opt to group the devices in “batches” and the latest date of commissioning of a device within the batch shall be used as the date of commissioning for the entire batch.
Value applied:	22-February-2023 (date when the first ICS under the PAI-1 is commissioned)
Comments	The operational lifetime of the ICS considered as per manufacturer specification. Other models of firewood stoves in future instances shall use the manufacturer’s life time for respective models.

Data / Parameter	μ_y
Data unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices during the year y
Value applied:	0.27
Comments	A 95 /10 confidence / margin of error has been achieved for the sampling parameter irrespective of annual/ biennial monitoring frequency as per para 22 of Standard: Sampling and surveys for CDM project activities and programmes of activities, Version 09.0. The desired precision/confidence was met for the parameter during the current monitoring period. Total sample monitored for this parameter for was 108 as PP conducted common survey for parameter $N_{y,i,j}$ and μ_y .

7.2 Baseline Emissions

There are no separate baseline emissions calculation provided in the applied methodology. Therefore, the ERs calculated as actuals shall be provided in Section 7.5 of this report.

7.3 Project Emissions

There are no separate project emissions calculation provided in the applied methodology. Therefore, the ERs calculated as actuals shall be provided in Section 7.5 of this report.

7.4 Leakage

Net to gross adjustment factor of 0.95 shall be multiplied with the ERs calculated, thus accounting for the leakage requirements provided in the methodology.

7.5 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 was applied to calculate the net GHG emission reductions.

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

Where:

- i = Indices for the situation where more than one type/model of improved cookstove is introduced to replace three-stone fire
- j = Indices for the situation where there is more than one batch of improved cookstove of type i
- ER_y = Emission reductions during year y in t CO₂e
- $ER_{y,i,j}$ = Emission reductions by improved cookstove of type i and batch j during year y in t CO₂e

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

Where:

- $B_{y,savings,i,j}$ = Quantity of woody biomass that is saved in tonnes per improved cookstove of type i and batch j during year y
- $f_{NRB,y}$ = Fraction of woody biomass that can be established as non-renewable biomass (f_{NRB})
- $NCV_{wood\ fuel}$ = Net calorific value of the non-renewable woody biomass that is substituted or reduced (IPCC default for wood fuel, 0.0156 TJ/tonne)²⁴
- EF_{wf,CO_2} = CO₂ emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO₂/TJ)²⁵

²⁴ 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 1 Introduction

²⁵ 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion

$EF_{wf,non\ CO2}$	=	Non-CO ₂ emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO ₂ /TJ) ²⁶
$N_{y,i,j}$	=	Number of improved cookstoves of type i and batch j operating during year y
0.95	=	Discount factor to account for leakage

To calculate $B_{y,savings,i,j}$ we use Option 1 of the applied methodology²⁷

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

Where:

B_{old} = Annual quantity of woody biomass that would have been used in the absence of the project activity (in tonnes per device) to generate useful thermal energy equivalent to that provided by the improved cook stove. The value of B_{old} has been sourced from baseline field surveys.

η_{old} = Efficiency of baseline cookstove

$\eta_{new,i,j}$ = Efficiency of the improved cook stove type i and batch j determined through water boiling test (WBT).

Efficiency of the improved cookstove will be updated as per equation 5 of applied methodology as below:

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

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). 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.

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

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

Where:

²⁶ 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion

²⁷ Equation 3 of methodology VMR 0006

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

The calculation for MP-1 has be reproduced below:

Data Ex Ante	Unit	Value	Source
B_{old}	tonnes/HH/ year	8.321	Baseline KPT.
$f_{NRB,y}$	Fraction	0.68	Fixed ex ante.
$E_{wf,non\ CO_2} + E_{wf,CO_2}$	tCO ₂ e/TJ	138.23	As per the methodology
LE	Fraction	0.95	As per the methodology
$NCV_{biomass}$	TJ/tonne	0.0156	As per the methodology
$\eta_{old,i,j}$	Percentage	11.30%	Project Survey
Data Ex Post	Unit	Value	Source
N_{total}	Number	2,090	ICS Installation database
$\eta_{new-skirt}$	Fraction	0.4822	Calculated using Eq.5 of VMR0006
$\eta_{new-nonskirt}$	Fraction	0.4080	Calculated using Eq.5 of VMR0006
% usage-Skirt	Percentage	84.55%	Monitoring survey
$\eta_{new,i,j}$	Fraction	0.4707	Calculated
μ_y	Fraction	0.27	Monitoring survey
$B_{old_adjusted}$	Tonnes/year	6.09	Calculated
$B_{y,saving}$	Tonnes/year	4.63	Calculated as per equation 3 of VMR0006 by using the above input values.
$ER_{y,i,j}$	tCO ₂	2,078	Calculated
Emission Reduction (ER)	tCO₂e	2,078	

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
22-February-2023 - 30-April-2023	2,078	-	-	2,078
Total	2,078	-	-	2,078

<u>Ex-ante emissions</u>	<u>Achieved emissions</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
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<u>reductions /removals</u>	<u>reductions /removals</u>		
31,425	2,078	-93.15%	The decrease in emission reduction is mainly due to ICS distributed in phases during current monitoring period and average operational age of ICS are significantly lower than number of days in current monitoring period, which is appropriate. Additionally, actual sales is also lower than the projected sales.

