Gold Standard for the Global Goals

TEMPLATE

KEY PROJECT INFORMATION & VPA DESIGN DOCUMENT (PDD)

PUBLICATION DATE **04.05.2022**

VERSION **v. 2.0**

RELATED SUPPORT - Programme of Activity requirements

This document contains the following Sections

KEY PROJECT INFORMATION

Type of VPA	☒ Real case VPA ☐ Regular VPA
Scale of VPA Note that a VPA can be of one scale. Please select applicable scale accordingly.	☒Microscale ☐Small scale ☐Large scale
Title of corresponding real case VPA (if applicable)	N/A
GS ID of real case VPA (if applicable)	N/A
GS ID of VPA	GS11509
Title of VPA	GS11508 VPA1: Clean Cooking with Biomass Gasification in Zambia
Time of First Submission Date	26/12/2021
Date of Design Certification	
Version number of the VPA-DD	Version 4
Completion date of version	24/01/2023
Coordinating/managing entity	Emerging Cooking Solutions Sweden AB
VPA Implementer (s)	Emerging Cooking Solutions (Zambia) Limited
Project Participants and any communities involved	Emerging Cooking Solutions (Zambia) Limited
Host Country (ies)	Zambia
GS ID and Title of applicable Design Certified VPA	N/A (this is the 1st VPA)
GS ID and Title of applicable Performance Certified VPA	N/A (this is the 1st VPA)
Activity Requirements applied	☒ Community Services Activities ☐ Renewable Energy Activities ☐ Land Use and Forestry Activities/Risks & Capacities

	☐ N/A
Other Requirements applied	N/A
Methodology (ies) applied and version number	Gold Standard "Methodology for metered & measured energy cooking devices"[1], version 1.0.
Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A
VPA Cycle:	☐ Regular ☒ Retroactive

Table 1 – Estimated Sustainable Development Contributions

Sustainable Development Goals Targeted	SDG Impact (defined inFehler! Verweisquelle konnte nicht gefunden werden.)	Estimated Annual Average	Units or Products
13 Climate Action (mandatory)	Reduced GHG emissions	8,853 t CO_2	
3 Good health and wellbeing	• Reduced (or avoided) kitchen smoke exposure • Reduced reported health impacts of kitchen smoke	• 1,584person-years • 1,584 person-years	
5 Gender Equality	Time saved by women faster cooking	120,450 hours saved per year in total	
7 Affordable and clean energy	Access to improved cooking technology	9,900 person-years	
8 Decent work and economic growth	Employment generation	25 full-time jobs	

[1] https://globalgoals.goldstandard.org/standards/431_V1.0_EE_ICS_Methodology-for-Metered-and-Measured-Energy-Cooking-Devices.pdf

SECTION A. DESCRIPTION OF PROJECT

A.1. Purpose and general description of project

Under this VPA, SupaMoto distributes micro gasifier cookstoves running with pellets in Zambia, with a focus on Lusaka. SupaMoto offers an "energy utility" model where cookstoves are the infrastructure and fuel pellets are the energy. By creating a system that incorporates both the fuel and the stove, SupaMoto enables clean cooking with an innovative product while maximizing the health, environmental, and social impacts.
The project boundary includes physical, geographical sites of stove usage and baseline and project fuel production.
The VPA focuses on the replacement of traditional cooking predominantly with charcoal which is responsible for severe deforestation in Zambia as well as indoor air pollution in households.

Tentative VPA implementation plan

- Since 2013	Pilot activities with stove distribution and pellet production in Zambia. In 2015, an agreement was signed to become part of the CDM PoA "CDM Sustainable Energy Programme" (evidence provided). Till date, no credits have been generated under this agreement for ECS, but in 2021 a monitoring survey was conducted, including stoves distributed in 2019 and 2020. Additionally, an own stove model with was developed, with better thermal efficiency than Mimimoto and real-time usage data transmission.
- Dec 14th 2021:	Local Stakeholder's Meeting
- from Q2 2022 on:	Start of project stove distribution and pellet supply to users.
- Q3 2022:	Envisioned registration under the Gold Standard planned
- Q3 2022:	First monitoring campaign planned

A.1.1. Eligibility of the VPA under approved PoA

Table 2 Eligibility for VPA inclusion as per PoA requirements

No.	Eligibility Criterion	Description/ Required condition	Description of the VPA in relation to the criteria, Means of Verification and Supporting evidence for inclusion
1	The Geographical boundaries of VPAs are consistent with the geographical boundary of the PoA	The geographical boundary of the VPA is within the geographical boundary of the PoA	The VPA is within Zambia, as shown in section A.2.
2	Conditions to avoid double counting of Impacts, such as unique identifications of product and end user locations	A unique numbering system for households (contract reference) will be applied in each VPA, assigning a unique number to each participating household and allowing to clearly identify for each household to which VPA it belongs. There may be households in neighboring areas belonging to different VPAs. Additionally, stoves will have a unique stove serial number.	A unique number (contract reference) is given to each participating household under the VPA and additionally, stoves have a unique stove serial number as shown in B.7.3. Moreover, pellet sales to customers, the key parameter for emission reductions, will be evidenced by unique mobile money transaction numbers.
3	Conditions to confirm that VPAs are neither registered as project activities with other offset Schemes, included in other registered PoAs, nor the project activities that have been deregistered;	The VPA, nor any of its devices, is not yet registered and not being registered as a standalone project under other carbon standards by ensuring that the VPAs has the full title over the emission reductions generated by the users listed in the VPA.	There is a mechanism to ensure the transfer of legal ownership to the emission reductions to the CME, as described in section A.1.2.
4	Specification of the technology/measure such as the level and type of	VPAs under this PoA will consist in the distribution of improved cook stoves to users predominantly	As described in section A.3, the VPA consists in distribution of improved

	service, as well as performance specification based on, inter alia, testing/certification;	cooking with non-renewable biomass on traditional biomass stoves (mainly charcoal stoves, also wood stoves eligible) in the baseline scenario. The improved cook stove technology will have a thermal efficiency of at least 40%.	cookstoves, with efficiencies >40%. B.4 describes the baseline scenario with predominant usage of charcoal.
5	Conditions to check the start dates of V/CPAs through documentary evidence;	A start date will be specifying with each VPA. All VPAs will have the start date not earlier than one year before the start date of the PoA.	As shown in C.1.1, the start date of the VPA is 07.04.2022, , clearly after the PoA start date (which is 26/12/2021).
6	Conditions to ensure compliance with the applicability of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents	Each VPA will meet the applicability criteria of the Gold Standard "Methodology for metered & measured energy cooking devices", version 1.0	Section B.2 shows the that the inclusion criteria for methodology application are met.
7	Conditions to ensure that V/CPAs meet the requirements for demonstration of additionality	Each VPA will demonstrate automatic additionality according to the GS community services activity requirements section 4.1.9. (c) – Microscale projects. As the PoA and VPAs are fall under microscale projects, hence deemed additional.	Section B.5 shows automatic additionality.
8	Conditions to ensure no diversion of official development assistance;	There will be no diversion of ODA for any of the proposed VPAs	A declaration of non-use of ODA is provided, and a corresponding statement is made in section A.5.
9	Target group (e.g. domestic/commercial/industrial, rural/urban, gridconnected/offgrid), and where applicable, distribution mechanisms (e.g. direct installation)	The PoA will target households and institutions that mainly depend on charcoal and/or fuelwood for cooking, located in urban, semi-urban and rural areas within the host countries. Project devices will be installed directly in the participating households.	Section A.3 explains the target group, and that advanced cookstoves will be distributed to users buying them from the VAP implementer or renting them in a pay-as-you-cooking scheme. Section B.4 explains the baseline fuel situation based on an independent study, showing clear charcoal dependency.

10	Conditions related to sampling requirements for the PoA	Conditions are in line with the GS "Methodology for metered & measured energy cooking devices", version 1.0 (Sampling may not be required since 100% fuel consumption is measured for SDG 13).	B.7.2 explains the sampling approach (non-systematic sampling, only required for a qualitative SDG 3 parameter).
11	Conditions to ensure that VPAs that will be included meet the small-scale or microscale thresholds and remain within those thresholds throughout the crediting period (N/A if all units qualify as "microscale CDM units")	N/A All units qualify as microscale CDM units because power ratings of cookstoves will always be <150kW according to MECD criterion 2.2.b)	N/A
12	Conditions to confirm that technologies in V/CPAs are eligible	Covered by inclusion criterion 4	Covered by inclusion criterion 4.
13	Conditions to be met by each VPA regarding SDG outcomes assessment	Positive outcomes expected for at least 3 SDGs.	This is the case, as shown in section B.6.4
14	(if applicable) Conditions to be met by each VPA regarding safeguarding principles	The safeguarding principles assessment is conducted at VPA level.	As explained in Appendix 1, no specific conditions have been identified.
15	Eligibility as per Community Services Activity Requirements	As described in the assessment at PoA level (see PoA-DD A.3), specific criteria to be met at VPA-level are covered by eligibility criterion No. 4 (technology includes end-use energy efficiency) and legal ownership (clear description of ownership, proofs that end users are aware and willing to give up rights on products) and discussion of the transfer of ownership during LSCs.	Eligibility of technology covered by inclusion criterion 4. Conditions on legal ownership: - Clear description in A.1.2 - LSC report showing discussion on transfer of ownership.
16	Eligibility as per GHG Emissions Reduction & Sequestration criteria	The relevant criteria include: - Only microscale VPAs are allowed under a microscale PoA (criterion 2.1.3)	- A.4 shows that this VPA is a microscale VPA

		- There is no mandatory operational scheme to reduce GHG emissions (3.1.1) - The VPA belongs to an eligible project type: End-use energy efficiency improvement (5.1.1.b)	- No mandatory scheme exists in Zambia[2] - A.3 shows that technology consists in efficient cookstoves, so the VPA belongs to the type of End-use energy efficiency improvement
17	Conditions to be met for a VPAs in another country than Zambia (condition for multi-country PoA)	The VPA must apply a similar technology; it must consist in the distribution of advanced cooking technologies eligible under the "Methodology for metered & measured energy cooking devices", and it must meet the eligibility criteria of this methodology. Moreover, a physical stakeholder consultation must be organized in cases where required according to PoA requirements (see section E of PoA-DD).	N/A

A.1.2. Legal ownership of products generated by the VPA and legal rights to alter use of resources required to service the project

The legal ownership of the emission reductions is with ECS. The same was discussed during the LSC meeting. Supamoto signed agreements with all the beneficiaries confirming the transfer of all legal rights of the emission reductions.

Pellets are produced in-house by SupaMoto, therefore an internal statement of legal ownership on carbon credit is provided to GS / VVB.

Also stoves are distributed directly by Supamoto, without intermediaries.

[2] The most recent NDC says: "Zambia does not rule out the possibility of using market based mechanisms in meeting emission reduction target." This shows that currently, there are no plans to establish such a scheme in the near future. www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Zambia%20First/Zambia_Provisional_Updated_NDC_2020.pdf

A.2. Location of VPA

Country: Zambia

Districts: Focus on Lusaka, but also Ndula possibly included.

The geographical coordinates of the VPA are (Lusaka):

Latitude: -15°’24' 24”08" S

Longitude: 28°’17' 13”67" E

A.3. Technologies and/or measures

The VPA will implement micro-gasifier technologies such as pellet stoves made by Mimi Moto (https://mimimoto.nl, user manual provided to VVB), targeting current users of charcoal in urban and periurban areas in Zambia, with focus on Lusaka. The project cookstoves will be distributed by selling them to users or renting them under a pay-as-

you-cook-model where Supamoto remains the owner of stoves and users buy pellets as fuel.

Also the "fourth Generation" advanced pellet stove, made by SupaMoto's parent company, is planned to be distributed. Moreover, larger, institutional pellet gasifiers made by SupaMoto's parent company are planned to be used. The certified thermal efficiency of selected technologies will always be more than 40%. By gasifying wood instead of burning it directly (like in an open fire), the extracted gasses burn as a clean and controllable flame. The pellets are produced by SupaMoto and are typically made of woody biomass from sawdust waste or sawmill offcuts.

Technical life of project stoves

The expected technical life of Mimimoto stoves is 5 years, based on experiences with early users in Zambia and Rwanda. For the new Supamoto stoves, still no long-term experiences exist, but similar results are expected.

Supamoto offers a cooking service model to all users included in this VPA which includes free repair/replacement services (specified in user contracts). Repairs/replacements are are free during all the usage period with no limit.

Due to constant fuel supply, the VPA implementer is constantly in touch with users and will thus notice if technical problems occur.

Thermal efficiency over time

The Advanced Biomass Combustion Lab (ALB) of the Colorado State University validated that no decrease of efficiency is to be expected[3]. (*"Based on the testing of the Mimi Moto stove, along with an understanding of the construction and operation of the stove, we concur with the supplier's statement regarding its expected non-decrease in efficiency over time.")*

This is because failures would rather stop the pyrolysis process would and entirely stop stove operation. Is such a case, no pellets would be consumed and no ER claimed.

Assumptions made by ABL are that:

- *"Air holes in burn chamber are cleaned regularly by the user."*

Extensive field experience in Zambia shows that there is no need to clean the airholes, because pellets used have an ash melting point which is higher than the temperatures achieved in the stove. For this reason, there is never any "sintering", i.e. formation of slag-like and hard deposits.

- *The stove chambers are replaced at the end of useful life*

Replacement of burning chambers is part of the maintenance program.

The same rationale is valid for the Supamoto stove.

Positive contributions to SDGs are as follows:

SDG 13, Climate Action: Reduction of GHG emissions by replacing non-renewable cooing fuels (mainly charcoal) with highly efficient wood pellets.

SDG 3, Good health and wellbeing: Avoidance of negative health impacts due to smoke from conventional charcoal stoves – the project stoves burn with a clean flame comparable to LPG.

