



**Verified Carbon
Standard**

IMPROVED COOKSTOVES FOR BURUNDI RESTAURANTS

Document Prepared by AERA Group

on behalf of OBEN E.A.C SA

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

OBEN E.A.C (SA) developed an improved cookstoves project for restaurants¹ of Burundi. The proposed small scale VCS project activity aims at:

1. Distributing institutional improved cookstoves (ICS) in restaurants of Burundi to replace currently used traditional open fire three-stone system (and traditional stoves); and
2. Switching from non-renewable wood fuel to a sustainable energy supply: briquettes made of renewable biomass waste.

Along with the diffusion of such a stove to replace currently inefficient cooking systems, a renewable biomass supply-chain was set up, by sourcing unutilized biomass residues to produce renewable biomass briquettes and market it to the participating restaurants in replacement of their non-renewable wood fuel. OBEN ensure a competitive and attractive price for using briquettes together with improved cook stoves to give incentives to the restaurants to switch 100% from the previous costly non-renewable wood fuel to the innovative briquettes made of renewable biomass wastes.²

From 03/02/2020 to 15/05/2020, 5,224 ICS have been installed in 801 restaurants. The ICS have been distributed in restaurants located in the province of Bujumbura, Mukaza, Muha and Ntahangwa. 3 types of ICS have been installed as specified in the project description. The stoves are installed by OBEN's team, and products acquisition agreements are signed by the end-users to confirm the installation of the cookstoves. As per the agreements, the cookstoves will be repaired or retrofitted if any problem occurs to the ICS during their lifetime.

During this monitoring period, 20,093 tonnes of renewable biomass (briquettes) have been delivered to the restaurants, leading to emissions reduction of 575, 239 tCO₂e.

¹ One restaurant should be understood as any commercial entities preparing meals. Bars and Hostels are covered under the proposed project and assimilated as restaurants.

² Thanks to ICS cook stoves, OBEN expect to replace 1 stere of wood by in average 20 kg of briquettes (based on experiences done in police camp (an average of 22 kg of briquettes per stere) and schools (an average of 18 kg of briquettes per stere) depending on Lower Heating Value of raw material used for the briquettes (indicative information is 3,300 kcal/kg briquettes for briquettes made of sugar mill wastes against 4,800 kcal/kg briquettes for briquettes made of pine needles). The report of test has been provided to DOE. Actually, one stere of wood is ~~at~~ about 15,000 FBU and one bag of charcoal of 23 kg at 30,000 FBU whereas OBEN E.A.C SA plans to sell 1 kg of briquettes at 378 FBU (indicative price); satisfying the same thermal energy need, will thus cost from two to ten times less than in baseline situation according to one-site visit interviews.

1.2 Sectoral Scope and Project Type

The technology to be implemented by the Project activity falls into Sectoral Scope 1: Energy (renewable/non-renewable), as it concerns the introduction of improved cooking devices supplied with renewable biomass sources to provide thermal energy to the restaurants and avoid consumption of non-renewable biomass. The Project activity concerns the provision of briquettes made of renewable biomass waste to restaurants for cooking activities together with the introduction of improved cooking devices supplied with renewable biomass briquettes to provide thermal energy to the restaurants, consequently avoiding consumption of non-renewable wood fuel. It falls into Type (I) project activities: renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (or an appropriate equivalent). Moreover, the SSC-VCS project falls into Category (C) project activities: thermal energy for the user.

Project type	Project category	Output capacity of renewable equipment	Equivalent output capacity of renewable equipment
Type (I): Renewable energy projects	C. Thermal energy for the user	15 MW	45 MWth ³

This project is not a grouped project

1.3 Project Proponent

Organization name	OBEN EAC (S.A.)
Contact person	Claver NDIZEYE
Title	Mr.
Address	B.P.4942, Bujumbura, Burundi
Telephone	0025776602600
Email	loicqueen@yahoo.fr

1.4 Other Entities Involved in the Project

³ Clean Development Mechanism Project Standard (Version 5.0), Section 8.2. project activity eligibility, §81. (a) &82. (c)

Organization name	AERA Group
Role in the Project	Carbon consultant and trader
Contact person	Alexandre Dunod
Title	Chief Operating Officer
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1.5 Project Start Date

03 February 2020. The start date has been determined as the date of distribution of stoves and renewable briquettes starting on 03 February 2020.

1.6 Project Crediting Period

The project crediting period is 7 years renewable twice for a total of 21 years. The first crediting period spans from 03 February 2020 to 02 February 2027.

1.7 Project Location

Host Party(ies): The Republic of Burundi is the host country

Region/State/Province: All provinces, starting by Bujumbura province. City/Town/Community etc. All major urban centers, starting by Bujumbura.

Physical/Geographical location

The project is to take place in restaurants in Burundi urban centers, starting with Bujumbura city. As a reference, Bujumbura city center's geo-coordinates are 3°22'34" S and 29°21'36" E (cf -3.3761, 29.3600). The country-wide geographical area corresponds to the area where renewable biomass will be distributed and used in replacement of the former non-renewable woodfuel in ICS (Figure1.



Figure 1: Area of implementation of the project activity.

1.8 Title and Reference of Methodology

The approved baseline and monitoring methodology applied to the project activity is Version 12.0 of AMS-I.E. – “Switch from non-renewable biomass for thermal applications by the user”, available at UNFCCC AMS-I.E.

Other tools used for the project are :

- The CDM tool 30 “Calculation of the fraction of non-renewable biomass” version 3
- CDM Tool 21: “Demonstration of additionality of small-scale project activity” version 13.1
- CDM tool 05: “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”. Version 3.0
- CDM tool 16: “Project and leakage emissions from biomass” Version 4

1.9 Participation under other GHG Programs

The project neither has nor intended to generate any other form of GHG related environmental credit for the GHG emission reduction or removal claimed under the VCS programme. Although it was originally registered under the CDM by its former developers⁴, it was postponed and re-designed by its new developers, for certification and verification under the VCS only.

1.10 Other Forms of Credit

The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading.

⁴ As per CDM Project 9911 : BQS improved cookstoves for Burundi restaurants, undergoing de-registration

The project has neither sought nor received another form of GHG-related environmental credits.

1.11 Sustainable Development Contributions

During the monitoring Period, the project has contributed to the following Sustainable Development Goals:

SDG 7.1: During the monitoring period, 801 restaurants were equipped with ICS. On a total 5,224 have been installed.

SDG 13: 575,239 tCO₂e have been saved during the current monitoring period as per methodology calculation.

SDG 15.2: During this monitoring period 20,093 tonnes of briquettes have been distributed corresponding to 5,168 ha of forest equivalent saved by the project. During the monitoring period 616,945 tonnes of biomass (294,692 in 2020 and 322, 253 in 2021) have been saved by the project.

1) Estimation of wood saved:

- a. In 2020: the quantity of biomass saved per restaurant was 368, and the number of restaurant operational was 801, hence the total biomass saved is : $368 \times 801 = 294,692$.
- b. In 2021: the quantity of biomass saved per restaurant was 403 tonnes, and the number of restaurant operational was 799, hence the total biomass saved is : $403 \times 799 = 322,253$.

