



EASTERN DRC COOKSTOVE PROJECT-SOUTH KIVU



Document Prepared by AERA SAS

on behalf of OBEN EAC S.A.

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PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This is the third monitoring report of the project “EASTERN DRC COOKSTOVE PROJECT-SOUTH KIVU, which started on 10/06/2020 (first distribution of ICS). The monitoring report covers the period from 01 January 2023 to 31 December 2023. The project aims to provide individuals with intermediate improved cookstove (ICS). The stoves are manufactured by OBEN E.A.C and are commercialized into the community via the local church communities that function in the various locations of the Sud-Kivu province and target primarily the regions covered by the diocese of Uvira.

The ICS are manufactured by OBEN E.A.C and distributed through this project encourage households to replace the prevailing inefficient three-stone fireplace or traditional charcoal cookstoves that are predominantly used across the region. The ICS provides for an efficient use of the thermal energy generated through the combustion of biomass while cooking and there is a more efficient transfer of this thermal energy to the cooking pot. There is thus a resultant reduction in both biomass consumption and greenhouse gas emissions.

In addition to the reduction of biomass consumption (and associated reduction in expenses to purchase wood or charcoal – or reduction in time gathering firewood), there is also an economic benefit in that the ICS will be produced locally in the region and will create jobs which will have a large proportion of female employees.

The project seeks to distribute up to 400,000 ICS to households (targeted population) in the eastern DRC. During this monitoring period spanning from 01/01/2023 to 31/12/2023, 0 cookstoves have been distributed to households. The commissioning date for each stove is included in the project’s database.

Thanks to carbon finance, the cookstoves are distributed at a 50% subsidy to users (Stoves are sold at 5\$ while the total manufacturing and distribution cost are 10\$/stove.

This project is implemented in Sud-Kivu, and since the start date of this monitoring period on 01 January 2023 until 31 December 2023 (third monitoring period), 0 stoves have been distributed to end-users in Sud-Kivu province, as distribution stopped in December 2022, and the total GHG emission reduction is 661,779 tCO₂e during this monitoring period.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	10-June-2020–09-June-2027	VCS	KBS Certification Services Pvt. Ltd.	Seven years

Verification	10-June-2020—31-December-2021	VCS	KBS Certification Services Pvt. Ltd.	1.56
Verification	01-January-2022—31-December-2022	VCS	earthhood services private limited	1
Verification	01-January-2023—31-December-2023	VCS	4K Earth Science Private Limited	1

1.3 Sectoral Scope and Project Type

Sectoral scope ¹	03
Project activity type	Type II –Energy Efficiency Improvement Project

1.4 Project Proponent

Organization name	OBEN EAC S. A
Contact person	Claver NDIZEYE
Title	Director
Address	B.P.4942, Bujumbura, Burundi
Telephone	0025776602600
Email	powainternational@gmail.com

1.5 Other Entities Involved in the Project

Organization name	AERA Group
Role in the project	Carbon advisor and offtaker
Contact person	Alexandre Dunod
Title	Chief Operating Officer
Address	28 cours Albert 1er, Paris, 75008, France

¹ Projects, activities, or methodologies may be developed under any of the 16 VCS sectoral scopes: <https://verra.org/programs/verified-carbon-standard/vcs-program-details/#sectoral-scopes>

Telephone	0033642960978
Email	a.dunod@aera-group.fr

1.6 Project Start Date

Project start date	10-June-2020
Justification	First date of project start date was January 2020, which was the start date of the pilot phase. The official start date is 10 June 2020. Stoves distributed before this date are not accounted for in the Emission reduction calculation sheet.

1.7 Project Crediting Period

Crediting period	☒ Seven years, twice renewable ☐ Ten years, fixed ☐ Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)
Start and end date of first or fixed crediting period	10-June-2020 to 09-June-2027

1.8 Project Location

The project activity will be located solely within the geographic borders of the Democratic Republic of Congo in central Africa. The project activity will occur within the Eastern regions of DRC – specifically the Sud-Kivu Province. The province is located around the co-ordinates: 3°0'41.969" S, 28°17' 57.966"E.



Figure 1: Location of DRC within Africa and Sud-Kivu Province within the DRC (from left to right).

The project takes place primarily in all the district covered by the UVIRA Diocese, which includes the districts of Uvira, Fizi and Mwenga (South Kivu province), and part of the district of Kabambare, located at the east of the Luama River. The project will target primarily all the villages and towns of the mentioned districts, but the project can expand to other towns of the Sud-Kivu province which is the project boundary. Project proponent will ensure that cookstoves are distributed to households in the project boundaries

1.9 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	VM0006	Methodology for Installation of High Efficiency Firewood Cookstoves	1.1
Tool	CDM tool 30	Calculation of the fraction of non-renewable biomass	3.0
Tool	CDM tool 01	Demonstration and Assessment of Additionality	7.0.0
Standard	N/A	Sampling and Surveys for CDM project activities and programmes of activities	9.0

1.10 Double Counting and Participation under Other GHG Programs

1.10.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.10.2 Registration in Other GHG Programs

Is the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

1.11 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.11.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

1.11.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

☐ Yes ☒ No

1.11.3 Supply Chain (Scope 3) Emissions

Do the project activities affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

If yes:

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

If yes:

Has the project proponent(s) or authorized representative posted a public statement on their website saying, "Carbon credits may be issued through the Verified Carbon Standard project [project ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities]."

☐ Yes ☒ No

1.12 Sustainable Development Contributions

From the Priorities listed in the Report of the Voluntary National Review of the Sustainable Development Goals 2020– DRC², this project will contribute to the SDG priorities in the following ways:

ENVIRONMENTAL

Greenhouse gas emissions are reduced by the project activity. This is also aligned to the Sustainable Development Goals (SDG).

Fuel consumption is reduced for cooking, this reduces the amount of non-renewable biomass use in the region. The project will avoid 3.2 million tCO₂e during the first crediting period (SDG 13)

Participating households will be more energy sufficient due to the reduction in fuel biomass requirement due to the efficiency of the devices.

