Project design document form for CDM project activities

(Version 08.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	EcoMakala Virunga Energy project (GS5391)
Version number of the PDD	1.0
Completion date of the PDD	17/06/2017
Project participant(s)	CO2logic, Belgium WWF, DRC
Host Party	Democratic Republic of Congo (DRC)
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	Gold Standard Methodology: Technologies and practices to displace decentralized thermal energy consumption (TPDDTEC), Version 2.0 AMS-III.BG: Emission reduction through sustainable charcoal production and consumption[1], Version 3.0
Sectoral scope(s) linked to the applied methodology(ies)	End-use Energy Efficiency (TPDDTEC) Scope 04 (Manufacturing Industries, Energy Efficiency)
Estimated amount of annual average GHG emission reductions	218,581 tCO_2e

[1] The combination of TPDDTEC (large-scale) and AMS-III.BG (small-scale) has been accepted by the GS Secretariat (see Email exchange: 'Ecomakala project - AMS-III.BG together with TPDDTEC_1', 'Re_ Ecomakala project - AMS-III.BG together with TPDDTEC_2')

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

BRIEF DESCRIPTION OF THE PROJECT

Eastern DRC and more specifically the North Kivu province is the most densely populated region of the Democratic Republic of the Congo (DRC). More than 90% of the population relies on energy wood and/or charcoal for their energy needs. These two facts lead to a huge pressure on the region's forest resources. The amount of legal forest resources are not sufficient to assure the needs of the local population, leading to an important increase of costs regarding the purchase of wood and charcoal (pressure on households) and a dependence of the provisioning through illegal and unsustainable exploitation of the forests of the Virunga Natural Park (ViPN), Africa's oldest and most diverse park. The ViNP is recognized as a UNESCO World Heritage Site, but is suffering from deforestation and degradation mainly due to agricultural expansion and wood extraction for energy purposes for and by the local population. But, the charcoal trade is almost totally illegal business in hands of armed groups and prices are continuing to raise, and so not in favour of the local population. However, the potential of sustainable wood production in the region is considerable with particular interesting yields due to the highly fertile volcanic soils and ideal climatic conditions. The actual estimated wood energy needs of the population of the city of Goma represents 1.340.192 m³/year, or about 53,600 ha of well managed exploitable plantations (ONFI 2015a[2]).

Since more than two decades, the World Wide Fund for Nature (WWF) promotes various activities in North Kivu in order to protect the PNVi and alleviate poverty of the surrounding communities. One of these activities, and probably the most important, is the EcoMakala[3] project, which consist in the improvement of the charcoal sector. For this, three main activities are being implemented: (i) Reforestation with fast growing species, (ii) displacement of non-renewable biomass used for charcoal production in unimproved traditional kilns by renewable biomass used in improved (more efficient) kilns with end-users of sustainably produced charcoal being households, SMEs or a group of households served by a charcoal market (e.g. charcoal consuming urban areas)[4].
(iii) production and dissemination of improved cookstoves (ICS) to households[5] [6]. The EcoMakala Virunga Energy project concerns the last two activities, under the energy scope. The first activity (EcoMakala Virunga Reforestation project) is being certified as a GS LUF VER project.

In regards to sustainable charcoal production, by the end of 2016, WWF has established more than 4,200 ha[7] of community forest plantations in 5 territories of North Kivu, whose purpose is primarily charcoal production.[8] Likewise, the first 'charcoal makers' co-operatives' are being established, and they are trained by WWF in order to optimize the production and marketing of renewable charcoal. The potential of sustainable charcoal production from eligible EcoMakala plantations is estimated to be around 7,500 tons per year, with an estimated 2,000 t in 2017 and a gradual increase to 5,000 t

[2] ONFI 2015a. Rapport de l'étude filière bois d'énergie en province du Nord Kivu, Projet pilote REDD Géographiquement intégré EcoMakala+ ; file name (uploaded to the GS registry) : ONFI 2015a_20150819 Ecomakala Etude Bois Energie au Nord Kivu - rapport final.pdf, page 23.

[3] The word 'makala' comes from Swahili language and means 'charcoal'. 'Ecomakala' refers to the charcoal which is produced from renewable biomass coming from dedicated plantations.

[4] This activity is further on in the PDD referred to as '*sustainable charcoal production/consumption component'*

[5] The project activity may accomodate institutions as target group later on as allowed by the applied methodology TPDDTEC. A design change request would be submitted to GS in this case.

[6] This activity is further on in the PDD referred to as '*Improved cookstove component'*

[7] 4,200 ha refers to the eligible plantations under the GS A/R and energy projects. In total, WWF has established more than 10,000 ha by the end of 2016.

[8] By 2025 more than 11,000 ha tree plantations (eligible under the GS A/R and energy projects) are envisaged which are amongst others used for charcoal production.

in 2018 and 6,000 t in 2019 before reaching 7,500 t in 2020.[9] Charcoal producers are using traditional kilns (stacks of wood covered by earth) in the baseline scenario[10]. The project activity will introduce improved stacking procedures and the use of chimneys and vents to regulate air flow leading to a more efficient production (see images below). Hence the benefits are twofold: fuel substitution of non-renewable wood by sustainably harvested wood and fuel savings through less fuel input to produce a certain amount of charcoal.

In regards to ICS, the WWF has run trials with users on several types of improved cookstoves, and from these selected three which, with minor modifications to suit local needs, could quickly be brought into production. All three were liked by users as well as end-users confirmed that they substantially reduce charcoal use, compared with the traditional stoves or copies ('pirates') of improved stoves.

Sale of improved stoves began in 2009 and by end of 2016, around 70,000 improved cookstoves have been sold to households in North Kivu, in particular in the cities of Goma and Beni. Though carbon revenues have been seriously taken into consideration prior to the project start date (July 2009), PP decided not to claim carbon credits for the previously disseminated stoves since those stoves have been sold without unique identification numbers (serial numbers) and the leaflet explaining the use of the ICS and handed out to the households did not contain the carbon waiver, i.e. end-users agreement to transfer all rights on the carbon credits to the PP. Improved cookstoves

[9] This is an initial estimate and will be re-evaluated after the forest inventories have been carried out and harvest plan has been revised. It is possible that the quantities of sustainably produced charcoal are higher than indicated. In the case that sustainable charcoal production is more than 7,500 tons/year, PP would claim carbon credits for the exceeding amount as long as type III SSC threshold of 60,000 tCO_2/year will not be exceeded.

[10] See baseline survey excel spreadsheet 'BS_PRODUCTION_Analysis_v.01' and 'Contribution of woodfuel to meet the energy needs of the population of Central Africa: prospects for sustainable management of available resources', Jolien Schure et al., 2012, page 113 (uploaded to GS registry).

of different models[11] disseminated from July 2017 onwards will be included in this carbon project activity with the aim to sell at least 45,000 ICS per year[12] to households in the cities of Goma, Beni and Butembo.

PRIOR SITUATION AND BASELINE

Sustainable charcoal production/consumption component: The current practice to produce charcoal is to produce it in traditional kilns by using non-renewable biomass.

Improved cookstove component': The current cooking practice in the target area is the use of traditional stoves or ICS copies ('pirates') or a combination of both.

The scenario existing prior to the implementation of the project activity is the same as the baseline scenario as described in more detail in section B.4 of this document.

SUSTAINABLE DEVELOPMENT BENEFITS

The project activity contributes to the sustainable development of energy wood supply of the populations in the North Kivu, mainly in the Southwest and Northwest periphery of the Virunga National Park (NPVi), in the Democratic Republic of the Congo. The project's beneficiaries are thus the participating farmer-planters, the charcoal makers' cooperatives and the households of Goma, Butembo and Beni. Last but not least, the charcoal provided by a legal source can be seen as the quantity of avoided deforestation within the park. The project's objective is thus the improvement of the socio-economic and environmental conditions (through avoided deforestation and degradation of the ViNP and biodiversity preservation) besides mitigating GHG emissions.

The following table illustrates some of the environmental and socio-economic benefits[13] of the project:

Environmental benefits	
Biodiversity	The deforestation of the Virunga park is reduced by the supply of alternative wood energy from plantations outside the park
Air quality	Improved cookstoves result in a cleaner burning of the charcoal and reduce fuel consumption, hence improving indoor air quality.
Socio-economic benefits	
Employment	The project involves several thousands of peasants, providing them a new source of income through the sale of wood for charcoal production. Further, employment is generated in the context of the production and sale of improved cookstoves. This involves artisans, salespeople and accountants.
Access to affordable and clean energy services	End-users get access to charcoal which comes from a legal source, hence do not rely anymore on unsustainably and illegally sourced charcoal. Improved cookstoves provide clean energy services.
Technology Transfer	More efficient charcoal production technology as well as improved cookstoves may result in spill-over effects outside of the project boundary.

[11] The 3 models to be included in the carbon project at the beginning are Goma Stove, Nguvu Nyeusi and Jiko Harkisha (for details see section A.3.2), however other different models might be included later on.

[12] Sales might be higher than 45,000 ICS per year and all stoves beyond 45,000 are entitled to claim carbon credits since the ICS component is large scale, i.e. does not have any SSC threshold.

[13] The list of SD benefits is not exhaustive. For more details to the SD impacts, see the LSC report and GS passport.

The project activity is a standalone activity and is not a CPA of a PoA or a CPA that has been excluded from a registered PoA as a result of erroneous inclusion of CPAs.

A.2. Location of project activity

A.2.1. Host Party

Democratic Republic of the Congo, GPS coordinates: -4°02'0.66" S 21°45'0.22" E (see http://latitude.to/map/cd/congo-democratic-republic)

A.2.2. Region/State/Province etc.

North Kivu province, GPS coordinates: 0°40'0.01" N 28°45'0.00" E (see http://latitude.to/map/cd/congo-democratic-republic/regions/north-kivu/north-kivu)

A.2.3. City/Town/Community etc.

Five territories: Masisi, Rutshuru, Nyiragongo, Lubero, Beni
Three cities:
Goma (GPS coordinates: -1°40'26.72" S 29°13'42.42" E, see http://latitude.to/map/cd/congo-democratic-republic/regions/north-kivu/north-kivu/cities/goma)
Butembo (GPS coordinates: 0°08'29.90" N 29°17'28.21" E, see http://latitude.to/map/cd/congo-democratic-republic/regions/north-kivu/north-kivu/cities/butembo)
Beni (GPS coordinates: 0°29'28.07" N 29°28'23.02" E, see http://latitude.to/map/cd/congo-democratic-republic/regions/north-kivu/north-kivu/cities/beni)

A.2.4. Physical/Geographical location

Project boundary:

a) The project boundary for the *charcoal production/consumption component* (AMS-III.BG methodology, page 6) includes the physical, geographical site of
-the use of biomass
-the carbonization units included in the project
-the areas for storage, processing, bagging and weighting of inputs (biomass) and outputs (charcoal)
-the use of charcoal or charcoal products
Hence the project boundary consists of all eligible dedicated plantations under the GS A/R project 'EcoMakala Virunga Reforestation project' and biomass coming from those plantations, the improved (efficient) charcoal production kilns implemented by the project activity, the area where biomass and outputs are stored, processed, bagged and weighted as well as all households, SMEs or a group of households served by a charcoal market (e.g. charcoal consuming urban areas).

b) The project boundary for the *improved cookstove component* (TPDDTEC methodology, page 5) is the physical, geographical sites of the project technologies. Thus, the project boundary includes all individual households, which receive an ICS.

Target area:

a) The *sustainable charcoal production/consumption component* targets the installation and operation of new and efficient charcoal production facilities and consumers of sustainably produced charcoal (households, SMEs and group of households served by a charcoal market (e.g. charcoal consuming urban areas) in five territories of North Kivu, namely Masisi, Rutshuru, Nyiragongo, Lubero, Beni including the three cities of Goma, Beni and Butembo.

b) The *improved cookstove component* targets end-users in the 'communes'/'quartiers' mentioned in the following table and located in the cities of Goma, Beni and Butembo.

City of Goma	
COMMUNE	**QUARTIER**
KARISIMBI	BUJOVU
	KAHEMBE
	KASIKA
	KATOYI
	MABANGA NORD
	MABANGA SUD
	MAJENGO
	MIKENO
	MUGUNGA
	MURARA
	NDOSHO
	VIRUNGA
GOMA	LAC VERT
	HIMBI
	MAPENDO
	KATINDO
	LES VOLCANS
	KESHERO

City of Beni	
COMMUNE	**QUARTIER**
BUNGULU	MABOLIO
	CITE BELGE
	KANZULINZULI
	RESIDENTIEL
BEU	BENENGULE
	MALEPE
	BUTANUKA
	BIAUTU
RWENZORI	KASABINYOLE
	PAIDA
	BOIKENE
	MABAKANGA
MULEKERA	MATONGE
	TAMENDE
	NGONGOLIO
	MASIANI
	KALINDA
	BUTSILI

City of Butembo	
COMMUNE	**QUARTIER**
BULENGERA	MUTIRI
	KIMBULU
	MUKUNA
	RUGHENDA
	KALEMIRE
KIMEMI	COMMERCIAL
	BIONDI
	LUMUMBA
	BWINYOLE
	VUTETSE
MUSUSA	VUNGI
	KITULU
	MATANDA
	KATWA
VULAMBA	KAMBALI
	CONGO YA SIKA

Fuel production and collection area

a) The *sustainable charcoal production/consumption component* involves the production of renewable charcoal. The biomass for that renewable charcoal production is sourced from dedicated plantations located in the five territories of Masisi, Rutshuru, Nyiragongo, Lubero, Beni in the province of North-Kivu and outside of the Virunga National Park. The fuel production and collection area comprises of all plantations eligible under the GS LUF VER project 'EcoMakala Virunga Reforestation project'. Please see the intervention zone (zone d'intervention) (see figure 3) where the eligible plantations are located.

b) The *improved cookstove component* involves the introduction of improved charcoal cookstoves (ICS). The charcoal used in these ICS has most likely been produced in North Kivu from biomass sourced from any of the territories in North Kivu, however might come from other provinces in DRC or even from the border regions from neighbouring countries (Rwanda, Uganda) too[14]. The charcoal used in the project ICS does not have to necessarily come from dedicated plantations established through the WWF project, nevertheless WWF recommends end-users to use 'EcoMakala'[15], the charcoal produced from biomass coming from dedicated plantations.

[14] It is most likely that the charcoal comes from North Kivu due to shorter distances and hence less involved transport costs to reach the final end-users.

[15] See the leaflet ('depliant') handed out to each end-user when buying the ICS which recommends the use of 'EcoMakala'.