2) The above ground biomass for forest in Burundi have been estimated to 119, 38 tonnes/ha in the latest available Forest resources assessment report of Burundi⁶

Therefore, the total area of forest saved has been estimated to 5,168 ha (616,945/119,38).

⁶ <https://www.fao.org/3/cb0116fr/cb0116fr.pdf>

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.1	7.1.2 Proportion of population with primary reliance on clean fuels and technology	Implemented activities to increase	During this monitoring period, 5,224 IICS have been installed in 801 restaurants.	In total, 5,224 IICS have been installed in 801 restaurants.
2)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By distributing improved cooked stoves powered by renewable biomass, the project avoided 575,239 tCO ₂ e during this monitoring period	By distributing improved cooked stoves powered by renewable biomass, the project avoided 575,239 tCO ₂ e since the start date.
3)	15.2	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Implemented activities to increase	5,168 ha of forest saved thanks to the introduction of renewable energy.	5,168 ha of forest saved thanks to the introduction of renewable energy since the project start date.

2 SAFEGUARDS

2.1 No Net Harm

There was no harm identified from the project and hence no mitigations measures are applicable.

2.2 Local Stakeholder Consultation

Procedure followed to invite stakeholder comments

The national stakeholder consultation consisted of a public meeting with the identified stakeholders. Local and national policy makers and stakeholders were invited by post mail – see invitation material. Local population was invited through post mail to their representatives, through flyers diffusion and public displays.

Program of the public

Date of meeting: January 13th, 2012 at 9.00 am

Place: Olympafrica (hall of Olympic Stadium), Kanyosha Commune, Bujumbura Mairie Province

Language: Kirundi

Duration: 3 hours and 30 minutes

Meeting procedure:

- Introduction / Mayor of Bujumbura / DNA Permanent Secretary/ Project Developers
- Context and objectives of public consultation
- Project description
- Improved cookstoves
- Renewable biomass
- Presentation of the Clean Development Mechanism
- Environmental and socio-economic impacts
- Modalities of purchase and use
- Status of the project
- Video Spot Projection

- Questions and answers with participants
- Conclusion / Cocktail

Note: During this meeting, OBEN E.A.C SA jointly presented the project for restaurants and its other projects aimed at other Burundian communities (households, schools, polices, etc.).

Key invitees present were:

- Mr. Sef Sabushimike, Presidential advisor, Government of Burundi
- Ms. Bernadette Hakizimana, Director of Environment at the Ministry of Water, Environment, Land Management and Urban Planning (MEEATU), DNA Permanent Secretary
- Mr. Felix Ngengabanyikwa, Director of Forest Department at the Ministry of Water, Environment, Land Management and Urban Planning (MEEATU)
- Mr. Ezeckiel Nibigira, National Deputy, President of party CNDD-FDD's youth league
- Deogratias Suzuguye, Head of Penitentiary Matters, Ministry of Justice
- Serges Irambona, Head of National Police Logistics, Ministry of Public Security
- Mr. Niragira Félix, National Deputy (CNDD-DDD)
- Mr. Evrard Giswaswa, Bujumbura Mayor
- Anatole NIYONKURU, Secretary of Education Ministry

Media:

- Burundi National Radio and Television (RTNB)
- “Le Renouveau” newspaper

Figure 5: Picture of the stakeholders attending public consultation



Participant's questions/concerns	Project proponent's answers
Julien Ntarugera, Manager, Techno Solar Company. Is there a lifetime guarantee on your improved cookstoves? How does warranty work? Have you considered local manufacturers, contributing to job creation, and lowering production cost? Why did you decide to outsource the manufacturing and assembling of improved cookstoves? Could the stove's high efficiency prematurely degrade the cooking pots?	Yes, BQS improved cookstoves will have a warranty of five years to the original owner against defects in materials and workmanship for the lifetime of improved cookstove. If a product ever fails due to a manufacturing defect, we will repair the product, without charge, or replace it, at our discretion. This warranty does not cover damage caused by accident, improper care, negligence, normal wear and tear, or the natural breakdown of colors and materials over extended time and use. Damage not covered under warranty will be repaired for a reasonable rate and return shipping will be charged Local artisans and entrepreneurs cannot support a massive manufacturing and ensuring quality and traceability of improved cookstoves at such scale. Few years ago, the Office of the United Nations High Commissioner for Refugees (UNHCR) embarked on an initiative of improved cookstoves in Burundi. The scheme was unsuccessful for many reasons: the custom-built stoves were expensive and not appropriate for refugees cooking habits; dissemination was limited because stoves were made on-site at a slow rate by local artisans and entrepreneurs, and quality control was nonexistent. BQS has decided to outsource the manufacturing and assembling of improved cookstoves for quality and quantity reasons. BQS has a partnership with Sabah Enamel & Stove Industry base in Turkey to support the manufacturing and assembling of improved cookstove. The project leads to a technology transfer. The project will provide employment opportunities for local people to improved cookstoves supply chain and distribution channels, renewable biomass supply chain and distribution channels, campaign marketing. No because wood & briquettes have a lower calorific value than woodfuel therefore such renewable fuels will be less harmful to the pots.

Participant's questions/concerns	Project proponent's answers
Ezeckiel Nibigira, National Deputy, Bujumbura Mairie and Rural Province [Full endorsement of the project, including congratulations to project developers, inputs on economic benefits to households and safeguard of existing forests] However, is it not possible to accelerate the project start? On behalf of a member of the "ADIDI" organization whose activity is nursery production, can you detail tree-planting operations that you intend to undertake during the project?⁷	There are prerequisites to start the CDM project, including public consultation. CDM project needs to be registered by the UNFCCC, namely the CDM Executive Board. One of renewable biomass resources identified for the PoA "Renewable biomass fired improved cookstoves programme for households in Burundi by BQS" is biomass wood wastes collected from existing forests. The exploitation of this resource will be achieved by BQS SA under contract partnership with forests department. We are planning to plant 1,000 hectares per year for the duration of the project, starting from first carbon credits availability. The "Association ADIDI" was identified as a future partner to supply seeds of trees. ⁸
Bernadette Hakizimana, Director of Environment at the Ministry of Water, Environment, Land Management and Urban Planning (MEEATU), DNA Permanent Secretary [Highlights on OBEN E.A.C SA project contribution to empowering women thanks to renewable biomass fired improved cookstoves achieving the following: Reduce the time and cost of procuring fuel, thereby freeing individuals for other productive activities. Reduce disease and save lives by decreasing exposure to indoor air pollution. Reduce the risk of violence against women a child gathering fuel in conflict areas.	

Participant's questions/concerns	Project proponent's answers
Venant Barindogo, IFDC [Supporting considerations on wood fuel consumption and the importance of raising awareness. Confirmation that their own experimentation with local manufacturing failed because of poor quality of the scrap metal and bricks used] Isn't the final cost still quite high compared to citizens' buying power?	The stove's cost must be aggregated with the significant monthly savings enabled on the fuel, hence a very profitable overall acquisition. [N.B. this answer was specifically given for the context of the parallel CDM initiative of BQS for households, although it remains valid in the case of communities which operating expenditures will also decrease].