[3] Certificate provided to the VVB

SDG 5, Gender Equality: The project stoves are much faster to light than conventional charcoal stoves, saving time particularly to women who mostly do the cooking.
SDG 7: Affordable and clean energy: Clean gasifier stoves are made available to customers; due to the high efficiency, customers can reduce cooking fuel expenses.
SDG 8, Decent work and economic growth: The project generates employment in stove distribution and in the pellet supply chain, among others.

A.4. Scale of the VPA

The project is microscale as the stoves that will be used in this project are expected to represent an annual CO2 reduction of nearly 10,000 tonnes of CO2e. See also inclusion criterion 5: All units qualify as microscale CDM units because power ratings of cookstoves will always be <150kW according to MECD criterion 2.2.b)

A.5. Funding sources of VPA

The project is financed by ECS/Supamoto. There is no ODA funding involved in the implementation of this VPA that comes under the condition of delivering carbon credits to a donor.

SECTION B. APPLICATION OF APPROVED GOLD STANDARD METHODOLOGY (IES) AND/OR DEMONSTRATION OF SDG CONTRIBUTIONS

B.1. Reference of approved methodology (ies)

The project applies the Gold Standard Methodology: Gold Standard "Methodology for metered & measured energy cooking devices"[4], version 1.0.

B.2. Applicability of methodology (ies)

Applicability Criterion as in 2.2 of MECD	Justification of applicability
a) Project shall choose a technology design that has predictable performance in that it is proven to be efficient and durable under field conditions; for cookstoves, the rated thermal efficiency shall be at least 40%.	The certified thermal efficiency is 54.7% for Mimi Moto and even higher for the new Supamoto stove (certificates provided). Mimi Moto has proven to be efficient and durable over many years, Supamoto stove is undergoing field testing.
b) The technology shall have continuous useful energy output of less than 150kW per unit, where "continuous useful energy output" is defined as the total useful energy delivered from start to end of operation of a unit divided by time of operation.	The max. energy output of the Mimimoto/Supamoto stove is 5/4.5 kW (certified WBTs[5] showing max. 4.06/4.82kW).
c) The project activity is implemented by a project developer and can include additional project participants. However, the individual households and institutions do not act as project participants.	It is confirmed that individual households and other stove users will not act as project participants.

[4] https://globalgoals.goldstandard.org/430_ee_ics_methodology-for-metered-measured-energy-cooking-devices
[5] Aprovecho WBT reports provided to VVB and SustainCert

d) The project developer must design incentives for the elimination of inefficient baseline stoves, which should be effective as fast as possible, and describe the incentives design in the PDD.	The most effective incentive is the cost advantage of cooking with pellets on the Mimimoto/Supamoto stove in comparison to baseline stoves. Also clean and comfortable cooking represent incentives.
e) To avoid double counting or double claiming, the project developer must: i. clearly communicate its ownership rights and intention of claiming the emission reductions resulting from the project activity to the following parties by contract or clear written assertions in the transaction paperwork: all other project participants; project technology manufacturers; and retailers of the project technology or the renewable fuel in use; and ii. inform and notify the end users that they cannot claim emission reductions from the project, and iii. ensure the technologies counted in the project shall neither be included in any other voluntary market or CDM project activity/PoA, nor displace the technologies of another CDM or voluntary project/PoA. See data and parameters not monitored, avoidance of double counting or double claiming with other mitigation actions, for details on this demonstration.	i. The transfer of ownership on carbon credits has been discussed during the LSC and it is confirmed by each individual user in the user agreement. Pellets are produced in-house by SupaMoto, therefore no transfer of ownership requirement applies for pellet delivieries (an internal statement is provided to GS / VVB). Also stoves are distributed directly by Supamoto, without intermediaries. ii. The same is also confirmed in the user agreement iii. This is ensured by a unique identification number of each household receiving a stove under this project (See B.7.3).
f) Under this methodology, emission reductions cannot be claimed for fuel-switch only. Proposed project activities also need to introduce new technologies, i.e. technology switch is also involved.	The project introduces micro gasifier stoves, a new technology.

g) For project cooking devices that use fossil fuel, only emission reductions from efficiency improvement are eligible.	Project devices use biomass.
h) For project cooking device that use grid electricity, only emission reductions from efficiency improvement are eligible.	No grid electricity is used for cooking. Stoves have a fan for which electricity is used from a solar panel attached to the stove. Surplus electricity can be used for lighting or phone charging, thereby even replacing grid electricity.
i) The measured fuel or energy is used to calculate both baseline and project emissions. The project developer must have systems in place to monitor the fuel or energy consumption by all the project devices under the project to be recorded in a database, which is maintained by the project developer.	Fuel consumption of all project devices will be monitored continuously and thoroughly through fuel sales to users (see B.7.1).

Additional note on the eligibility according to the scope of the of the technology as "metered energy cooking device"

Demonstration that the VPA is within the Scope of MECD (2.1.1 and 2.1.2 of MECD):

> 2.1.1 | This methodology is applicable to project activities that introduce technologies that reduce or avoid greenhouse gas (GHG) emissions and quantify emission reductions from cooking devices through direct measurement of energy or fuel consumed, in households, communities, and/or institutions such as schools, prisons or hospitals (hereinafter referred as end-users).

Advanced pellet cookstoves are introduced that quantify emissions reductions from pellet fuel consumption (see detailed explanation below).

2.1.2 | This methodology may be applied by project developers promoting the installation of improved cooking devices, where the actual amount of energy or fuel used in the project scenario is measured directly in real-time for every device or otherwise monitored via measurement. This includes, but is not restricted to:

d. bio-ethanol cookstove where the amount of bio-ethanol purchased for cooking by each customer is recorded with arrangements to ensure the bio-ethanol is used for cooking and to prevent the alternative use of the bio-ethanol.

,

See detailed comment below. Pellet stoves are not mentioned explicitly, but they are similar to ethanol stoves since pellet fuel purchased by each customer for cooking is recorded and alternative uses are prevented (by the high prices of pellets and missing suitability for alternative uses, see B.7.2).

Detailed comment on eligibility

The definition for metered cooking devices in 1.1.1b requires devices to "record fuel or energy use directly, or through a supplementary meter with the ability to record amount of energy or fuel used for cooking over a period of time.

"Supplementary meter" is not further defined in this section, but more detailed provisions are given in the parameter table MECD 10 ($P_{p,d,y}$_*amount of fuel used in the project in by device d in year y)*,. According to these provisions, such "supplementary meters" include weighing scales applied when packaging the fuel together with sales receipts for quantities of fuel sold to stove users. Additionally, 1.1.1b, mentions as an example for eligible stoves *"… ethanol cookers when metered and sold for use in a dedicated device*" which apparently refers to metered ethanol fuel, in analogy to pellets. MECD is chosen because, in line with 2.1.2, "*the actual amount of energy or fuel used in the project scenario is measured directly in real-time for every device or otherwise monitored via measurement".* Measurement occurs according to the provision in the parameter box MECD 10 on the parameter $P_{p,d,y}$_*(amount of fuel used in the project in by device d in year y)* which requires under source of data: *"Direct measurement by metering or at sales, either on a device basis or cluster-of-devices basis."* Moreover, under *"any comment"* in the same box, it says*: "In case direct metering is not applied, then the fuel purchases, which are summarized on a monthly basis, are automatically*

captured on a continuous basis. Measurement may occur cluster-wise where project-specific retailers can clearly be assigned to customers and alternative uses are obviously excluded (if, for example, a new fuel is introduced specifically for project devices)." Moreover, as mentioned under B.7.1, parameter $P_{p,d,y}$, the VPA plans to include a small number stoves with remote measurement of stove running time, delivering additional real-time data that will be used to cross-check that fuel consumption rates from sales are correct.

Additional note on technical life of project technology

Section 2.3.2 of MECD requires a description of measures to ensure the durability of the technology over the time credits can be claimed. Specifications on life time and repair/replacement are given in A.3.

B.3. VPA boundary

The project boundary is the physical, geographical site of baseline and project cookstoves and fuel collection/production areas.

The physical boundary of the project is shown in the map in section A.2 of this document.

Sources an GHG included:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Combustion of charcoal for cooking, and also minor amounts of firewood, LPG and kerosene	CO_2	Yes	Major source of emissions
		CH_4	Yes	Important source of emission
		N_2O	Yes	In line with IPCC & methodology
	Production of fuel, transport of fuel	CO_2	Yes	Major source of emissions
		CH_4	Yes	Important source of emission
		N_2O	Yes	In line with IPCC & methodology

Project scenario	Production of pellets from residual biomass and transport (electricity and fuel consumption)	CO_2	Yes	Minor source of emissions
		CH_4	No	Not relevant
		N_2O	No	Not relevant

B.4. Establishment and description of baseline scenario

In absence of the project, households and institutions cook on traditional stoves with conventional fuels, mainly charcoal. There may be additional usage of some electricity and very little LPG. The project targets users with charcoal as primary fuel (which is the predominant fuel in the vast majority of the urban population in Zambia anyway). Preliminary evaluations have shown that project stoves are generally used to replace charcoal, because charcoal is less convenient in comparison to LPG and electricity. Nevertheless, a proportional replacement of baseline fuels is assumed, based on an evaluation of useful cooking energy delivered by the different fuels. As require by MECD 3.4.1, a baseline emission factor per useful energy unit is derived from the mix of baseline fuels and then applied to the useful cooking energy delivered by the project.

A detailed study on cooking fuels has been evaluated: "Alternatives to charcoal (A2C) – Baseline Report", published 2022 by USAID[6]. It reports the results of an exhaustive survey conducted with >2,000 representative households in Lusaka, Ndola and Solwezi, distinguishing settlement areas of high, medium and low density areas. (High density areas show the lowest incomes; the vast majority of the VPA's target group lives in these areas). The report shows a huge prevalence of charcoal in all areas, with 99% of households using it in high-density areas. Electricity as the second fuel was found to be used by a small part of the population mainly for small cooking tasks like breakfast and snacks, LPG was found to play a very minor role. The findings confirm findings of a national survey by the Zambian government in 2017[7] showed average charcoal consumption > 1 ton per household and year (page 12: "*Daily national average household charcoal consumption across the seasons was estimated at 3.4 kg per household per day translating to an annual average of 1, 235.5kg per household*".

A detailed description on how baseline fuel consumptions were evaluated from the report is given in B.6.1 under parameter $\boldsymbol{P_{b,d,j}}$ and in the ER calculation sheet.

[6] Report provided to VVB
[7] Report provided to VVB

B.5. Demonstration of additionality

Use this table for Automatic Additionality Only – delete if N/A

Specify the methodology, activity requirement or product requirement that establishes deemed additionality for the proposed project (including the version number and the specific paragraph, if applicable).	According to the GS community services activity requirements section 4.1.9. (c) – community services microscale projects are automatically additional.
Describe how the proposed VPA meets the criteria for deemed additionality.	The VPAs falls under microscale projects, hence deemed additional.

Additionality is shown in A.1.1 under inclusion criteria (#7).

The VPA meets the conditions for additionality in the PoA inclusion criteria (#7), since improved biomass cookstoves are distributed.

B.5.1. Prior Consideration

The start date (07/04/2022) is within after the date of first submission (26/12/2021).

B.5.2. Ongoing Financial Need

N/A

B.6. Sustainable Development Goals (SDG) outcomes

Relevant Target/Indicator for each of the three SDGs

Sustainable Development Goals Targeted	Most relevant SDG Target	SDG Impact Indicator (Proposed or SDG Indicator)
13 Climate Action	N/A	Reduced GHG emissions

3 Good health and wellbeing	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	• Avoided kitchen smoke exposure • Reduced reported health impacts of kitchen smoke
5 Gender equality	5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	Time saved by women from faster cooking
7 Affordable and clean energy	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	Access to improved cooking technology
8 Decent work and economic growth	8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	Employment generation

B.6.1. Explanation of methodological choices/approaches for estimating the SDG Impact

Baseline Emissions

According to the methodology MECD, a baseline emission factor per unit of useful cooking energy will be established, based on the fuel mix in the pre-project case and baseline stove efficiencies. Baseline emissions will then be calculated by multiplying the useful cooking energy provided by project devices (based on monitoring of pellet consumption) with the baseline emission factor.

Baseline Emission Factor:

$$= \sum_k \left(\sum_{i,j} P_{b,i,j} \times EF_{b,i} \times fNRB_{i,y} \right)_k \div \sum_k \left(\sum_{i,j} P_{b,i,j} \times NCV_{b,i} \times \eta_{b,i,j} \right)_k \quad \textit{Eq 1 of MECD}$$

Where:

EF_b	=	Baseline emissions factor (tCO_2e per TJ of useful energy)
$P_{b,i,j}$	=	Amount of baseline fuel *i* used in device *j* in year *y* (tonnes)
$EF_{b,i}$	=	Emission factor of the baseline fuel *i* (tCO_2e/tonne)
$fNRB_{i,y}$	=	Non-renewability status of woody biomass fuel i during year y
$NCV_{b,i}$	=	The net calorific value of the baseline fuel type *i* (TJ/tonne)
$\eta_{b,i,j}$	=	Efficiency of baseline device *j* with fuel i (fraction)
k	=	Household *k* from the target population
j	=	Baseline devices *j*
i	=	Baseline fuel *i*

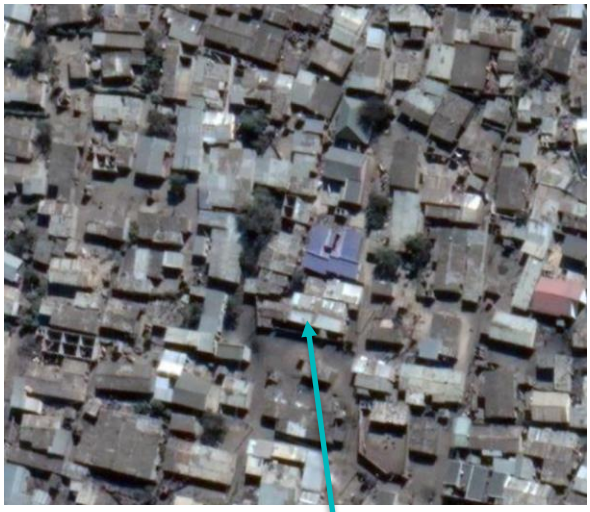
Parameter values for Eq. 1 are obtained as described in the parameter tables (B.6.2). On ***$P_{b,d,j}$*** explanations are also given here below. On ***fNRB***, explanation have been moved to the bottom of this section B.6.1., for better readability.