Figure 1: Provinces of DRC

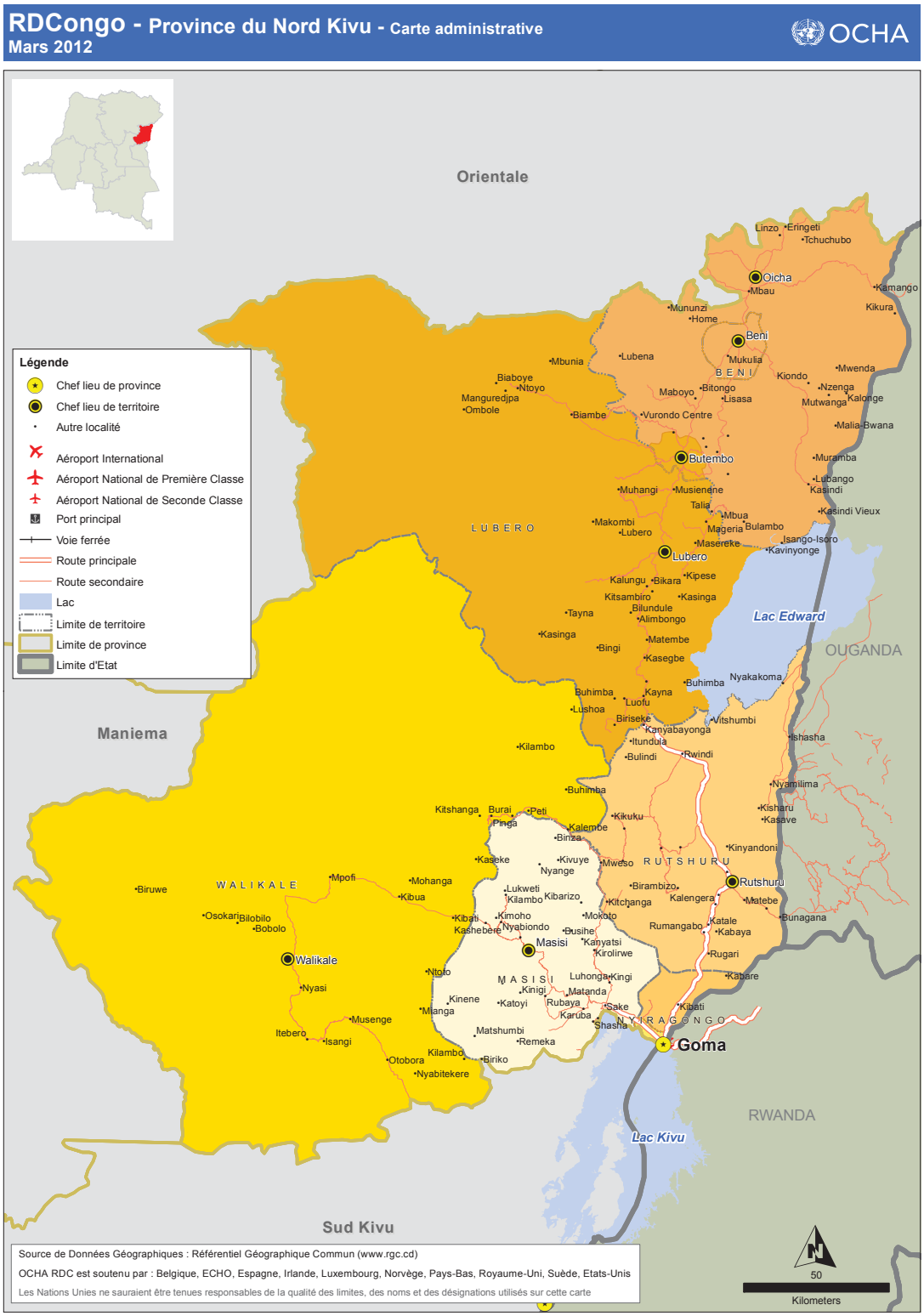

Figure 2: Territories of North Kivu

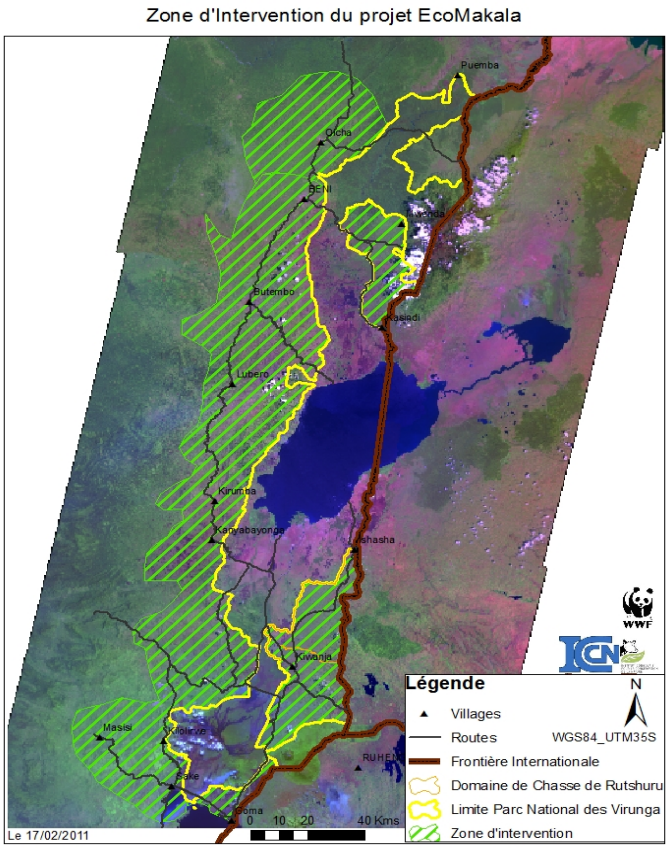

Figure 3: Intervention zone of the LUF VER project 'EcoMakala Virunga Reforestation project'

A.3. Technologies and/or measures

EcoMakala Virunga Energy project is constituted of two components: A first component is the displacement of non-renewable biomass used for charcoal production in unimproved traditional kilns by renewable biomass used in improved (more efficient) kilns with end-users of sustainably produced charcoal being households, SMEs or a group of households served by a charcoal market (e.g. charcoal consuming urban areas), and a second component is the introduction of improved charcoal cookstoves that enables reduction of charcoal consumption.

A.3.1 Sustainable charcoal production/consumption component

This component involves displacement of non-renewable biomass used for charcoal production in unimproved traditional kilns by renewable biomass coming from dedicated plantations used in improved (more efficient) kilns. The sustainably produced charcoal is being used by households, SMEs or a group of households served by a charcoal market (e.g. charcoal consuming urban areas).

WWF promotes the creation of cooperatives, which are responsible for the exploitation and commercialisation of wood products (in particular for production of charcoal) coming from the dedicated plantations. The cooperatives sign contracts with growers carrying out the reforestation activities and charcoal producers which in many cases produce the charcoal on behalf of the growers.

WWF supports the cooperatives by training the main charcoal producers in the more efficient stacking procedures and make them familiar with the new equipment like chimneys and vents to

regulate air flow[16]. Those trained charcoal producers can pass on the knowledge to other charcoal producers who do not have experience with the new technology yet. The charcoal production process can be grouped into three sequential phases: pre-carbonization, carbonization and post-carbonization:

***Pre-carbonization*:**
This phase involves the identification, quantification and preparation of raw material (wood) to be carbonized, as well the selection of kiln type. At this stage the following activities are performed:

- Cutting trees: trees are felled, the branches are removed and the log is divided into sections of equal size.
- Quantification: the quantity of wood to be carbonized is measured in stere[17], volume and/or weight in order to determine the size of kiln.
- Wood drying: Wood for carbonization is dried outdoors for two to three months to reach equilibrium moisture content of wood, which for this zone, is between 17 and 23%. This increases the efficiency of the carbonization process.

Carbonization
In this phase wood is converted into carbon through pyrolysis. The following activities are performed at this stage:

- Wood cutting: logs are cut into pieces of 2.5 m.
- Location and installation of the kiln: preparation of soil in which kiln will be located in order to facilitate air circulation during pyrolysis.
- Stacking wood: wood is placed in piles, avoiding empty spaces between the logs.
- Installation of kiln's cover: the kiln cover is composed of a frame of branches forming a grid upon which clods are placed in order to seal the air inlets in the kiln.
- Installation of elements for air circulation: Kilns can be constructed with or without vents and fireplace, these elements, the goal is to create a forced air circulation between the chimney and vents for proper combustion.
- Kiln ignition: for igniting the kiln, small wood or charcoal is burned outside the kiln and introduced in the kiln.
- Kiln monitoring: during carbonization, kiln must be monitored in order to prevent air intakes through fissures in the oven cover, which would cause the complete combustion of wood, or conversely, if the combustion is slow or if the pyrolysis process stops.
- Removal charcoal from kiln: charcoal is removed from kiln by removing the kiln cover. In such case the coal begins to burn, it must be off covering it with soil.

[16] See example of such trainings in file 'RAPPORT Formation_Carbonisation_JUIN ET JUILLET 2015_COOPAL.pdf' (uploaded to GS registry)

[17] A stere is a cubic metre of stacked firewood. A stere is less than a full cubic metre of wood, because the spaces between the woodblocks are included in a stere, while they do not count towards a full cubic metre.

Post-carbonization

After obtaining charcoal, it must be prepared for marketing, which involves conducting the following activities:

- Packing and weighing: The charcoal coal produced is packaged in bags of around 60 kilos.
- Distribution: Charcoal is transported to the point of storage of sale by trucks in order to reduce unit costs.

Detailed information of the steps listed above are found in the following documents: 'Manuel pour l'exploitation et la carbonisation.pdf', April 2013 and 'RAPPORT Formation_Carbonisation_JUIN ET JUILLET 2015_COOPAL.pdf'.

A.3.2 Improved stoves

The project initially will produce three portable ICS stoves (see technical specifications in the following table), however the list is not exhaustive and further stove models (either portable or fixed) might be included into the project later on.

Technical Specifications	JIKO NGUVU NYEUSI	JIKO GOMA STOVE	JIKO HARKISHA (Conical shape)
Colour	Black	Blue	Black
Weight	8 kg	12 kg	7 kg
Outer Body	Height (cm): 22 Diameter (cm): 28	Height (cm): 26 Diameter (cm): 29	Height (cm): 26 Diameter (cm): 29
Combustion Chamber	Height (cm): 7 Diameter (cm): 19 Volume (cm³): 2240 Average diameter of air hole (cm): 2 Number of air holes: 22	Height (cm): 8 Diameter (cm): 20 Volume (cm³): 2880 Average diameter of air hole (cm): 2 Number of air holes: 21	Height (cm): 7 Diameter (cm): 19 Volume (cm³): 2394 Average diameter of air hole (cm): 2 Number of air holes: 18

	Total area of air holes (cm^2): 16	Total area of air holes (cm^2): 18	Total area of air holes (cm^2): 18
Air/Ash opening	Length (cm): 13 Height (cm): 9 Controllable: Yes	Length (cm): 13 Height (cm): 9.5 Controllable: Yes	Length (cm): 12 Height (cm): 9 Controllable: Yes
Insulation	Material: clay + wood sawdust Thickness (cm): 2	Material: clay + wood sawdust Thickness (cm): 2	Material: clay + wood sawdust Thickness (cm): 2
Lifetime	3 years (see pdf document 'Certification FA REPROFCA_lifetime')	4 years (see pdf document 'Certification FA REPROFCA_lifetime')	3 years (still to be confirmed by manufacturer)
Thermal efficiency	To be included after WBT have been finalized	To be included after WBT have been finalized	To be included after WBT have been finalized
Photo			
			

The three aforementioned portable charcoal stoves are made up of two parts, namely:
-The ceramic liner manufactured by clay (70%) from Masisi district and sawdust (30%) serving as binder and insulation material
-The metal part consisting of metal sheets 'BG28' currently coming from Uganda
A layer of concrete is provided on the base of the ICS recovering the ash. At the top of the ICS a thin layer of a mixture consisting of cement and sand is put in order to protect the ICS from cracks resulting from overflow during cooking.
Materials used for producing the ICS as well as technical specifications of the ICS may change in future.

The different ICS models are considered under one single project scenario as long as they are of similar design and performance characteristics, i.e. as long as the ICS have the same fundamental combustion technology and their respective thermal efficiencies or specific consumptions do not differ by more than +/- 5% in absolute terms (see page 8 in TPDDTEC).

WWF provides as part of the project activity technical and financial support to the network of ICS producers called 'Reseau des Producteurs des Foyers Culinaires Ameliores' (abbreviated: REPROFCA) which was set up in August 2011 and consists of 20 member associations with a workforce of more than 300 people.
To evolve towards independence, the network REPROFCA passed through a status change from a non-profit organisation towards the company Goma Stove Sarl, a private company with limited liability, being REPROFCA the major shareholder of Goma Stove Sarl. The main activity of Goma Stove Sarl is the production and sale of improved stoves (mostly in Goma[18]) with the shift from artisanal production to semi-industrial production, with the possibility to even gradually being improved to industrial production.
The network JIKO BORA will be responsible[19] to produce and sell the stoves in Butembo and Beni.

With the training received from WWF, the company GOMA STOVE Sarl (and similarly for Butembo and Beni JIKO BORA or any company emerging from JIKO BORA) ensures the technical capacities of work staff by providing continuous training and to follow up and control the quality of the ICS produced. WWF conducts regular visits to verify and ensure that the ICS meet the defined standards. The production of the ceramic part (made out of clay) and the assembly (made with a thermal insulation consisting of a mixture of clay and sawdust) of the ICS is usually carried out by women whereas the men are usually involved in the manufacture of the metal part and the painting. The finishing work is carried out by men (serial number) and women (cleaning of the ICS) together before the ICS are being stored in a depot.

After production, the ICS are transported to the sales outlets. The Jiko Nguvu Nyeusi and Jiko Harkisha are currently sold for around US$ 5 whereas the Jiko Goma Stove for around US$ 10. These prices might change in future.
The ICS will be marketed through amongst others media awareness raising campaigns (commercials on radio and television), motorized caravans using local actors as well as promoted through door-to-door sales. Sales on credit might be an option.

ICS are sold with a one-month warranty to reassure that the customer uses it without problem. In the unlikely event of damaged or non-functioning ICS, the ICS is replaced by a new one.

Though the manufacturer specifies the lifetime with 3 to 4 years (depending on the model) and some households reported to use the stoves over this period, the PP conservatively assumes an average ICS lifetime of 2 years and does not claim carbon credits for ICS beyond 2 years' age anymore.

The person responsible for the sale hands out an information leaflet ('depliant')[20] in the local language (Swahili) and records all necessary data (for more details see the monitoring plan).

[18] Goma Stove Sarl sells ICS also in South Kivu, not being part of the ICS target area. The database will clearly differentiate between ICS sold in the target area and ICS sold outside of the target area.

[19] It is possible that a private company is set up (in a similar way as it was done for Goma) being responsible for production and sale of ICS in Beni and Butembo. In this case, JIKO BORA most likely would be a major shareholder of this company.

[20] The 'depliant' provides information on the characteristics of the ICS, how to use the improved cookstove and informs about the transfer of carbon credits from the end-user to the project participant.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
The Democratic Republic of Congo (host)	WWF, DRC (private entity)	No
Belgium	CO2logic, Belgium (private entity)	No

A.5. Public funding of project activity

The project has received some funding in the past, however in none of the cases there were any diversion of ODA. The PP will also ensure for the future that there won't be any diversion of ODA. See signed ODA declaration uploaded to the GS registry.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

>> Gold standard Methodology: Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC), Version 2.0.

Note: TPDDEC is applied for the *improved cookstove component*.

CDM methodology: AMS-III.BG: Emission reduction through sustainable charcoal production and consumption, Version 3.0
along with the following tools:
-Tool 'Project and leakage emissions from biomass', version 03.0, EB92, Annex 6
-Tool 'Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation', version 02.0, EB87, Annex 8
-'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion', version 02, EB41, Annex 11
-Tool on the demonstration of additionality of small-scale project activities, version 11.0, EB94, Annex 11

Note: AMS-III.BG is applied for the *sustainable charcoal production/consumption component*.