⁷ This question regarded the PoA "Renewable biomass fired improved cookstoves programme for households in Burundi by OBEN E.A.C SA" developed by OBEN E.A.C SA where renewable biomass will be produced thanks to sustainable management of existing Forests for households

⁸ For the proposed project the biomass will come from agro-industrial wastes transformed into renewable briquettes.

Felix Ngengabanyikwa, Director of Forest Department at the Ministry of Water, Environment, Land Management and Urban Planning (MEEATU) Felix Ngengabanyikwa is suggesting that each improved cookstoves purchaser could plant a new tree at home to mitigate further the climate change effects. Do you accommodate for recycling of discarded improved cookstoves at the end of their use?	BQS has taken note of proposal and will analyze how to integrate this aspect in its programme. Anyway, its commitment to plant 1,000 ha per annum already exceeds this individual suggestion. Most parts of the improved cookstoves can be recycled. BQS will contact existing recycling industries that can collect and process such recyclables.
Jean Marie Masumbuko, Pastor of ECCA Kanyosha (Evangelical Church of Central Africa) How many improved cookstoves do you plan per households? ⁹ If the refractory brick breaks down, do you plan to replace them for free?	Each household might buy as many improved cookstoves as necessary if one ICS replaces one former traditional stove. Spare bricks will be available. Warranty application or replacement for a fee in case of misuse will be assessed on a case-by-case basis.

Participant's questions/concerns	Project proponent's answers
Salvator Mpangaje, Neighborhood Leader of Nyakabiga Could you tell me more about the product acquisition agreement between OBEN E.A.C SA and end user?	This agreement contains the terms and conditions that apply between BQS and improved cookstoves end user: A complete abandonment of the use of traditional stove(s) Adoption and sustained use of ICS. Exclusive use of renewable biomass with ICS Record of periodic consumption of renewable biomass Acceptance of periodical audits by monitoring agents. Such monitoring is needed for transparent verification in carbon projects and for improved dissemination with the highest adoption and the substitution of cooking practices.
Zacharie Tuyaga, Pastor of ECCA Ruziba (Evangelical Church of Central Africa) Is it forbidden that craftsman imitate and manufacture the improved cookstove?	No, it is not forbidden and could be included in later additions to the program. They are even encouraged to do the same, there is no restriction as the objective is to substitute as much renewable biomass or briquettes as possible instead of non-renewable woodfuel.

⁹ This question regarded the PoA "Renewable biomass fired improved cookstoves programme for households in Burundi by BQS SA" developed by BQS where target population is households.

Aaron Ntakarutimana, Local Councilor, Commune of Kamesa-Musaga, Bujumbura Mairie Province Since the project is of national interest, could you not convince the Government to fund free cookstoves for the benefit of the population?	[answers by Ezeckiel Nibigira, National Deputy, Bujumbura Mairie and Rural Province] The current policy aims at raising people's awareness about changing habits to consume less and be more concerned by environment preservation, based on everyone's means. Government support is ensured in many ways, including facilitation of access to renewable biomass and administrative support, but Government cannot afford financial support.
Agnès Hakizimana, Local Councilor, Commune of Murwi, Cibitoke Province If woodfuel is phased out, how will the less fortunate who couldn't acquire the improved cookstove cope? How do you to commercialize your improved cookstoves and renewable biomass? What is OBEN E.A.C SA commercialization strategy?	The objective is to decrease wood fuel consumption as much as possible but totally suppressing is not possible. Anyway, all efforts are made to bring the stove price affordable to all. BQS has taken the challenge up of developing markets for improved cookstoves and renewable biomass in Burundi by: Leveraging mass marketing resources and traditional trade networks. Working with existing local dealer networks that market, sell, and distribute products while pragmatically ramping up depending on penetration rates. Teaming up with NGOs and Microfinance Institutions to take advantage of a pre-existing network of relationships.

Participant's questions/concerns	Project proponent's answers
Innocent Ngomirakiza, Association « Action ceinture verte pour l'environnement (ACVE) » ACVE implements projects to protect the riversides in Bujumbura through afforestation. Our association is 100% behind OBEN E.A.C SA project; We are asking to be associated through afforestation. How can low-income users with no access to banks of microfinance still acquire the stoves? ¹⁰ Can the stoves accommodate for locally made brick pots?	BQS sees no inconvenient for partnering with ACVE. Thank you for your interest in submitting a partnership proposal to BQS. We will contact you soon. Low-income Burundian households disconnected from retail markets will be able to access the stoves through the local NGOs identified as sales partners; local authorities' network will also be leveraged on. The use of local brick pans is getting very marginal given the availability and affordability of metal pots countrywide.

¹⁰ This question regarded the PoA "Renewable biomass fired improved cookstoves programme for households in Burundi by OBEN E.A.C SA" developed by OBEN E.A.C SA where target population is households.

Oscar Ntirandekura, Neighborhood Leader of Twinyoni, Kamenge Commune Do you plan information and demonstrations on improved cookstoves use in neighborhoods? What woodfuel will be used before the plantations start yielding wood?	The sale outlets will be places of information and demonstrations on stove use. A booklet will also be available for end users. Government has awarded BQS with mature forests to sustainably clean and maintain, duty which wasn't performed for the last 20 years. Hence the immediately available renewable wood source.
Participant's questions/concerns	Project proponent's answers
Shemsa Ciza, Local Councillor, Commune of Kinama, Bujumbura Mairie Province Is it possible to grill meat/fish like on a BBQ? Why improved cookstoves are effective in terms of reduction on health impacts?	Yes indeed, you only need to install an appropriate grate. According to the World Health Organization, exposure to smoke from open fires and traditional cookstoves leads to pneumonia, chronic respiratory disease, and lung cancer, etc. With an ICS, you reduce pollution emissions, and you reduce kitchen concentrations of carbon monoxide. You reduce disease and save lives by decreasing exposure to indoor air pollution. Note that fuelwood needs to be well dried, which BQS will ensure before commercializing it.

At the end of the meeting, the contact details of BQS have been shared with the participants to ensure on-going communication with the stakeholders.

Following details have been communicated to participants:

- Company Name: Burundi Quality Stoves (BQS)
- Physical address: Quartier Industriel, Avenue Nyabissindu BP 5612, Bujumbura, Burundi
- Contact name: Pascal Rwemera
- Phone number: +257 22259470
- Email address: info@bqs.bi

The participants have been encouraged to use contact information for any questions/complaints/proposition related to the project.

Following the on-going communication guidelines, the stakeholders, are still able to provide comments during the project lifecycle. No comments have been received during this monitoring period.

2.3 AFOLU-Specific Safeguards

Not applicable as this is not an AFOLU project

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

During this monitoring period, 801 restaurants were equipped with ICS. On a total 5,224 ICS have been distributed to the restaurants. In 2020, 9,015 tonnes of briquettes have been distributed (11,079 tonnes in 2021) to restaurants. 3 models of cookstoves were distributed (Large Turkish, Medium Turkish and OBEN Matawi).

The project has been in normal operation since the start date, and there have been no events that may impact the GHG emission reductions.