$P_{b,d,j}$

Baseline fuels considered include charcoal, electricity and LPG. *fNRB* is applied for charcoal, but obviously not for electricity or LPG. The reference for baseline fuel consumptions is the report "Alternatives to charcoal (A2C) – Baseline Report", published 2022 by USAID[8]. It reports the results of an exhaustive survey conducted with >2,000 representative households in Lusaka, Ndola and Solwezi, distinguishing settlement

[8] Report provided to VVB

areas of high, medium and low density areas. High density areas show the lowest incomes; the vast majority of the VPA's target group lives in these areas. They can be distinguished easily on satellite images:



High density area

Low density area

The report mentions average annual charcoal quantities consumed in the three areas:

Table 7: Household charcoal consumption by Population-density areas

Housing Area	Quantity (kg)		Expenditure (ZMW/year)	
	Monthly	Annual	Monthly	Annual
High Density	67	802	190	2277
Medium Density	66	796	178	2135
Low Density	66	792	171	2048

For other fuels, no quantities are indicated, but relative usage becomes clear from data on cooking events shown:

Table 22: Energy source use by cooking and heating event and by population density

Population	Energy source	Meal/Purpose				
		Breakfast	Lunch	Dinner	Snack	Water heating
Low density	Electricity	61	37	43	60	41
	LPG	6	6	6.6	6	4
	Ethanol	0	0	0.2	0.2	0
	Charcoal	33	57	50	33.6	55
	Pellets	0	0	0	0	0
	Paraffin	0	0	0.2	0.2	0
	Solar	0	0	0	0	0
Medium density	Electricity	41	18	24	40	19.8
	LPG	1	1	1	1	0.2
	Ethanol	0	0	0	0	0
	Charcoal	58	81	75	59	80
	Pellets	0	0	0	0	0
	Paraffin	0	0	0	0	0
	Solar	0	0	0	0	0
High density	Electricity	23	6	7.4	20	8.7
	LPG	0.4	0.3	0.4	0.4	0.2
	Ethanol	0	0	0.1	0	0.1
	Charcoal	76.5	93.6	92	79.5	91
	Pellets	0.1	0.1	0.1	0.1	0
	Paraffin	0	0	0	0	0
	Solar	0	0	0	0	0

It becomes clear that the cleanest fuels (electricity and LPG) are mostly used for smaller cooking events (breakfast and snack). It is therefore conservative to assume equal amounts of cooking energy fuel to be used in each event, since the "dirtiness" of the baseline will be underestimated. (See also ER calculation sheet for a demonstration of conservativeness).

For the calculation of the baseline emission factor, amounts of electricity and LPG are derived from useful cooking energies which are deducted from the percentages is the table (See ER calculation sheet).

Overall baseline emissions are calculated as per Eq. 2:

$$BE_y = EG_{p,useful,y} \times EF_b$$ *Eq. 2 of MECD*

Where:

BE_y	=	Baseline emissions (tCO_2e) in the year y
$EG_{p,useful,y}$	=	The amount of useful energy applied in the project in year y (TJ)
EF_b	=	Baseline emissions factor (tCO_2e per TJ of useful energy)

The amount of useful energy applied in the project is derived by Eq. 4. (Eq. 3 of MECD is not applicable since no electric stoves are deployed):

$$EG_{p,useful,y} = \sum_d P_{p,d,y} \times NCV_{p,i} \times \eta_{p,d,y}$$ *Eq. 4 of MECD*

Where:

$EG_{p,d,y}$	=	The amount of fuel used in the project in by device *d* in year *y*, considering cap (mass or volume unit)
$NCV_{p,i}$	=	The net calorific value of the fuel *i* used in the project scenario in year *y*
$\eta_{p,d,y}$	=	Energy efficiency of the project device, *d* in year *y* (fraction)
d	=	Project device *d*

All parameters used to calculate Eq. 4 are monitored, as explained in B.7.1

Project Emissions

Since the project uses biomass-based fuel, project emissions associated with production and transport of fuel must be evaluated (3.6.2 of MECD).

Pellet production uses electricity. A highly conservative value of 250kWh/ton of pellets is used, higher than according to a fact sheet of the World Bioenergy Association that gives a range from 100-200kWh/t[9]. This is substantiated with power ratings of pellet production machinery[10]. A grid emission factor of 1kg CO_2/kWh is conservatively chosen, clearly above the highest value for the combined margin in the latest CDM standardized baseline[11] which showed a decreasing tendency. It is increased by 20% according to the CDM default value for TDL (Average technical transmission and distribution losses, see CDM tool 5 version 3 7.2[12])

Project emissions from electricity consumption are thus calculated as (according to equation 1 of CDM tool 5 version 3):

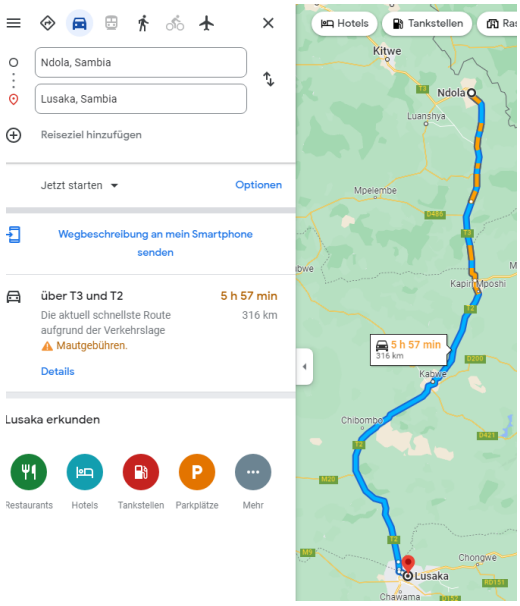
$$PE_{electricity,y} = 0.25\ MWh * P_{total,y} * 1tCO_2/MWh\ (1+20\%) = 0.3tCO2 * P_{total,y}$$

Where:

$PE_{electricity,y}$ = Project emissions caused by electricity consumption for pellet production

$P_{total,y}$ = Total amount of pellets consumed in project devices in a monitoring period

Transport emission have to be considered according to 3.6.3 C of MECD; the pellet factory is situated in Ndola, 316 km from Lusaka. Transport emissions are considered in a generalized way by applying an emission factor given in the CDM tool "Project and leakage emissions from transportation of freight, version 1.1" [13]. In section 5.3, default values of 129/245 gCO2/tkm are given for light/heavy vehicles. The average (187) is applied, assuming 50% usage of each vehicle type. This is a conservative choice because



[9] www.worldbioenergy.org/uploads/Factsheet%20-%20Pellets.pdf

[10] Three main motors are:
-wood chipper (1.5 t/hr): 35 kW --> maximum 23 kW per tonne processed
-hammer mill (2.5 t/hr): 160kW --> maximum 64 kW per tonne processed
-pellet press (1.7t/hr): 160kW --> maximum 94 kW per tonne processed
With all motors running at 100% (normally at about 50%), it would take 181 kWh to produce a tonne of pellets

[11] https://cdm.unfccc.int/methodologies/standard_base/2015/sb131.html

[12] am-tool-05-v3.0.pdf (unfccc.int)

[13] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf

mostly heavy vehicles are use which are transporting much larger quantities of pellets per ride. If multiplying with 316km, project emissions of 59kg CO2/t is obtained. This is conservatively set to 0.06tCO_2 per ton of biomass.

Since transport is contracted, it is plausible that vehicles will return with load also, therefore, one-way trips can be assumed.

$PE_{transport,y} = 0.06tCO_2 * P_{total,y}$

Where:

$PE_{transport,y}$ = Project emissions caused by transport of pellets

$P_{total,y}$ = Total amount of pellets consumed in project devices in a monitoring period

Furthermore, pellets cause CO_2 emissions when burned in the project stove. Mostly, pellets are made from sawdust which is waste biomass, equivalent to renewable biomass. Where raw biomass other than sawdust is used that cannot be deemed waste biomass, project emissions are calculated by applying the same factors that apply for wood consumed for charcoal production in the baseline.

$PE_{combustion,pellets,y} = P_{total,y} * conversion_{wood\_pellets} * share_{non\text{-}waste} * EF_{b,wood} * f_{NRB}$

Where:

$PE_{combustion,\ pellets,y}$ = Project emissions caused by burning pellets in the project stove

$conversion_{wood\_pellets}$ = Wood-to-pellet conversion factor (1.2, meaning that 1.2t dry woody biomass are required to produce 1t of dry pellets, see explanation in parameter table in B.6.2)

$share_{non\text{-}waste}$ = Percentage of the raw material not deemed waste biomass (equivalent to non-renewable), monitored.

$EF_{b,wood}$ = Emission factor for wood 1.89t CO2/t, based on 121.6tCO2/TJ[14]) times NCV_{wood} (0.0156TJ/t[15])

[14] $EF_{wood,per\ energy}$ (121.6tCO2/TJ), as per table 2.5 of Chapter 2 of Vol. 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories (112,000 kgCO2/TJ, 300kgCH4/TJ and 4kgN2O/TJ), and AR 5 GWPs (28 for CH4 and 265 for N2O)
[15] Table 1.2 of Chapter 1, Introduction to Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Total project emissions are thus calculated as:

$PE_y = PE_{electricity,y} + PE_{transport,y} + PE_{combustion,pellets,y}$

Leakage Emissions

MECD makes reference to 3.11 of RECH. Here an approach is described for a systematic assessment of leakage.

a. The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or with a higher intensity than would have occurred in the absence of the project.

Baseline stoves will often remain in use, while continued usage is automatically considered when monitoring fuel consumption in the project stove. If baseline stoves should be displaced, it is not plausible that other households would use these devices and in consequence increase biomass consumption. Since biomass is the cheaper option, non-availability of conventional biomass stoves is not a limiting factor.

b. Members of the population who do not participate in the project, and previously used lower emitting energy sources, instead use the non-renewable biomass or fossil fuels saved under the project activity.

The VPA is too small to have a significant effect on the charcoal market, given that there are > 500,000 HH in Lusaka only, a multiple of HH targeted by the VPA.

c. The project significantly reduces the NRB fraction within an area where other GHG mitigation project activities account for NRB fraction in their baseline scenario.

The influence of the VPA on fNRB is insignificant, given that there are > 500,000 HH in Lusaka only.

d. The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of space heating or by retaining some use of inefficient technology.

The climate in Lusaka is very stable, average temperatures are >20°. Moreover, baseline stoves will often remain in use, while continued usage is automatically monitored by metering pellet consumption.

e. By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution with this technology by households who commonly used a technology with relatively lower emissions.

All users are known to the project, both stoves and fuel are sold centrally. Moreover, the baseline survey considers average usage of different technologies (of which the project technology is still the most efficient).

In conclusion, no leakage emissions have to be considered.

Calculation of Emission Reductions

$$ER_y = BE_y - PE_y - LE_y$$ *Eq. 7of MECD*

Where:

ER_y	=	Emission reductions in year y (t CO2e/yr)
BE_y	=	Baseline emissions in year y (t CO2e/yr)
PE_y	=	Project emissions in year y (t CO2/yr)
LE_y	=	Leakage emissions in year y (t CO2/yr)

Determination of the fraction of non-renewable biomass

As per the CDM tool "Calculation of the fraction of non-renewable biomass" (V.3.0)[16].

The overall equation to be applied is:

$$fNRB = \frac{NRB}{NRB + RB} \qquad \textbf{(equation 1 of tool)}$$

where:

fNRB:	*Fraction of non-renewable biomass (fraction or %)*
NRB:	*Quantity of non-renewable biomass (t/yr)*
RB:	*Quantity of renewable biomass (t/yr)*

The quantity of non-renewable biomass is derived by the equation given by:

$$NRB = H - RB \qquad \textbf{(equation 2 of tool)}$$

Where:

H: Total annual consumption of wood in the absence of the project activity in tons/yr

Determination of the total wood consumption *H*

$$H = HW * N + CE + NE - RB \qquad \textbf{(equation 3 of tool)}$$

Where:

*HW * N:*	*Total household's fuelwood consumption in tons. The tool par. 15 allows to use an aggregated value for consumption per household (HW) times the number of households (N).*
CE:	*Commercial woody biomass consumption for energy applications (e.g., commercial, industrial or institutional uses of woody biomass in ovens, boilers etc.) that are extracted from forests or other land areas in the applicable area in the relevant period (tonnes)*
NE:	*Commercial woody biomass consumption for non-energy applications (e.g. construction, furniture) that are extracted from forests or other land areas in the applicable area in the relevant period (tonnes)*

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

The fNRB calculation is based on the calculation of CDM PoA 8060 (Improved Cookstoves Program for Zambia), available at https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/ZG3XY1INVKUQ2WEO4FC0PTMD5JRLAB/view .