Distribute 400,000 high-efficiency, clean burning Matawi Cooktoves in DRC, to benefit over 2 million individuals. (SDG 7.1.2)

Thanks to ICS efficiency compared to baseline devices, Significantly reduce Household Air Pollution (HAP) in rural households (SDG3.9.1)

ECONOMIC

In a region where economic activity and inputs are strained, the annual spend on fuel for cooking will be reduced due to the efficient cookstove use, benefiting households to allow the expenditure of resources elsewhere.

Production of the cookstoves regionally will create employment in the region and promote indirect opportunities in the sales, distribution, training and management roles within the supply chain.

Additional time will be freed in households from fuel collection – these can now be applied elsewhere in economic or social pursuits.

SOCIAL

Reduce the proportion of time rural women spend on unpaid domestic work related to collection of firewood, and cooking meals on inefficient traditional cookstoves. (SDG5.4.1). Therefore, additional time will be freed in households from fuel collection – these can now be applied elsewhere in economic or social pursuits.

² https://sustainabledevelopment.un.org/content/documents/26296VNR_2020_DRC_Report_French.pdf

Indoor pollutants – specifically VOCs and particulates are reduced due to more efficient combustion having a positive effect on health. This has been confirmed by the World Health Organisation.

Reduce the risk of mortality among infants and children under five years of age due to (1) acute lower respiratory illnesses (ALRI), such as pneumonia and bronchitis, the cause of mortality in 12% of children under five, and (2) burns resulting from children falling into open cooking fires. (SDG3.2.1, 3.2.2)

Participating households will be more energy sufficient due to the reduction in fuel biomass requirement due to the efficiency of the devices.

Table 1: Sustainable Development Contributions

Row number	SDG target	SDG indicator	Net impact on SDG indicator	Current project contributions	Contributions over project lifetime
1)	1.4	Number of users that experience money savings thanks to the use of the ICS	Implemented activities to increase	193,103 end-users during the monitoring period	In total, 193,103 end-users
2)	3.9	Number of users that experience less fumes thanks to the better combustion of the ICS	Implemented activities to increase	193,103 end-users during the monitoring period	In total, 193,103 end-users
3)	7.1	Number of Improved cookstoves distributed	Implemented activities to increase	0 end-users equipped with ICS during this monitoring period	193,103 end-users equipped with ICS over project lifetime
4)	8.3	Number of descent Job created	Implemented activities to increase	10 jobs created during this monitoring period	30 jobs created

5)	13.2	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	661,779 tCO2e	1,273,827 tCO2e during the project lifetime
6)	15	Quantity of wood saved.	Implemented activities to increase	327,653 tonnes of wood ³	659,640 tonnes of wood during the crediting period

³ The quantity of wood saved is calculated by multiplying the Number of cookstoves installed (full-use equivalent), by the fNRB, the quantity of biomass saved by each ICS and the number of days the stoves have been working during the year. Hence for 2022 it is : $122,129 \times 84.0\% \times 2,13 = 218,467$ tons of non-renewable biomass saved. Full and detailed calculation is available in the ER sheet

1.13 Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the monitoring report.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification	For the purpose of initiating and developing this project, the implementer, either directly or through his team of professionals, has undertaken correspondence and consultations. Stakeholders were identified at validation and since, the project design has not changed. This was confirmed by auditors during validation and verified during each monitoring period. Thus, this section is not applicable.
Legal or customary tenure/access rights	N/A
Stakeholder diversity and changes over time	N/A
Expected changes in well-being	N/A
Location of stakeholders	N/A
Location of resources	N/A

2.1.2 Stakeholder Consultation and Ongoing Communication

Ongoing consultation	Contact details of OBEN in Burundi as well as CDPE in DRC are provided to all the stakeholders, they can either contact OBEN by phone or CDPE physically at the church or remotely by phone... OBEN contact details are provided on
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	the contract signed by the end-users who acquire a cookstove, to ensure that they can contact project proponent at any time.
Date(s) of stakeholder consultation	08-July-2021
Communication of monitored results	As a part of on-going communication with local stakeholders, end users were encouraged to provide any comments or propositions during stakeholder feedback round spanning from the meeting date to 07 September 2021. Local stakeholders were also informed about the grievance registering system, at the end of the meeting.
Consultation records	A grievance logbook used for compiling all comments received is available. During this monitoring period, there were 8 comments regarding damaged ICS. All ICS have been replaced or rehabilitated.
Stakeholder input	No negative feedback is received during the interviews with respect to the project operations. Thus, no modifications have been since comments received during the LSC did not question the design of the project activity in principle.

2.1.3 Free, Prior, and Informed Consent

Consent	BQS-OBEN and the Diocesan Center for the Protection of the Environment (CDPE) of Uvira in the Democratic Republic of Congo have entered into a formal agreement by which OBEN will provide information and capacity building to CDPE who will in turn ensure that the local populace and potential users are informed of the ICS benefits, register any concerns and act as a conduit to the project developers to ensure that stakeholder views are communicated and incorporated into the project design.
Outcome of FPIC	A formal contract was signed between BQS-OBEN and the Diocesan Center for the Protection of the Environment (CDPE) of Uvira on 26/05/2017. As per Local Stakeholders Minutes, the project did not encroach on land, relocated people without consent, and forced physical or economic displacement. Furthermore, the project aims at providing

	improved cookstoves to households thus, there is no need to displace local population.
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2.1.4 Grievance Redress Procedure

Grievances received	Resolution and outcome
Damaged ICS for 8 households	All ICS have been replaced or rehabilitated.