B.2. Applicability of methodology and standardized baseline

Applicability conditions of the methodology AMS-III.BG (referring to *sustainable charcoal production/consumption component*) are:

The methodology is applicable to project activities that displace the use of non-renewable biomass in the production of charcoal supplied to identified consumers for thermal applications included in the project boundary.	The project will produce charcoal using an improved technology and renewable biomass (from dedicated plantations) compared to the baseline where unimproved traditional kilns using non-renewable biomass are the common practice. Hence, the project will displace the use of non-renewable biomass (reflected in the

	fNRB default value of 90% in DRC[21]) in the production of charcoal supplied to identified consumers. Renewable biomass used for carbonization in the project activity comes exclusively from forest plantations established in the framework of the EcoMakala project established with this purpose. The plantations from which the woody biomass comes from for the sustainable charcoal production are being certified as GS A/R project and it is ensured that the land areas selected for the plantations are degraded cropland and/or grassland. Biomass from plantations being considered as forests already in the baseline will not be considered. Already existing biomass in the baseline has been conservatively taken into account in the ER calculation in the GS A/R project. The biomass is deemed to be 'renewable' as per EB23, Annex 18, since it complies with criterion 2: *2. The biomass is **woody biomass** and originates from **croplands and/or grasslands** where:* *(a) The land area remains cropland and/or grasslands or is reverted to forest; and* *(b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and* *(c) Any national or regional forestry, agriculture and nature conservation regulations are complied with.* The plantations from which the woody biomass comes from for the sustainable charcoal production are being certified as GS A/R project, hence it is ensured that the land areas being cropland and/or grassland in the baseline revert to forest and permanence is ensured, i.e. that carbon stocks are ensured during the crediting period of both energy and A/R project. Since all land areas foreseen for plantations are on degraded, private land, no specific national/regional regulations have to be followed. If however at any moment any of the regulations became relevant, it would be ensured that the same will be complied with. It will be ensured during the whole crediting period that the definition of renewable biomass is met at any time and be included in the sustainability monitoring plan. The demonstration of the actual displacement of charcoal production in the traditional (unimproved) kilns, i.e. the monitoring of

[21] https://cdm.unfccc.int/DNA/fNRB/index.html

	baseline charcoal production facilities in project scenario is however not possible since the charcoal production in the traditional kilns is carried out by the informal sector, often illegally, hence beyond the control of the PP to force them to halt charcoal production. There is also no monitoring requirement in the methodology AMS-III.BG which would request PP to demonstrate that each and every of those traditional kilns is being replaced by the improved kilns of the project activity. The same has been confirmed by the GS secretariat in an Email on March 09, 2017[22] to be acceptable. Applicability criterion is met.
The methodology is also applicable to charcoal generated as a by-product in micro- gasifier stoves using woody biomass for households cooking when used in conjunction with "AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass". Auxiliary power consumption in a blower or fan for forced convection is not covered by the methodology.	Not applicable since the project does not involve micro-gasifier stoves and does not use methodology AMS-II.G.
End users of charcoal shall be: (i) households; or (ii) small and medium enterprises (SMEs); or (iii) a group of households served by a charcoal market (e.g. charcoal consuming urban areas).[23] End users do not include large scale industries.	The project will ensure that end-users of sustainably produced charcoal will be households, SMEs or a group of households served by a charcoal market (e.g. charcoal consuming urban areas. The PP will maintain sales records and receipts of delivery (to the largest extent possible[24]) of charcoal products directly to eligible end-users and/or long-term contracts (to the largest extent possible[25]) with an entity (retailer, cooperative, trader etc.) supplying charcoal products to the eligible end-users. End users do not include large scale industries. Applicability criterion is met.
Measures such as contractual agreements shall be implemented to avoid potential double counting because of potential claims of	All relevant stakeholders involved in the production, distribution, sale or consumption of sustainably produced charcoal will be

[22] See Email, March 09, 2017 'Re_ Ecomakala project - AMS-III.BG together with TPDDTEC_2'.

[23] Acceptable evidence include, but are not limited to: sales records and receipts of delivery of charcoal products directly to eligible end-users, long-term contracts with an entity (retailer, cooperative, trader etc.) supplying charcoal products to the eligible end-users.

[24] Due to the high number of charcoal sales to end-users and charcoal sales to end users which are not fully under PP's control (e.g. if sales are carried out through intermediaries beyond PP's control), it won't be possible to have sales records and receipts of delivery of charcoal products for each and every sale.

[25] For some of the intermediaries involved in the charcoal sale and which are beyond PP's control, no contracts will be available.

emission reductions by the end users. These measures shall be described in the Project Design Document (PDD).	communicated by contract or clear written assertion in the transaction paperwork (like e.g. receipts of delivery and/or leaflets and/or labelled charcoal bags alerting end-users to the waiving of carbon rights to PP) about the entity claiming ownership rights on the credits and that they themselves cannot claim for emission reductions from the project. Applicability criterion is met.
Project activity, except for the case indicated in paragraph 3 above, shall introduce efficient charcoal production technologies using biomass feedstock such as biomass residues to displace the production of charcoal in unimproved traditional kilns by the informal sector thereby leading to emission reductions. Charcoal production facility may include briquetting facility for the agglomeration of smaller biomass particles. Methane produced during charcoaling process is either: (a) captured and destructed or gainfully used for heat or electricity; or (b) not captured and not destructed. Examples of these technologies include but are not limited to: *a) Retort sedentary kilns which capture the pyrolysis gas; captured gas may be gainfully used for example as a fuel for pre-heating the facility or for wood drying or for production of heat and/or power;* *b) Improved sedentary kilns without the capture of pyrolysis gas;* *c) Casamance kilns.*	The project will introduce efficient charcoal production technologies[26] using biomass from dedicated plantations to displace the production of charcoal in unimproved traditional kilns by the informal sector[27] thereby leading to emission reductions. The methane produced during charcoaling process is not captured and not destructed, hence option (b) is relevant. The project technologies consist of either improved sedentary kilns without the capture of pyrolysis gas or casamance kilns. The demonstration of the actual displacement of charcoal production in the traditional (unimproved) kilns, i.e. the monitoring of baseline charcoal production facilities in project scenario is however not possible since the charcoal production in the traditional kilns is carried out by the informal sector, often illegally (like e.g. in the Virunga National Park), hence beyond the control of the PP to force them to halt charcoal production. There is also no monitoring requirement in the methodology AMS-III.BG which would request PP to demonstrate that each and every of those traditional kilns is being replaced by the improved kilns of the project activity. The same has been confirmed by the GS secretariat in an Email on March 09, 2017[28] to be acceptable. Applicability criterion is met.
Project kilns not equipped with capture and destruction of the pyrolysis gases are not eligible to claim emission reductions on account of avoidance of methane emissions from the project activity under this	The project activity will not claim emission reductions on account of avoidance of methane emissions. Applicability criterion is met.

[26] The technology improvement is characterized by the use of a chimney, vent, moisture meter and following a defined standardized operating mode as described in the report 'RAPPORT Formation_Carbonisation_ JUIN ET JUILLET 2015_COOPAL.pdf', pages 4-8.

[27] The baseline survey excel spreadsheet 'BS_PRODUCTION_Analysis_v.01' and document 'Contribution of woodfuel to meet the energy needs of the population of Central Africa: prospects for sustainable management of available resources', Jolien Schure et al., 2012, page 113 confirm the baseline scenario being the use of traditional kilns for charcoal production.

[28] See Email, March 09, 2017 'Re_ Ecomakala project - AMS-III.BG together with TPDDTEC_2'.

methodology. It is assumed that methane emissions in the project equals to methane emissions in the baseline charcoal generation process.	
The project activity shall install and operate new (Greenfield) charcoal production facilities characterized by a new investment; replacement and retrofit of existing facilities is not eligible under this methodology. Provisions of "General guidelines for SSC CDM methodologies" shall be applied to demonstrate that the most plausible baseline scenario is the production of charcoal in unimproved traditional kilns by the informal sector.	The project activity will install and operate new (Greenfield) charcoal production facilities characterized by a new investment[29] and there won't be any replacement or retrofit of existing facilities. The baseline survey excel spreadsheet 'BS_PRODUCTION_Analysis_v.01' and document 'Contribution of woodfuel to meet the energy needs of the population of Central Africa: prospects for sustainable management of available resources', Jolien Schure et al., 2012, page 113 confirm the baseline scenario being the use of unimproved traditional kilns by the informal sector for charcoal production. Applicability criterion is met.
Charcoal manufacturing equipment transferred from existing or decommissioned charcoal production facilities are not eligible.	The project activity will ensure that no charcoal manufacturing equipment will be transferred from existing or decommissioned charcoal production facilities. All of the production facilities are characterized by a new investment. Applicability criterion is met.
The biomass utilized by the project activity shall not be chemically processed (e.g. esterification to produce biodiesel, degumming and/or neutralization by chemical reagents) prior to the pyrolysis, but it may be processed mechanically (e.g. pressing, filtering, agglomeration) or thermally (e.g. drying, roasting).	The project activity will ensure that the biomass coming from the dedicated plantations and utilized for charcoal production will not be chemically processed. The wood is only air dried after it has been cut in wood pieces of similar size before it gets carbonized. No chemical or other mechanical processing is necessary (for details see section A.3.1).
Biomass used by the project facilities is not stored for more than one year. No storage of the biomass is done in anaerobic conditions.	It is ensured that biomass is not stored for more than one year or stored under anaerobic conditions. Charcoal is produced within a few months after harvest and drying the wood, hence storage is never for more than one year.
The embedded energy in charcoal produced as by-product in micro-gasifier stoves as indicated in paragraph 3 above shall be neglected when performing water boiling test as per AMS-II.G (see paragraph 17 of AMS-II.G, version 6) to ensure that efficiency estimates are conservative.	Not applicable as no micro-gasifier stoves will be included in the project activity.

[29] See document 'Materiels de carbonisation _2014à 2025_estimation cout d'investissement.xlsx' (uploaded to the GS registry) indicating the purchased material (including cost) so far and an estimate for the upcoming years of material needed and costs involved. Note that the excel spreadsheet provides a rough estimate, hence actual costs may be lower or higher than what is indicated in the excel spreadsheet.

Applicability conditions of the tool 'Project and leakage emissions from biomass' (referring to sustainable charcoal production/consumption component) are:

Applicability criterion	Compliance with applicability criterion
The land in which biomass is cultivated: (i) Does not contain wetlands (ii) Does not contain organic soils as defined in paragraph 12c (iii) Is not subjected to flood irrigation	None of the plantations included in the project activity is on wetlands or contains organic soils. For more details see GS A/R documents, in particular template 5.1 Applicability 'GS5618 5.1 – EcoMakala – Applicability…'. The project does not consider the irrigation of plantations; plantations are naturally irrigated by rainwater. The only water required is the one used in the nurseries for watering the seedlings. For more details see GS A/R documents, in particular template 3.1 Do-No-Harm Assessment 'GS5618 3.1 – Ecomakala – Do-No-Harm Assessment…', item 36.
The land in which biomass is cultivated: (i) Does not contain forest nor contained forest for at least 10 years[30] prior to the planting start or (ii) Contains a forest plantation that before the start of the project will be harvested and the land would be neither reforested nor will regenerate on its own into a forest in the absence of the project activity	(i) It is ensured that all of the plantations included in the project for sustainable charcoal production have not had forest for at least 10 years prior to the planting start. For more details see GS A/R documents, in particular template 4.1 Additionality 'GS5618 4.1 – Ecomakala – Additionality…', item 4. (ii) Not applicable, since plantations being considered as forest as per the criteria established by the DNA of DRC (see https://cdm.unfccc.int/DNA/index.html) are not eligible for the project activity.
Desalination is not a substantial source of water in the host country	Desalination is not practised in the project area (North Kivu). North Kivu is landlocked and without access to the sea. The lakes in North Kivu are all with freshwater and none of them has salt water.
In case the land contains a forest plantation, the project proponent shall demonstrate and document transparently in the CDM-PDD that before the start of the project activity the plantation will be finally harvested and regeneration to forestland (according to the respective national definition) will not take place. In doing so, the project proponent shall: (a) Identify realistic and credible alternatives with regard to the possible land use scenarios that would occur in the absence of the project activity, including but not limited to: (i) The forest plantation continues under the	Not applicable, since all of the plantations included in the project for sustainable charcoal production have not had forest for at least 10 years prior to the planting start. For more details see GS A/R documents, in particular template 4.1 Additionality 'GS5618 4.1 – Ecomakala – Additionality…', item 4.

[30] The CDM tool mentions as requirement not to contain forest since 31 December 1989, however since the given project follows GS certification requirements, the GS A/R requirement is applied (see GS A/R requirements (http://www.goldstandard.org/sites/default/files/documents/ar_requirements_v0-9.pdf), 4.1 Additionality, item 4).

current management practice; (ii) The forest plantation is harvested and the land is replanted; (iii) The forest plantation is harvested and the land is abandoned. (b) Assess the economic attractiveness of the existing forest plantation by applying Step 2 of the latest approved version of the "Tool for the demonstration and assessment of additionality"; (c) Confirm, based on the plantation management practices in the region for the considered species, that the situation referred to in paragraph 6 (b) (ii) is the common practice; and (d) Use relevant credible evidence, including but not limited to official land use maps, satellite images/aerial photographs, cadastral information, official land use records.	
The tool is also applicable if biomass residues are consumed in a CDM project activity. These could be: (a) Procured by the project proponents; or (b) The result of an agro-industrial process under the control of the project proponents.	Not applicable since no biomass residues are consumed in the project activity.

Applicability conditions of the methodology TPDDTEC (referring to the *improved cookstove component*) are:

Applicability criterion	Compliance with applicability criterion
The methodology is applicable to programmes or activities introducing technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and non-domestic premises.	The project includes as one component the introduction of improved cookstoves. This component of the project targets households[31] in the province of North Kivu reducing GHG emissions. The activity is covered by the methodology and even mentioned as example on page 3 of the methodology. Applicability criterion is met.

[31] Non-domestic premises like institutions as allowed by TPDDTEC are initially not targeted but might be an option later on. A design change would be requested to GS if institutions were included into the project.

Project activities that claim emission reductions from improved practices only (e.g. there is no installation of improved devices) are expected to provide a detailed discussion of the chosen monitoring approach so as to demonstrate that emission reductions do indeed result from the practices introduced by the project activity.	Emission reductions will be claimed from sustainably produced charcoal in improved (efficient) kilns targeting households, SMEs and group of households served by a charcoal market (e.g. charcoal consuming urban areas which changed their practice (i.e.), however methodology AMS-III.BG will be used for this component. Hence, this criterion under TPDDTEC is not applicable.
The project boundary needs to be clearly identified, and the technologies counted in the project are not included in any other voluntary market or CDM project activity (i.e. no double counting takes place). In some cases there maybe another similar activity within the same target area. Project proponents must therefore have a survey mechanism in place together with appropriate mitigation measures so as to prevent any possibility of double counting.	The project boundary, target area and fuel production and collection area are clearly identified and described in section A.2. The project activities proposed in this document are the first of its kind in North-Kivu province, and they are not included in any other voluntary market or CDM project activity. The PP will ensure that each ICS has an unique identification number (serial number) to avoid double counting and that none of the ICS will claim carbon credits under another project or be included in any activity under a PoA. An appropriate database will ensure that the same ICS is not counted twice. Applicability criterion is met.
The technologies each have continuous useful energy outputs of less than 150kW per unit (defined as the total useful energy delivered from start to end of operation of a unit divided by time of operation). For technologies or practices that do not deliver thermal energy in the project scenario but only displace thermal energy supplied in the baseline scenario, the 150kW threshold applies to the displaced baseline technology.	The improved cookstoves have a continuous useful energy output which is clearly below 150 kW (e.g. for an estimated daily use of 3 hours: 2.04 kW). Please see tab 'Energy output'/ER calculation Ecomakala_Energy' for more details. Applicability criterion is met.
Using the baseline technology as a backup or auxiliary technology in parallel with the improved technology introduced by the project activity is permitted as long as a mechanism is put into place to encourage the removal of the old technology (e.g. discounted price for the improved technology) and the definitive discontinuity of its use. The project documentation must provide a clear description of the approach chosen and the monitoring plan must allow for a good understanding of the extent to which the baseline technology is still in use after the introduction of the improved technology.	The project promotes the removal of the baseline technology and change of practices (replacement of non-renewable charcoal by renewable charcoal) [32] however, given the scope of the project, it is expected that some use of baseline stoves will continue in the project scenario. The PP will ensure that the proportion of baseline stove use will be accounted for in the emission reduction calculation (as part of project emissions) and the proportions will be determined through project surveys and/or project KPTs (for more details see section B.7). Applicability criterion is met.

[32] The information leaflet ('depliant') handed out to the purchaser of the stove recommends the use of EcoMakala charcoal and informs the purchaser of the stove that he/she agrees on the discontinuation of the traditional stoves/ICS copies with the purchase of the project stove.