It has been updated with recent values and adjusted for the new version of the CDM tool 30 (version 3.0 instead of 2.0)

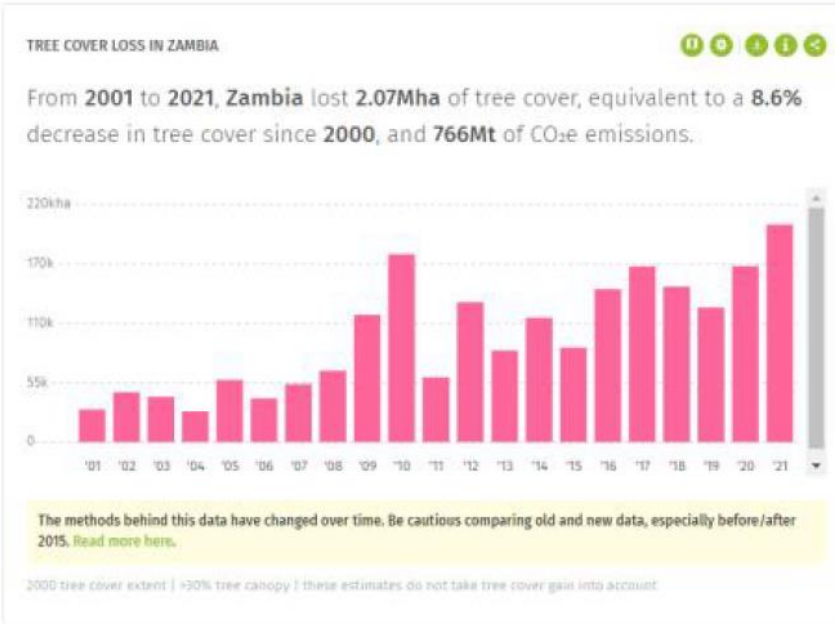
Details are given in the ER calculation sheet. Here, accumulated values per parameter are shown.

NRB = H – RB = 28.86 – 3.78 = 25.01 mio tonnes of biomass per year

fNRB = NRB/(NRB+RB) = 25.01 / (25.01+3.78) = **86.9%**

The calculation is conservative because values of renewable biomass supply have not been updated from 2018, in spite of heavily increasing deforestation going on in Zambia[17]:

[17] https://www.globalforestwatch.org/dashboards/country/ZMB/?category=summary&location=WyJjb3VudHJ5IiwiWk1CIl0%3D&map=eyJjZW50ZXIiOnsibGF0IjotMTMuMjI0NDY0OTg3ODAyNzAxLCJsbmciOjI3Ljg1MjM1MDIzNTAwNDIxNn0sInpvb20iOjUuMzUyMTQ1MTcxNjM2NzY3LCJjYW5Cb3VuZCI6ZmFsc2UsImRhdGFzZXRzIjpbeyJvcGFjaXR5IjowLjcsInZpc2liaWxpdHkiOnRydWUsImRhdGFzZXQiOiJwcmltYXJ5LWZvcmVzdHMiLCJsYXllcnMiOlsicHJpbWFyeS1mb3Jlc3RzLTIwMDEiXX0seyJkYXRhc2V0IjoicG9saXRpY2FsLWJvdW5kYXJpZXMiLCJsYXllcnMiOlsiZGlzcHV0ZWQtcG9saXRpY2FsLWJvdW5kYXJpZXMiLCJwb2xpdGljYWwtYm91bmRhcmllcyJdLCJib3VuZGFyeSI6dHJ1ZSwib3BhY2l0eSI6MSwidmlzaWJpbGl0eSI6dHJ1ZX0seyJkYXRhc2V0IjoidHJlZS1jb3Zlci1sb3NzIiwibGF5ZXJzIjpbInRyZWUtY292ZXItbG9zcyJdLCJvcGFjaXR5IjoxLCJ2aXNpYmlsaXR5Ijp0cnVlLCJ0aW1lbGluZVBhcmFtcyI6eyJzdGFydERhdGUiOiIyMDAyLTAxLTAxIiwiZW5kRGF0ZSI6IjIwMjEtMTItMzEiLCJ0cmltRW5kRGF0ZSI6IjIwMjEtMTItMzEifSwicGFyYW1zIjp7InRocmVzaG9sZCI6MzAsInZpc2liaWxpdHkiOnRydWV9fV19&showMap=true



This is also underlined by the fact that similar projects use a slightly higher values of 88-89% (CDM PoA 6864, CDM PoA 8060, GS 10886, GS11145).

B.6.2. Data and parameters fixed ex ante

Copy the table for each piece of data and parameter; use headings to group parameter tables by SDG

SDG13

Data/parameter ID	MECD 1
Data/parameter	$P_{b,i,j}$
Unit	Tonne/ year-device
Description	Amount of baseline fuel i used in device j (tonnes) in the baseline.

Source of data	"Alternatives to charcoal (A2C) – Baseline Report", published 2022 by USAID[18]. It reports the results of an exhaustive survey conducted with >2,000 representative households in Lusaka, Ndola and Solwezi, distinguishing settlement areas of high-, medium- and low-density areas. High-density areas show the lowest incomes; the vast majority of the VPA's target group lives in these areas.
Value(s) applied	<table><tr><th rowspan="2">Parameter</th><th colspan="3">Value per density area</th><th rowspan="2">Unit</th></tr><tr><th>high</th><th>medium</th><th>low</th></tr><tr><td>$P_{b,charcoal}$</td><td>0.802</td><td>0.796</td><td>0.792</td><td>t/a</td></tr><tr><td>$P_{b,electricity}$</td><td>267</td><td>713</td><td>1,857</td><td>kWh/a</td></tr><tr><td>$P_{b,LPG}$</td><td>1.13</td><td>2.76</td><td>24.23</td><td>kg/a</td></tr></table> Note: Values for charcoal are directly taken from A2C report, values for electricity and LPG are calculated back from useful cooking energy based on shares of cooking events for which different fuels are used. (See B.6.1 and ER calculation sheet for details).
Choice of data or Measurement methods and procedures	Third party study
Purpose of data	Emission reduction calculation
Additional comment	

Data/parameter ID	MECD 2
Data/parameter	$NCV_{b,i}$
Unit	Terrajoules (TJ)/tonne of fuel (charcoal and LPG), GJ/kWh (electricity)
Description	The net calorific value of the baseline fuel type i
Source of data	IPCC default data: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol 2 Chapter 1, Table 1.2

[18] Report provided to VVB

	-
Value(s) applied	Charcoal: 0.0295 Electricity: 0.0036GJ/kWh LPG: 0.047 Note: For electricity, just the conversion factor GJ/kWh is applied.
Choice of data or Measurement methods and procedures	IPCC default values
Purpose of data	Emission reduction calculation
Additional comment	n/a

Data/parameter ID	MECD 3
Data/parameter	$EF_{b,i}$
Unit	tCO_2e/tonne (charcoal and LPG), tCO2/kWH (electricity)
Description	The emission factor of baseline fuel *i*
Source of data	IPCC default value converted by applying $NCV_{b,i}$
Value(s) applied	Charcoal: 11.37 Electricity: 0.87tCO2e/MWh LPG: 2.98
Choice of data or Measurement methods and procedures	**Charcoal:** Based on $EF_{wood,per\ energy}$ (121.6tCO2/TJ[19]) times NCV_{wood} (0.0156TJ/t) times 6 wood equivalents per t of charcoal[20]) **Electricity:** Conservative estimate: Build margin for South African Power Pool[21]

[19] $EF_{wood,per\ energy}$ (121.6tCO2/TJ), as per table 2.5 of Chapter 2 of Vol. 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories (112,000 kgCO2/TJ, 300kgCH4/TJ and 4kgN2O/TJ), and AR 5 GWPs (28 for CH4 and 265 for N2O)
[20] www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf
[21] https://cdm.unfccc.int/methodologies/standard_base/2015/sb131.html

	LPG: Calculated as NCV_{LPG} X 63.1 kgCO2/GJ (Table 2.5 of Chapter 2 of Vol. 2, 2006 IPCC Guidelines))
Purpose of data	Emission reduction calculation
Additional comment	The parameter is used to calculate baseline emissions factor.

Data/parameter ID	MECD 4
Data/parameter	$\eta_{b,i,j}$
Unit	Fraction
Description	Energy efficiency of baseline device *j* with fuel *i*
Source of data	Charcoal: MECD default value for other conventional systems using woody biomass Electricity: https://www.aceee.org/files/proceedings/2014/data/papers/9-702.pdf LPG: Scientific paper [22]
Value(s) applied	Charcoal: 20% Electricity: 74% LPG: 51%
Choice of data or Measurement methods and procedures	- According to the methodology for metered & measured cooking devices: Other conventional systems using woody biomass: default efficiency 20%
Purpose of data	Emission reduction calculation
Additional comment	The parameter is used to determine the baseline emission factor.

[22] cited on http://aprovecho.org/the-big-picture/lpg-cooking-and-health

Data/parameter ID	No ID assigned, not described in MECD
Data/parameter	$Conversion_{wood\text{-}pellets}$
Unit	t/t
Description	Conversion factor wood-pellet. This parameter is only needed if non-renewable biomass is used to produce pellets, i.e. if $Share_{non\text{-}waste}$ >0 (see B.7.1). It indicates how much woody biomass is used as input to generate a ton of pellets.
Source of data	Derived from factory data.
Value(s) applied	1.2 (preliminary value)
Choice of data or Measurement methods and procedures	When woody biomass is transformed into pellets, a mass reduction occurs, basically due to moisture reduction. Incoming biomass typically has a moisture content between 20% and 45%, since it is stored in huge piles (for example, sawdust at sawmills). Pellets have an average moisture content around 8%. During moisture reduction, the carbon content of biomass does not change. For the calculation of project emission due to combustion of pellets made from non-renewable biomass ($PE_{combustion,pellets,y}$), default values for NCV_{wood} and EF_{wood} for air dried wood with up to 20% moisture are used[23]. If solely considering differences in moisture, 1kg of pellets corresponds to 1.11 kg wood (120%/108%).

[23] AMS-II.G parameter table "NCVwood"; 20% fuelwood moisture is a conservative estimate for air dried wood: https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1903131256_Seasoning_Wood_Web_Feb_2019_V5.pdf ; IPCC Guidelines for GHG inventories Vol. 2 Ch.2 table 2.9: *"Values were originally based on gross calorific value; they were converted to net calorific value by assuming that net calorific value for dry wood was 20 per cent lower than the gross calorific value."*

	Normally, all biomass is transformed into pellets. However, there may be some losses of biomass in the process, due to dust and unusable bark (which is waste in anyway). We conservatively assume a loss of 8.9% biomass. The resulting wood-to-pellet factor is thus set as 1.2
Purpose of data	Project Emission reduction calculation
Additional comment	Fixed for the project for the crediting period. It will be reassessed at each crediting period renewal.

Data/parameter ID	No ID assigned, entirely based on other Parameters
Data/parameter	EF_b
Unit	tCO_2e per GJ of useful energy
Description	Baseline emissions factor
Source of data	Calculated according to equation 1 of MECD (see B.6.3 and ER calculation sheet for the detailed calculation).
Value(s) applied	**Value per density area** | | | | **high** | **medium** | **low** | | **1.49** | **1.27** | **0.93** | **tCO2/GJ**
Choice of data or Measurement methods and procedures	See other parameter tables in this section and calculation in B.6.3
Purpose of data	Emission reduction calculation
Additional comment	Fixed for the project for the crediting period. It shall be reassessed at each crediting period renewal. This parameter table was included due to the central position of EF_b.

B.6.3. Ex ante estimation of SDG Impact

SDG 13 Reduced GHG emissions

A step-by-step calculation according to formulas in the MECD methodology is shown below for stoves in the different density areas.

Step 1: Baseline emission factor

$$EF_b = \sum_k \left(\sum_{i,j} P_{b,i,j} \times EF_{b,i} \right)_k \div \sum_k \left(\sum_{i,j} P_{b,i,j} \times NCV_{b,i} \times \eta_{b,i,j} \right)_k$$

1 a) Emissions from baseline fuel consumption					$\sum_{i,j} P_{b,i,j} \times EF_{b,i} \times fNRB_{i,y}$	
Parameter	Value per density area			Unit	Explanation	Source
	high	medium	low			
$P_{b,charcoal}$	0.802	0.796	0.792	t/a	charcoal consumption (t/a)	Baseline survey „Alternatives to charcoal"
$P_{b,electricity}$	267	713	1857	kWh/a	electricity consumption (kWh/a)	calculated back from cooking energy in 1b)
$P_{b,LPG}$	1.13	2.76	24.23	kg/a	LPG consumption (t/a)	
$EF_{b,charcoal}$	11.37			tCO2/t	Emission factor charcoal	See parameter table B.6.2
$EF_{b,electricity}$	0.87			tCO2/MWh	Grid emission factor electricity	
$EF_{b,LPG,t}$	2.98			tCO2/t	Emission factor LPG	
f_{NRB}	86.9%				Fraction non-renewable biomass	calculated (see B.6.1)
$Emissions_{b,charcoal}$	7.92	7.86	7.82	tCO2/a	Baseline emissions charcoal	calculated as Pb,charcoal * Efb, charcoal * fNRB
$Emissions_{b,electricity}$	0.23	0.62	1.62	tCO2/a	Baseline emissions electricity	calculated from useful energy (1b) and grid emission factor
$Emissions_{b,LPG}$	0.00	0.01	0.07	tCO2/a	Baseline emissions LPG	calculated as Pb,LPG * $EF_{b,LPG}$
$Emissions_{b,\ total}$	**8.16**	**8.49**	**9.51**	**tCO2/a**	Baseline emissions total	calculated as $\sum Emissions_b$