2.1.5 Public Comments

Summary of comments received	Actions taken
Marie Rose Kabonge Saidi – Member of Parliament Congratulated the speakers and project proponents on the initiative and spoke well of the cross-border collaboration and expressed her delight. She promised to raise awareness among her colleagues in the Territorial Assembly and promote the project activity.	No response required.
Serge Bahati Bintu – Director Territorial Environmental Service of Uvira He raised a concern about the negative effects of deforestation in the region, noting that the informal charcoal sector has denuded the forests in the area leading towards an ecological disaster. He praised the mitigation of this through the use of the more efficient ICS devices and encouraged all households to get at least one.	Positive intervention and support for project.
Ms Safi Awadi – facilitator for Action for the Development of Peasant Communities Firstly, she expressed her support for the project and gave the support of her organization.	A1: The manufacturing process outlined in the PD was explained, including the benefits of employment.

Q1: She wanted to know about the manufacturing process. Q2: Can it be produced locally Q3: Does the higher efficiency affect the cooking pots negatively?	A2: OBEN explained that in the second phase of the project, it is planning to collaborate with CDPE to produce the devices in the DRC. A3: No, higher efficiency does not wear pots quicker, but does cook food quicker.
Ms Fatuma Maman Sifa – Representative of association of Christian mothers – Uvira Given the expense mothers have to incur to purchase fuel for cooking, she was positive to the introduction of the ICS devices. Q1: She hoped that mothers could be involved in the distribution in the future. Q2: What is the price of an ICS for a household? Q3: Could the project roll out not be accelerated?	A1: This could be possible in the future. A2: The cost is around 10 USD but due to the project activity and carbon finance, the price will be USD 5 per ICS device for affordability. A3: The project needs to follow due process to ensure carbon finance is possible, so it cannot be rushed.
Hillaire Salloum – from Head Office of International Committee of the Red Cross Q1: Asked if it would be possible for a large number of ICS devices to be made available to the ICRC for distribution in emergency periods.	A1: OBEN took note and could do this in the future as part of a different project as they have done elsewhere in the region (e.g. Burundi).
Rachidi Nyambuza – a Representative of the Rice Growers Association Q1: Mentioned that the Rice growers association represents many growers and they could offset pre purchase of the ICS devices against the sale of the rice crop.	A1: OBEN replied that this was not a problem and they need to work through the CDPE to facilitate this, but that household registration is very important for monitoring and traceability.
Francis Bahoza – Action Humanitaire pour L'Assistance et le Développement. Q1: Asked about reducing the cost of the ICS to USD5 as it was expensive.	A1: OBEN explained carbon finance and that the costs is already greatly reduced and without other inputs it could not be reduced further.

Michelle Ehouman – Office of the High Commissioner for Refugees. Q1: It was mentioned that the UNHCR struggled to find sufficient fuel for refugees and enquired about the possibility of OBEN assisting with ICS devices for refugees.	A1: It was possible, and OBEN are doing this in other areas. Discussions would need to be held as that is a large project and outside of design scope this project, but it is possible.
Bekoutare Pepe – Head Office – Uvira – African Initiative for Relief and Development Q1: Praised the project activity as he mentioned he had seen the benefits of a similar project elsewhere and said it made a significant positive impact. He suggested that all households that get a ICS device should be encouraged to plant a tree too to mitigate the impacts of climate change.	A1: The audience were unanimous in supporting this with applause.

2.2 Risks to Stakeholders and the Environment

	Risk identified	Mitigation or preventative measure taken
Risks to stakeholder participation	No risk identified	As per grievance book, no negative feedback is received
Working conditions	No risk identified	The project's personnel is interviewed during monitoring period and never reported any health and safety risk or incident during the operation phase.
Safety of women and girls	No risk identified	. As mentioned above, the project's personnel is interviewed during each monitoring period and women never reported any security problem.
Safety of minority and marginalized	No risk identified	It is observed during each site visit.

groups, including children		
Pollutants (air, noise, discharges to water, generation of waste, release of hazardous materials)	No risk identified	The project activity consists of the distribution of improved cooking stoves, thus those risks are not applicable.

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

Discrimination and sexual harassment	OBEN follows the applicable laws in Burundi regarding discrimination and sexual harassment policy. In addition to the applicable laws regarding prevention, protection of victims and repression of gender-based violence ⁴ , the state of Burundi developed an action plan, in 2019, in order to enhance the applicable law ⁵ . In RDC, the Convention on the Elimination of All Forms of Discrimination against Women has been adopted since 1979 by the Member States of the United Nations. It was ratified by the Democratic Republic of Congo (DRC) in October 1985. Thus, it is applicable to all companies operating in the country.
Management experience	N/A
Gender equity in labor and work	According to the list of employees provided by the PP, both women and men are part of the operational team..
Human trafficking, forced labor, and child labor	<i>The project aligns with the labour convention and labour rights of Burundi, which is a member of the International Labour Organisation (ILO) since 1963. The project does not use victims of human trafficking, forced laborer and child labor and this is verified during each site visit for each monitoring period by the audit team.</i>

⁴ <http://www.presidence.gov.bi/wp-content/uploads/2017/07/loi-013-2016.pdf>

⁵ <https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/CSW/64/National-reviews/Burundi.pdf>

2.3.2 Human Rights

OBEN employs local population for project management and the project aligns with the labour convention and labour rights of Burundi, which is a member of the International Labour Organisation (ILO) since 1963 and signed the following fundamental conventions⁶:

C029 – Forced Labour Convention, 1930. Since 11.03.1963.

C087 – Freedom of Association and Protection of the Right to Organise Convention, 1948 (No.98). Since 25.06.1993

C098 – Right to Organise and Collective Bargaining Convention, 1949. Since 10.10.1997.

C100 – Equal Remuneration Convention, 1951. Since 25.06.1993.

C105 – Abolition of Forced Labour Convention, 1957. Since 11.03.1963.

C111 – Discrimination (Employment and Occupation) Convention, 1958. Since 25.06.1993.

C138 – Minimum Age Convention, 1973. Since 19.07.2000.