During the reporting period there has been no instances of change of improved cook stoves.

As the operational lifetime of the cookstove is 5 to 8 years (depending on the stove model), the cook stove will be replaced as and when 5 years. However, if any of the components of cook stove or the cook stoves are damaged and cannot be repaired the damaged cookstove will be replaced with immediate effect as per agreement with end-users.

During this monitoring period, grates of cookstoves have been replaced for some restaurants as per the monitoring surveys. Some restaurants, informed OBEN that the grate of their cookstoves was broken. All the grates have been replaced. As per agreement with the end-users, damaged stoves, will be either repaired or changed to new ones during the lifetime of the project.

CDM methodology AMS-I.E version 12.0 allows the use of a correction factor of 0.95 applied to the overall emissions reductions to account for any possible leakage. This factor has been applied to the emissions reductions presented in this report.

During the current monitoring period under VCS starting from 03/02/2020 to 31/12/2021 (both

Days included) total number of VER achieved are 575,239 tCO₂e).

3.2 Deviations

2.1.1 Methodology Deviations

Two deviations were applied:

- 1) As per methodology para 29, option c, the quantity of biomass substituted, is calculated using the number of person served per institution. However, for this project the exact number of people could not directly be monitored. Therefore, it is assumed that restaurants distribute 1 meal/persons, and the number of persons is deemed equivalent to the number of meals distributed.
- 2) The parameter $BC_{PJ,PP,y}$ that refers to the average annual consumption of woody biomass per person in the pre project devices during the project activity (tonnes/person/year). Could not be assessed directly. Therefor this parameter is assessed by multiplying the proportion of meals cooked with preproject devices or baseline fuels (assessed during monitoring surveys) by the quantity of fuel used to prepare one meal (0.00351 ex-ante).

The two deviations does not impact the conservativeness of the quantification of GHG emissions reductions. The first deviation only replace the term "person" per "meal", as the restaurant assess number of persons served, by the numbers of meals cooked and distributed.

The second deviation does not change the conservativeness of the methodology. It only refers to the use of proportion of meals cooked with preproject devices, or baseline fuels, and this proportion is multiplied by the average quantity of biomass needed for one meal.

2.1.2 Project Description Deviations

Not applicable as no project description deviation happened during this monitoring period.

3.3 Grouped Projects

Not applicable as this is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	P_j			
Data unit	kW_{th}			
Description	Useful thermal output capacity of the ICS type j			
Source of data	Performance test results			
Value applied:	ICS type j	Medium	Large	Matawi
	Useful thermal output capacity	2.49 kW_{th}	4.82 kW_{th}	2.074 kW_{th}
Justification of choice of data or description of measurement methods and procedures applied	Useful thermal output of the ICS has been estimated by Water Boiling Test by the Turkish supplier for the Turkish stoves and by the CRUEA laboratory for OBEN Matawi stoves			
Purpose of Data	Small-scale threshold, debundle and automatic additionality compliance			
Comments	-			

Data / Parameter	$f_{NRB,y}$
Data unit	Fraction
Description	Fraction of biomass used in the absence of the CDM project in year y that can be established as non-renewable biomass
Source of data	Forest resources assessments 2015 (FAO)
Value applied:	0.8183
Justification of choice of data or description of measurement methods and procedures applied	The fraction of non-renewable biomass has been calculated following the CDM tool 30 version 3
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$NCV_{biomass}$
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.0156
Justification of choice of data or description of measurement methods and procedures applied	According to methodology AMS-I.E, the Net Calorific Value of the non-renewable woody biomass that is substituted has to be taken as IPCC default for wood fuel.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{projected_fossilfuel}$
------------------	------------------------------

Data unit	tCO ₂ /TJ
Description	Emission factor for the substitution of non-renewable woody biomass by similar consumers
Source of data	AMS-I.E version 12.0
Value applied:	73.2
Justification of choice of data or description of measurement methods and procedures applied	As indicated by the methodology AMS-I.E, this value represents the emission factor of the substitution fuels likely to be used by similar users in Sub-Saharan Africa
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$BC_{BL,PP}$
Data unit	Tonnes of wood equivalent / meal
Description	Average historical consumption of woodfuel equivalent per meal (Tonnes of wood equivalent/meal)
Source of data	Derived from baseline survey discounted by a factor of 0.89.
Value applied:	0.00351
Justification of choice of data or description of measurement methods and procedures applied	As permitted by the methodology AMS-I.E, this was derived from Baseline survey gathering restaurants woodfuel consumption data of two communes of Bujumbura. The historical consumption of restaurants has been divided by the historical number of meals distributed in order to get the historical consumption of woodfuel equivalent per meal. The value obtained has been discounted by a factor of 0.89 to account for model uncertainties.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	Leakage _{adj}
Data unit	fraction
Description	Net to gross adjustment factor to account for leakages
Source of data	Methodology AMS-I.E Version 12
Value applied:	0.95
Justification of choice of data or description of measurement methods and procedures applied	In case this leakage adjustment factor is applied, it is not required to survey
Purpose of Data	Calculation of leakage emissions
Comments	the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources.

Data / Parameter	EF _{EL,j,y}
Data unit	tCO ₂ /MWh
Description	Emission factor for electricity generation for source j in year y
Source of data	“Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (Version 03)
Value applied:	1.3
Justification of choice of data or description of measurement methods and procedures applied	Option A2: Use a conservative default value of 1.3 tCO ₂ /MWh
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	$TDL_{j,y}$
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to the briquetting machine
Source of data	“Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (Version 03)
Value applied:	0.20
Justification of choice of data or description of measurement methods and procedures applied	Use as default values of 20% for option: (a) project or leakage electricity consumption sources;
Purpose of Data	Calculation of leakage emissions
Comments	-

Data / Parameter	SEC_{briq}
Data unit	MWh/tonne
Description	Default value for the specific quantity of electricity consumed per tonne of briquettes produced
Source of data	Estimated ex-ante based on historic specific electricity consumption per tonne of briquettes produced.
Value applied:	0.04
Justification of choice of data or description of measurement methods and procedures applied	The specific electricity consumption is estimated ex-ante based on historic data of electricity consumption per tonne of briquettes produced
Purpose of Data	Calculation of leakage emissions
Comments	Specific consumption provided by the constructor is 35-40 kWh/Metric tonne of Biomass. To be conservative, a value of 40 kWh/tonne is chosen.