APPENDIX 1: CALCULATION OF FNRB

The f_{NRB} report using CDM Tool 30 version 4.0 was prepared by a third part expert C4 EcoSolutions (Pty) Ltd. They have 16+ years of experience of working on climate change, biodiversity, ecosystem restoration and scientific research/publications. They have been working in 105 countries across Africa, Asia, Europe, Asia Pacific, Latin America and the Caribbean. They have a diverse group of people working which includes scientist, hydrologist, botanist, climate change experts, forestry experts etc. Details of the work and experience can be found on <https://c4es.co.za/>.

Step 1: Estimation of renewable biomass (RB) in the country of Sierra Leone as per equation (4) of the f_{NRB} tool

$$RB = \sum (MAI_{forest,i} \times (F_{forest,i} - P_{forest,i})) + \sum (MAI_{other,i} \times (F_{other,i} - P_{other,i})) \quad \text{Equation (4)}$$

Where:

- $MAI_{forest,i}$ = Mean Annual Increment of woody biomass growth per hectare in sub-category i of forest areas in the relevant period (tonnes/ha/yr)
- $MAI_{other,i}$ = Mean Annual Increment of woody biomass growth per hectare in sub-category i of other land areas in the relevant period (tonnes/ha/yr)
- $F_{forest,i}$ = Extent of forest in sub-category i in the relevant period (ha)
- $F_{other,i}$ = Extent of other land in sub-category i in the relevant period (ha)
- $P_{forest,i}$ = Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within forest areas (in sub-category i) in the relevant period (ha)
- $P_{other,i}$ = Extent of non-accessible area (e.g. protected area where extraction of wood is prohibited, geographically remote area) within other land areas (in sub-category i) in the relevant period (ha)
- i = Sub-category i of forest areas and other land areas³

Parameters used:

Input parameter	Value	Data source
Extent of forest and other wooded land in 2021 (in ha), $F_{forest,i}$	2,350,945	Geospatial data products for Sierra Leone were analysed in R19–23 to estimate Sierra Leone’s renewable biomass. The forest and other wooded land cover for 2000 and 2021 was estimated using Hansen/UMD/Google/USGS/NASA ²⁸ spatial data for 2000 and 2021, which is derived
Tropical Moist Forest	1,132,693	
Tropical Mountain System	15,678	
Tropical rain forest	1,202.574	

²⁸ Hansen/UMD/Google/USGS/NASA. Hansen Global Forest Change v1.9 (2000–2021).

Extend of non-accessible area (in ha), $P_{forest,i}$	395,819	from Hansen et al. ²⁹ , and disaggregated according to the FAO ³⁰ global ecological zones. The total woody cover extent, including forests and other wooded areas, was calculated for each ecological zone, within the protected areas and within areas that are either accessible or geographically remote.
Protected areas within forest areas (in ha)	117,138	
Remote areas within forest areas (in ha)	278,681	
Mean Annual Increment (MAI)	In t/ha/year	
Tropical Moist Forest	0.92	The mean annual increment for forest is calculated as weighted average of the forest type and their MAI as per IPCC ³¹ values for Tropical moist forest, Tropical Mountain system and tropical rain forest.
Tropical Mountain System	1.61	
Tropical rain forest	3.38	

Geographically remote areas were determined to be areas beyond a harvestable distance from roads and settlements. Conservatively, it was assumed that forests and wooded areas adjacent to all roads within a distance of 2.5 km are harvestable, despite how geographically remote or inaccessible these roads may be. This threshold was determined based on the peer-reviewed literature on wood harvesting practices.

Banks et al.¹⁸ found that woody biomass density increases significantly as a function of distance from the edge of a settled area. Beyond 450 m, average biomass density was found to increase from 2.1 to 16.6 t/ha. Jumbe and Angelsen³² modelled fuelwood choice from household survey data. They found that the most significant determinants of fuelwood choice are source attributes (size and species composition) and distance to source. The mean harvesting distance for their study was found to be 0.95 km. Bandyopadhyay et al.³³ matched household survey and remote sensing data to investigate wood fuel use in relation to poverty levels. They concluded that the one-way walk duration to wood fuel source for both poor and non-poor households is 0.6 hours. Assuming an average walking speed of 4 km/hr over uneven terrain, the average one-way distance to wood fuel source is less than 2.5 km. Areas beyond the harvestable distance were, therefore, determined to be geographically remote. Accessible areas are those that are not

²⁹ Hansen, M. C. C. et al. High-resolution global maps of 21st-century forest cover change. *Science* (80- .). **342**, 850–854 (2013)

³⁰ FAO. *Global Forest Resources Assessment*. (2015)

³¹ IPCC. *Forest Land. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use 4*, 1–29 (2019)

³² Jumbe, C. B. L. & Angelsen, A. Modeling choice of fuelwood source among rural households in Malawi: A multinomial probit analysis. *Energy Econ.* **33**, 732–738 (2011).