C182 – Worst Forms of Child Labour Convention, 1999. Since 11.06.2002

2.3.3 Indigenous Peoples and Cultural Heritage

N/A

2.3.4 Property Rights

Disputes over rights to territories and resources	N/A.
Respect for property rights	N/A

2.3.5 Benefit Sharing

Summary of the benefit sharing plan	N/A
Benefit sharing during the monitoring period	N/A

⁶ https://www.ilo.org/dyn/normlex/en/f?p=1000:11200:::P11200_INSTRUMENT_SORT:1

2.4 Ecosystem Health

	Risk identified	Mitigation or preventative measure taken during the monitoring period
Impacts on biodiversity and ecosystems	No risk identified	The project involves reduction of the deforestation. Thus, this is not applicable.
Soil degradation and soil erosion	No risk identified	The project involves the distribution of ICS. Thus, it is not linked to soil activities and related impacts.
Water consumption and stress	No risk identified	The project involves the distribution of ICS. Thus, it is not linked to water consumption activities and its related impacts.
Usage of fertilizers	No risk identified	Not applicable to project activity.

2.4.1 Rare, Threatened, and Endangered species

Species or habitat	N/A
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2.4.2 Introduction of species

Species introduced	Classification	Justification for use	Adverse effects and mitigation
N/A	N/A	N/A	N/A

Existing invasive species	Mitigation measures to prevent spread or continued existence of invasive species
N/A	N/A

2.4.3 Ecosystem conversion

Not applicable

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

From the project start date on 10-June-2020, 193,103 cookstoves have been sold in South-Kivu by the project implementer. 17,919 stoves have been sold in 2020, 60,146 in 2021 and, 115,038 during the previous monitoring period, spanning from 01-January-2022 to 31-

December-2022. The distribution occurred in different territories of South Kivu. The number of stoves distributed per territory as well as share of total are presented in the table 2 below:

Territory	Number of stoves distributed	Distribution per Territory (% of total)
IDJWI	14,402	7%
KABARE	18,594	10%
KALEHE	2,204	1%
KAMANYOLA	26,909	14%
KATOGOTA	2,220	1%
MWENGA	18,380	10%
RUNINGU	3,100	2%
SHABUNDA	3,421	2%
UVIRA	88,314	46%
WALUNGU	15,559	8%
Total général	193,103	100%

Table 2: Stoves distribution

The ICS distributed can use both firewood and/or charcoal, which is greatly appreciated by the end-users. At the time of distribution, end-users are asked what predominant fuel, they use, and the response is recorded in the project database. On the 193,103 cookstoves distributed, 122,672 are charcoal users (64%) and 70,431 are firewood users (36%).

There were no events or changes to the project, the project proponent, or entities during the monitoring period.

Also, despite troubles in the project area, OBEN and CDPE Team conducts regular spot checks to evaluate the status of ICS and give advice on the use of ICS. During this monitoring period, the field team was able to visit 1,188⁷ households equipped with the stoves as part of the follow-up visits. During those visits 43 households with damaged stoves but also the 8 households that reported through grievance book), have been able to get their stoves repaired or changed. Those 43 stoves correspond to 3.6% of all the households visited, hence an operational status of 96.4%⁸ which is higher than average operational status of 93% found during monitoring surveys. Maintenance book and proof of follow-up visit are provided to VVB.

The distribution has been stopped in December 2022, and project developer now targets other regions of eastern DRC to expand the project.

⁷ The visits have been registered on KoboToolBox and same have been shared with VVB.

⁸ As monitoring surveys operational status results are more conservative than follow-up visits, the stoves found damaged and replaced during follow-up visits have not been retrieved from database for ERs calculation during this monitoring period.

3.2 Deviations

3.2.1 Methodology Deviations

No deviation was applied to the methodology during this monitoring period nor during previous verification periods.

3.2.2 Project Description Deviations

There is no project description deviation applied during previous or actual monitoring period.

3.3 Grouped Projects

Not applicable as this is not a grouped project.

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes ☒ No

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	Bold	
Data unit	tonnes/year	
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	Data from Study conducted by the CIRAD for the city of Bukavu. The study highlight average number of persons per households, as well as average charcoal and firewood consumption per capita and per day	
	Number of person by households	6.5
	Yearly biomass consumption by capita (tonnes)	$((0.31*6)+0.05)*365*6.5=4.531$ tonnes of biomass per year
Value applied	4.531 tonnes of firewood equivalent per household and per year	
Justification of choice of data or description of measurement methods and procedures applied	Based on approximate value of biomass consumed by person/year times the average numbers of people per household. Values are based	

	on historical data (CIRAD report ⁹) as permitted by the methodology and as explained in section 4.4. According to CIRAD report, average household size is 6.5 persons and average woody biomass per person and per day is 0.31kg of charcoal and 0.05kg of firewood
Purpose of Data	Calculation of Quantity of woody biomass that is saved in tonnes per device
Comments	This parameter shall remain fixed for the monitoring periods.

Data / Parameter	n_p
Data unit	Fraction
Description	Efficiency of the project stove at the start of project activity
Source of data	Manufacturer's specification based on Water boiling Test conducted
Value applied	0.321
Justification of choice of data or description of measurement methods and procedures applied	Parameter determined ex-ante
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$f_{NRB,y}$
Data unit	Percentage
Description	Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass
Source of data	Use a default value of 0.3 as per Tool 30 - Calculation of the fraction of non-renewable biomass. Or 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. This parameter has been determined ex-ante, during project validation phase
Value applied	84.02%
Justification of choice of data or description of measurement methods and procedures applied	Any changes/ revisions to this value would be monitored and if new default values are approved by the CDM EB the value of the fraction of NRB used will be updated.
Purpose of Data	Calculation of baseline emissions

⁹ https://agritrop.cirad.fr/600193/1/20211111_Rapport_Consommation_Bukavu_Vf.pdf

Comments	This parameter shall remain fixed for the monitoring periods
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Data / Parameter	NCV _{biomass}
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	Default as per applied approved methodology VMR0006 V1.1
Value applied	0.0156
Justification of choice of data or description of measurement methods and procedures applied	Default as per applied approved methodology VMR0006 V1.1
Purpose of Data	Calculation of baseline emissions
Comments	This parameter shall remain fixed for the monitoring periods