Data / Parameter	mbiomass / mcharcoal
Data unit	kg biomass/kg charcoal
Description	Conversion factor wood/charcoal
Source of data	IPCC 1996- Reference Manual, Chapter 1, Energy, p 1.45 Or national/local values from literature, surveys, or expert judgments if available
Value applied:	6
Justification of choice of data or description of measurement methods and procedures applied	The default value should be applied according to recommendations of the IPCC Guidelines if no national/local value is available. However, such default value may be revised ex-post would reliable and country-specific data become available during monitoring.
Purpose of Data	Calculation of baseline
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	Ndistributed_ICS,j,y
Data unit	Number
Description	Total number of distributed ICS (medium and large) or replaced by an equivalent appliance in year y
Source of data	Project implementer database
Description of measurement methods and procedures applied	Each participating restaurant who acquires an ICS signs a product acquisition agreement with the project implementer. The project implementer keeps a database of all distributed ICS.
Frequency of monitoring/recording	Continuously

Value applied:	<table><tr><td>Turkish medium ICS</td><td>Turkish large ICS</td><td>Matawi ICS</td><td>Total</td></tr><tr><td>841</td><td>495</td><td>3,888</td><td>5,224</td></tr></table>	Turkish medium ICS	Turkish large ICS	Matawi ICS	Total	841	495	3,888	5,224
Turkish medium ICS	Turkish large ICS	Matawi ICS	Total						
841	495	3,888	5,224						
Monitoring equipment	Not applicable. The number of ICS distributed is calculated by the addition of all the ICS distributed since the start of the project								
QA/QC procedures applied	The total number of distributed ICS mentioned in the data base will be cross-check by the project implementer with number of contracts(product acquisition agreement) signed with participating restaurants. Databases are periodically checked by the project implementer to countthe total number of distributed ICS under the project.								
Purpose of data	Used to record the number/location of each stove distributed and verify the compliance with small scale limit.								
Calculation method	PP has an internal control of the quantity of stoves distributed. The number is rechecked according to sales agreement.								
Comments	Capped in compliance with the small-scale limit with regard to thermal energy power output of the stoves as detailed in B.2. $N_{distributed_ICS,medium} * P_{medium} + N_{distriuted_ICS,large} * P_{large} < 45 \text{ MWth}$.								

Data / Parameter	$N_{IN,Y}$
Data unit	Number
Description	Total number of participating restaurants in year y
Source of data	Project implementer database
Description of measurement methods and procedures applied	Each participating restaurant who acquires an ICS signs a product acquisition agreement with the project implementer.

	The project implementer will keep a database of all distributed ICS and participating restaurant.	
Frequency of monitoring/recording	Continuously	
Value applied:	2020	2021
	801	799
Monitoring equipment	The Number of restaurants is extract from the project database maintained by the PP	
QA/QC procedures applied	The total number of restaurants mentioned in the data base is cross- checked by the project implementer with number of contracts signed with participating restaurants. Databases are periodically checked by the project implementer to countthe total number of restaurant under the project.	
Purpose of data	Used to record the number/location of each restaurant.	
Calculation method	Not applicable	
Comments	-	

Data / Parameter	Pop restaurant,y
Data unit	Fraction
Description	Proportion of restaurants still operating ICS or having replaced their ICS byan equivalent in service one under similar conditions under the project activity in year y.
Source of data	Monitored sample observations.
Description of measurement methods and procedures applied	Determined using monitoring surveys. OBEN's team conducted monitoring survey on a sample of 50 restaurants. The sample size have been calculated for 95/10 confidence precision, with an oversampling of 20% A total of 50 restaurant have been chosen randomly for this monitoring period.
Frequency of monitoring/recording	At least once every two years

Value applied:	0.94																						
Monitoring equipment	Not applicable																						
QA/QC procedures applied	$0 \leq \text{pop restaurant}, y \leq 1$ Database is periodically checked by the project proponent. Each stove is traced from manufacturer to user (restaurant) using its unique ID. The count, prorated from the monitoring sample size, cannot exceed the total distributed number of stoves at any point in time and number of participating restaurants, as recorded in the stove sales register. Any invalid or incomplete entries related to cook stove sales is not taken into consideration in Emissions Reductions calculation.																						
Purpose of data	Calculation of baseline emissions																						
Calculation method	Parameter estimated ex-post with monitoring surveys. Monitored restaurants have been asked if their ICS was still operating. The total number of restaurants with operating stoves have been divided by the total number of restaurants surveyed. The confidence precision is met <table> <tr> <td>Global average</td><td>94.00%</td></tr> <tr> <td>Sample size</td><td>50</td></tr> <tr> <td>Total population size</td><td>801</td></tr> <tr> <td>Required precision</td><td>95%</td></tr> <tr> <td>z-value at 90% confidence</td><td>1.96</td></tr> <tr> <td>Confidence interval (+/-)</td><td>6.4%</td></tr> <tr> <td>Lower bound of the interval</td><td>88%</td></tr> <tr> <td>Higher bound of the interval</td><td>100%</td></tr> <tr> <td>Maximum error (precision)</td><td>10.00%</td></tr> <tr> <td>Sample monitoring precision</td><td>6.78%</td></tr> <tr> <td>Conclusion</td><td>Precision OK</td></tr> </table>	Global average	94.00%	Sample size	50	Total population size	801	Required precision	95%	z-value at 90% confidence	1.96	Confidence interval (+/-)	6.4%	Lower bound of the interval	88%	Higher bound of the interval	100%	Maximum error (precision)	10.00%	Sample monitoring precision	6.78%	Conclusion	Precision OK
Global average	94.00%																						
Sample size	50																						
Total population size	801																						
Required precision	95%																						
z-value at 90% confidence	1.96																						
Confidence interval (+/-)	6.4%																						
Lower bound of the interval	88%																						
Higher bound of the interval	100%																						
Maximum error (precision)	10.00%																						
Sample monitoring precision	6.78%																						
Conclusion	Precision OK																						
Comments	For subsequent monitoring sessions $\text{pop restaurant}, y-1$ measured during the previous monitoring session shall be used as an estimation of $\text{pop restaurant}, y$ for the new sample size calculation. Guidance for monitoring is provided to field agents in order to																						

	determine the operating status of each appliance during monitoring session with specific conditions to comply with.	
Data / Parameter	Mrenewable_biomass,y	
Data unit	tonnes/year	
Description	Quantity of renewable biomass consumed by the participating restaurants in year y	
Source of data	Project distribution database (ER calculation sheet)	
Description of measurement methods and procedures applied	The quantity of briquettes distributed is monitored each month and reported in the database. Therefore, Project implementer can assess the total quantity of briquettes distributed within a particular period	
Frequency of monitoring/recording	Every month	
Value applied:	2020	2021
	9,015 tonnes	11,079 tonnes
Monitoring equipment	Not applicable	
QA/QC procedures applied	-	
Purpose of data	Project emissions and Methodology requirements	
Calculation method	-	
Comments	-	