The project proponent must clearly communicate to all project participants the entity that is claiming ownership rights of and selling the emission reductions resulting from the project activity. For technology producers and the retailers of the improved technology or the renewable fuel in use, this must be communicated by contract or clear written assertions in the transaction paperwork. If the claimants are not the project technology end users, the end users will need to be informed and notified that they cannot claim for emission reductions from the project.	The information leaflet ('depliant') handed out to the purchaser at the moment of sale provides information about the transfer of carbon credits from the end-user to the project participant (CO2logic). Salesmen/-women and retailers are sensitized to hand out the information leaflet with each cookstove sale explaining to end-users the transfer of carbon credits from the end-user to the project participant (CO2logic). All relevant stakeholders involved in the manufacturing, distribution or commercialisation of the improved cookstoves will be communicated by contract or clear written assertion in the transaction paperwork about the entity claiming ownership rights on the credits and that they themselves cannot claim for emission reductions from the project. Applicability criterion is met.
Project activities making use of a new biomass feedstock in the project situation (e.g. shift from non-renewable to green charcoal, plant oil or renewable biomass briquettes) must comply with relevant Gold Standard specific requirements for biomass related project activities, as defined in the latest version of the Gold Standard rules. If the biomass feedstock is sourced from a dedicated plantation, the criteria must apply to both plantations established for the project activity and existing plantations that were established in the context of other activities but will supply biomass feedstock. *According to Gold Standard Rules, the project applicant shall meet the following requirements:* *1) Project participants shall therefore provide convincing evidence that the project activities make use of renewable biomass resources. This criterion shall be monitored along the crediting period and therefore be included in the sustainability monitoring plan.* *2) Activities expected to make use of biomass resources already in use shall NOT be eligible for Gold Standard registration unless convincing evidence is provided showing that the current users are in agreement with the envisioned shift of use (potential leakage associated to such a shift must be taken into account). In the absence of such an agreement, Project Participants shall demonstrate that their project makes use of* ***surplus biomass*** *for each type of biomass resources used. They must do so once, ex-ante on time for validation for small-scale activities, and in time for validation and for*	The methodology AMS-III.BG will be used for sustainably produced charcoal and the switch from non-renewable to green charcoal, hence these criteria under TPDDTEC are not applicable.

each one of the verifications (inclusion in the Sustainability Monitoring Plan) for large-scale activities. *3) Project Participants shall demonstrate that their activity will only make use of* ***degraded land*** *and shall include this criterion in the Sustainability Monitoring Plan. Two exceptions may be considered: convincing evidence is provided showing that the envisioned energy crop is part of a traditional rotational cropping, OR an increase of the productivity is obtained, locally and to the benefit of the current users, through measures implemented in the context of the activity so as to at a minimum compensate for the part of the land newly allocated to growing the energy crop. Compliance with these criteria above must be monitored over the crediting period and thus be part of the Sustainability Monitoring Plan.* *4) Activities making use of* ***GMOs*** *shall declare so in a transparent way. Local stakeholders opinion on GMOs shall prevail and appropriate mitigation measures shall be put in place to address their concerns, if any, in a satisfactory way.*	
Adequate evidence is supplied to demonstrate that indoor air pollution (IAP) levels are not worsened compared to the baseline, and greenhouse gases (as listed in section II.1) emitted by the project fuel/stove combination are estimated with adequate precision. The project fuel/stove combination may include instances in which the project stove is a baseline stove.	The methodology AMS-III.BG will be used for sustainably produced charcoal and the switch from non-renewable to green charcoal, hence this criterion under TPDDTEC is not applicable.
Records of renewable fuel sales may not be used as sole parameters for emission reduction calculation, but may be used as data informing the equations in section II of this methodology. These records need to be correlated to data on distribution and results of field tests and surveys confirming (a) actual use of the renewable fuel and usage patterns (such as average fraction of non-renewable fuels used in mixed combustion or seasonal variation of fuel types), (b) GHG emissions, (c) evidence of CO levels not deteriorating (d) any further factors effecting emission reductions significantly.	The methodology AMS-III.BG will be used for sustainably produced charcoal and the switch from non-renewable to green charcoal, hence this criterion under TPDDTEC is not applicable.

B.3. Project boundary

Emission sources referring to *sustainable charcoal production/consumption component* following AMS-III.BG:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Displacement of non-renewable biomass by renewable biomass in the production of charcoal	CO_2	Yes	Important source of emissions
		CH_4	No	Not included for simplification
		N_2O	No	Not included for simplification
	Production of charcoal	CO_2	No	Not included for simplification
		CH_4	No	Project kilns are not equipped with capture and destruction of pyrolysis gases, hence no avoidance of methane emissions can be claimed for. It is assumed that methane emissions in the project equals to methane emissions in the baseline charcoal generation process (see AMS-III.BG, paragraph 7).
		N_2O	No	Not included for simplification It is assumed that N_2O in the project equals to N_2O emissions in the baseline charcoal generation process
	Transport of charcoal	CO_2	No	Not included for simplification
		CH_4	No	Not included for simplification
		N_2O	No	Not included for simplification
Project scenario	Emissions due to fossil fuel consumption in charcoal production facilities	CO_2	No	No fossil fuel use in charcoal production facilities in the project scenario
		CH_4	No	No significant source of emissions
		N_2O	No	No significant source of emissions
	Emissions due to electricity consumption in charcoal production facilities	CO_2	No	No electricity consumption in charcoal production facilities in the project scenario
		CH_4	No	No significant source of emissions
		N_2O	No	No significant source of emissions
	Emissions due to biomass cultivation	CO_2	Yes	Though included as emission source in the project boundary, no emissions are expected from soil management, energy consumption or burning of biomass
		CH_4	No	No need to be accounted for under Tool 'Project emissions from cultivation of biomass'
		N_2O	No	No need to be accounted for under Tool 'Project emissions from cultivation of biomass'
	Transport of charcoal	CO_2	No	No need to be accounted for under AMS-III.BG[33]. Further, charcoal is also transported in the baseline scenario, hence no significant increase in emissions expected due to the project activity
		CH_4	No	No need to be accounted for under AMS-III.BG Further, charcoal is also transported in the baseline scenario, hence no significant increase in emissions expected due to the project activity

		N_2O	No	No need to be accounted for under AMS-III.BG Further, charcoal is also transported in the baseline scenario, hence no significant increase in emissions expected due to the project activity

According to paragraph 18 of AMS-III.BG, the project boundary includes the physical, geographical site(s) of:

- (a) The use of biomass;
- (b) The carbonization units (improved kilns) included in the project;
- (c) The areas for storage, processing, bagging and weighting of inputs (biomass) and outputs (charcoal and/or charcoal briquettes);
- (d) The use of charcoal or charcoal products.

Emission sources referring to *improved cookstove component* following TPDDTEC:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Heat delivery	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Significant for charcoal, hence included
	Production of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Significant for charcoal, hence included
	Transport of fuel	CO_2	No	Not included for simplification
		CH_4	No	Not included for simplification
		N_2O	No	Not included for simplification
Project scenario	Heat delivery	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Significant for charcoal, hence included
	Production of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Significant for charcoal, hence included
	Transport of fuel	CO_2	No	Not included since no significant increase of fuel transport compared to the baseline
		CH_4	No	Not included since no significant increase of fuel transport compared to the baseline
		N_2O	No	Not included since no significant increase of fuel transport compared to the baseline

The PP has defined project boundary, target area and fuel production and collection area as requested in section II, item 1 (page 5) of TPDDTEC. Please see section A.2.4

B.4. Establishment and description of baseline scenario

[33] See footnote 4 of methodology AMS-III.BG which mentions that 'project emissions on account of transport are assumed to be negligible'.

Baseline scenario for *sustainable charcoal production/consumption component*

As per the applied methodology AMS-III.BG, the baseline scenario is defined as per the following:

For the charcoal portion produced from non-renewable biomass in the baseline, it is assumed that in the absence of the project activity, the baseline scenario would be the future use of fossil fuels for meeting similar thermal energy needs. For the charcoal portion produced from renewable biomass in the baseline, traditional open-ended methods resulting in methane emitted to the atmosphere forms the baseline scenario.

The project activity claims emission reductions from the displacement of non-renewable biomass used for charcoal production in unimproved traditional kilns by renewable biomass used in improved (more efficient) kilns. The project activity does not claim emission reductions for avoidance of methane emissions.

A baseline survey carried out with 120 randomly selected charcoal producers[34] in the 5 territories of North Kivu included in the target area confirmed the baseline scenario being the use of traditional kilns. At least one sector ('chefferie') of each territory has been randomly selected (in two out of the 5 territories 2 'chefferies') and in each of the 'chefferies' again a few groupings ('groupement') have been randomly selected[35]. Hence, the selected samples are deemed to be representative of the overall population. In case of the territory of Beni, less samples have been taken than for the other 4 territories due to the tense security situation in many areas at the time when doing the survey. Surveys have been conducted by WWF staff which has been trained by the carbon consultant before.
Only 2 of the 120 interviewed charcoal producers answered to use improved technology[36] however one of the 2 indicated to make part of the given EcoMakala project, hence only 1 out of 120 utilises the improved technology in the baseline. This represents less than 1%, which is deemed to be insignificant. For more details, see baseline survey excel spreadsheet 'BS_PRODUCTION_Analysis_v.01' (questions 6 to 8).

The fact that most of the charcoal in the baseline is produced with non-renewable biomass is reflected in the fNRB value of 90% for DRC (see https://cdm.unfccc.int/DNA/fNRB/index.html). Further, a survey conducted in 2008[37] found out that 80% of the charcoal consumed in Goma comes from Virunga National Park, hence is obviously produced from non-renewable biomass.

Baseline scenario for *improved cookstove component*

As per TPDDTEC, the baseline scenario is defined by the typical baseline fuel consumption patterns in a population that is targeted for adoption of the project technology.

A few studies have been conducted for North-Kivu (e.g. 'Enquete sur les foyers ameliores dans les quartiers de Goma', 10/2008, E. Balole-Bwami and Jean-Claude Balole-Bwami) in order to evaluate

[34] The applied methodology AMS-III.BG does not refer to baseline surveys, hence the minimum sample size of 100 for group size > 1000 as indicated in the TPDDTEC methodology, page 10 has been chosen for the baseline survey.

[35] See https://en.wikipedia.org/wiki/Subdivisions_of_the_Democratic_Republic_of_the_Congo (accessed on 05/06/2017) explaining the territorial organisation in DRC. A 'territoire' is composed of cities which are subdivided in quartiers (in the case of urban areas) and in case of rural areas composed of 'chefferies' subdivided into 'groupement' and each 'groupement' again subdivided into 'villages'.

[36] The technology improvement is characterized by the use of a chimney, vent, moisture meter and following a defined standardized operating mode as described in the report 'RAPPORT Formation_Carbonisation_ JUIN ET JUILLET 2015_COOPAL.pdf', pages 4-8.

[37] 'Enquete sur les foyers ameliores dans les quartiers de Goma', 10/2008, E. Balole-Bwami and Jean-Claude Balole-Bwami, page 6 refers to another study 'Etude sur la consummation du charbon de bois a Goma', 02/2008, E. Balole-Bwami and Jean-Claude Balole-Bwami.

the energy requirements of the population and supply sources. However, none of the studies have been precise enough to conclude the typical baseline fuel consumption patterns in the target area. Hence, the PP has decided to conduct baseline surveys in the cities of Goma, Beni and Butembo to find out the typical baseline fuel consumption patterns representative of the target area (for more details see section A.2.4). Though the applied methodology TPDDEC requires in total a sample size of 'only' 100 surveys in case the group size is > 1,000, the PP decided to conduct at least 100 surveys in each of the 3 cities (Goma, Beni, Butembo) included in the target area. This allowed PP to get more representative results.

Baseline survey Goma:

103 HHs have been randomly selected from the 18 neighbourhoods ('quartiers') in the 2 'communes'[38] of Goma between 12/2016 and 03/2017. Surveys have been conducted by WWF staff which has been trained by the carbon consultant before.

Surveyors were instructed

-not to interview households which are less than 300 m distance from each other to ensure a certain geographic representativeness.

-not to interview households which use WWF ICS[39] without serial numbers sold from July 2009 onwards[40] since those ICS make actually part of the project activity but will finally not credited due to the missing serial number and lack of a carbon waiver.

4 baseline scenarios have been identified for Goma (see following table). However, only for 3 out of the 4 baseline scenarios, baseline KPTs will be conducted. The KPT results for scenario N° 2 will be also applied for scenario N° 3. This is conservative since the baseline fuel consumption in scenario N° 3 would be higher than for N° 2.

For the detailed results of the baseline survey see the excel spreadsheet 'BS_GS_Analysis_Goma_v.01.xlsx'.

N° Baseline Scenario	Baseline Scenario	Proportion	Baseline KPT (Yes/No)
1	Traditional charcoal stove	18.4%	Yes
2	Charcoal ICS copy ('pirate')	60.2%	Yes (N° 2 is more conservative than N° 3)
3	Traditional charcoal stove in combination with charcoal ICS copy ('pirate')	5.3%	No
4	Charcoal ICS copy ('pirate') in combination with electric stove	7.8%	Yes
Not applicable	Other stove/fuel combinations (not defined as baseline scenarios since each of those other combinations has a proportion of less than 5% of the total and hence are not considered significant)	8.3%	Not applicable
Total		100%	Not applicable

Baseline survey Beni:

[38] 'Communes' correspond to a municipality in DRC.

[39] This does of course not exclude households using any other ICS apart from WWF's ICS.

[40] See email exchange with the GS secretariat and approval Email from 15/10/2016 (file : 'Re_ EcoMakala improved cookstove project_GS secretariat response 15102016' available upon request)

104 HHs have been randomly selected from 18 neighbourhoods ('quartiers') in 4 'communes' of Beni in 03/2017. Surveys have been conducted by WWF staff which has been trained by the carbon consultant before.
Surveyors were instructed
-not to interview households which are less than 300 m distance from each other to ensure a certain geographic representativeness.
-not to interview households which use WWF ICS without serial numbers sold from July 2009 onwards since those ICS make actually part of the project activity but will finally not credited due to the missing serial number and lack of a carbon waiver.

6 baseline scenarios have been identified for Beni (see following table). However, only for 3 out of the 6 baseline scenarios, baseline KPTs will be conducted. The KPT results for scenario N° 3 will be also applied for scenarios N° 1 and N° 2. This is conservative since the baseline fuel consumption in scenarios N° 1 and N° 2 would be higher than for N° 3. The KPT results for scenario N° 6 will be also applied for scenario N° 5. This is conservative since the baseline fuel consumption in scenario N° 5 would be higher than for N° 6.
For the detailed results of the baseline survey see the excel spreadsheet 'BS_GS_Analysis_Béni_v.01.xlsx'.

N° Baseline Scenario	Baseline Scenario	Proportion	Baseline KPT (Yes/No)
1	3-stone fire in combination with charcoal ICS copy ('pirate')	6.7%	No
2	Traditional firewood stove in combination with traditional charcoal stove	14.4%	No
3	Traditional firewood stove in combination with charcoal ICS copy ('pirate')	14.4%	Yes (N° 3 is more conservative than N° 1 and N° 2)
4	Traditional charcoal stove	28.8%	Yes
5	Traditional charcoal stove in combination with charcoal ICS copy ('pirate')	8.6%	No
6	Charcoal ICS copy ('pirate')	22.1%	Yes (N° 6 is more conservative than N° 5)
Not applicable	Other stove/fuel combinations (not defined as baseline scenarios since each of those other combinations has a proportion of less than 5% of the total and hence are not considered significant)	5%	Not applicable
Total		100%	Not applicable

<u>Baseline survey Butembo:</u>
108 HHs have been randomly selected from 16 neighbourhoods ('quartiers') in 4 'communes' of Butembo between 12/2016 and 02/2017. Surveys have been conducted by WWF staff which has been trained by the carbon consultant before.
Surveyors were instructed
-not to interview households which are less than 300 m distance from each other to ensure a certain geographic representativeness.
-not to interview households which use WWF ICS without serial numbers sold from July 2009 onwards since those ICS make actually part of the project activity but will finally not credited due to the missing serial number and lack of a carbon waiver.