Data / Parameter	EF _{wf, non CO2}
Data unit	tCO ₂ /TJ
Description	CO ₂ emission factor for the use of wood fuel in baseline scenario
Source of data	Default as per applied approved methodology VMR0006 V1.1
Value applied	26.23
Justification of choice of data or description of measurement methods and procedures applied	Default as per applied approved methodology VMR0006 V1.1
Purpose of Data	Emission reduction calculations
Comments	This parameter shall remain fixed for the monitoring periods

Data / Parameter	EF _{wf, CO2}
Data unit	tCO ₂ /TJ
Description	CO ₂ emission factor for the use of wood fuel in baseline scenario
Source of data	Default as per applied approved methodology VMR0006 V1.1
Value applied	112
Justification of choice of data or description of measurement methods and procedures applied	Default as per applied approved methodology VMR0006 V1.1

Purpose of Data	Emission reduction calculations
Comments	This parameter shall remain fixed for the monitoring periods

4.2 Data and Parameters Monitored

Data / Parameter	$N_{y,i,j}$
Data unit	Number
Description	Number of project devices of type i and age a that are operating in year y
Source of data	Monitoring Survey
Description of measurement methods and procedures to be applied	Measured directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision according to the latest version of Standard for sampling and surveys for CDM project activities and programme of activities.
Frequency of monitoring/recording	At least once every two years
Value monitored	179,831
Monitoring equipment	Monitoring surveys.
QA/QC procedures to be applied	The project implementor shall maintain a distribution record to calculate this parameter
Purpose of the data	Calculation of baseline emissions
Calculation method	Proportion of operational stoves obtained from the survey is multiplied by the total commissioned stoves to arrive at this value. The surveys have been conducted from 30/12/2023 to 20/01/2024 on 135 households..
Comments	-

Data / Parameter	η_{old}
Data unit	Fraction
Description	Efficiency of baseline stoves
Source of data	Methodology default value
Description of measurement methods	Weighted average values regarding the type of stoves (0.1 for wood users and 0.2 for charcoal users). ¹⁰

¹⁰ However, for the ex-ante calculation purposes, on conservative basis the value considered is 0.20.

and procedures to be applied	During the monitoring period, on the, 193,103 households equipped, 122,672 are charcoal users and 70,431 are firewood users. The weighted average gives 16% as per emission reduction calculation sheet
Frequency of monitoring/recording	At least once every two years
Value monitored	16%
Purpose of the data	Calculation of Quantity of woody biomass that is saved in tonnes per device (baseline emissions)
Comments	This parameter will be updated during the monitoring periods

Data / Parameter	$\eta_{new,y,i,j}$											
Data unit	Fraction											
Description	Efficiency of the improved cookstove type i and batch											
Source of data	Water Boiling Test											
Description of measurement methods and procedures to be applied	The efficiency is retrieved from the Water Boiling test conducted for each vintage. Sample size has been calculated to achieve 90/10 precision. The sample size required was 2 stoves and 3 stoves after oversampling of 20%. 3 stoves have therefore been testes per batch and per type of fuel used.											
Frequency of monitoring/recording	Annual											
Value monitored	<table><tr><td> Batch Efficiency </td><td>Batch 2020</td><td>Batch 2021</td><td>Batch 2022</td></tr><tr><td>Average efficiency</td><td>30.4%</td><td>31.4%</td><td>31.6%</td></tr></table>	Batch Efficiency	Batch 2020	Batch 2021	Batch 2022	Average efficiency	30.4%	31.4%	31.6%			
Batch Efficiency	Batch 2020	Batch 2021	Batch 2022									
Average efficiency	30.4%	31.4%	31.6%									
Monitoring equipment	n/a											
QA/QC procedures to be applied	n/a											
Purpose of the data	Calculation of baseline emissions											
Calculation method	n/a											
Comments	The assessment of stoves efficiency is done through WBTs conducted annually for each stove batch. For this monitoring period,the WBTs have been conducted on 25/01/2024 on both ICS using charcoal and ICS using firewood. The most conservatives results (efficiency of ICS using											

	firewood have been used). WBT were done using calibrated equipment (equipment was calibrated on 05/01/2024 at CRUEA laboratory).
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Data / Parameter	μy															
Data unit	Fraction															
Description	Adjustment to account for any continued use of pre-project devices during the year y															
Source of data	Monitoring survey															
Description of measurement methods and procedures to be applied	The parameter was assessed during surveys. Users where asked if they were still using baseline stoves															
Frequency of monitoring/recording	Once every 2 years. During this monitoring period, the surveys were conducted from 30/12/2023 to 20/01/2024. Previous surveys were done from 30/12/2022 to 10/01/2023.															
Value monitored	<table><tr><td> Batch μy </td><td>Batch 2020</td><td>Batch 2021</td><td>Batch 2022</td></tr><tr><td>μy</td><td>5.3%</td><td>1.85%</td><td>0.7%</td></tr><tr><td>1-μy</td><td>94.7%</td><td>98.1%</td><td>99.3%</td></tr></table>	Batch μy	Batch 2020	Batch 2021	Batch 2022	μy	5.3%	1.85%	0.7%	1- μy	94.7%	98.1%	99.3%			
Batch μy	Batch 2020	Batch 2021	Batch 2022													
μy	5.3%	1.85%	0.7%													
1- μy	94.7%	98.1%	99.3%													
Monitoring equipment	Monitoring surveys															
QA/QC procedures to be applied	90 /10 confidence / margin of error shall be 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. In the case the desired precision is not met, lower bound values shall be used against repeating the survey to determine the operational fraction of stoves.															
Purpose of the data	Calculation of baseline emissions															
Calculation method	n/a															
Comments	The proportion of continued use of pre-project stoves is a monitored parameter. i.e. only available ex-post.															