Data / Parameter	Np,IN,y
Data unit	meals/restaurant/year

Description	Average number of meals prepared per restaurant in the year y (meals/y)																			
Source of data	Derived from monitoring survey conducted ,																			
Description of measurement methods and procedures applied	Number of meals prepared per restaurant sampled is recorded during each monitoring period.																			
Frequency of monitoring/recording	At least once every year																			
Value applied:	2020	2021																		
	111,622	122,348																		
Monitoring equipment	Not applicable																			
QA/QC procedures applied	Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision (or 95/10 confidence precision) for the sample size calculation (if conducted biennially). 95/10 applicable for this MP																			
Purpose of data	Calculation of baseline emissions																			
Calculation method	Ex-post assessment of the parameter is determined by monitoring surveys. The number of meals cooked by restaurant is assessed on 50 restaurants to obtain 95/10 confidence precision. The confidence precision is met <table><tr><th colspan="2">NpINy</th></tr><tr><td>Global average</td><td>122,348</td></tr><tr><td>Sample size</td><td>50</td></tr><tr><td>Total population size</td><td>801</td></tr><tr><td>Required precision</td><td>95%</td></tr><tr><td>z-value at 90% confidence</td><td>1.96</td></tr><tr><td>Confidence interval (+/-)</td><td>10,552</td></tr><tr><td>Lower bound of the interval</td><td>111,796</td></tr><tr><td>Higher bound of the interval</td><td>132,900</td></tr></table>		NpINy		Global average	122,348	Sample size	50	Total population size	801	Required precision	95%	z-value at 90% confidence	1.96	Confidence interval (+/-)	10,552	Lower bound of the interval	111,796	Higher bound of the interval	132,900
NpINy																				
Global average	122,348																			
Sample size	50																			
Total population size	801																			
Required precision	95%																			
z-value at 90% confidence	1.96																			
Confidence interval (+/-)	10,552																			
Lower bound of the interval	111,796																			
Higher bound of the interval	132,900																			

	Maximum error (precision)	10.00%
	Sample monitoring precision	8.62%
	Conclusion	Precision OK
Comments	-	

Data / Parameter	BCEP,PP
Data unit	Tonnes of wood equivalent / meal
Description	Average annual consumption of woody biomass permeal in the preproject devices during the project activity during year y
Source of data	Monitoring surveys
Description of measurement methods and procedures to be applied	The consumption of woody biomass could not be assessed directly. Therefore, is assessed as the proportion of meals cooked with baseline stoves, or project stoves during briquettes delivery shortages
Frequency of monitoring/recording	At least once every two years
Value monitored	0.000043 (1.23% of meals cooked, are cooked with baseline stoves or baseline fuels)
Monitoring equipment	-.
QA/QC procedures to be applied	Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision (or 95/10 confidence precision) for the sample size calculation (if conducted biennially). 95/10 applicable for this MP
Purpose of the data	Calculation of baseline emissions
Calculation method	The value is derived from the proportion of meals cooked with preproject devices. Monitoring surveys pointed that 1.23% of the

	meals were cooked with baseline fuels. To assess the quantity in tonnes, this value has been multiplied by BCBL,PP. The parameter 1-% of meals cooked with preproject cookstove have been calculated.	
	The confidence precision is met.	
	1-% of meals cooked with baseline devices	
	Global average	98.77%
	Sample size	50
	Total population size	801
	Required precision	95%
	z-value at 90% confidence	1.96
	Confidence interval (+/-)	3.0%
	Lower bound of the interval	96%
	Higher bound of the interval	102%
	Maximum error (precision)	10.00%
	Sample monitoring precision	3.00%
	Conclusion	Precision OK
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 AMS-I.E. 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 restaurants 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
- Restaurant serial number(s)
- Type and size of ICS(s) distributed
- Installation date of the ICS
- Quantity of briquettes distributed
- Contact details of restaurant

Sampling Method

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

Random sampling has been carried out to draw a sample of 50 restaurants to carry out monitoring surveys using excel's RAND function.

A random number is attributed to each entry of the restaurant database using the RAND function, which is copied and pasted to a new column (without formula) to become fixed. The previous column(with formula) is deleted. The restaurants in the database are then sorted by the random number column starting with the lowest random number in the top row, i.e. by ascending numbers. Thus, they become 'shuffled' and a random sample can be drawn simply by selecting the number of entries from the top towards the bottom of the database according to the required sample sized. All other entries are deleted. Since an excel sheet with several large databases becomes difficult to navigate, the sample drawing is carried out in a separate excel sheet and the data sets of the final sampled households is copied and pasted into the ER calculation sheet.

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-I.E.

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”.

A biennial inspection have been conducted for this monitoring period, the sample size have been calculated to obtain a 95/10 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:

$$np \geq \frac{t_{\alpha/2}^2 N_y \times p(1-p)}{(N_y - 1) \cdot 0.1^2 + t_{\alpha/2}^2 p(1-p)}$$

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

For the average number of meals cooked, 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:

$$Nn \geq \frac{t_{\alpha/2}^2 N_{ags,y} V}{(N_{ags,y} - 1) \cdot 0.1^2 + t_{\alpha/2}^2 V}$$

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 (95%) 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 1: Calculation of sample size of proportions (95/10 confidence/precision)

Parameter	$Z_{\alpha/2}$	N	p	Minimum sample size	Final sample size
pop restaurant, y	1.96	855	0.90	41	50
$BC_{PJ,PP}$	1.96	855	0.90	41	50

Table 2: Calculation of sample size of means (95/10 confidence/precision)

Parameter	$Z_{\alpha/2}$	N	SD	Mean	Calculated sample size	Calculated sample size w/ oversampling	Final sample size
Np, IN, y	1.96	855	42,785	145,505	33	40	50

Final total sample sizes during this monitoring period have been 50 restaurants.

A sample of 50 restaurants have been drawn among the full database of the participating restaurants. The sample have been drawn by AERA Group, and the identification of the 50 restaurants have been shared with OBEN for the monitoring.

The z-value depends on the level of confidence. For 95% confidence it is 1.96 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 have been conducted by 2 members (NKURUNZIZA Thierry, BIZIMANA Gaspard) of OBEN team from 03/02/2021 to 04/06/2021, under the supervision of Claver NDIZEYE.

Table 3: 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	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 survey template to the OBEN monitoring team indicating the selected random sample of restaurants 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

It is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs.

Baseline emissions are calculated as:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

Where:

BE_y = Baseline emissions in the year y (tCO₂e)

B_y = Quantity of woody biomass that is substituted or displaced in year y (tonnes)

$f_{NRB,y}$ = Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass (fraction or %)

$NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (TJ/tonne)

$EF_{projected_fossil_fuel}$ = Emission factor of fossil fuels projected to substitute non-renewable woody biomass by similar consumers (tCO₂e/TJ).

Determination of B_y

B_y has been calculated after para 29 option C:

Calculated as the product of the number of persons served per institution multiplied by the number of institutions and the estimate of average annual consumption of woody biomass per person that is displaced by the project activity:

$$B_y = \sum N_{IN,y} \times N_{p,IN,y} \times (BC_{BL,PP} - BC_{PJ,PP,y})$$

Where:

$N_{p,IN,y}$ = Average number of persons served per institution¹¹ in year y (number)

¹¹ Institutions refers to restaurants in this project

$N_{IN,y}$ = Number of institutions with functional cookstoves distributed under the project activity in year y (number)

$BC_{BL,PP}$ = Average annual consumption of woody biomass per person before the start of the project activity or at the renewal of each crediting period whichever is later (tonnes/person/year)

$BC_{PJ,PP,y}$ = Average annual consumption of woody biomass per person in the pre project devices during the project activity (tonnes/person/year). This parameter shall be considered if it is found that pre-project devices were not completely displaced but continue to be used to some extent.