1 b) Baseline useful energy					$\sum_{i,j} P_{b,i,j} \times NCV_{b,i} \times \eta_{b,i,j}$	
	Value per density area					
Parameter	**high**	**medium**	**low**	**Unit**	**Explanation**	**Source**
$NCV_{charcoal}$	0.0295			TJ/t	Net calorific value charcoal	IPCC default
$NCV_{electricity}$	0.0036			GJ/kWh	Net calorific value electricity	calculated via grid emission factor
NCV_{LPG}	0.0473			TJ/t	Net calorific value LPG	IPCC default
$\eta_{charcoalstove}$	20%					MECD default conventional charcoal stove
$\eta_{electricstove}$	74%				Electric stove efficiency	conservative assumption
$\eta_{LPGstove}$	51%				LPG stove efficiency	See parameter table
$EG_{charcoal,useful}$	4.73	4.70	4.67	GJ/a	Useful energy charcoal	Calculated
$EG_{electricity,useful}$	0.71	1.90	4.95	GJ/a	Useful energy electricity	Calculated from fuel shares for cooking events, B.6.1
$EG_{LPG,useful}$	0.03	0.07	0.58	GJ/a	Useful energy LPG	
EGuseful, total	**5.47**	**6.66**	**10.20**	**GJ/a**	right part of formula	Calculated
1 c) Baseline Emission Factors					Emissions from baseline fuel consumption / Baseline useful energy	
EF_b	**1.491**	**1.275**	**0.932**	**tCO2/GJ**	**Baseline emission factor**	calculated

Step 2: Useful energy delivered by the project

$$EG_{p,useful,y} = \sum_d P_{p,d,y} \times NCV_{p,i} \times \eta_{p,d,y}$$

Parameter	**Value**	**Unit**	**Explanation**	**Source**
$P_{pellets,d,y}$	0.324	t/a	Pellet consumption per stove	monitored, now preliminary value
$NCV_{pellets}$	0.0176	TJ/T	Net calorific value pellets	monitored, now preliminary value
$\eta_{pellets}$	54.7%		Mimimoto stove efficiency	ISO test certificate
$EG_{p,useful}$	**3.12**	GJ/a	Useful energy pellets	calculated

Step 3: Baseline emissions derived from useful project energy

$$BE_y = EG_{p,useful,y} \times EF_b$$

Parameter	Value per density area			Unit	Explanation	Source
	high	medium	low			
$EG_{p,\ useful}$	3.12			GJ/a	Useful energy pellets	from above
EF_b	1.49	1.27	0.93	tCO2/TJ	Baseline emission factor	from above
BE_y	**4.65**	**3.98**	**2.91**	**tCO2/a**	**Baseline emissions**	calculated

Step 4: Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Parameter	Value per density area			Unit	Explanation	Source
	high	medium	low			
BE_y	4.65	3.98	2.91	tCO2/a	Baseline emissions	from above
$PE_{electricity,y}$	0.10			tCO2/a	Project emissions from electricity	calculated as 0.2tCO2/tpellets, see B.6.1
$PE_{transport,y}$	0.02			tCO2/ton pellets	Project emissions from transport	calculated as 0.05tCO2/tpellets, see B.6.1
$Share_{non\text{-}waste}$	10%				Share of pellets made from non-waste biomass	Monitored, now preliminary value
$convers_{wood\text{-}pellets,y}$	1.2				Wood per pellet (dry basis)	Fixed ex-ante (see B.6.2)
$PE_{combustion,pellets,y}$	0.06			tCO2/a	Project emissions from burning pellets	calculated from wood emission factor and wood consumption for pellet production
PE_y	0.18			tCO2/a	Project emissions	Sum of project emissions
LE_y	0.00			tCO2/a	Leakage emissions	See B.6.1
ER_y	**4.47**	**3.8**	**2.73**	**tCO2/a**	**Emission reductions per average stove**	calculated

SDG 3: Avoided or reduced smoke exposure

$$SmokeAvoided_y = N_{improvedstove,y} * Share\_charcoal\_baseline$$

Where:

$SmokeAvoided_y$	Avoided kitchen smoke exposure in person-years
$N_{improvedstove,y}$	Number of smoke-reduced cookstoves (such as portable rocket stoves)
$Share\_charcoal\_baseline$	Share of charcoal energy usage in the baseline

Preliminary annual result per stove: $SmokeAvoided_y$ = 1 stove * 80% of charcoal usage in the baseline = 0.8 person-years

Note: 80% charcoal usage conservatively derived from useful cooking energy in the baseline (4.73/5.47 GJ/a)

SDG 3: Reduced health impacts

$$Healthimprovement_y = N_{P,y} * U_{P,y} * 80\%$$

Where:

$Healthimprovement_y$	Reported health improvements such a cough reduction in person-years
$Share_{healthimproved,y}$	Share of positive respondents (ex-ante estimate). Will be monitored.

Preliminary annual result per stove: $Healthimprovement_y$ = 1 stove * 80% of positive respondents line = 0.8 person-years

SDG 5: Time savings

For ex-ante calculations:

$$Timesavedtotal_y = N_{P,y} * Timesavedstove$$

Where:

$Timesavedtotal_y$	Accumulated time saved from faster cooking
$Timesavedstove$	Average time saved per stove due to faster cooking (mainly stove lighting)

Preliminary annual result per stove: $Timesavedtotal_y$ = 1 stove * 10min * 365days = 61 hours

SDG 7: Improved access to cleaner cooking energy

$$Accesscleanercooking_y = N_{P,y} * Householdsize$$

Where:

$Accesscleanercooking_y$	Access to clean cooking in personyears
$Householdsize$	Average number of persons per household

Preliminary annual result per stove: $Acccesscleanercooking_y$ = 1 stove * 5 = 5 person-years

SDG 8: Job openings)

Calculated based on payrolls. Standardized to person-years of fulltime employment (for example, two persons with half time job are equivalent to one person with a full-time job.

Preliminary annual average: 5 person years (5 full-time employees)

B.6.4. Summary of ex ante estimates of each SDG outcome

SDG 13: Reduced GHG emissions

Results are based on the distribution of 2,200 stoves with an average ER for 4.47tCO2/a (preliminary assumption). During the first year, only 50% impact is expected due to stepwise distribution.

ER measured in tCO2e

Year	Baseline estimate	Project estimate	Net benefit
Year 1	5,117	199	4,918
Year 2	10,234	397	9,836
Year 2	10,234	397	9,836
Year 4	10,234	397	9,836
Year 5	10,234	397	9,836
Year n (delete if N/A)			
Total	**46,051**	**1,789**	**44,263**
Total number of crediting years: 5			
Annual average over the crediting period	9,210	358	8,853

SDG 3: Reduced kitchen smoke exposure

Results are based on 2,200 households targeted. During the first year, only 50% impact is expected due to stepwise distribution.
Calculated in person-years. Assumption: A household switches from 80% charcoal cooking on a traditional charcoal stove to cooking on a project stove. This household contributes 0.8 person-years of reduced smoke exposure per year.

Year	Baseline estimate	Project estimate	Net benefit
Year 1			880
Year 2			1,760
Year 2			1,760
Year 4			1,760
Year 5			1,760
Total			**7,920**
Total number of crediting years: 5			
Annual average over the crediting period			1,584

SDG 3: Reduced reported health impacts of kitchen smoke

Results are based on 2,200 households targeted. During the first year, only 50% impact is expected due to stepwise distribution.

Calculated in person-years. Assumption: 80% of households report perceived health improvements. An average household therefore contributes 0.8 person-years of reduced smoke exposure per year.

Year	Baseline estimate	Project estimate	Net benefit
Year 1			880
Year 2			1,760
Year 2			1,760
Year 4			1,760
Year 5			1,760
Total			**7,920**
Total number of crediting years: 5			
Annual average over the crediting period			1,584

SDG 5: Time saved from faster stove lighting procedure

Results are based on 2,200 households targeted. During the first year, only 50% impact is expected due to stepwise distribution. Calculated in total hours saved, assuming 10min saved per day.

Year	Baseline estimate	Project estimate	Net benefit
Year 1			66,917
Year 2			133,833
Year 2			133,833
Year 4			133,833
Year 5			133,833
Total			**602,250**
Total number of crediting years: 5			
Annual average over the crediting period			120,450

SDG 7: Access to clean cooking

Results are based on 2,200 households targeted, with average household size of 5. (Access to clean cooking is calculated per person). During the first year, only 50% impact expected due to stepwise distribution. Calculated in person-years, accounting for all household members (5 assumed).

Year	Baseline estimate	Project estimate	Net benefit
Year 1			5,500
Year 2			11,000
Year 2			11,000
Year 4			11,000
Year 5			11,000
Total			**49,500**
Total number of crediting years: 5			
Annual average over the crediting period			9,900

SDG 8: Job Openings

Calculated in person-years. Preliminarily, 5 full-time employees assumed.

Year	Baseline estimate	Project estimate	Net benefit
Year 1			25
Year 2			25
Year 2			25
Year 4			25
Year 5			25
Total			**125**
Total number of crediting years: 5			
Annual average over the crediting period			25

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

SDG 13

Data/parameter ID	MECD 5
Data / Parameter	$\eta_{p,d,y}$
Unit	Fraction
Description	Thermal efficiency of the project device
Source of data	Any of the following sources shall be used: - Manufacturer specifications - Third-party certification by a qualified entity - Commercial guarantee Technical reports from the installer
Value(s) applied	Mimi Moto: 54.7% No decrease of this value is considered (see below).Supamoto Stove: 55% No decrease of this value is considered (see below).
Measurement methods and procedures	Certified ISO/WBT (certificates provided). Certificate of the Advanced Biomass Lab of Colorado State University on non-decrease of efficiency. See A.3. The same rational applies to the Supamoto stove.
Monitoring frequency	Annual
QA/QC procedures	Regular maintenance of stoves as described to ensure that ensure full functioning of the critical factors, see A.3.
Purpose of data	This parameter is used in the determination of useful energy
Additional comment	Non-decrease of efficiency is plausible since in case of failures, pyrolysis for gasification and thereby stove operation will stop, see A.3.

Data/parameter ID	MECD 9
Data/parameter	$f_{NRB,y}$
Unit	% (fraction of non-renewability)
Description	Non-renewability status of woody biomass fuel in scenario i during year y
Source of data	Applicable NRB assessment following the main methodology
Value(s) applied	86.9%
Measurement methods and procedures	See fNRB calculation sheet, following the CDM tool 30 version 3.0.
Monitoring frequency	It is planned to establish fNRB once at the beginning of a crediting period instead of monitoring it annually. This is conservative given the heavily increasing deforestation in Zambia (see B.6.1).
QA/QC procedures	Conservative estimates, application of CDM tool.
Purpose of data	As applicable, NRB assessment may be used for multiple scenarios where woody biomass is used
Additional comment	It is planned to establish fNRB once at the beginning of a crediting period instead of monitoring it annually. This is conservative given the heavily increasing deforestation in Zambia (see B.6.1).

Data/parameter ID	MECD 10
Data / Parameter	$P_{p,d,y}$
Unit	tonnes
Description	The amount of wood pellets used in the project in device d in year y, considering cap
Source of data	Direct measurement by pellets sales, probably also based on remotely measured stove usage times.

Value(s) applied	324 kg/a per device (preliminary estimate, based on 30kg per month as per the pay-as-you cook scheme t * 90%)
Measurement methods and procedures	Pellet sales data to customers, mostly on an individual base, partly on a clustered basis per store. Also real-time data on usage time, transmitted by stoves automatically, are planned to be used, in combination with fuel usage rates.
Monitoring frequency	Continuously, aggregated monthly
QA/QC procedures	Measurement occurs by evaluating sales receipts for packaging units with standardized content. Users pay for pellets, therefore exhaustive usage is not plausible. Pellets are exclusively distributed by the project and there are no sensible alternative uses for pellets; they do not burn well in other cookstove stoves and would be far too expensive for usage in biomass boilers etc. A corresponding statement is provided. Packaging is done with calibrated equipment according to industry standards and relevant national requirements. For calculating ER, a cap will be applied to individual pellet consumption corresponding to a per-capita energy consumption of 0.0045 GJ per day. In order to avoid crediting of unused pellet at the end of a monitoring period, only transactions taking place after the start of the monitoring period will be considered, and in addition, no ER will be claimed for the first 5kg used after onboarding of a new user. This has been added under B.7.3.
Purpose of data	Emission reduction calculation
Additional comment	

Data/parameter ID	MECD 11
Data / Parameter	LE_y
Unit	tCO_2e per year
Description	Leakage in project scenario in year y
Source of data	Option 2 of MECD is followed: Evaluate leakage following the procedure described there.
Value(s) applied	0 (no discount)
Measurement methods and procedures	No significant potential sources of leakage have been identified (see B.6.2). The assessment will be repeated at least annually.
Monitoring frequency	Annually
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Emission reduction calculation
Additional comment	Emissions from pellet production and transport are considered as Project Emissions.

Data/parameter ID	No ID assigned, not described in MECD
Data / Parameter	$NCV_{p,i}$
Unit	Terrajoules (TJ)/tonne of fuel
Description	The net calorific value of pellets type i
Source of data	Analyses in independent laboratories
Value(s) applied	0.0176

Measurement methods and procedures	Tested and certified by the independent PSB Inspection Laboratory[24].
Monitoring frequency	Annually
QA/QC procedures	Analyses in independent laboratories, cross-check with comparable measurements of other pellets.
Purpose of data	Emission reduction calculation
Additional comment	

Data/parameter ID	No ID assigned, not described in MECD
Data/parameter	$Share_{non\text{-}waste}$
Unit	%
Description	Indicates the percentage of biomass used for pellet production that cannot be deemed waste biomass, i.e., that is regarded non-renewable biomass. For this share, project emissions are calculated as for wood in the baseline.
Source of data	Monitored
Value(s) applied	10%, preliminarily. (Normally, all pellets are produced from sawdust that is waste biomass.)
Measurement methods and procedures	Factory book keeping, registering procurement of raw material for pellet production.
Monitoring frequency	monthly
QA/QC procedures	Raw Material input will be cross-checked against pellet output.
Purpose of data	Emission reduction calculation

[24] Certificate provided to VVB

Non-carbon SDGs

Note: Indicators with standardized units such as "person-years" are used. These units have the advantage of representing absolute (not relative) values, therefore being summable and making projects comparable between each other. (For details, see https://www.fairclimatefund.nl/content/1-onze-aanpak/5-onze-impact/guidance-project-level-sdg-indicators-27mar2021.pdf).