5 baseline scenarios have been identified for Butembo (see following table). However, only for 3 out of the 5 baseline scenarios, baseline KPTs will be conducted. The KPT results for scenario N° 2 will be also applied for scenario N° 1. This is conservative since the baseline fuel consumption in scenarios N° 1 would be higher than for N° 2. The KPT results for scenario N° 5 will be also applied for scenario N° 4. This is conservative since the baseline fuel consumption in scenario N° 4 would be higher than for N° 5.
For the detailed results of the baseline survey see the excel spreadsheet 'BS_GS_Analysis_Butembo_v.01.xlsx'.

N° Baseline Scenario	Baseline Scenario	Proportion	Baseline KPT (Yes/No)
1	Traditional firewood stove in combination with traditional charcoal stove	6.5%	No
2	Traditional firewood stove in combination with charcoal ICS copy ('pirate')	14.8%	Yes (N° 2 is more conservative than N° 1)
3	Traditional charcoal stove	18.5%	Yes
4	Traditional charcoal stove in combination with charcoal ICS copy ('pirate')	10.2%	No
5	Charcoal ICS copy ('pirate')	45.4%	Yes (N° 5 is more conservative than N° 4)
Not applicable	Other stove/fuel combinations (not defined as baseline scenarios since each of those other combinations has a proportion of less than 5% of the total and hence are not considered significant)	4.6%	Not applicable
Total		100%	Not applicable

B.5. Demonstration of additionality

The table below is only applicable if the proposed project activity is a type of project activity which is deemed automatically additional, as defined by the applied approved methodology or standardized baseline.

Specify the methodology or standardized baseline that establish automatic additionality for the proposed project activity (including the version number and the specific paragraph, if applicable).	Not applicable
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology or standardized baselines.	Not applicable

The document 'GS memo_consideration of carbon revenues_v.1.4' including its supporting

documents[41] demonstrate that revenues from CO2-certificates were seriously considered in the decision to implement both components (*improved cookstove component* and *sustainable charcoal production/consumption component*) of the project and that there was continuous interest in CO_2 certificates for the project in parallel with its implementation.

Both components of the project are considered as 'first of its kind' in the province of North Kivu, therefore a realistic and credible barrier due to prevailing practice is being claimed.

AMS-III.BG (used for *sustainable charcoal production/consumption component*) refers to the Guidelines (now 'tool') on the demonstration of additionality of small-scale project activities.
The tool[42] indicates in paragraph 10 the following:
Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

<u>Barrier due to prevailing practice:</u>
According to PP's internet and literature research[43] done and according to its work experience in North Kivu and its best knowledge, the Mampu project on the Batéké Plateau with production of charcoal from 8,000 ha of acacia trees, and the neighbouring reforestation project Ibi Village with related charcoal production registered under the CDM[44] are the only two other projects besides EcoMakala project involving sustainable charcoal production in DRC[45], however none of the two is located in the project's target area, namely North Kivu.

The paper 'Cooking in the Congo' (11/2014) refers to a project implemented by ICCN in collaboration with the NGO ACF Virunga and UNHCR and which was running between 2008 and 2012. The project comprised of the production of biomass briquettes from wood waste, such as sawdust, paper and cardboard as well as waste from coffee and peanuts without involving the production of charcoal. The project ran out of funding by the end of 2012 and manufacturers of biomass briquettes were ceasing their activities in 2013 and all briquettes presses have been abandoned. Another biomass briquette distribution project referred to in the same paper have been implemented by WFP and the local NGO CRSM which however focuses on internally displaced people (IDPs) and refugee camps. Again charcoal does not make part of the briquettes produced.

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[41] All of the documents will be submitted to GS for PFA review and to the DOE for validation.

[42] EB94, Annex 11, version 11.0

[43] This included amongst others a carbon registry research

[44] https://cdm.unfccc.int/Projects/DB/ErnstYoung1291309493.36/view

[45] Contribution of woodfuel to meet the energy needs of the population of Central Africa prospects for sustainable management of available resources_ Jolien Schure et al_2012.pdf, page 115 and AAM Schure et al., 2014 - Institutions and access to woodfuel commerce in the Democratic Republic of Congo.pdf (uploaded to GS registry)

Further, the baseline survey carried out with 120 randomly selected charcoal producers in the 5 territories of North Kivu included in the target area confirmed the baseline scenario being the use of traditional kilns and there was no indication for another project similar to the EcoMakala project.

Hence, it can be concluded that there is no other project in North Kivu which has introduced new and efficient charcoal production technologies using renewable biomass and that the prevailing practice in North Kivu is the baseline scenario as described in section B.4., namely to produce charcoal in traditional kilns using non-renewable biomass.

TPDDTEC (used for the *improved cookstove component*) mentions the following (on page 9):

In situations where it can be shown that the project technology has been adopted by less than 20% of the population in the target area (as defined in section II, 1.b), the technology can be qualified as "first of its kind" and hence a realistic and credible barrier due to prevailing practice can be claimed. The demonstration must rely on existing credible sources of information or on a survey conducted specifically for the occasion by a third party within a sample representative enough of the overall population in the target region.

The PP conducted a literature and carbon registry research[46]. Only one registered GS CDM PoA[47] located in DRC could be found, however that programme does not include the province of North Kivu in its project boundary.
The paper 'Cooking in the Congo' (11/2014)[48] mentions that the first experience with improved cookstoves (ICS) in North Kivu happened between 2000 and 2002. The FIDA/GTZ project supported initiatives to promote the use of ICS (both portable and fixed) and over 6,740 ICS were constructed. The project came to an end due to conflicts in the region and the eruption of the Nyiragongo volcano, the most destructive eruption in modern history, which destroyed part of Goma. Besides WWF, it was Mercy Corps in 2008 and IFDC in 2009 who initiated fuel-efficient stove programs in North Kivu. Mercy Corps supported the construction of 20,000 ICS while IFDC has not provided data on the number of stoves, but reports having given support to 7 organisations of artisans to produce from 6 to 100 stoves daily. However, the Mercy Corps and IFDC projects ended due to the lack of funding in 2012 and 2013 respectively. It is stated that artisans trained previously were struggling to continue running their ICS businesses. Further it is mentioned that stoves models promoted by the 2 NGOs are not being produced anymore, but switched to the more popular 'Jiko Nguvu Nyeusi'[49]. It is reasonable to assume that all of the stoves disseminated until 2013 are not in use anymore since the stoves have a lifetime of between 2 to 3 years.
The paper mentions a few barriers identified by ICS producers, amongst others the 'absence of a proof of quality, such as a quality seal, does not allow them to confirm that their stoves meet certain quality requirements and efficiency'. The paper still refers to another pilot implemented by IRC and WRC distributing 2,500 Envirofit M-5000 ICS, however exclusively to internally displaced people and the pilot being completed already.

The baseline surveys carried out in the target area for ICS (Goma, Butembo and Beni) have shown that households use a significant number of improved stoves, however all of those improved stoves are copies (so called 'pirates') of the WWF stoves (Jiko and Nguvu Nyeusi) or are produced as follow

[46] The most important carbon registries, namely CDM, GS, VCS and Plan Vivo have been checked.

[47] https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/RSPUDC53EQI206JHO84ZVTXBM7AGF1/view

[48] Women's Refugee Commission, Cooking in the Congo, Technical assessment of cooking fuel and stoves for displaced communities in North Kivu, DRC, 11/2014, https://www.womensrefugeecommission.org/images/zdocs/Cooking-in-the-Congo-North-Kivu-Tech-Assess.pdf, downloaded 20/05/2017.

[49] This stove was conceived in Goma around in 2000 by the GTZ/FIDA program and improved by WWF from 2008 onwards.

up of the aforementioned IFDC project (Butembo stove)[50] with artisans not receiving training and not following a standardized protocol resulting in differences of weight, geometric dimensions and quality. 'Pirate' stoves are usually not consistent in the dimensions of e.g. combustion chamber, air/ash opening and have an inferior quality compared to WWF stoves due to low quality materials (like metal and clay) used.

Based on the aforementioned it can be concluded that there is no other ongoing ICS project in North Kivu with a similar scale and target population as the EcoMakala Virunga Energy project. Standardised production of ICS with an appropriate quality assurance and quality control in place are key components of the project, which has been identified as key barrier in other projects and are missing in the production of 'pirate' stoves.
Hence, the PP concludes that the project ICS technology can be qualified as 'first of its kind', since the project technology had been adopted by less than 20% of the population in the target area before starting the EcoMakala Virunga Energy project.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Emission reductions for the *sustainable charcoal production/consumption* component are calculated as per equation (3) of methodology AMS-III.BG since the project activity is not equipped with capture and destruction of the pyrolysis gases.

$$ER_y = \sum_i Q_{CCP,i_y} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal,i}}{NCV_{charcoal,default}} \times f_{NRB,BL,wood} \times EF_{projected_{fossilfuel}}\right)\right] - PE_{FF,y} - PE_{El,y} - PE_{BC,y}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

$Q_{CCP,i,y}$ = Quantity of charcoal type *i* produced and used in year *y* (t)

CF = Default wood to charcoal conversion factor

NCV_{wood} = Net calorific value of wood (TJ/t) (use a default value of 0.0156)

$NCV_{charcoal,i}$ = Net calorific value of the charcoal type *i* produced during the project (TJ/t)

$NCV_{charcoal,default}$ = Default net calorific value of charcoal (TJ/t) (use a default value of 0.0295)

$f_{NRB,BL,wood}$ = Fraction of biomass of type *i* used in the absence of the project activity that can be established as non-renewable biomass; determined on the basis of the published DNA endorsed default values available on the UNFCCC website (fNRB default value = 90%)

$EF_{projected\_fossilfuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumers (t CO_2/TJ) (use a default value of 81.6)

$PE_{FF,y}$ = Project emissions due to fossil fuel consumption in charcoal production facilities in year *y*

[50] Apart from the Jiko and Nguvu Nyeusi 'pirate' stoves and Butembo stoves, there were 3 out of 315 households using so called 'Ringa' ICS. Since however this represents less than 1%, it is not considered to be significant.

(t CO_2)

$PE_{El,y}$ = Project emissions due to electricity consumption in charcoal production facilities in year *y* (t CO_2)

$PE_{BC,y}$ = Project emissions due to biomass cultivation in year *y* (t CO_2)

As per AMS-III.BG, project emissions might occur due to fossil fuel consumption in charcoal production facilities ($PE_{FF,y}$), due to electricity consumption in charcoal production facilities ($PE_{El,y}$) and due to biomass cultivation ($PE_{BC,y}$).

None of the charcoal production facilities use fossil fuels or electricity. The improved charcoal production facilities and carbonization process (see description in section A.3.1 and document 'RAPPORT Formation_Carbonisation_ JUIN ET JUILLET 2015_COOPAL.pdf') are designed in such a way that no fossil fuel or electricity consumption is necessary. Charcoal production is not mechanised and takes place in continuously changing decentralised locations in rural areas with no electricity access. The document 'Materiels de carbonisation _2014à 2025_estimation cout d'investissement.xls' lists the necessary equipment needed for charcoal production. None of the equipment's involve electricity or fossil fuel use. Hence, no monitoring of fossil fuel and electricity consumption charcoal production facilities is necessary.

In regards to project emissions resulting from cultivation of biomass in dedicated plantations, the same are composed of[51]:

a) Emissions resulting from loss of soil organic carbon ($PE_{SOC,y}$)
b) Emissions resulting from soil management ($PE_{SM,y}$)
c) Emissions resulting from energy consumption ($PE_{EC,y}$)
d) Emissions resulting from burning of biomass ($PE_{BB,y}$)
e) Emissions resulting from transport of biomass ($PE_{TR,y}$)

Emissions from loss of soil organic carbon ($PE_{SOC,y}$): The PP has demonstrated as part of the A/R EcoMakala Virunga Reforestation project that there is no loss of soil organic carbon, but on the contrary SOC sequestration occurs.[52] Hence, it is confirmed that there are no project emissions from loss of soil organic carbon. Hence, no monitoring of emissions resulting from loss of soil organic carbon is necessary.

Emissions resulting from soil management ($PE_{SM,y}$) consists of:

a) Emissions resulting from soil fertilization and management ($PE_{SF,y}$)
b) Emissions resulting from soil amendment (liming) ($PE_{SA,y}$)

Emissions resulting from soil fertilization and management ($PE_{SF,y}$): It is not expected that nitrogen (in form of synthetic fertilisers, organic manure or nitrogen fixing cover crops) will be applied to the plantations. A random number of plantations will be sampled during monitoring to confirm the same. In case that nitrogen would be applied to the plantations, project emissions will be calculated as per equation (5) of the Tool 'Project emissions from cultivation of biomass'.

[51] See tool 'Project and leakage emissions from biomass', version 03.0, https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v7.0.pdf

[52] See SOC related documents submitted to GS for A/R PFA.

$$PE_{SF,y} = q_{N,y} \times A_{FTM,y} \times EF_{FT}$$ Equation (5)

Where:

$PE_{SF,y}$	=	Emissions resulting from soil fertilization and management, in year *y* (t CO_2e)
$q_{N,y}$	=	Rate of nitrogen applied, in year *y* (t N/ha)
$A_{FTM,y}$	=	Area of land subjected to soil fertilization and management, in year *y* (ha)

Emissions resulting from soil amendment (liming) ($PE_{SA,y}$) are not expected. No soil amendment agent types, like limestone, urea, dolomite or other carbon containing agent will be applied to the plantations. A random number of plantations will be sampled during monitoring to confirm the same. In case that soil amendment agent types would be applied to the plantations, project emissions will be calculated as per equation (6) of the Tool 'Project emissions from cultivation of biomass'.

$$PE_{SA,y} = \sum_{i} q_{SA,i,y} \times A_{SA,i,y} \times EF_{SA,i,y}$$ Equation (6)

Where:

$PE_{SA,y}$	=	Emissions resulting from soil amendment by liming, application of dolomite, urea or other carbon containing agent, in year *y* (t CO_2e)
$q_{SA.i,y}$	=	Rate of application of soil amendment agent type *i*, in year *y* (t/ha)
$A_{SA,i,y}$	=	Area of land in which soil amendment agent type *i* is applied, in year *y* (ha)
$EF_{SA,i}$	=	Emission factor for CO_2 emissions from application of soil amendment agent type *i* (t CO_2e/t). Default values for limestone (0.12 t CO_2e/t)[7], dolomite (0.13 t CO2e/t)[8] and urea (0.20 t CO2e/t)[9] shall be used.

Emissions resulting from energy consumption ($PE_{EC,y}$) are not expected. It is not expected that farm machinery (like e.g. tractors, harvesters), irrigation or use of machinery in transport and application of fertiliser will be used. A random number of plantations will be sampled during monitoring to confirm the same. In case that however any fossil fuels or electricity would be used, project emissions will be calculated as per the 'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion' and/or 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption'.

Emissions resulting from clearance or burning of biomass ($PE_{BB,y}$): Clearance or burning of biomass can happen prior to starting any planting activities (initial removal/clearance) or after the first plantations and/or first harvest of biomass have been carried out. In regards to potential PE from initial removal/clearance, the same are not relevant in this context since the biomass in the baseline had been already discounted as part of the GS A/R project activity in the year when the plantations were realised. In regards to potential PE arising from clearance of biomass within the plantations or after harvest, the project activity should not be subject to a debit, i.e. there should not be a reduction in potential emission reductions since the biomass grew as part of the project activity and was emitted within the activity. The only potential project emissions which could arise as part of the project activity (e.g. after harvest) would be from burning biomass. Though no burning of biomass is expected, PP will conduct surveys with a random number of growers during monitoring to confirm the same.