5.2 Project Emissions

According to the methodology para 36:

If the project cookstoves use biomass, the following sources of project emissions shall be considered as applicable, bearing in mind that some sources may be only relevant for specific fuels (e.g. production of bioethanol):

- (a) Project emissions from cultivation, use and processing of biomass shall be calculated using the latest version of "TOOL16: Project and leakage emissions from biomass" including
 - (i) CO₂ emissions from on-site consumption of fossil fuels due to the project activity, (e.g. consumption of fossil fuels for any processing of feedstock);
 - (ii) CO₂ emissions from electricity consumption by the project activity (e.g. the consumption of electricity for any processing of feedstock);
 - (iii) Project emissions related to cultivation of feedstock. (iv) Project emissions from transportation of biomass if the transportation distance is more than 200 km; otherwise, they can be neglected.
- (b) Methane emission from solid waste disposal or wastewater calculated as per provisions in AMS-III.G. (landfill); AMS-III.F. (composting) and AMS-III.H. (wastewater treatment) in cases where the wastes resulting from production and processing of biomass is disposed in anaerobic conditions.

Furthermore, as per tool 16. V4 "Project and leakage emissions from biomass". Following project emissions must be considered:

Project emissions from cultivation of biomass:

As the renewable biomass used is all from residue/waste, this emission source is not applicable to this project.

Project emissions from utilization of biomass residues that account for:

Emissions resulting from energy consumption as per para 30,
Emissions resulting from energy consumption are estimated, unless otherwise required in the relevant methodology, by following the provisions in the "Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion" and the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". These emissions include emissions due to thermal and mechanical processing of the biomass residue. In the project activity, there is no leakage or project emissions linked to consumption of fuel. Therefore, the only emissions come from electricity consumption for transformation of renewable biomass into briquettes. These emissions are calculated as follow:

Emissions related to the transformation of renewable biomass into briquettes

Potential project emissions may arise from the electricity consumption from the machines processing the transformation from renewable biomass into briquettes¹². This emissions source is calculated as per the tool 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' version 3. A conservative specific electricity consumption per tonnes of briquettes produced is estimated ex-ante.

Project emissions from electricity consumption

Project emissions from consumption of electricity are calculated, as follows:

$$PE = PE_{EC,y} = \sum EC_{PJ,j,y} * EF_{EF,j,y} * (1 + TDL_{j,y})$$

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption in year y (tCO₂/yr)

$EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)

$EF_{EL,j,y}$ = Emission factor for electricity generation for source j in year y (tCO₂/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source j in year y

j = Sources of electricity consumption in the project.

Determination of the quantity of electricity consumed by the project ($EC_{PJ,j,y}$)

The renewable briquettes production sites are likely to provide briquettes to different projects therefore it is not possible to monitor electricity consumption for the project alone. Thus the quantity of electricity consumed by the project $EC_{PJ,j,y}$ is calculated based on a default value for the specific quantity of electricity consumed per ton of briquettes produced SEC_{bri} (0.04MWh/ton)

Determination of the emission factor for electricity generation ($EF_{EL,j,y}$)

The determination of the emission factor for electricity generation EF depends on scenario applied to the source of electricity consumption:

Electricity consumption per tonne of briquettes produced is calculated as follows:

Scenario A: Electricity consumption from the grid

In this case, project participants may choose among the following options:

Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the Tool to calculate the emission factor for an electricity system. ($EF_{EL,j/k,l,y} = EF_{grid,CM,y}$).

Option A2: Use the following conservative default values:

- (a) A value of 1.3 tCO₂/MWh if
 - (i) Scenario A applies only to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources; or
 - (ii) Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the project and leakage sources is greater than the electricity consumption of the baseline sources.
- (b) A value of 0.4 tCO₂/MWh for electricity grids where hydro power plants constitute less than 50% of total grid generation in 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production, and a value of 0.25 tCO₂/MWh for other electricity grids. These values can be used if

¹² The briquettes production sites are not included within the boundaries of the project because they will supply different separated projects, different communities and because it is not possible to allocate one production site to one specific city's restaurants as this will depend on the capacity production per site and the regional demand.

- (i) Scenario A applies only to baseline electricity consumption sources but not to project or leakage electricity consumption sources; or
- (ii) Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the baseline sources is greater than the electricity consumption of the project and leakage sources.

Option A2 is chosen conservative default value of 1.3 tCO₂e/MWh.

Average technical transmission and distribution losses for providing electricity to source j in year y (TDL_{j,y})

In case of scenario A, choose one of the following options:

1. Use recent, accurate and reliable data available within the host country.
2. Use as default values of 20% for project or leakage electricity consumption sources.

Option 2 is chosen default values of 20%.

Therefore, project emissions are calculated as per the formula and the table below

$$PE_y = M_{\text{renewable_biomass},y} * SEC_{\text{briq},y} * EF_{EL,j,y} * (1 + TDL_{j,y})$$

year	SEC _{briq,y}	EF _{EL,j,y}	TDL _{j,y}	PE _y
2020	0.04	1.3	0.2	563
2021	0.04	1.3	0.2	691

Small scale project activities may, unless otherwise required by the methodology, neglect emissions from energy consumption associated with processing of biomass residue.

Emissions resulting from transport

Emissions resulting from transport of biomass residue to the processing/utilization facility are estimated, unless otherwise required in the relevant methodology, by following the provisions in the methodological tool “Project and leakage emissions from transportation of freight”.

Small scale project activities may, unless otherwise required by the methodology, neglect this source of emissions if the transportation distance is less than 200 km.

Transportation of renewable biomass wastes from collection sites to the briquetting plant is neglected as the briquetting plants operate close to the residues provision sites. Moreover, the average distance of transportation of renewable briquettes from briquetting plants to restaurants is shorter than the baseline situation where non-renewable woody biomass was transported over a longer distance from isolated rural production site thus can be neglected.

Moreover, taking into consideration that the average distance of collection of renewable biomass for the Project activity is shorter than the mean distance of origin of previously used biomass in the baseline and;

For the proposed project, the residues/briquettes will never be transported over a distance more than 200 km (one way), then emissions from transportation can be neglected.

5.3 Leakage

The following leakages emissions are considered according to the tool 16 version 4

1) Shifts of pre-project activities

According to tool 16 para 34 “This section is applicable only if the project activity utilizes biomass cultivated in a dedicated plantation. Project proponents are advised to avoid pre-project activities from being shifted outside the project boundary, to avoid indirect land use changes because of the project activity. Rather, project proponents are encouraged to include in the project boundary the land in which the pre-project activities will take place after the project implementation” As the renewable biomass used is all from residue/waste, this emission source is not applicable to this project.

2) Leakage due to diversion of biomass residues from other applications

According to tool 16 para 39, “This section is applicable for project activities which utilize biomass residues. It quantifies leakage due to diversion of biomass residues to the project to be used as either fuel or feedstock. These biomass residues could have been used outside the project boundary in competing applications, and due to the implementation of the project activity these competing application might be forced to use inputs which are not carbon neutral.”

The biomass residues, collected in this project would have been burnt in an uncontrolled manner without utilizing it for energy purposes. This situation refers to scenario B3 para 40 of the tool.