Data / Parameter	Life Span
Data unit	Number of years

Description	The operating lifetime of the project device. The life span should be reported if the methodology equation 5 is adopted to determine the project stove efficiency
Source of data	Manufacturer's specification supported by CRUEA Lab
Description of measurement methods and procedures to be applied	Lifetime determined as per laboratory test
Frequency of monitoring/recording	Once at the time of project stove installation
Value monitored	8
Monitoring equipment	n/a
QA/QC procedures to be applied	n/a
Purpose of the data	Calculation of baseline emissions
Calculation method	n/a
Comments	-

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.			
Source of data	Project database			
Description of measurement methods and procedures to be applied	Fixed and recorded at the time of commissioning/distribution of the last project device in the batch			
Frequency of monitoring/recording	Fixed and recorded at the time of commissioning/distribution of the last project device in the batch			
Value monitored	Batch Date	Batch 2020	Batch 2021	Batch 2022

	Date of commissioning	10/06/2020	02/01/2021	07/01/2022
Monitoring equipment	n/a			
QA/QC procedures to be applied	n/a			
Purpose of the data	Calculation of baseline emissions			
Calculation method	n/a			
Comments	-			

4.3 Monitoring Plan

The monitoring plan is designed to monitor the parameters listed in Section 4.2. above, which are required for calculation of the actual GHG emission reduction achieved by the project activity using ex post sampling survey. The share of operating stoves and the continued use of pre-project devices is determined based on sampling procedures as outlined below. The project proponent is responsible for conducting the sampling surveys and maintaining a database with all operating stoves.

No monitoring for leakage through competitive uses of biomass is required, as the parameter By is multiplied by 95% to account for leakage.

As per the Guideline for Sampling and Surveys for CDM Project Activities and Programme of Activities, version 04, the sampling plan is the following:

Objectives and reliability requirements

The sampling objective is to provide unbiased and reliable estimates of these parameter values during the crediting period with the confidence/precision level required by VMRO006. And summarized in the table below. This is achieved through a smaller but representative (statistically valid) sample of distributed ICS, as compared to the study of the total population of cooking stoves distributed, which is often not feasible or possible.

Target population and sampling frame

The target population is the totality of households equipped with ICS. The sampling frame is the data on ICS sales entered and/or available in the project electronic database. The electronic database records information for each sale at least on the following:

- Sales date (age class)/date of replacement of the ICS
- Household serial number(s)
- Type and size of ICS(s) distributed

- Installation date of the ICS
- Contact details of household

Sampling Method

For this monitoring period, sampling has been carried out over all the households currently covered in the user database.

Random sampling has been carried out to draw a sample of 135 households to carry out monitoring surveys using excel's RAND function.

Sample Size

A sample size is calculated in order to meet reliability requirements.

Parameter values are estimated by sampling in accordance with the requirements in AMS-II_G

As per methodology para 48, "When biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error shall be achieved for the sampling parameter. On the other hand, when the project proponent chooses to inspect annually, a 90 per cent confidence interval and a 10 per cent margin of error shall be achieved for the sampled parameters. In cases where survey results indicate that 90/10 precision or 95/10 precision are not achieved, the lower bound of the 90 per cent or 95 per cent confidence interval of the parameter value may be chosen as an alternative to repeating the survey efforts to achieve the 90/10 or 95/10 precision".

An annual inspection have been conducted for this monitoring period, the sample size has been calculated to obtain a 90/10 confidence precision.

The sample size for estimating the proportional parameters pop_y and the proportion of meals cooked with preproject devices (or their reverse) is calculated using the formula provided in the "Guideline: Sampling and surveys for CDM project activities and PoAs" Appendix 1 para 12:

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

The monitoring of pop_y and the proportion of meals cooked with pre-project devices is based on the same sample, which is the sample with the larger sample size of the two.

For the average efficiency of the cookstoves, the sample size is calculated using the formula mentioned in the "Guideline: Sampling and surveys for CDM project activities and PoAs" version

04.0 (simple random sampling, Appendix 1, para.51) applicable to the determination of a mean value parameter:

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

In general, if the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 is chosen when the parameter of interest is a proportion. If the parameter of interest is a numeric mean value (i.e. not a proportion or percentage) the student's t-distribution is used if the resulting sample size is less than 30.

The t-value depends on (i) the level of confidence (90%) and (ii) the size of the sample (n=40, with oversampling). The exact figure is derived in Microsoft Excel using the TINV function, as per para. 13 of the "Guideline: Sampling and surveys for CDM project activities and PoAs."

Please refer to the ER calculations for a detailed calculation

The following minimum sample sizes (after oversampling) have been calculated:

Table 3: Calculation of sample size of proportions (90/10 confidence/precision)

Batch 2020

Parameter	$Z_{\alpha/2}$	N	p	Minimum sample size	Final sample size	Monitoring precision achieved
pop household,y	1.645	17,919	92.50	27	45	Yes
1-U _y	1.645	17,919	98.72	5	45	Yes

Batch 2021

Parameter	$Z_{\alpha/2}$	N	p	Minimum sample size	Final sample size	Monitoring precision achieved
pop household,y	1.645	60,146	92.11	29	45	Yes
1-U _y	1.645	60,146	91.23	33	45	Yes

Batch 2022

Parameter	$Z_{\alpha/2}$	N	p	Minimum sample size	Final sample size	Monitoring precision achieved
pop household,y	1.645	115,038	95	18	45	Yes
1-U _y	1.645	115,038	97.75	9	45	Yes

Table 4: Calculation of sample size of means (90/10 confidence/precision)

The WBTs are conducted annually for each batch. For this monitoring period, stoves distributed from batch 2020 those from batch 2021 and stoves from batch 2022 have been tested on January, 25, 2024.

Batch 2020 tested in 2024

Parameter		N	SD	Mean	Calculated sample size	Calculated sample size w/ oversampling	Final sample size	Precision achieved
efficiency	1.645	17,919	0.0022	29.6%	1	2	3	0%

Batch 2021 tested in 2024

Parameter		N	SD	Mean	Calculated sample size	Calculated sample size w/ oversampling	Final sample size	Precision achieved
efficiency	1.645	60.146	0.0002	30.8%	1	2	3	1%

Batch 2022 tested in 2024

Parameter		N	SD	Mean	Calculated sample size	Calculated sample size w/ oversampling	Final sample size	Precision achieved
efficiency	1.645	115,038	0.0003	30.8%	1	2	3	0%

Final total sample sizes during this monitoring period have been 135 households.