Data / Parameter	SDG 3: $SmokeAvoided_y$:
Unit	Person-years of cooking with avoided smoke exposure
Description	Accumulated life time of ICS users during which they are able to cook with avoided smoke exposure from charcoal stoves.
Source of data	Monitoring campaigns
Value(s) applied	Preliminary value: 1,760 person-years of cooking with reduced smoke exposure, per year.
Measurement methods and procedures	Calculated from the share of total cooking done with project stoves in replacement of charcoal stoves. Only one person assumed to cook per household. Example: A household switches from 80% charcoal cooking on a traditional charcoal stove to cooking on the project stove. This household contributes 0.8 person-years of reduced smoke exposure per year.
Monitoring frequency	Annually
QA/QC procedures	Certificate on emissions from Mimimoto / Supamoto stove.
Purpose of data	Calculation of project scenario
Additional comment	The baseline smoke exposure is not measured physically, instead an average smoke exposure from traditional cookstoves is assumed. If possible, accompanying studies directly measuring smoke concentration (PM, CO, …) might be used to substantiate the findings.

Data / Parameter	SDG 3: $Healthimproved_y$: Reduced reported health impacts of kitchen smoke
Unit	Person-years with reported health improvement
Description	Accumulated life time of ICS users during which they are report improved health due to avoided exposure to smoke from charcoal stoves.
Source of data	Monitoring campaigns
Value(s) applied	Preliminary value: 1,760 person-years of cooking with reduced smoke exposure, per year, assuming 80% of positive respondents.
Measurement methods and procedures	Calculated from the total number of stove users time the share of respondents indicating health improvements ($Share_{healthimproved,y}$). Only one person assumed to cook per household.
Monitoring frequency	Annually
QA/QC procedures	Certificate on emissions from Mimimoto/Supamoto stove.
Purpose of data	Calculation of project scenario
Additional comment	The parameter is based on subjective user perceptions. If possible, accompanying studies directly measuring smoke concentration (PM, CO, …) might be used to substantiate the findings.

Data / Parameter	SDG 5: $Timesavedtotal_y$: Total time saved from faster cooking
Unit	Total accumulated hours saved by woman using project stoves.
Description	Time savings achieved by women who can reduce cooking times due to faster lighting of the Mimimoto/Supamoto stove.
Source of data	Stove database, fuel sales showing stove usage.
Value(s) applied	10 min per day
Measurement methods and procedures	Calculated based on project stove usage and survey data on time consumption on baseline stoves.
Monitoring frequency	Annually
QA/QC procedures	
Purpose of data	Calculation of project scenario

Additional comment	

Data / Parameter	SDG 7: $Accesscleanercooking_y$:
Unit	Person-years of using clean cookstoves
Description	Accumulated life time of persons in households during which the clean project stoves is used instead of a charcoal stove.
Source of data	Monitoring
Value(s) applied	Preliminary value: 11,000
Measurement methods and procedures	Calculated from the share of total cooking done with the project stoves in replacement of charcoal stoves. Example: A household of 5 switches to cooking on the project stove. This household contributes 5 person-years of clean cooking per year.
Monitoring frequency	Annually
QA/QC procedures	
Purpose of data	Calculation of project scenario
Additional comment	Calculated per household member, since SDG focuses on clean energy access, not smoke reduction.

Data / Parameter	SDG 8: $Jobopenings_y$ Employment generation by the project
Unit	Person-years of employment due to the project
Description	Employment generation standardized to person-years of fulltime employment.
Source of data	Monitoring
Value(s) applied	Preliminary value: 25
Measurement methods and procedures	Calculated based on payrolls. Standardized to person-years of fulltime employment (for example, two persons with half time job are equivalent to one person with a full-time job.
Monitoring frequency	Annually
QA/QC procedures	
Purpose of data	Calculation of project scenario
Additional comment	

B.7.2. Sampling plan

The only variable that is not monitored continuously through stove distribution and pellet sales is $Healthimproved_y$, the perceived effects of smoke reduction. Since it is a rather qualitative variable, non-systematic sampling will be applied. Perceptions of at least 30 users will be gathered, for example, during a defined period before verification, users that get in touch with project staff for fuel purchases or stove maintenance will be asked about perceived health impacts.
Alternatively, phone interviews will be conducted with at least 30 randomly selected users. This number is deemed sufficient because it is a qualitative parameter that does not require high statistical significance.
.

B.7.3. Other elements of monitoring plan

A. Unique numbering system

All customer data are managed in an electronic database (details given below under B). Two central unique identifiers are used (the current practice below might be adjusted in the future, but always maintaining uniqueness):

- The **stove serial number** is included both in the user contract and in the database, thereby serving as a unique identifier. It is composed by a ***9-digit numerical code,***
- The **contract reference** is created by the system and serves as a unique identifier to link customer data and pellet purchases, among others. Contract References are generated in the format C*******, where "***" represents a sequence of numbers.

B. Stove Deployment Record:

The VPA implementer will maintain and continuously update an electronic database with all stove records. The data management system currently used is PaygOps (a system owned by Solaris). The main purpose of the database is to track customer payments for stoves and pellets, but at the same time, it is suitable to monitor data relevant for carbon calculation.

The following data are recorded (adjustments possible):

i. Unique serial number of the stove
ii. Contract reference of the user

iii. Model/type of the project stove supplied to the user
iv. Date of stove installation ("onboarding date")
v. User name
vi. Location of household
vii. Telephone number (if available)
viii. GPS coordinates of the households
ix. Assignment to density zones (high - medium - low density)

Below, screenshots of the systema are shown for illustration.

Data entries are created when inserting user data in a smartphone app. Each user also signs a paper contract when onboarding, containing the data saved in the database, except contract reference and GPS data which are automatically assigned by the system when inserting user data. Paper contracts are stored and serve as a backup in well secured containers on site, with an administrative filing system in place that makes it possible to trace where every stored contract is. Scans of the paper contracts are also available through a link in the database.

C. Pellet sales record

Pellet sales to customers are recorded continuously by the data management system since all payments are made electronically through mobile money.

Different types of pellet sales records may apply to different groups of users:

i. Individual users with personalized purchase records for own consumption: Such pellet sales are directly recorded by the data management system. Most of these users are registered under the "utility model"; they agreed to buy a minimum quantity of 30kg of pellets per month. The utility model will be applied nearly exclusively in the future.
ii. Resellers with personalized purchase records (exceptional cases, if any): These records include both own consumption and quantities of pellets resold to other users (see below). The data management system does not differentiate between those purposes.
iii. Active users without personalized purchase records who are buying pellets from resellers (exceptional cases, if any): For these users, the data management system does not show pellet purchase data. Pellet consumption of these users is derived by assigning a share of the corresponding reseller to them. Assignment is done manually, based on the reseller's information and geographic proximity.

Measures to guarantee that pellets are exclusively used in project stoves

There are no sensible alternative usages for wood pellets in Zambia than usage in the gasifier stoves distributed by SupaMoto, because:

- There are no other pellet-based cooking solutions being distributed to households in Zambia
- Wood pellets are not suitable as a cooking fuel in other common cookstove stoves than gasifiers, they cannot even be lighted properly.
- Other potential usages for wood pellets, such as in biomass boilers or for animal bedding, would make no economic sense at all, due to the extremely high comparative high cost of wood pellets.

The same is confirmed by an independent expert leading the ACE baseline cooking fuel study in Zambia. A letter of confirmation is provided to the VVB.

Together with each monitoring event, these points will be evaluated again.

Moreover, it will be shown in each monitoring event that $P_{p,d,y}$ exclusively refers to pellets that are used in stoves included under this VPA. This will be done by:

- Considering only pellet purchases taking place after the start of the monitoring period, and in addition, not claiming ER for the first 5kg used after onboarding of a new user.
- Mapping customers who buy pellets from resellers, and assigning them to resellers.
- Investigating any individual user's pellet consumption that surpasses 480kg per year, below the MECD cap of 0.0045GJ per capita and day, in order to either find a transparent and plausible explanation (the household may be very large, he may order pellets for his neighbor also), or to consider only the amount below the cap for ER calculation.

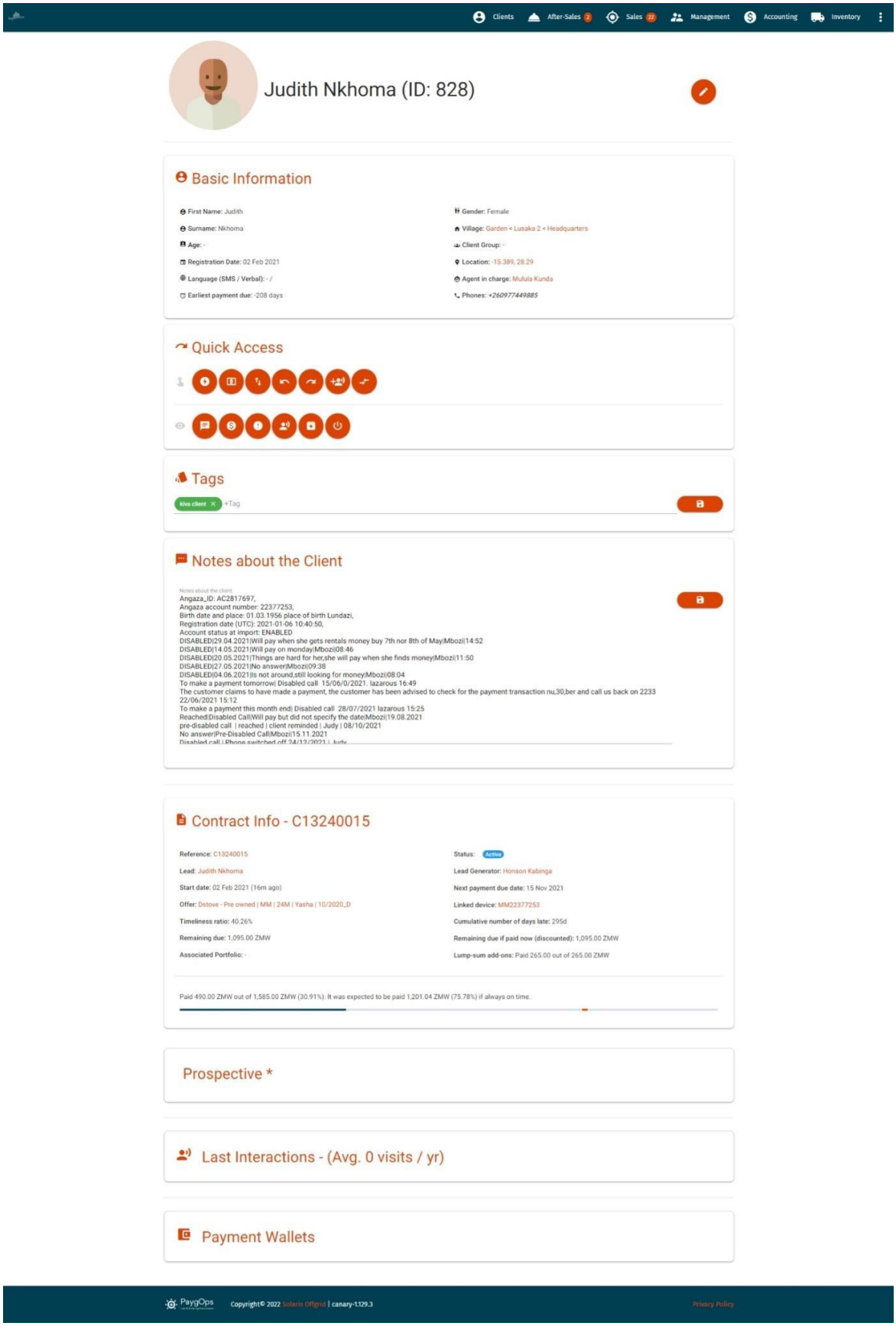
D. Data preparation for verifications

Stove and fuel sales are recorded continuously in real time. For verifications (and regular inventories), data are exported from the data management system to Excel. The resulting spreadsheets will contain a complete list of users, together with pellet purchase data individually assigned to these users (individual users and resellers). On

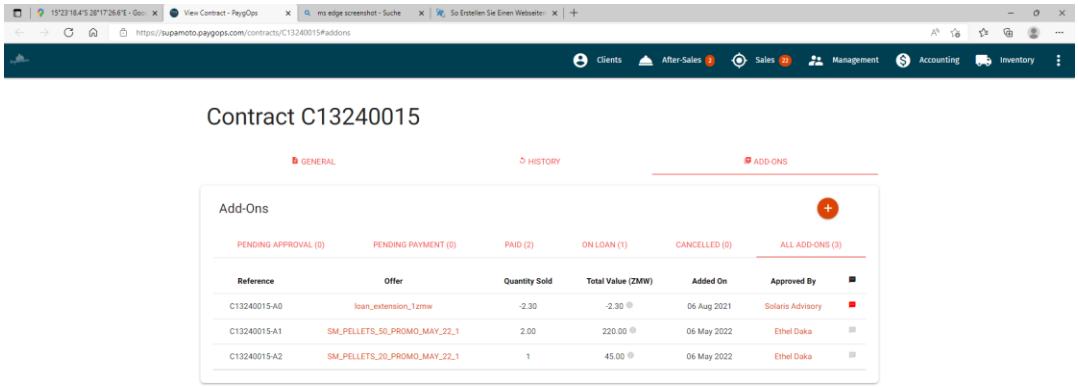
a separate sheet, pellet purchase per customer will be disaggregated by single purchase events, specifying purchase date and packaging sizes (typically 5, 10, 20 and 50kg).
The key monitoring parameter $P_{p,d,y}$ (amount of wood pellets used in the project devices in year y) will be derived by summarizing pellet purchases by all individual users in the corresponding time plus the share of resold pellets that can clearly be assigned to customers, applying conservative discount factors where necessary.
Pellet purchases will further be evidenced by cross-checking with factory output data.