Emissions resulting from transport are not applicable to the project activity, since the component

applying AMS-III.BG is of small-scale and transportation distance is less than 200 km. Distance from plantations to the charcoal production facilities are usually not more than 5 to 10 km and distance from the charcoal production facilities to the nearest cooperative from where the charcoal is sold, not more than 100 km. Hence, there is no need to monitor this parameter.

Project emissions from utilization of biomass residues is not applicable to the project activity since the project activity does not utilise biomass residues, but consists of 'new forests'.

In case that the emission reductions from the A/R EcoMakala Virunga Reforestation project[53] have been verified and issued for the time period in which the biomass was harvested, biomass originating from land areas included in the A/R EcoMakala Virunga Reforestation project may be considered to have <u>no project emissions</u> (see paragraph 14 of the tool 'Project and leakage emissions from biomass').

In regards to leakage assessment, AMS-III.BG requests to follow the general guidance on leakage in biomass project activities to quantify leakages pertaining to the use of biomass residues[54]. The PP has demonstrated as part of the A/R EcoMakala Virunga Reforestation project that leakage due to 'shift of pre-project activities' can be excluded.[55] Leakage due to diversion of biomass residues from other applications is not applicable to the project activity since the project activity does not utilise biomass residues, but consists of 'new forests'.

Emission reductions for the *improved cookstove component* are calculated as per equation (1) of the Gold standard Methodology: Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC) Version 2.0. since baseline fuel and project fuel are the same (charcoal)[56] and the baseline emission factor and project emission factor are considered the same.

$$ER_y = \sum_{b,p} \left(N_{p,y} * U_{p,y} * P_{p,b,y} * NCV_{b,charcoal} * \left(f_{NRB,b,y} * EF_{charcoal,CO2} + EF_{charcoal,non\ CO2} \right) \right) - \sum LE_{p,y}$$

Where:

$\Sigma_{b,p}$ = Sum over all relevant (baseline b/project p) couples

$N_{p,y}$ = Cumulative number of project technology-days included in the project database for project scenario p against baseline scenario b in year y

$U_{p,y}$ = Cumulative usage rate for technologies in project scenario p in year y, based on cumulative adoption rate and drop off rate revealed by usage surveys (fraction)

$P_{p,b,y}$ = Specific fuel savings for an individual technology of project p against an individual technology of baseline b in year y, in tons/day, as derived from the statistical analysis of the data collected from the field tests

$f_{NRB,b,y}$ = Fraction of biomass used in year y for baseline scenario b that can be established as non-

[53] Expected to be registered more or less at the same time as this project activity.

[54] Guidance on leakage has been integrated into the tool 'Project and leakage emissions from biomass' (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v7.0.pdf)

[55] See template 'GS5618 5.6 - Ecomakala - Leakage_04052017.pdf' and PFA review report submitted to the GS for PFA.

[56] In some baseline scenarios firewood is used along with charcoal. It is expected that firewood is continued to be used in those cases as well in the project scenario. PP will decide upon whether ER credits will be claimed from any potential firewood savings after all baseline and project KPTs will have been carried out.

renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)

$NCV_{b,fuel}$ = Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)

$EF_{b,fuel,CO2}$ = CO_2 emission factor of the fuel that is substituted or reduced. 112 tCO2/TJ for Wood/charcoal, or the IPCC default value of other relevant fuel

$EF_{b,fuel,nonCO2}$ = Non-CO_2 emission factor of the fuel that is reduced

$LE_{p,y}$ = Leakage for project scenario p in year y (tCO_2e/yr)

For ex-ante ER estimation, PP take advantage of footnote 24 of TPDDTEC since project KPT have not been conducted yet, hence fuel savings cannot be calculated as difference between baseline and project fuel consumption. The project fuel consumption is calculated based on baseline fuel consumption (determined through baseline KPT), baseline stove efficiency (assuming 27.25% thermal efficiency for baseline stoves – for more details see section B.6.2) and project stove efficiency (determined through WBTs):

$$Fuel_{project} = \eta_{baseline}/\eta_{project} \text{ x } Fuel_{baseline}$$

At the time of monitoring, PP will choose one of the two following options for project fuel updates:

1) The PP updates the project fuel consumption by carrying out biennial project KPTs to account for changes in the project scenario over time as project technologies age and calculate the fuel savings as difference between the baseline fuel consumption (fixed ex-ante) and project fuel consumption.
2) The PP follows the approach as outlined in the GS TAC rule update from 18/12/2015 (http://www.goldstandard.org/sites/default/files/documents/tpddtec_-_rule_update_dec_2015_publication_181215.pdf) :
   a) The project developer shall carry out the Water Boiling Test to determine the thermal efficiency of the project cookstove along with the project KPTs prior to first issuance. The efficiency of the project cookstove shall be determined in the field or laboratory, following the latest version of Water Boling Test protocol, by an independent expert or entity.
   b) Monitor the degradation in the efficiency of project cookstove: The degradation in the efficiency of the project cookstove shall be monitored annually by carrying out the WBT in the field or laboratory by an independent expert or entity.
   c) Update the project fuel consumption level: To update project fuel consumption, the fuel consumption level determined under step a (i.e. result of project KPTs prior to first issuance), shall be adjusted with the ratio of efficiency level determined under step a. and the efficiency level determined under step b. It would imply adjusting the project fuel consumption value for efficiency degradation.

In regards to leakage assessment, TPDDTEC requires the PP to investigate the following potential sources of leakage:

Leakage from	Yes/No	Justification

a) The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or in a manner suggesting more usage than would have occurred in the absence of the project.	No	The displaced baseline stoves' (traditional stoves and ICS copies) efficiency is at the lower end. It is highly unlikely that households outside the project boundaries who may have obtained a more efficient stove or other lower emitting technologies (like e.g. gas) would go back to the use of traditional stoves or ICS copies.
b) Non-project users who previously used lower emitting energy sources use the non-renewable biomass or fossil fuels saved under the project activity.	No	Project users have to spend money for the charcoal. It can be excluded that the fuel saved by the project would be given for free by the project users and used by non-project users who previously used lower emitting energy sources.
c) The project significantly impacts the NRB fraction within an area where other CDM or VER project activities account for NRB fraction in their baseline scenario.	No	As the charcoal is produced from biomass in the project area, it is not expected that the NRB in other areas will be affected. There is no known CDM or VER project in the project area. Thus, it is unlikely that the project significantly affects another CDM or VER project activity for its NRB fraction.
d) The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of heating or by retaining some use of inefficient technology	No	It has been shown through the baseline surveys that using the stove for space heating is not significant in Beni (0%) and Butembo (4%). In the case of Goma, 17% indicated to use the stove for space heating. Any continued use of the baseline (inefficient) technology would be captured through the project KPTs and/or checked through monitoring surveys.
e) By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution within households who commonly used a technology with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.	No	The baseline surveys showed that end-users in the baseline use traditional stoves and ICS copies which are less efficient, i.e. with higher emissions than the project ICS. Hence, it is highly unlikely that the project stimulates substitution within households who commonly used a technology with relatively lower emissions.

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Sustainable charcoal production/consumption component

Data / Parameter:	CF
Unit	-
Description	Default wood to charcoal conversion factor
Source of data	IPCC
Value(s) applied	6
Measurement methods and procedures	A factor of 6 kg of firewood (wet basis) per kg of charcoal (dry basis).
Purpose of data	ER calculation
Additional comment	Refer to:<http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf>. The term 'wet basis' assumes that the wood is 'air-dried' as is specified in the IPCC default table

Data / Parameter:	NCV_{wood}
Unit	TJ/t
Description	Net calorific value of wood
Source of data	IPCC default 2006, volume 2, chapter 1 (Table 1.2)
Value(s) applied	0.0156
Measurement methods and procedures	Use a default value of 0.0156 TJ/t based on the gross weight of the wood that is 'air-dried'
Purpose of data	ER calculation
Additional comment	-

Data / Parameter:	$NCV_{charcoal,default}$
Unit	TJ/t
Description	Default net calorific value of charcoal
Source of data	IPCC default 2006, volume 2, chapter 1 (Table 1.2)
Value(s) applied	0.0295
Measurement methods and procedures	Default value provided in section 1 in appendix 1
Purpose of data	ER calculation
Additional comment	-

Data / Parameter:	EFprojected_fossilfuel
Unit	tCO2/TJ
Description	Emission factor for the substitution of non-renewable woody biomass by similar consumers
Source of data	AMS-III.BG
Value(s) applied	81.6
Measurement methods and procedures	Default value of 81.6
Purpose of data	ER calculation
Additional comment	-

Data / Parameter:	fNRBi,y
Unit	%
Description	Non-renewability status of woody biomass fuel in scenario i during yeary
Source of data	Default value (see: https://cdm.unfccc.int/DNA/fNRB/index.html)
Value(s) applied	90
Measurement methods and procedures	
Purpose of data	ER calculation
Additional comment	The fNRB value will remain fixed during the crediting period. It was confirmed by the GS secretariat in an Email on March 01, 2017 and follow up clarification on March 09, 2017[57] that the current fNRB value as indicated on https://cdm.unfccc.int/DNA/fNRB/index.html can be applied to the project activity on condition that the DOE is contracted and the project documentation is submitted to GS for PFA review before the fNRB expiry date being July 12, 2017. The DOE contract has been signed on June 08, 2017[58] and the project documentation for PFA review has been uploaded in the week starting 12/06/2017.

Data / Parameter:	Pre-project land use
Unit	Variable
Description	Service level of the pre-project land use
Source of data	Land management records, growers' interviews
Value(s) applied	-
Measurement methods and procedures	
Purpose of data	Potential leakage calculation
Additional comment	-

Improved cookstove component

Data / Parameter:	$EF_{b,CO2}$
Unit	tCO_2/TJ
Description	CO2 emission factor arising from use of charcoal in baseline scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2, chapter 2 (Table 2.5)
Value(s) applied	112
Measurement methods and procedures	Default IPCC value for charcoal is applied.
Purpose of data	CO2 Emission calculation in baseline
Additional comment	If EF is in units of tCO_2/t_fuel, remove NCV term from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use.

Data / Parameter:	$EF_{b,non\text{-}CO2}$

[57] The Email exchange with the GS secretariat has been uploaded to the GS registry : 'FW_ GS5391 'EcoMakala Virunga Energy project'_ fNRB DRC'

[58] The DOE contract has been uploaded to the GS registry : 'GS5391 EcoMakala Energy - Validation - DOE contract - KBS – Signed'

Unit	tCO_2e/TJ
Description	Non-CO2 emission factor arising from use of charcoal in baseline scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2, chapter 2 (Table 2.9)
Value(s) applied	8.2625 tCO_2e/TJ for methane and 1.6241 tCO_2e/TJ for N_2O CH_4 = 0.3305 tCH_4/TJ * 25 (GWP) N_2O = 0.00545 tN_2O/TJ * 298 (GWP)
Measurement methods and procedures	CH_4: PP used the average of the range of 275 – 386 kg/TJ indicated for charcoal stoves on Table 2.9, volume 2, chapter 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories N_2O: PP used the average of the range of 1.6 – 9.3 kg/TJ indicated for charcoal stoves on Table 2.9, volume 2, chapter 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Non-CO2 Emission calculation in baseline
Additional comment	If EF is in units of tCO_2/t_fuel, remove NCV term from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use.

Data / Parameter:	$EF_{p,CO2}$
Unit	tCO_2/TJ
Description	CO_2 emission factor arising from use of charcoal in project scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2, chapter 2 (Table 2.5)
Value(s) applied	112
Measurement methods and procedures	Default IPCC value for charcoal is applied.
Purpose of data	CO_2 emission calculation in project scenario
Additional comment	If EF is in units of tCO_2/t_fuel, remove NCV term from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use.

Data / Parameter:	$EF_{p,non\text{-}CO2}$
Unit	tCO_2e/TJ
Description	Non-CO2 emission factor arising from use of charcoal in project scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2, chapter 2 (Table 2.9)
Value(s) applied	8.2625 tCO_2e/TJ for methane 1.6241 tCO_2e/TJ for N_2O CH_4 = 0.3305 tCH_4/TJ * 25 (GWP) N_2O = 0.00545 tN_2O/TJ * 298 (GWP)
Measurement methods and procedures	CH_4: PP used the average of the range of 275 – 386 kg/TJ indicated for charcoal stoves on Table 2.9, volume 2, chapter 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories N_2O: PP used the average of the range of 1.6 – 9.3 kg/TJ indicated for charcoal stoves on Table 2.9, volume 2, chapter 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Non-CO_2 emission calculation in project scenario

Additional comment	If EF is in units of tCO_2/t fuel, remove NCV term from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use.

Data / Parameter:	$EF_{ch,prod,CO2}$
Unit	tCO_2/ton charcoal
Description	CO_2 emission factor arising from production of charcoal
Source of data	Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise, Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27, 2001.
Value(s) applied	1.802
Measurement methods and procedures	There are no IPCC default values available. Therefore, scenario-specific values are applied. The published emission factors in use here are found in Table 6A of "Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise, Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27 2001". See http://ehsdiv.sph.berkeley.edu/krsmith/publications/JGRPennise.pdf
Purpose of data	CO_2 emission calculation in baseline and project scenario
Additional comment	As per 'Consolidated GHG database for the charcoal sector' (https://www.google.com/url?q=https://cdm.unfccc.int/methodologies/standard_base/GHDdatabase.xls&sa=U&ved=0ahUKEwj1kKms84_LAhXMV44KHWo-CCAQFggEMAA&client=internal-uds-cse&usg=AFQjCNHxfn6_0vdrn0E4c368OrOJgKUa1g), the emission of CO_2 from 1 Kg of Charcoal Production is 6513 Grams. The value used here for the calculation is 1,802 grams, which is conservative.

Data / Parameter:	$EF_{ch,prod,non-CO2}$
Unit	tCO2/ton of charcoal
Description	Non-CO2 emission factor arising from production of charcoal
Source of data	Methane emission factor arising from production of charcoal: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, Table I-14, page I.46 N2O emission factor arising from production of charcoal: Table 6A of "Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise, Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27 2001.
Value(s) applied	0.7375 tCO2e/ton of charcoal for methane 0.0447 tCO2e/ton of charcoal for N_2O
Measurement methods and procedures	There are no IPCC default values available for N_2O. Therefore, scenario-specific values are applied. The published emission factors in use here are found in Table 6A of "Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise, Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27 2001". See http://ehsdiv.sph.berkeley.edu/krsmith/publications/JGRPennise.pdf
Purpose of data	CO_2 emission calculation in baseline and project scenario
Additional comment	In regards to methane emission factor arising from production of charcoal:

	Using the data source 'Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise, Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27, 2001' would result in a less conservative value of 1.115 tCO2e/ton of charcoal, hence the more conservative value from the 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, Table I-14, page I.46 has been applied.

Data / Parameter:	$NCV_{b,}$
Unit	TJ/ton of charcoal
Description	Net calorific value of the charcoal used in baseline
Source of data	IPCC default 2006, volume 2, chapter 1 (Table 1.2)
Value(s) applied	0.0295
Measurement methods and procedures	Default IPCC value for charcoal is applied.
Purpoase of data	CO_2 emission calculation in baseline scenario
Additional comment	

Data / Parameter:	NCV_p
Unit	TJ/ton of charcoal
Description	Net calorific value of the charcoal used in project scenario
Source of data	IPCC default 2006, volume 2, chapter 1 (Table 1.2)
Value(s) applied	0.0295
Measurement methods and procedures	Default IPCC values for charcoal is applied.
Purpose of data	CO_2 emission calculation in project scenario
Additional comment	

Data / Parameter:	fNRBi,y
Unit	%
Description	Non-renewability status of woody biomass fuel in scenario i during yeary
Source of data	Default value (see: https://cdm.unfccc.int/DNA/fNRB/index.html)
Value(s) applied	90
Measurement methods and procedures	
Purpose of data	ER calculation
Additional comment	The fNRB value will remain fixed during the crediting period It was confirmed by the GS secretariat in an Email on March 01, 2017 and follow up clarification on March 09, 2017[59] that the current fNRB value as indicated on https://cdm.unfccc.int/DNA/fNRB/index.html can be applied to the project activity on condition that the DOE is contracted and the project documentation is submitted to GS for PFA review before the fNRB expiry date being July 12, 2017. The DOE contract has been signed on June 08, 2017[60] and the project documentation for PFA review has been uploaded in the week starting 12/06/2017.