A sample of 135 households have been drawn among the full database of the participating households. The sample have been drawn by AERA Group, and the identification of the 135 households have been shared with OBEN for the monitoring.

The z-value depends on the level of confidence. For 90% confidence it is 1.645 as per para. 116 of the “Guideline: Sampling and surveys for CDM project activities and PoAs”

Please refer to the ER calculations for a detailed calculation.

Organization of the monitoring

The project proponent is responsible for overall monitoring organization. The sampling plan, data collection & consolidation and results analysis are implemented by an adequately trained monitoring team, well aware of monitoring requirements and they were supervised by the project implementer (OBEN). The monitoring team consists of following:

The survey of the households has been conducted by OBEN team from 30/12/2023 to 20/01/2024, under the supervision of Claver NDIZEYE. During this monitoring period, the surveys have been done thanks to the usage of Kobo ToolBox, which is an improvement with regards to prior practices (paper-based monitoring). Thanks to the usage of Kobo, pictures of end-user’s agreements, stoves, GPS coordinates and end-users monitored have been collected. Same are provided to VVB.

Table 5: Monitoring team and responsibilities

Role	Responsibilities	Identity
Monitoring manager	- In general, ensure that the project follow the monitoring plan - Ensure that the equipment and measurements are in line with the measurement methods, recording frequency and archiving approaches in monitoring plan - Ensure that monitoring data collected is consolidated and entered in electronic database - Ensure that monitoring team receives proper training - Ensure a coherent and standard monitoring report for the verification	Mr. Claver NDIZEYE
Data manager	- Collect monitoring data - Enter data in electronic database and archive hardcopies	Mr. Christian Bob NYABUZANA
Consultant	- Carry out sample size determination and emission reduction calculations	Aera Group

During this monitoring period, monitoring has been carried out by OBEN Team. Therefore, the project's consultant (AERA Group) has transmitted the digital survey form to the OBEN monitoring team indicating the selected random sample of households to be interviewed and some guidance on how to carry out the survey. After conducting the survey, the team has sent back the filled forms to the project's consultant team, who checked and processed the data collected.

Procedures used for handling any internal auditing performed and any non-conformities identified:

Project proponent trained monitoring personnel on monitoring procedures, including provisions for maximizing response rates, documenting out-of-population cases, refusals and other sources of non-response. The monitoring survey included several questions to support the information on the key monitoring parameters. These included visual inspections to confirm stove use and presence of baseline stoves, comments by surveyors, check of randomly selected households against actual household information, and refusal tracking. These strategies were aimed at minimizing surveyor or non-response biases. No non-conformities were identified during this monitoring period.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The approved methodology does not account for baseline emissions separately but 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 (see section 5.4. below).

5.2 Project Emissions

The approved methodology does not account for project emissions separately but 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 (see section 5.4. below).

5.3 Leakage Emissions

Leakage shall be considered as default 0.95 in accordance with Section 5.4 of the approved methodology.

5.4 GHG Emission Reductions and Carbon Dioxide Removals

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

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

Where:

i	=	Indices for the situation where more than one type/model of improved cookstove is introduced to replace three-stone fire
j	=	Indices for the situation where there is more than one batch of improved cookstove of type i
ER_y	=	Emission reductions during year y in t CO ₂ e
$ER_{y,i,j}$	=	Emission reductions by improved cookstove of type i and batch j during year y in t CO ₂ e

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

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
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$f_{NRB,y}$	=	Fraction of woody biomass that can be established as non-renewable biomass (fNRB)
$NCV_{wood\ fuel}$	=	Net calorific value of the non-renewable woody biomass that is substituted or reduced (IPCC default for wood fuel, 0.0156 TJ/tonne)
$EF_{wf,CO2}$	=	CO2 emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO2/TJ)
$EF_{wf,non\ CO2}$	=	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 leakages

The quantity of woody biomass saved $B_{y,savings,i,j}$ due to implementation of improved cookstoves is estimated using equation 3 as per VCS-PD:

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

Where the project households continue to use baseline cookstoves along with improved cookstoves, *Bold* shall be adjusted ex-post based on the percentage of project households found to continue such practice according to Equation 6. 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.

$$Bold_{adjusted} = Bold \times (1 - \mu_y). \quad \text{Equation 6}$$

Where:

Bold	=	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 Bold can be sourced from historical data or baseline surveys. Alternatively, a default value of 0.5t/capita/year may be used.
$B_{y=1,new,i,survey}$	=	Annual quantity of woody biomass used by improved cook stoves in tonnes per device of type i and batch j, determined in the first year of the implementation of the project through a sample survey.
$Bold_{adjusted}$	=	Adjusted <i>Bold</i> 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
η_{old}		=	Efficiency of baseline cookstove
$\eta_{new,i,j}$		=	Efficiency of the improved cookstove type i and batch j determined through waterboiling test (WBT) during year y Alternatively, efficiency may be determined using Equation 4
η_P		=	Efficiency of project stove (fraction) at the start of project activity,

The quantity of firewood consumed in absence of project activity (*Bold*) shall be determined using an estimation of average annual consumption of firewood per household which may be derived using any of the following options:

- (a) Historical Data. Project proponent shall ensure that the relevance of data is appropriately justified for the target population and is the latest available data from credible source(s).
- (b) Baseline Survey of Local Usage. Project proponent shall carry out a survey of usage prior to implementation of the project activity following the sampling approach described in the latest version of CDM document Sampling and surveys for CDM project activities and programme of activities. Alternatively, the project participant may follow the simple random sampling approach and the minimum sample size should be determined as per the following guidelines:
 - Project target population < 300: Minimum sample size 30
 - Project target population 300 – 1000: Minimum sample size 10% of group size
 - Project target population > 1000: Minimum sample size 100

This simplified approach may also be used for determining minimum sample size for parameters listed under Sections 9.1 and 9.2 in which case it is not requisite for the sample size to meet confidence/precision requirements.