Screenshots of the data management system:

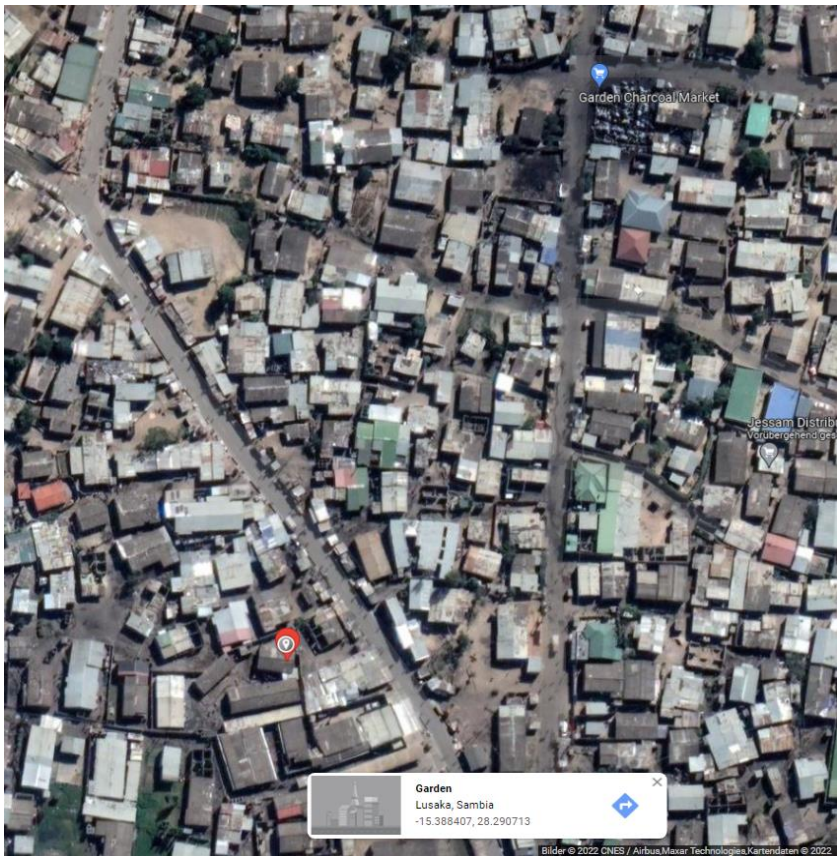
General user data



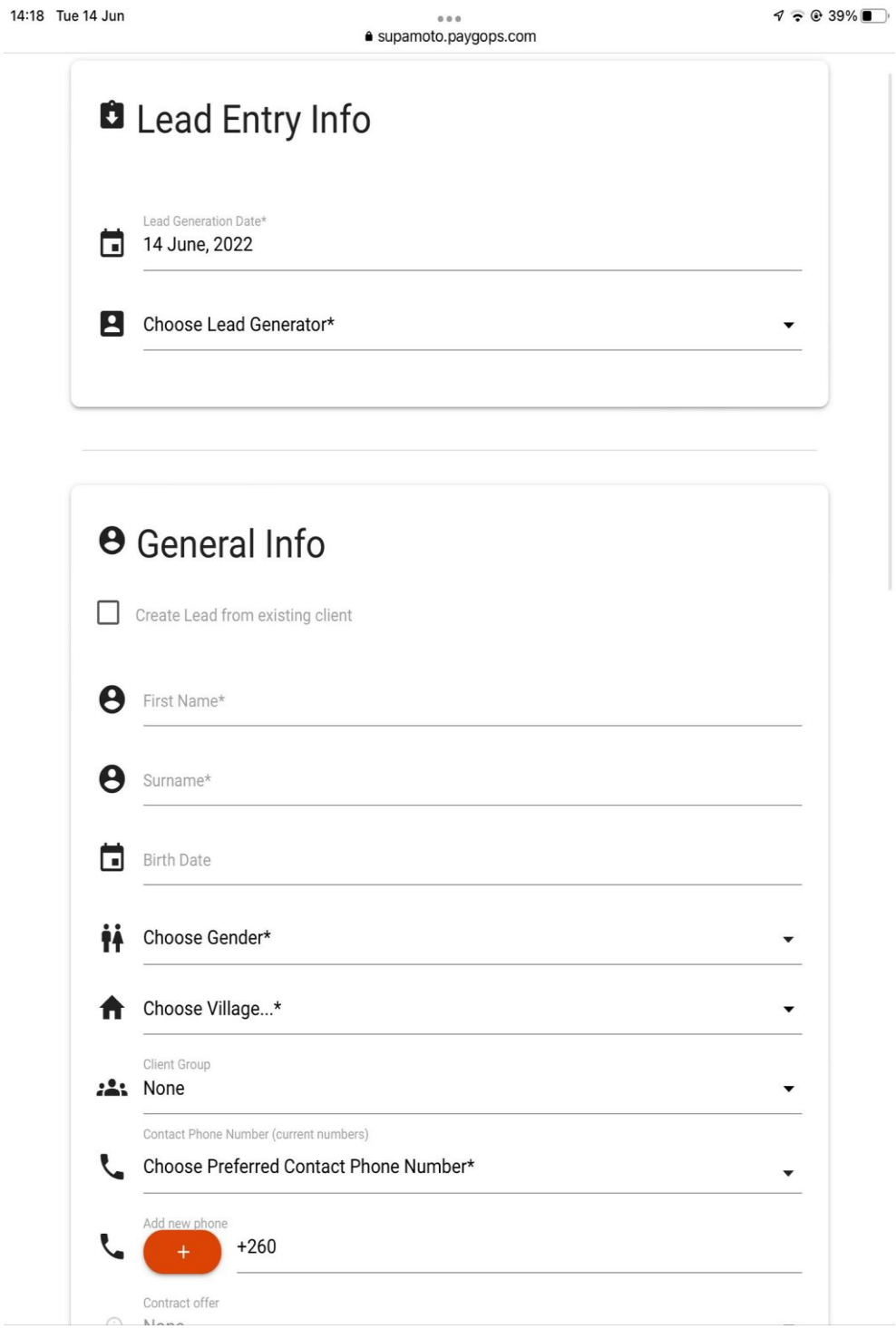
Pellet purchase data

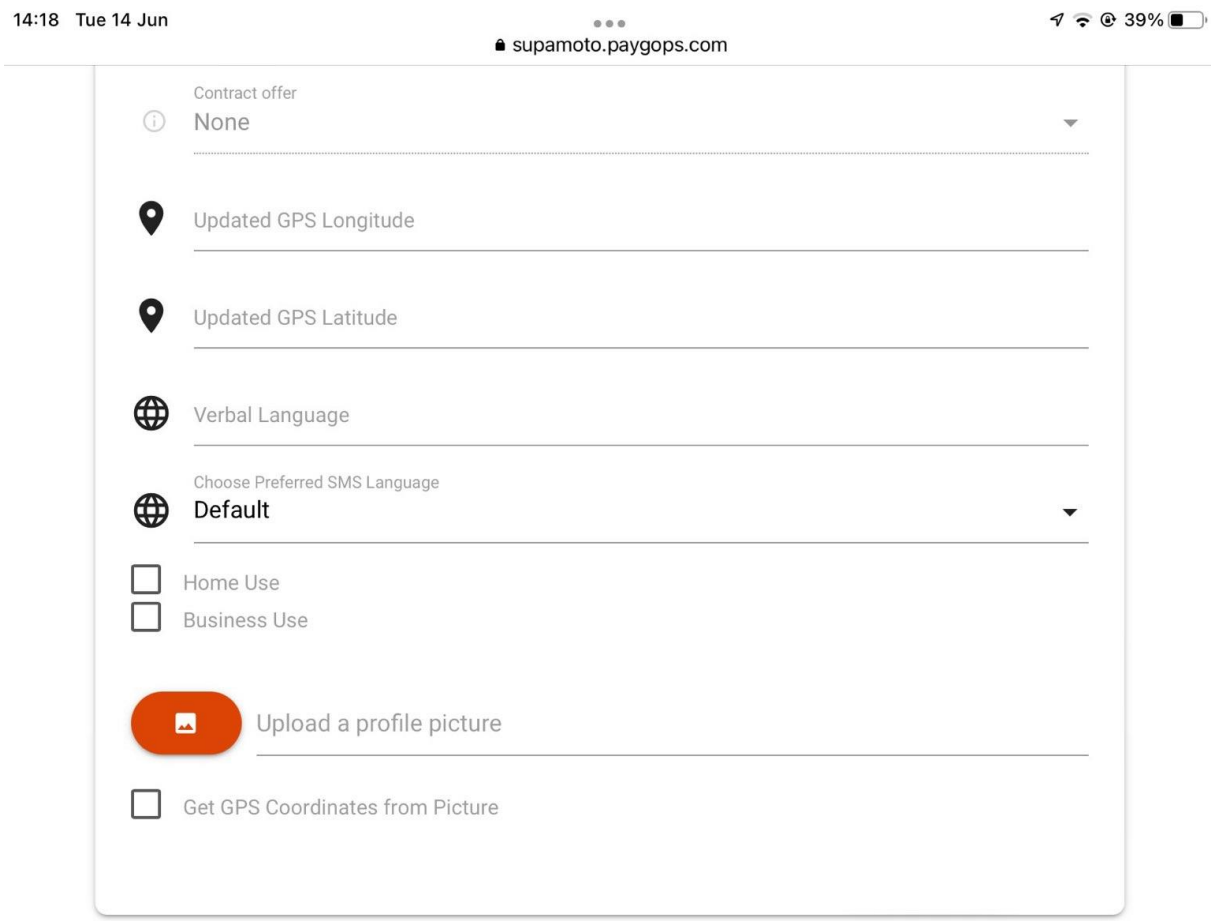


GPS location



Screenshot of the smartphone App for data collection:




14:18 Tue 14 Jun
supamoto.paygops.com
39%
Contract offer
None
Updated GPS Longitude
Updated GPS Latitude
Verbal Language
Choose Preferred SMS Language
Default
Home Use
Business Use
Upload a profile picture
Get GPS Coordinates from Picture

SECTION C. DURATION AND CREDITING PERIOD

C.1. Duration of project

C.1.1. Start date of VPA

07/04/2022

C.1.2. Expected operational lifetime of VPA

20 Years

C.2. Crediting period of project

C.2.1. Start date of crediting period

07/04/2022

C.2.2. Total length of crediting period

5 Years

SECTION D. SUMMARY OF SAFEGUARDING PRINCIPLES AND GENDER SENSITIVE ASSESSMENT

D.1. Safeguarding Principles that will be monitored

Safeguarding assessment (see appendix 1) showed that there are no principles with a need to be monitored.

Principles	Mitigation Measures added to the Monitoring Plan
n.a.	n.a.

D.2. Assessment that project complies with GS4GG Gender Sensitive requirements

Question 1 - Explain how the project reflects the key issues and requirements of Gender Sensitive design and implementation as outlined in the Gender Policy?	The project reflects the key gender issues and requirements of gender-sensitive design and implementation of the project. SDG#5 is one of the impact areas of the project. The introduction of new and clean cookstoves will result in reducing use of charcoal at the user's place. In Zambia, cooking activity at household level is mostly still managed by women. Therefore, women are more exposed to the indoor air pollution and the associated hazard and will benefit more from clean cookstoves. Time savings due to faster cooking also provides special benefits to women.
Question 2 - Explain how the project aligns with existing country policies, strategies and best practices	The Zambian Gender Equality and Equity Act defines principles and concrete approaches towards the aim society free

	from gender-based discrimination in many different areas of daily life[25]. The project aligns with this policy by providing practical benefits to women who use the clean stoves (see above), but also by directly dealing with women as main and fully responsible customers and workers, thereby fully respecting women's equal rights and economic independence.
Question 3 - Is an Expert required for the Gender Safeguarding Principles & Requirements?	All the gender safeguarding principles and requirements are carefully assessed and an expert is not required.
Question 4 - Is an Expert required to assist with Gender issues at the Stakeholder Consultation?	The project team responsible for organizing the stakeholder consultation did ensure the gender representation at the meeting. So, no expert is required.

25 www.parliament.gov.zm/sites/default/files/documents/acts/The%20Gender%20Equity%20and%20Equality%20Bill%2C%202015.pdf

SECTION E. SUMMARY OF LOCAL STAKEHOLDER CONSULTATION

The below is a summary of the 2 step GS4GG Consultation for monitoring purposes. Please refer to the separate Stakeholder Consultation Report for a complete report on the initial consultation and stakeholder feedback round.

E.1. Summary of stakeholder mitigation measures

No mitigation measures were identified in the LSC meeting.

E.2. Final continuous input / grievance mechanism

Method	Include all details of Chosen Method (s) so that they may be understood and, where relevant, used by readers.
Continuous Input / Grievance Expression Process Book (mandatory)	Location of book: 9160 Lunsemfwa Road, Kalundu, Lusaka
GS Contact (mandatory)	help@goldstandard.org
Telephone access (optional)	Short code to SupaMoto's call centre (toll-free): 2233 Co-Founder Marion Peterson's direct number: +260 953 282 492
Internet/email access (optional)	www.supamoto.co.zm ceo@emerging.se Co-Founder Marion Peterson's direct email: marion@emerging.s
The Nominated Independent Mediator (optional)	N/A

SECTION F. **Eligibility and inclusion criteria for VPAs inclusion**

>>

The below table shall be completed for all VPAs.