Data / Parameter:	$P_{b,y}$

[59] The Email exchange with the GS secretariat has been uploaded to the GS registry : 'FW_ GS5391 'EcoMakala Virunga Energy project'_ fNRB DRC'

[60] The DOE contract has been uploaded to the GS registry : 'GS5391 EcoMakala Energy - Validation - DOE contract - KBS – Signed'

Unit	t/household/year
Description	Quantity of fuel that is consumed in baseline scenario b during year y
Source of data	Baseline KPT
Value(s) applied	1.00 (Baseline KPT Goma)
Measurement methods and procedures	Determined through baseline KPTs in Goma, Butembo and Beni
Purpose of data	Used to calculate the fuel savings
Additional comment	The baseline will remain by-default fixed during the crediting period since the project activity targets non-industrial applications (see page 6 of TPDDTEC)

Data / Parameter:	$\eta_{baseline}$
Unit	Fraction
Description	Thermal efficiency for baseline stoves
Source of data	WBT, CREEC, 'Report on Stove Tests for IFDC Congo', 09/2012, table 3.1
Value(s) applied	27.25
Measurement methods and procedures	Average cold start/hot start traditional metal stove (TMS): 18% Average cold start/hot start Butembo stove: 36.5% Average TMS and Butembo stove used for ex-ante ER calculation: 27.25%
Purpose of data	For calculating ex-ante emission reductions
Additional comment	The thermal efficiency for baseline stoves is only used for ex-ante ER calculation. It is used for ex-ante purpose, because project KPT results won't be available prior to 1st issuance. Ex-post, fuel savings are calculated as the difference between baseline fuel consumption and project fuel consumption (both determined through a KPT, whereas the baseline fuel consumption is fixed and the project fuel consumption updated biennially) or determined through the ageing test approach by monitoring the degradation in the performance of cookstove efficiency following the WBT and accordingly adjust the project fuel consumption level. The baseline fuel consumption is fixed in this case too.

B.6.3. Ex ante calculation of emission reductions

Emission reductions for the *sustainable charcoal production/consumption* component are calculated as per equation (3) of methodology AMS-III.BG since the project activity is not equipped with capture and destruction of the pyrolysis gases.

$$ER_y = \sum_i Q_{CCP,i_y} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal,i}}{NCV_{charcoal,default}} \times f_{NRB,BL,wood} \times EF_{projected_{fossilfuel}}\right)\right] - PE_{FF,y} - PE_{El,y} - PE_{BC,y}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

$Q_{CCP,i,y}$ = Quantity of charcoal type *i* produced and used in year *y* (t)

CF = Default wood to charcoal conversion factor

NCV_{wood} = Net calorific value of wood (TJ/t) (use a default value of 0.0156)

$NCV_{charcoal,i}$ = Net calorific value of the charcoal type *i* produced during the project (TJ/t)

$NCV_{charcoal,default}$ = Default net calorific value of charcoal (TJ/t) (use a default value of 0.0295)

$f_{NRB,BL,wood}$ = Fraction of biomass of type *i* used in the absence of the project activity that can be established as non-renewable biomass; determined on the basis of the published DNA endorsed default values available on the UNFCCC website (fNRB default value = 90%)

$EF_{projected\_fossilfuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumers (t CO_2/TJ) (use a default value of 81.6)

$PE_{FF,y}$ = Project emissions due to fossil fuel consumption in charcoal production facilities in year *y* (t CO_2)

$PE_{El,y}$ = Project emissions due to electricity consumption in charcoal production facilities in year *y* (t CO_2)

$PE_{BC,y}$ = Project emissions due to biomass cultivation in year *y* (t CO_2)

Emission reductions for the *improved cookstove component* are calculated as per equation (1) of the Gold standard Methodology: Technologies and Practices to Displace Decentralized Thermal Energy Consumption (TPDDTEC) Version 2.0. since baseline fuel and project fuel are the same (charcoal)[61] and the baseline emission factor and project emission factor are considered the same.

$$ER_y = \sum_{b,p} \left(N_{p,y} * U_{p,y} * P_{p,b,y} * NCV_{b,charcoal} * \left(f_{NRB,b,y} * EF_{charcoal,CO2} + EF_{charcoal,non\ CO2} \right) \right) - \sum LE_{p,y}$$

Where:

ER_y	Emission reductions in year *y*
$\sum_{b,p}$	Sum over all relevant (baseline b/project p) couples
$N_{p,y}$	Cumulative number of project technology-days included in the project database for project scenario p against baseline scenario b in year y
$U_{p,y}$	Cumulative usage rate for technologies in project scenario *p* in year *y,* based on cumulative adoption rate and drop off rate revealed by usage surveys (fraction)
$P_{p,b,y}$	Specific charcoal savings for an individual technology of project p against an individual technology of baseline b in year y, in tons/day, as derived from the statistical analysis of the data collected from field tests.
$f_{NRB,b,y}$	Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass.
$NCV_{b,charcoal}$	Net calorific value of the charcoal substituted or reduced.
$EF_{charcoal,CO2}$	CO_2 emission factor of the fuel that is substituted or reduced.
$EF_{charcoal,non\ CO2}$	Non-CO_2 emission dactor of the charcoal that is reduced or substituted
$LE_{p,y}$	Leakage for project scenario p in year y (tCO_2e/yr)

[61] In some baseline scenarios firewood is used along with charcoal. It is expected that firewood is continued to be used in those cases as well in the project scenario. PP will decide upon whether ER credits will be claimed from any potential firewood savings after all baseline and project KPTs will have been carried out.

Detailed ex-ante ER calculation including all assumptions and input parameters are available in the ER calculation excel spreadsheet.

B.6.4. Summary of ex ante estimates of emission reductions

Ex-ante estimates of emissions reductions from *sustainable charcoal production component*

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2017[62]	5,728	0	0	5,728
2018	34,370	0	0	34,370
2019	41,244	0	0	41,244
2020	51,555	0	0	51,555
2021	51,555	0	0	51,555
2022	51,555	0	0	51,555
2023	51,555	0	0	51,555
2024	30,074	0	0	30,074
Total	317,635	0	0	317,635
Total number of crediting years	7			
Annual average over the crediting period	45,376	0	0	45,376

Ex-ante estimates of emissions reductions from *improved cookstoves component*

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2017[63]	23,917	15,157	0	8,760
2018	229,605	145,505	0	84,099
2019	459,210	291,011	0	168,199
2020	574,012	363,763	0	210,249
2021	574,012	363,763	0	210,249
2022	574,012	363,763	0	210,249
2023	574,012	363,763	0	210,249
2024	301,356	190,976	0	110,381
Total	3,310,136	2,097,703	0	1,212,434
Total number of crediting years	7			

[62] Crediting period starts on 01/08/2017, hence ER for 2017 and 2024 have not been calculated for the whole year (12 months) but for 5 months in 2017 and 7 months in 2024.

[63] Crediting period starts on 01/08/2017, hence ER for 2017 and 2024 have not been calculated for the whole year (12 months) but for 5 months in 2017 and 7 months in 2024.

Annual average over the crediting period	472,877	299,672	0	173,205

Total ex-ante estimates of emissions reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2017	29,645	15,157	0	14,489
2018	263,975	145,505	0	118,469
2019	500,454	291,011	0	209,443
2020	625,567	363,763	0	261,803
2021	625,567	363,763	0	261,803
2022	625,567	363,763	0	261,803
2023	625,567	363,763	0	261,803
2024	331,430	190,976	0	140,454
Total	3,627,771	2,097,703	0	1,530,069
Total number of crediting years	7			
Annual average over the crediting period	518,253	299,672	0	218,581

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Sustainable charcoal production/consumption component

Data / Parameter	$Q_{CCP,i,y}$
Unit	tonnes
Description	Produced quantity of charcoal product i in year y
Source of data	Measurement from project activity production
Value(s) applied	Values estimated for ex-ante calculation: 2017: 2,000 2018: 5,000 2019: 6,000 2020 to 2024: 7,500
Measurements methods and procedures	As per AMS-III.BG, the parameter can be monitored according to one of the following options: Option1: Direct measurement (e.g. use of a scale) of the weight of

	charcoal products supplied; Option 2: Calculation of the total weight of charcoal supplied; based on the total number of bags supplied and the average weight of charcoal product per bag. The weight of charcoal products per bag is determined on sample basis in accordance with the sampling standard (e.g. using systematic sampling method). Option 2 can only be used if Option 1 is not available.
Monitoring frequency	Continuously
QA / QC procedures	The produced quantities of charcoal will be cross-checked with the quantities sold to end-consumers, distributors and depot (Goma Stove).
Additional comment	Option 1 is the first option, however if direct measurements are not possibly for any reason, option 2 will be chosen.

Data / Parameter	$NCV_{charcoal,i}$
Unit	TJ/t
Description	Net calorific value of the charcoal i produced
Source of data	Default value or laboratory measurements
Value(s) applied	0.0295
Measurements methods and procedures	Use of option 1 of Appendix (default value of 29.5 GJ/tonne = 0.0295 TJ/t) Or Monitored once during the first year of the crediting period. Measurement is undertaken in laboratories according to relevant national/international standards. Measure quarterly, taking at least three samples for each measurement. The average value can be used for the rest of the crediting period provided that there is no change in the biomass types used for charcoal *i* production.
Monitoring frequency	No monitoring in case of option 1 of Appendix (equation 1) Monitored once during 1st year of crediting period
QA / QC procedures	If laboratory measurements are chosen, check the consistency of the measurements by comparing the measurement results with, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. (If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements or provide justification)
Additional comment	In case of using option 1 of Appendix in AMS-III.BG (equation 1), $NCV_{charcoal,i}$ will not be monitored but instead the deemed value of 29.5 GJ/tonne will be applied. All charcoal will be produced from purely woody source of biomass it is justified to apply this default value.

Data / Parameter	$q_{N,y}$

Unit	t N/ha
Description	Rate of nitrogen applied, in year y
Source of data	Survey records maintained by PP and fertilizer composition information from supplier, study or independent laboratory. Alternatively, the default conservative value of 0.20 t N/ha per year may be used.
Value(s) applied	0 (estimated for ex-ante estimation)
Measurements methods and procedures	A survey with at least 100 randomly selected growers (planters) will be conducted to check on the utilization and rate of synthetic fertilisers, organic manure and/or nitrogen fixing cover crops. The results will be extrapolated to the whole population. The default value would be applied if it is too difficult to find out the applied rate of nitrogen (if any) through survey.
Monitoring frequency	Annual
QA / QC procedures	Please note that a cross-check of applied quantities with purchase receipts and inventory as proposed by the methodology is difficult since organic manure and cover crops do often not involve a purchase or are informally purchased and purchase of synthetic 49ertilizer is handled by growers themselves, hence record keeping beyond control of PP.
Additional comment	Nitrogen applied through the following methods shall be added up to arrive at this value: (i) synthetic fertilisers; (ii) organic manure; (iii) return of the residues or cover crops

Data / Parameter	$A_{FTM,y}$
Unit	ha
Description	Area of land subjected to soil fertilization and management, in year y
Source of data	Survey records maintained by PP
Value applied	0 (estimated for ex-ante estimation)
Measurements methods and procedures	GPS land area measurement A survey with at least 100 randomly selected growers (planters) will be conducted to check on the utilization of synthetic fertilisers, organic manure and/or nitrogen fixing cover crops. The area on which nitrogen is applied will be set in relation to the total area included in the survey and the calculated proportion (%) of areas subjected to nitrogen application will be extrapolated to the overall population to get the % of area of land which is subjected to soil fertilization and management.
Monitoring frequency	Annual
QA / QC procedures	GPS land area measurements are widely recognized in DRC
Additional comment	Areas receiving one or more of the following inputs shall be added up to arrive at this value: (i) synthetic fertilisers; (ii) organic manure; (iii) return of the residues or cover crops

Data / Parameter	$q_{SA,I,y}$
Unit	t/ha
Description	Rate of application of soil amendment agent type i, in year y
Source of data	Survey records maintained by PP
Value applied	0 (estimated for ex-ante estimation)

Measurements methods and procedures	A survey with at least 100 randomly selected growers (planters) will be conducted to check on the utilization and rate of soil amendment agents. The results will be extrapolated to the whole population.
Monitoring frequency	Annual
QA / QC procedures	Please note that a cross-check of applied quantities with purchase receipts and inventory as proposed by the methodology is difficult since purchase of soil amendment agents (if any) would be handled by growers themselves, hence record keeping beyond control of PP.
Additional comment	-

Data / Parameter	$A_{SA,i,y}$
Unit	ha
Description	Area of land in which soil amendment agent type i is applied, in year y
Source of data	Survey records maintained by PP
Value applied	0 (estimated for ex-ante estimation)
Measurements methods and procedures	GPS land area measurement A survey with at least 100 randomly selected growers (planters) will be conducted to check on the utilization of soil amendment agents. The area on which soil amendment agents are applied will be set in relation to the total area included in the survey and the calculated proportion (%) of areas subjected to soil amendment agents application will be extrapolated to the overall population to get the % of area of land which is subjected to soil amendment agents application.
Monitoring frequency	Annual
QA / QC procedures	GPS land area measurements are widely recognized in DRC
Additional comment	-

Data / Parameter	$Q_{FF,i,y}$
Unit	t
Description	Quantity of fossil fuel of type i consumed in year y
Source of data	Survey records maintained by PP
Value applied	0 (estimated for ex-ante estimation)
Measurements methods and procedures	A survey with at least 100 randomly selected growers (planters) will be conducted to check on the utilization of fossil fuels. The results will be extrapolated to the whole population.
Monitoring frequency	Annual
QA / QC procedures	-
Additional comment	Fossil fuels used in the following activities shall be added up to arrive at this value: (i) use of farm machinery e.g. tractors, harvesters; (ii) treatment, pumping, and application of water for irrigation; (iii) use of machinery in transport and application of inorganic fertilisers, organic fertilisers, soil amending materials (e.g. limestone, dolomite)

Data / Parameter	$Q_{EL,y}$
Unit	MWh
Description	Quantity of electricity consumed in year y
Source of data	Survey records maintained by PP
Value applied	0 (estimated for ex-ante estimation)

Measurements methods and procedures	A survey with at least 100 randomly selected growers (planters) will be conducted to check on the utilization of electricity. The results will be extrapolated to the whole population.
Monitoring frequency	Annual
QA / QC procedures	-
Additional comment	Electricity used in the following activities shall be added up to arrive at this value: (i) use of farm machinery run on electricity; (ii) treatment, pumping, and application of water for irrigation; (iii) transport and application of inorganic fertilisers, organic fertilisers, soil amending materials (e.g. limestone, dolomite)

Data / Parameter	**Land use**
Unit	Variable
Description	Service level of the project land use
Source of data	Survey records maintained by PP
Value applied	Service level in project land use assumed to be the same as for pre-project service level (Assumption for ex-ante calculation)
Measurements methods and procedures	A survey with at least 100 randomly selected growers (planters) will be conducted to check on the service level of the project land use. The results will be extrapolated to the whole population.
Monitoring frequency	Annually
QA / QC procedures	-
Additional comment	The service level of the project land use shall at least provide the pre-project service level, otherwise leakage shall be accounted for.