(a) Minimum Service Level. Where historical data or a baseline survey has not been conducted, a default value of 0.5 ton/capita/year may be considered as the baseline biomass consumption. Household size shall be determined using credible references/literature or target population specific surveys. The survey shall be conducted as per guidelines outlined in option (b) above.

The equations below shall be used for calculating biomass consumed in absence of project activity in case more than one project stove is used in household:

$$B_{old,i,j} = B_{old,HH} \div N_{d,HH} \quad B_{old,HH} = B_{old,p} \times N_p, \quad HH$$

Where:

Bold, p	=	Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices (tonnes/person/year)
Np, HH	=	Average number of households
Nd,HH	=	Number of project devices per household
Bold, HH	=	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 (tonnes/household/year)

As per section 8.4 of the applied methodology, Bold can be estimated using historical data (Option a). This option is chosen for the determination of Bold. Therefore, above parameters are determined using historical data.

The consumption of woody biomass is retrieved from most recent, credible and project specific data available from credible source.

Determination of Bold,p

A recent report¹¹ from CIRAD published in June 2020 concluded that 0.31kg of charcoal and 0.05kg of firewood was used per person and per day in Bukavu (project area) which corresponds to yearly consumption per person of 113.15kg of charcoal and 18.25 kg of firewood or 0.697¹² tonnes of woody biomass per person and per year.

Therefore, data from CIRAD as most recent and more conservative will be used for Bold,p

Determination of Np,HH

A report¹³ from Secure Livelihood Research Consortium in the South Kivu province and published in 2015, estimated that the average household size was 6.7 persons per household, while the cited report from CIRAD estimated number of persons per household at 6.5 persons. The value from CIRAD report as most recent and conservative available data regarding the project boundary is selected to estimate the average household size.

Determination of Nd,HH

As the project is expected to distribute only one ICS per household, therefore the Nd,HH value is 1

¹¹ https://agritrop.cirad.fr/600193/1/20211111_Rapport_Consommation_Bukavu_Vf.pdf

¹² Considering a wood-to-charcoal of 6 as per methodology applied.

¹³ https://assets.publishing.service.gov.uk/media/57a08985ed915d3cfd0002b8/WP30_governance-Democratic-Republic-Congo.pdf

All the parameters are resumed in the table below:

Parameter	Value	Source
Bold,p	0.697 tonne	CIRAD report. Values is found conservative and in line with methodology requirements
Nd,HH	1	Ex-ante estimation
Np,HH	6.5	CIRAD report.
$\mu y,2020$	5.3%	Ex-post calculation.
$\mu y,2021$	1.9%	Ex-post calculation.
$\mu y,2022$	0.7%	Ex-post calculation.
Bold,HH	4.53	Calculated as per methodology

Determination of efficiency of ICS during year y

The Efficiency of the batch were assessed trough Water Boiling test:

Batch (year)	$\eta_{new,i,j}$
2020	30.4%
2021	31.4%
2022	31.6%

Determination of Bysavings

$$B_{y,savings,i,j} = \text{Bold} \times (1 - (\eta_{old} / \eta_{new,i,j}))$$

Batch (Year)	Bold adjusted(tonnes)	$\eta_{new,i,j}$	η_{old}	$B_{y,savings,i,j}$ (tonnes)
2020	4.53	30.4%	16%	2.09
2021	4.53	31.4%	16%	2.17
2022	4.53	31.6%	16%	2.18

Determination of fNRB

fNRB was estimated following applicable tool 30 v3 guidelines: The values obtained is 84.02% as per the registered VCS-PD

$$ER_{y,i,j} = By_{savings,i,j} \times fNRB_{y,i,j} \times NCV_{wood\ fuel} \times (EF_{wf,CO2} + EF_{wf,non\ CO2}) \times Ny_{i,j} \times 0.95$$

For Batch 1 (2020):

ER	$fNRB_{y,i,j}$	$NCV_{wood\ fuel}$	$(EF_{wf,CO2} + EF_{wf,non\ CO2})$	$By_{savings,i,j}$	$Ny_{i,j}$	Pop stove	Leakge	1- u_y
55,695	84%	0.0156	138.2	2.09	16,326	91.1%	0.95	94.7%

For Batch 2 (2021):

ER	$fNRB_{y,i,j}$	$NCV_{wood\ fuel}$	$(EF_{wf,CO2} + EF_{wf,non\ CO2})$	$By_{savings,i,j}$	$Ny_{i,j}$	Pop stove	Leakge	1- u_y
205,648	84%	0.0156	138.2	2.17	56,136	93.3%	0.95	98.1%

For Batch 3 (2022)

ER	$fNRB_{y,i,j}$	$NCV_{wood\ fuel}$	$(EF_{wf,CO2} + EF_{wf,non\ CO2})$	$By_{savings,i,j}$	$Ny_{i,j}$	Pop stove	Leakge	1- u_y
400,436	84%	0.0156	138.2	2.18	107,369	93.3%	0.95	99.3%

The total emissions reductions achieved during this monitoring period are therefore
55,695+205,648+400,436 = 661,779tCO₂e avoided

Vintage period	Baseline emissions (tCO ₂ e)	Project emissions (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Reduction VCU (tCO ₂ e)	Removal VCU (tCO ₂ e)	Total VCU (tCO ₂ e)
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01-Jan-2023 to 31-Dec-2023	661,779	0	0	661,779	0	661,779
Total	661,779	0	0	661,779	0	661,779

Vintage period	Ex-ante estimated reductions/removals	Achieved reductions/removals	Percent difference	Explanation for the difference
01-Jan-2023 to 31-Dec-2023	679,099	661,779	-3%	The difference is due to the Nyi parameter that correspond to the number of operational stoves. In the PDD it was estimated that 200,000 ICS would be operational in 2023, however only 179,831 stoves are operational.
Total	679,099	661,779		