³³ Bandyopadhyay, S., Shyamsundar, P. & Baccini, A. Forests, biomass use and poverty in Malawi. *Ecol. Econ.* **70**, 2461–2471 (2011)

protected and not geographically remote, from which the annual renewable biomass production is calculated.

The default age-weighted mean annual increment (MAI) estimates of each ecological zone, as reported by the IPCC, were used for this study. The proportion of forest stand ages above and below 20 years old, including primary forests, were estimated for each ecological zone by extrapolating the observed forest gain extents between 2000 and 2012 to a 20-year period. The average MAI estimates for Sierra Leone are 0.92, 1.61 and 3.38 t/ha/year for tropical moist forests, tropical mountain system and tropical rain forest, respectively between 2000 and 2012 to a 20 years period.

FAO Global Ecological Zone	Total forest cover (ha)	Protected area cover (ha)	Remote area cover (ha)	MAI (t/ha/yr)	Annual growth (t/yr)
Tropical moist forest	1,132,693	51,513	176,030	0.92	836,708
Tropical mountain system	15,678	-	4,741	1.61	17,556
Tropical rainforest	1,202,574	65,625	97,890	3.38	3,512,627
Total	2,350,945	117,138	278,661	-	4,366,891

Total renewable biomass RB = 4,366,891 t/year

Step 2: Estimation of consumption of woody biomass (H) in the country of Sierra Leone as per equation (2) of the fNRB tool

$$NRB = H - RB$$

Where,

H = Total consumption of woody biomass in the applicable area in the relevant period (tonnes)

$$H = HW \times N + CE + NE$$

Where,

HW = Average consumption of wood fuel per household, including fuelwood and charcoal, in the applicable area in the relevant period (tonnes//household)

N= Number of households consuming wood fuel within the applicable area in the relevant period (number)

CE= Commercial woody biomass consumption for energy applications (e.g. commercial, industrial or institutional uses of woody biomass in ovens, boilers etc.) that are extracted from forests or other land areas in the applicable area in the relevant period (tonnes)

NE= Commercial woody biomass consumption for non-energy applications (e.g. construction, furniture) that are extracted from forests or other land areas in the applicable area in the relevant period (tonnes)

The total woody biomass consumption combines the country's domestic and non-domestic *energy* and non-domestic *non-energy* consumption. Sierra Leone's estimate of total woody biomass consumption estimation is derived from World Bank population statistics³⁴ and consumption data sourced from literature^{35,36}, the FAO³⁷ and KPT surveys. Reported values of charcoal consumption are converted to the equivalent woody biomass using guidelines on kiln efficiency from the FAO forestry paper on industrial charcoal making³⁸ and the latest CDM Tool 30 v04.0 2022 default charcoal-to-wood biomass conversion factor. The CDM default value of 4 was applied to the urban domestic charcoal consumption and non-domestic energy charcoal consumption.

Data was drawn from the most recently available official reports/statistics, in this case from the UN's Statistics Division to demonstrate both the recent trend in increase of wood fuel use at the household level, plus also the most recently available data (from 2021). This increase in fuelwood use at the household level has had a significant impact on the parameter value fNRB. The density of fuel is not a time bound parameter, hence average of Africa is used as per published data by FAO.

Input parameter	Value	Data source
H (in t/year)	13,638,120	Calculated (2021)
Wood density (in t/m ³)	0.725	FAO ³⁹
Rural fuelwood (t/capita/yr)	1.368	KPT Survey ⁴⁰
Rural charcoal (t/capita/yr)	0.080	FAO 2020
Urban fuelwood (t/capita/yr)	0.323	UN Environment 2019
Urban fuelwood (t/capita/yr)	0.080	FAO 2020
HW woody biomass consumption in households (in t/year)	11,515,164	Calculated
CE Non domestic woody biomass consumption for energy application (in t/year)	1,953,922	Calculated, using wood to charcoal conversion factor 4 ⁴¹
NE Non domestic woody biomass consumption for non-energy application (in t/year)	169,034	Calculated using biomass expansion factor 2.050
Population of the country	8,141,343	World Bank