Furthermore, as per para 42 guidelines for credible alternative scenario states that When defining plausible and credible alternative scenarios for the use of biomass residues, the guidance below shall be followed:

- (a) If the biomass residues processing (drying, pelletization, shredding, briquetting, etc.) is not included in the project boundary, the processed biomass obtained from that plant should be considered as B4 above.
- (b) The alternative scenario for the categories of biomass residues identified according to paragraphs 40 and 41 above should be separately identified, covering the whole amount of biomass residues supposed to be used in the project activity along the crediting period.
- (c) A category of biomass residues is defined by three attributes: (1) its type or types (i.e. bagasse, rice husks, empty fruit bunches, etc.); (2) its source (e.g. produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc.); and (3) its alternative scenario in the absence of the project activity (Scenarios B1 to B4 above);
- (d) Explain and document transparently in the CDM-PDD, using a table similar to Table 1 in Appendix 2, what quantities of which biomass residues categories are used in which installation(s) under the project activity and what is their alternative scenario;
- (e) For biomass residues categories for which scenarios B1, B2 or B3 are deemed a plausible alternative scenario, the following procedures should be applied for the combined amount of biomass identified:
 - (i) Demonstrate that there is an abundant surplus of the biomass residue in the project region which is not utilized. For this purpose, demonstrate that the total quantity of that type of biomass residues annually available in the project region is at least 25 per cent larger than the quantity of biomass residues which is utilized annually in the project region (e.g. for energy generation or as feedstock), including the project facility;
 - (ii) Demonstrate for the sites from where biomass residues are sourced that the biomass residues have not been collected or utilized (e.g., as fuel, fertilizer, or feedstock) but have been dumped and left to decay, land-filled, left in the field to decay after harvest, or burnt without energy generation (e.g., field burning). This approach is only applicable to biomass residues categories for which project participants can clearly identify the site from where the biomass residues are sourced.

The Project activity's biomass supply involves agro-industrial wastes such as sugar cane wastes, coffee parchments and sawmills residues. These types of wastes are widely available in the region and currently burnt without energy purpose¹³. The biomass residue processing is included in the project boundaries and calculated in the project emissions. Therefore, option B3 para 40 of the tool is applicable. The biomass used in the project activity would be burnt in the absence of the project.

The Project activity's biomass supply involves agro-industrial wastes such as sugar cane wastes, coffee parchments and sawmills residues. These types of wastes are widely available in the region and currently burnt without energy purpose¹⁴. The biomass residue processing is included in the project boundaries and calculated in the project emissions. Therefore, option B3 para 40 of the tool is applicable. The biomass used in the project activity would be burnt in the absence of the project.

The estimation for the quantity of renewable biomass available regarding the types of biomass used for briquettes productions is presented below.

Product	Production in 2019 (tonnes) ¹⁵	% of agricultural residus ¹⁶	Average estimation of waste available (tonnes)
Coffee	14,059	35.7%	5,019
Rice	241,211	170%	410,058
Palm Oil	17,668	72.5%	12,809
Sorghum	8,851	250%	22,127
Sugar	154,139	30%	46,241
Total	435,928		496,254

Moreover, Burundi has a peat reserve of nearly 60,000,000¹⁷ tonnes

Based on production capacity of 3 briquetting machines of 500 tonnes per month the quantity of biomass needed is 18,000 tonnes of dry biomass, thus 36,000 tonnes of wet biomass residues assuming 50% moisture of biomass residues. Therefore, the quantity of available biomass residues in the region is at least 25% larger than the quantity of biomass that is utilized including the project activity. This source of leakage can thus be neglected.

¹³ Apart from the cogeneration project of SOSUMO where already residues is declared as too many. Indeed, SOSUMO has too much residues and has to burn a great part of it. That's why, OBEN E.A.C SA is signing a partnership with SOSUMO at the sugar cane plant location in order to process the surplus into briquettes

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¹⁵ <https://www.fao.org/faostat/en/#data/QCL>

¹⁶ Percentage of agricultural residues is extracted from the report from Burundi ministry of Energy and mines available at [Ministry of Energy and Mine \(Burundi\)](#)

¹⁷ http://obpe.bi/images/pdf/bulletin_numero_4.pdf

Methodology AMS-I.E further indicates that leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples). The following potential source of leakage shall be considered:

- a) The use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project households/users that is attributable to the project activity, then B_y is adjusted to account for the quantified leakage.

Alternatively, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. Therefore, as per the methodology B_y will be adjusted by a factor of 0.95.)

5.4 Net GHG Emission Reductions and Removals

Emissions reduction calculations are estimated as follow:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emissions reductions in year y, tonnes CO₂e

Baseline emissions are calculated as follows:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

Where:

$$B_y = \sum N_{IN,y} \times N_{p,IN,y} \times (BC_{BL,PP} - BC_{PJ,PP,y})$$

$$B_y = 122,348 \times 801 \times (0.00351 - 0.000043) \times 0.95 = 323,011 \text{ tonnes}$$

Year	$N_{p,IN,y}$	$N_{IN,y}$ (units)	$BC_{BL,PP}$ (Tonnes/meal)	$BC_{PJ,PP,y}$ (Tonnes/meal)	B_y (Tonnes)
2020	111,622	801	0.00351	0.000043	294,692
2021	122,348	799	0.00351	0.000043	322,253

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

Year	B_y	$f_{NRB,y}$	$NCV_{biomass}$	$EF_{projected_fossil_fuel}$	BE_y
2020	294,692	81.83%	0.0156	73.2	275,370
2021	322,253	81.83%	0.0156	73.2	301,124

Project emissions are calculated as follows:

$$PE_y = PEEC_{j,y} = \sum EC_{PJ,j,y} * EF_{EF,j,y} * (1 + TDL_{j,y})$$

Year	EC _{PJ,j,y} (MWh/tonne)	EF _{EF,j,y} (tCO ₂ e/MWh)	TDL _{j,y}	Quantity of briquettes distributed (Tonnes)	PE (tCO ₂ e)
2020	0.04	1.3	20%	9,015	563
2021	0.04	1.3	20%	11, 079	691

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)
03 February 2020- 31 December 2020	275,370	563	-	274,807
01 January 2021 - 31 December 2022	301,124	691	-	300,432
Total	576,494	1,254	-	575,239

The emissions reductions expected for this monitoring period as per the registered VCS-PD, and the emission reduction achieved as calculated in the present monitoring report are included in the table below. Period	Estimated emissions reduction in the VCS-PD	Emissions reduction achieved during the monitoring period
03/02/2020- 31/12/2020	594,906	274,807
01/01/2021-	661,007	300,432

31/12/2021		
Total	1,255,913	575,239

The emissions reduction achieved are well below the estimated emissions reduction in the VCS-PD. This is due to the fact that many parameters estimated ex-ante are well below the values observed during the monitoring period. It was estimated ex-ante that 1,483 and 1,630 restaurants, would be equipped respectively by 2020 and 2021, while only 801 restaurants (2020) and 799 restaurants (2021) were really equipped. Therefore, the estimated quantity of briquettes delivered was also lower than the monitored quantity of briquettes delivered, hence lower emissions reduction achieved in comparison with estimated values in the registered VCS-PD.