The CME shall provide clear description on how eligibility criteria set at real case VPAs are complied with for each real case and regular VPAs submitted for inclusion.

The CME shall not change the eligibility criteria and required condition set at real case VPAs. At the time of inclusion of regular VPAs, the CME shall only describe how the regular VPAs comply with the eligibility criterion.

No.	Eligibility Criterion	Description/ Required condition	Description of the VPA in relation to the criteria, means of Verification/Supporting evidence for inclusion
1	Technology	Mimimoto or Supamoto gasifier stoves are used with pellets	Both types are used with pellets (see A.3)
2	Project area	The VPA is implemented in Lusaka or Ndola	Implemented in both areas (Ndola possibly). (See A.2)
3	VPA implementer	The VPA is implemented by ECS Zambia (Supamoto)	Implemented by ECS Zambia (see KPI)
4	PoA eligibility	The VPA complies with all PoA eligibility criteria	Compliance shown in A.1.1
5	Local Stakeholder consultation	A new physical meeting is conducted if the conditions for a grouped consultation are not given, as explained in section E of the PoA-DD (with reference to the PoA requirements).	A new physical meeting was conducted since this is the first VPA of the PoA.

APPENDIX 1 - SAFEGUARDING PRINCIPLES ASSESSMENT

Complete the Assessment below and copy all Mitigation Measures for each Principle into SECTION D above. Please refer to the instructions in the Guide to Completing this Form below.

Assessment Questions/ Requirements	Justification of Relevance (Yes/potentially/no)	How Project will achieve Requirements through design, management or risk mitigation.	Mitigation Measures added to the Monitoring Plan (if required)
Principle 1. Human Rights			
1. The Project Developer and the Project shall respect internationally proclaimed human rights and shall not be complicit in violence or human rights abuses of any kind as defined in the Universal Declaration of Human Rights 2. The Project shall not discriminate with regards to participation and inclusion	No	1. The project does not negatively affect human rights. Participation is fully voluntary. 2. No discrimination occurs because the project offers clean cookstoves to interested people who can freely decide to use them or not. The project is basically targeting women in poor households depending on charcoal for cooking.	n.a.
Principle 2. Gender Equality			

1. The Project shall not directly or indirectly lead to/contribute to adverse impacts on gender equality and/or the situation of women 2. Projects shall apply the principles of nondiscrimination, equal treatment, and equal pay for equal work 3. The Project shall refer to the country's national gender strategy or equivalent national commitment to aid in assessing gender risks 4. (where required) Summary of opinions and recommendations of an Expert Stakeholder(s)	No	1. The project focuses on a gender sensitive design and planning. Women were involved from the beginning when exploring the feasibility of the project and designing its implementation. Furthermore, the Stakeholder Consultation was organized with a majority of participants being women. 2. The project does apply the principles of non-discrimination and equal treatment in distribution and usage of the products. It embraces the spirit of the Zambian Policy on Gender and Cild Developemt[26] and the national Labour Laws[27] and ILO guidelines. SupaMoto also ensures equal pay for equal work during any activity in the project. 3. The project applies the principles of the Zambian Policy on Gender and Child Development (see section D.2). 4. n.a.	n.a.
Principle 3. Community Health, Safety and Working Conditions			
1. The Project shall avoid community exposure to increased health risks and shall not	No	There are no health risks associated to the usage of the improved cookstoves offered. To the contrary, the reduction of kitchen smoke is an	n.a.

[26] www.pmrczambia.com/wp-content/uploads/2015/06/Ministry-of-Gender-and-Child-Development.pdf
[27] https://iclg.com/practice-areas/employment-and-labour-laws-and-regulations/Zambia

adversely affect the health of the workers and the community		important objective of the programme and part of monitoring under SDG 3. Due to the principle of pyrolysis producing wood gas, the stoves burn as clear as LPG stoves.	
Principle 4.1 Sites of Cultural and Historical Heritage			
Does the Project Area include sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture?	No	The Project Area consists of the compounds of the participating households, institutions and small enterprises. Therefore, cultural heritage sites are generally not included in the Project Area.	n.a.
>>			
Principle 4.2 Forced Eviction and Displacement			
Does the Project require or cause the physical or economic relocation of peoples (temporary or permanent, full or partial)?	No	To the contrary, the provision of clean cookstoves to households improves their economic situation and rather mitigates their relocation for economic reasons.	n.a.
>>			
Principle 4.3 Land Tenure and Other Rights			
Does the Project require any change, or have any uncertainties related to land tenure arrangements and/or access rights, usage rights or land ownership?	No	Land tenure and land rights are not relevant for or affected by the program at all.	n.a.
>>			
Principle 4.4 – Indigenous people			
Are indigenous peoples present in or within the area of influence of the Project and/or is the	No	The project is in urban areas where no land is claimed by indigenous people	n.a.

Project located on land/territory claimed by indigenous peoples? >>			
Principle 5. Corruption			
1. The Project shall not involve, be complicit in or inadvertently contribute to or reinforce corruption or corrupt Projects	No	The program and its associated participants are not and will not be involved in any kind of corruption, in accordance with Zambia's Anti-Corruption Policy[28]	n.a.
Principle 6.1 Labour Rights			
1. The Project Developer shall ensure that all employment is in compliance with national labour occupational health and safety laws and with the principles and standards embodied in the ILO fundamental conventions 2. Workers shall be able to establish and join labour organisations 3. Working agreements with all individual workers shall be documented and implemented and include:	No	1. The project will respect Zambian Labour regulations and ILO standards. 2. SupaMoto workers will not be hindered in establishing or joining labour organizations. 3. Proper labour contracts will be signed with all workers by SupaMoto, including at least the following element: a. Working hours not exceeding 48 hours per week b. Description of duties and tasks c. Remuneration (including overtime provisions) d. Modalities on health insurance e. Termination modalities for both sides f. Annual leave >10 days per year	n.a.

[28] www.academia.edu/attachments/57748932/download_file?st=MTY0MDM0NjAzMywyLjIwMy4xNDguMTM3&s=swp-splash-paper-cover

a) Working hours (must not exceed 48 hours per week on a regular basis), AND b) Duties and tasks, AND c) Remuneration (must include provision for payment of overtime), AND d) Modalities on health insurance, AND e) Modalities on termination of the contract with provision for voluntary resignation by employee, AND f) Provision for annual leave of not less than 10 days per year, not including sick and casual leave. 4. No child labour is allowed (Exceptions for children working on their families' property requires an Expert Stakeholder opinion) 5. The Project Developer shall ensure the use of appropriate equipment, training of workers, documentation and reporting of accidents and incidents, and emergency preparedness and response measures		4. All workers for SupaMoto shall be over 18. Age will be checked using national identity cards 5. Safety measures will be followed, in accordance with §6 & 47-95 of the Occupational Safety and Health Act 2007. Any accidents or incidents during work for SupaMoto will be duly reported and documented. Appropriate response measures will be discussed and implemented.	
Principle 6.2 Negative Economic Consequences			
1. Does the project cause negative economic consequences during and after project implementation?	No	The program has nothing but positive economic impacts on the local economy, creating jobs and enabling women to reduce fuelwood expenses.	n.a.
>>			
Principle 7.1 Emissions			

Will the Project increase greenhouse gas emissions over the Baseline Scenario? >>	No	As per the application of the GS methodologies no increase of emissions over the baseline scenario occurs.	n.a.
Principle 7.2 Energy Supply			
Will the Project use energy from a local grid or power supply (i.e., not connected to a national or regional grid) or fuel resource (such as wood, biomass) that provides for other local users? >>	No	Since the project stoves rely on residual biomass (sawdust), household energy sourcing from local resources will be reduced. Therefore, the energy supply to other users is not negatively affected, if anything it is positively affected.	n.a.
Principle 8.1 Impact on Natural Water Patterns/Flows			
Will the Project affect the natural or pre-existing pattern of watercourses, ground-water and/or the watershed(s) such as high seasonal flow variability, flooding potential, lack of aquatic connectivity or water scarcity? >>	No	The project has no direct impact on natural water resources. If anything, there is a positive impact through the reduction of charcoal production related to deforestation and desertification.	n.a.
Principle 8.2 Erosion and/or Water Body Instability			
a) Could the Project directly or indirectly cause additional erosion and/or water body instability or disrupt the natural pattern of erosion? b) Is the Project's area of influence susceptible to excessive erosion and/or water body instability?	No	The project has no direct impact on natural water resources. If anything, there is a positive impact through the reduction of charcoal production related to deforestation and desertification. There is no susceptibility to erosion or water body instability.	n.a.

>>			
Principle 9.1 Landscape Modification and Soil			
Does the Project involve the use of land and soil for production of crops or other products?	No	The project does not involve the use of land and soil.	n.a.
>>			
Principle 9.2 Vulnerability to Natural Disaster			
Will the Project be susceptible to or lead to increased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions?	No	If any, the project will have a positive impact by mitigating climate change and reducing charcoal production related to deforestation and desertification.	n.a.
>>			
Principle 9.3 Genetic Resources			
Could the Project be negatively impacted by or involve genetically modified organisms or GMOs (e.g., contamination, collection and/or harvesting, commercial development, or take place in facilities or farms that include GMOs in their processes and production)?	no	There is no possible impact of GMOs on the use of clean cookstoves.	n.a.
>>			
Principle 9.4 Release of pollutants			
Could the Project potentially result in the release of pollutants to the environment?	no	There is no use of pollutants in the program. Cookstoves will be taken back by the project after usage.	n.a.
>>			

Principle 9.5 Hazardous and Non-hazardous Waste			
Will the Project involve the manufacture, trade, release, and/ or use of hazardous and non-hazardous chemicals and/or materials?	no	No chemicals are used by the project.	n.a.
>>			
Principle 9.6 Pesticides & Fertilisers			
Will the Project involve the application of pesticides and/or fertilisers?	no	This project will not use any kind of pesticide or herbicides or chemical fertilizer.	n.a.
>>			
Principle 9.7 Harvesting of Forests			
Will the Project involve the harvesting of forests?	no	The project does involve the harvesting of forests, but: Since the project will reduce the consumption of charcoal significantly, harvesting of forests will be reduced, and hence the sustainable management of forests will be fostered and there will be a positive impact on biodiversity and ecosystem functionality. The fuel used by the project is made from residual biomass.	n.a.
>>			
Principle 9.8 Food			
Does the Project modify the quantity or nutritional quality of food available such as through crop regime alteration or export or economic incentives?	no	The impact of the program is only on cooking energy, but not on the nutritional quality or quantity of food available to households. Although, it is possible that the savings on expenditures for fuel wood will be used by some families to increase or improve their food supply.	n.a.
>>			

Principle 9.9 Animal husbandry			
Will the Project involve animal husbandry?	no	This project will not involve any animal husbandry.	n.a.
>>			
Principle 9.10 High Conservation Value Areas and Critical Habitats			
Does the Project physically affect or alter largely intact or High Conservation Value (HCV) ecosystems, critical habitats, landscapes, key biodiversity areas or sites identified?	no	The program promotes interventions only at the household level, not affecting critical ecosystems.	n.a.
>>			
Principle 9.11 Endangered Species			
Are there any endangered species identified as potentially being present within the Project boundary (including those that may route through the area)? AND/OR Does the Project potentially impact other areas where endangered species may be present through transboundary affects?	no	The program promotes interventions only at the household level, not affecting endangered species.	n.a.

APPENDIX 2- CONTACT INFORMATION OF VPA IMPLEMENTER

Organization name	Emerging Cooking Solutions Zambia (limited)
Registration number with relevant authority	103772, Patents and Registration Agency of the Republic of Zambia
Street/P.O. Box	9160 Lunsemfwa Road
Building	
City	Lusaka
State/Region	Kalundu
Postcode	10101
Country	Zambia
Telephone	+260 953 282 492
E-mail	ceo@emerging.se
Website	www.supamoto.co.zm
Contact person	Mattias Ohlson
Title	CEO
Salutation	Mr.
Last name	Ohlson
Middle name	
First name	Mattias
Department	Management
Mobile	+260953282492
Direct tel.	+260 953 282 492
Personal e-mail	ceo@emerging.se

APPENDIX 3- LUF ADDITIONAL INFORMATION

Risk of change to the Project Area during Project Certification Period:	
Risk of change to the Project activities during Project Certification Period:	
Land-use history and current status of Project Area:	
Socio-Economic history:	
Forest management applied (past and future)	
Forest characteristics (including main tree species planted)	
Main social impacts (risks and benefits)	
Main environmental impacts (risks and benefits)	
Financial structure	
Infrastructure (roads/houses etc):	
Water bodies:	
Sites with special significance for indigenous people and local communities - resulting from the Stakeholder Consultation:	
Where indigenous people and local communities are situated:	
Where indigenous people and local communities have legal rights, customary rights or sites with special cultural, ecological, economic, religious or spiritual significance:	

APPENDIX 4-SUMMARY OF APPROVED DESIGN CHANGES

Please refer to Design Changes Requirements for more information on procedures governing Design Changes

Revision History

Version	Date	Remarks
2.0	4 May 2022	
1.1	7 October 2020	Hyperlinked section summary to enable quick access to key sections Improved clarity on Key Project Information Inclusion criteria table added Gender sensitive requirements added Prior consideration (1 yr rule) and Ongoing Financial Need added Safeguard Principles Assessment as annex and a new section to include applicable safeguards for clarity Improved Clarity on SDG contribution/SDG Impact term used throughout Clarity on Stakeholder Consultation information required Provision of an accompanying Guide to help the user understand detailed rules and requirements
1.0	10 July 2017	Initial adoption