34 UCLouvain. *ESA CCI Land Cover Maps v2.1.1*. (2019)

35 United Nations & African Union. *Review of woodfuel biomass production and utilization in Africa*

36 FAO. *Forestry Sector in 2020*

37 FAO Statistics. *Forest Products 2019*. <https://www.fao.org/3/cb3795m/cb3795m.pdf> (2021)

38 Energy Pedia. *Charcoal Production*. https://energypedia.info/wiki/Charcoal_Production (2022)

39 <http://www.fao.org/3/a-i6935e.pdf>

40 KPT. *Baseline KPT Survey Report for Sierra Leone*. (2022)

41 <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-33-v2.0.pdf>

Equation (3) of the fNRB tool stipulates that the average household wood fuel consumption is multiplied with the number of households and industries consuming wood fuel for energy and non-energy applications within the country. Since most of the available and reliable data is total wood fuel consumption in households and commercial and other use.

The total population of host country has been sourced as per the published World Bank population data from 2021. This is in line with the fNRB tool.

Step 3: Estimation of quantity of non-renewable biomass (t/year) as per equation (2) of the fNRB tool

$$NRB = H - RB$$

Where,

H = Total consumption of woody biomass in the applicable area in the relevant period (tonnes)

This step calculates the quantity of non-renewable biomass (t/year) (NRB) by subtracting the renewable biomass estimated in step 1 from the total consumption of woody biomass estimated in step 2. No further input parameters are needed under this step.

$$NRB = 13,638,120 - 4,366,891$$

$$NRB = 9,271,229 \text{ t/year}$$

Step 4: Estimation of fraction of woody biomass that can be established as non-renewable (fNRB) as per equation (1) of the fNRB tool

$$fNRB = \frac{NRB}{NRB + RB} \quad \text{Equation (1)}$$

This step calculates the fraction of woody biomass that can be established as non-renewable (fNRB). The non-renewable biomass calculated in step 3 is divided by the sum of non-renewable biomass and renewable biomass calculated in step 1. No further input parameters are needed under this step.

$$fNRB = 9,271,229 / (9,271,229 + 4,366,891)$$

$$fNRB = 68.0\%$$

Step 5: Comparison as per para 6 of CDM Tool 30 version 4

The resulting fNRB value is higher than expected fNRB values determined using the WISDOM method as reported by Bailis *et al.*, 2015⁴² for the same region. While direct comparisons between the WISDOM and CDM methodologies are only sometimes appropriate given the

⁴² Bailis, R., Drigo, R., Ghilardi, A. & Masera, O. The carbon footprint of traditional woodfuels. *Nat Clim Chang* 5, 266–272 (2015)

different approaches of the methodologies, the following factors can contribute to variations in the fNRB estimates between the two methods:

1. More recent population statistics (2021)⁴³ for Sierra Leone were used in the present study. The more recent data represents a 30% increase in population numbers since the 2009 data utilised by Bailis *et al.*, 2015.
2. Updated 2019 FAO forest products statistics were used in the present study, whereas the study conducted by Bailis *et al.*, 2015 used 2013 FAO forest products statistics. The current study additionally makes use of recent KPT survey results for rural per capita fuelwood and charcoal consumption that are specific to Sierra Leone.
3. Mean annual increments (MAI) were calculated by means of a weighted average that is based on the forest area of three categories (i.e., primary forests, above and below 20 years secondary forests). Data from the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for “Above-ground biomass growth rates for different ecological zones” was utilised⁴⁴. As per the Bailis *et al.*, 2015 article, MAI values were derived from field observations followed by an estimation of growth rates as a percentage of standing stock and IPCC values. This approach yields higher MAIs compared to IPCC values leading to lower estimations of non-renewable biomass (NRB).

Step 6: Cross check in line with para 13 of CDM Tool 30 version 4.0

The resulting non-renewable biomass (NRB) was compared to the top-down product of average above-ground biomass (82.00 t/ha) and the most recent annual deforestation data (19,730 ha/yr)⁴⁵. NRB, as calculated in this report according to the CDM Tool 30 v4.0 2022, was found to be 9,271,229 t/yr, greater than the cross-check results based on deforestation (1,617,860 t/yr). It is expected that the cross-check estimate of biomass loss from deforestation could underestimate the extent of non-renewable biomass consumption as it only considers the average biomass stocks from completely deforested areas. Unsustainable wood harvesting resulting in forest degradation and substantial reductions in biomass stocks, but not complete deforestation, are not considered in the cross-check. Therefore, the estimate of NRB is deemed applicable to this study, given that the guidance provided by CDM Tool 30 v4.0 2022 was followed.

⁴³ The World Bank. World Bank Open Data. Accessed on 05/05/2022 from <https://data.worldbank.org/> (2022)

⁴⁴ IPCC. Forest Land. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use 4, 1–29 (2019)

⁴⁵ FAO. Global Forest Resources Assessment - Sierra Leone. (2020)