Data / Parameter	$A_{FR,i,y}$
Unit	ha
Description	Area of statum i of land subjected to fire in year y
Source of data	Survey records maintained by PP
Value applied	0 (estimated for ex-ante estimation)
Measurements methods and procedures	GPS land area measurement A survey with at least 100 randomly selected growers (planters) will be conducted to check on whether they burn any of the biomass making part of the project activity (e.g. burning of remaining biomass after harvest of trees). The area on which biomass is burnt will be set in relation to the total area included in the survey and the calculated proportion (%) of areas subjected to fire will be extrapolated to the overall population to get the % of area of land which is subjected to fire.
Monitoring frequency	Annual
QA / QC procedures	GPS land area measurements are widely recognized in DRC
Additional comment	-

Data / Parameter	b_i
Unit	t dry matter/ha
Description	Fuel biomass consumption per hectare in stratum i of land subjected to fire
Source of data	Measurement by PP. Alternatively, the default ‘average above-ground

	biomass content in forest' values from Table 3A.1.4 of the Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC-GPG-LULUCF 2003)
Value applied	0 (estimated for ex-ante estimation)
Measurements methods and procedures	Measurements would be carried out on those areas of the 100 surveyed plantations on which biomass is burnt. The average measured fuel biomass consumption per ha subjected to fire will be calculated amongst the 100 plantations and multiplied with the total area in ha included in the project activity. The IPCC default value will be applied if it is too difficult to conduct measurements.
Monitoring frequency	Annual
QA / QC procedures	If sample plots are used, the estimated mean value should not have an uncertainty of greater than 10 per cent at 90 per cent confidence level
Additional comment	-

Data / Parameter	R_i
Unit	Dimensionless
Description	Root-shoot ratio (i.e. ratio of below-ground biomass to above-ground biomass) for stratum I of land subjected to fire
Source of data	Measurement by project participants. Alternatively, the default values from Table 4.4 of the 2006 IPCC Guidelines for National GHG Inventories may be used
Value applied	Not applicable for ex-ante ER calculation
Measurements methods and procedures	Measurements would be carried out on those areas of the 100 surveyed plantations on which biomass is burnt. The average root-shoot ratio would be applied to the overall population. The IPCC default value will be applied if it is too difficult to conduct measurements.
Monitoring frequency	Annual
QA / QC procedures	If sample plots are used, the estimated mean value should not have an uncertainty of greater than 10 per cent at 90 per cent confidence level
Additional comment	-

Improved cookstove component

Data / Parameter	$N_{p,y}$
Unit	Project technologies credited (units)
Description	Technologies in the project database for project scenario p through year y
Source of data	Total sales record
Value(s) applied	45,000 ICS/year (value applied for ex-ante calculation)
Measurements methods and procedures	All ICS sales will be recorded through smartphones or in exceptional cases through paper records (if smartphones are not available). Smartphones use ODK software or any other appropriate software tool and capture all required data related to sale, ICS and end-users to the largest extent possible. Data are automatically transferred to a centralized database whenever the vendor is online. The database will be continuously checked for possible double-entries or implausible data entries.
Monitoring frequency	Continuously
QA / QC procedures	Transparent data analysis and reporting
Additional comment	The total sales record is divided based on project scenario (in case that there is more than one project scenario) to create the project database. Though a household may own more than one ICS at the same time, only one ICS with serial number and being within the age of 2 years can claim carbon credits.

Data / Parameter	$P_{p,y}$
Unit	t/household/year
Description	Quantity of fuel that is consumed in project scenario p during year y
Source of data	Project KPT
Value(s) applied	0.634 (value applied for ex-ante ER estimation)
Measurement methods and procedures	KPT protocol as per Annex of TPDDTEC will be followed. Households are randomly selected from each of the 3 cities (Goma, Butembo, Beni). It is envisaged to conduct 3 separate KPTs for each of the towns. The sample results shall comply with a 90/30 precision (in case of paired or independent samples) or 90/10 precision (in case of single samples).
Monitoring frequency	Updated at least every 2 years
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	To calculate project fuel consumption and fuel savings

Additional comment	A single project fuel consumption parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario This option is only applicable if project fuel consumption is updated by carrying out the biennial project KPTs (instead of the ageing test approach through WBTs) to account for changes in the project scenario over time as project technologies age

Data / Parameter	Up,y
Unit	Percentage
Description	Usage rate in project scenario p during year y
Source of data	Annual usage survey
Value(s) applied	90% (value assumed for ex-ante calculation)
Measurement methods and procedures	Households are randomly selected from each of the 3 cities (Goma, Butembo, Beni). It is envisaged to conduct 3 separate usage surveys for each of the towns comprising of at least 100 households per survey.
Monitoring frequency	At least annually, in all cases on time for any request for issuance
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Calculation of emission reductions
Additional comment	A single usage parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario.

Data / Parameter	LEp,y
Unit	tCO2e per year
Description	Leakage in project scenario p during year y
Source of data	Monitoring survey
Value(s) applied	0 (value applied for ex-ante estimation)
Measurement methods and procedures	-
Monitoring frequency	Every 2 years
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Leakage emissions
Additional comment	Aggregate leakage can be assessed for multiple project scenarios

Data / Parameter	$\eta_{new,i}$
Unit	Fraction

Description	Efficiency of the IICS of each type i being deployed as part of the project activity
Source of data	WBT, CREEC, 'Report on Stove Tests for IFDC Congo', 09/2012, table 3.1 using an average of Nguvu Nyeusi and Nguvu Nyeusi Bis
Value(s) applied	43% (value applied for ex-ante calculation)
Measurement methods and procedures	The procedures as outlined in the revision to the TPDDTEC methodology for cookstove activities (18/12/2015) will be followed (http://www.goldstandard.org/sites/default/files/documents/tpddtec_-_rule_update_dec_2015_publication_181215.pdf). The sample size will be big enough so that the results comply with the 90/10 rule. To determine the initial thermal efficiency of the ICS (i.e. for new ICS), three tests on three different ICS will be conducted for each model included in the project activity. If the results do not comply with the 90/10 rule, additional tests will be conducted or the lower bound of the results applied.
Monitoring frequency	Annual
QA/QC procedures	-
Purpose of data	To calculate project fuel consumption
Additional comment	Only applicable if the ageing test approach is chosen instead of the biennial project KPTs to account for changes in the project scenario over time as project technologies age.

Data / Parameter	μ_y
Unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices (baseline stove) in the project scenario during the year y
Source of data	Monitoring/usage surveys
Value(s) applied	Not applicable for ex-ante ER estimation

Measurement methods and procedures	-Monitoring surveys in at least 100 households to capture cooking habits and stove usage of households in the region, including quantification of use of baseline devices, by formulating questions and/or collecting evidences to determine the frequency of usage of both the project devices and baseline devices or -Monitoring surveys in at least 100 households to capture the number of meals cooked or -Measurement campaigns shall be undertaken using data loggers such as stove utilization monitors (SUMs) which can log the operation of all devices in order to determine the average device utilization intensity. The measurement campaign shall be conducted in at least 10 randomly selected households of the project activity for at least 90 days during the year *y*. If seasonal variation is observed, the average value determined through the campaign shall be annualised taking into account seasonal variation of device utilization[64].
Monitoring frequency	Annual
QA/QC procedures	-
Purpose of data	Emission reduction calculation
Additional comment	Only applicable if the ageing test approach is chosen instead of the biennial project KPTs to account for changes in the project scenario over time as project technologies age. No need to monitor this parameter in case that biennial project KPTs are conducted, since in this case the KPTs capture the total project fuel consumption on all stoves, i.e. also includes the fuels consumed on any baseline stoves.

B.7.2. Sampling plan

>>

Sustainable charcoal production/consumption component

In the case that the parameter $Q_{CCP,i,y}$ (Produced quantity of charcoal product i in year y) is not directly measured (option 1), but option 2 will be chosen, the PP would apply the systematic sampling method to determine the weight of charcoal product per bag.

A sample on a regular basis of every *n* charcoal bags accepted by a cooperative would be taken. The sample frame would include all cooperatives receiving renewable charcoal (Ecomakala). The total number of samples needed will be equally distributed to each of the cooperatives accepting Ecomakala.
The sample size equation for a required 90/10 confidence/precision would be the following[65]:

[64] The number of samples and approach for the measurement campaign was adopted from the CDM methodology AMS-II.G, version 08.

[65] See paragraph 185, equation (79) in the Guideline for 'Sampling and surveys for CDM project activities and PoAs', version 04.0

$$n \geq \frac{1.645^2 * V}{0.1^2}$$

Where: $V = \left(\frac{SD}{mean}\right)^2$

n = Sample Size
SD = Standard Deviation
Mean = Sample mean

A survey with at least 100 randomly selected growers (planters) will be annually conducted in order to check on the following parameters for any potential project and leakage emissions from biomass:

$q_{N,y}$: Rate of nitrogen applied, in year y
NB: in the case that the default conservative value of 0.20 t N/ha per year will be used, no sampling survey would be conducted for this parameter;
$A_{FTM,y}$: Area of land subjected to soil fertilization and management, in year y
$q_{SA,I,y}$: Rate of application of soil amendment agent type i, in year y
$A_{SA,i,y}$: Area of land in which soil amendment agent type i is applied, in year y
$Q_{FF,i,y}$: Quantity of fossil fuel of type i consumed in year y
$Q_{EL,y}$: Quantity of electricity consumed in year y
Land use: Service level of the project land use
$A_{FR,i,y}$: Area of statum i of land subjected to fire in year y
b_i: Fuel biomass consumption per hectare in stratum i of land subjected to fire
NB: in the case that the default values as per Table 3A.1.4 of the Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC-GPG-LULUCF 2003) will be applied, no sampling survey would be conducted for this parameter;
R_i: Root-shoot ratio (i.e. ratio of below-ground biomass to above-ground biomass) for stratum i of land subjected to fire
NB: in the case that the default values as per Table 4.4 of the Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC-GPG-LULUCF 2003) will be applied, no sampling survey would be conducted for this parameter;

Improved cookstove component

Ongoing monitoring

Usage survey: An annual usage survey determines the drop off rates as project technologies age and users switch back to the baseline technology[66]. The usage parameter will be weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario. The minimum total sample size is 100 randomly selected households, with at least 30 samples for project technologies of each age being credited. The majority of interviews will be conducted in person by the local team of WWF in DRC or by hired externals which would be trained before[67].

[66] It may be the case that the drop off rate is lower in the second year than in the first year, reflecting possible difficulties in the early adoption of a new technology.

[67] Some interviews may be conducted via telephone by the same interviewers on condition that in-kitchen observational interviews are first concluded and analysed such that typical circumstances are well understood by the telephone interviewers.

Monitoring survey: Along with the usage survey, a monitoring survey is carried out annually to assess end-user characteristics such as technology use, fuel consumption and seasonal variation. At least with every 2nd monitoring survey a leakage assessment will be conducted.

The PP will update the project fuel consumption by carrying out biennial *project KPTs* to account for changes in the project scenario over time as project technologies age. Alternatively, the PP will monitor the degradation in the performance of cookstove efficiency following the WBT and accordingly adjust the project fuel consumption level.
In case of the first KPT for which a paired sampling is envisaged[68], the results of randomly selected households shall comply with the 90/30 rule in order to apply the mean fuel savings for the calculation of emission reductions. In case that the 90/30 rule is not met, additional random samples will be taken or the lower bound of the 90% confidence interval will be applied. Follow up project KPTs are conducted as single sample tests[69], hence have to comply with the 90/10 rule for applying the mean fuel savings in the emission reduction calculation.

In case PP opts for the *ageing test approach* instead of biennial project KPTs, annual WBTs would be conducted on a representative sample of each age group[70]. The sample size of each age group will be big enough so that the results comply with the 90/10 rule. To determine the initial thermal efficiency of the ICS (i.e. for new ICS), three tests on three different ICS will be conducted for each model included in the project activity. If the results do not comply with the 90/10 rule, additional tests will be conducted or the lower bound of the results applied. For follow up WBTs, one WBT per ICS will be conducted on a sufficient large number of randomly selected ICS so that the 90/10 rule is met for each age group. The WBTs should be conducted in the last 3 months of the monitoring period, provided it is representative of annual conditions. Choosing the ageing test approach, the PP would have to ensure to a) raise additional questions in the monitoring survey related to the frequency of usage of both the project and baseline devices or capture the number of meals cooked or b) carry out measurement campaigns to take into account for the parallel use of baseline stoves in the project scenario. The monitoring survey would comprise of at least 100 randomly selected households whereas the measurement campaign conducted in at least 10 randomly selected households of the project activity for at least 90 days during the year *y*. If seasonal variation is observed, the average value determined through the campaign shall be annualised taking into account seasonal variation of device utilization.

All of the aforementioned surveys/tests (except WBTs) would be carried out with smartphones (by using e.g. ODK or any other appropriate software tools) and as soon as the user is online all the captured data are transferred to a centralised database. The team of WWF DRC/CO2logic carries out from there the further data analysis.

The sampling frame for the aforementioned ICS surveys/KPTs comprises of all households in each of the three towns[71] which purchased an ICS with serial number and whose ICS is not older than 2 years.
The surveys/tests will be carried out by the local team of WWF in DRC or hired externals. Training will be provided to the surveyors before starting the surveys. Quality of the data will be checked by the carbon consultant.

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[68] The first project KPT is intended to be conducted in the same households as the previous baseline KPT, hence it is considered as paired sampling.

[69] The baseline will remain by-default fixed during the crediting period since the project activity targets non-industrial applications (see page 6 of TPDDTEC).

[70] If the stove models fall under one single project scenario, no differentiation is made between the different models. ICS for the WBTs would be sampled from one single sampling frame including ICS sold in Goma, Beni and Butembo, i.e. WBTs would not be carried out for each town separately.

[71] Surveys and KPTs are carried out separately for each of the three towns (Goma, Butembo, Beni), however WBTs (in case the ageing test approach was chosen) are carried out across all three towns.

B.7.3. Other elements of monitoring plan

Sustainable charcoal production/consumption component

The produced quantities of charcoal will be continuously monitored through a census approach; hence no sampling will be applied in this regard. Sales to end-consumers, distributors and depot (e.g. Goma Stove) will be as well continuously monitored to the largest extent possible and as far down in the supply chain as possible[72].
Produced charcoal quantities will be compared with sold quantities. Since the sold quantities comprise of the charcoal produced from eligible plantations included in the GS A/R project and plantations which are not eligible under the GS A/R project[73], one of the following 2 options will be chosen:

a) If possible, charcoal bags coming from eligible plantations will be differentiated from those coming from non-eligible plantations (e.g. through labels on the bags) and will be recorded separately.
b) If option a) reveals to be impractical, the 'eligible fraction' of charcoal sold is being calculated based on the figures of produced charcoal coming from eligible and non-eligible plantations. Example: As per the available sales records, the total quantity of charcoal sold was 16,000 t/year and the production records show that 12,000 t/year came from non-eligible plantations whereas 8,000 t/year came from eligible plantations. Subsequently, the project would not claim ER from 8,000 t/year, but 'only' from 6,400 t/year (16,000 t / 20,000 t * 8,000 t). In the case that for any reason the total sales records were higher than the total production records, the ER claim would be limited to the amount of charcoal produced from eligible plantations. This is also the case, when total sales records are exactly the same as the total production records.

For each charcoal acceptance from a grower/charcoal producer, the cooperatives are responsible for recording certain information, like amongst others grower and charcoal producer related data, date of acceptance, quantity of charcoal accepted, information about whether grower is member of association and cooperative, photo of the signed carbon waiver etc. (see below preliminary data entry form for production related data on cooperative level). These data are envisaged to be captured through smartphones (by using e.g. ODK or any other appropriate software tools) and as soon as the user is online transferred to a centralised database. The team of WWF DRC works from there on a further analysis and allocates the different charcoal deliveries to eligible plantations making part of the GS A/R project and non-eligible plantations. Quality of the data will be checked by the carbon consultant.

Fiche de production de EcoMakala au niveau des cooperatives

Mois et Année:									Adresse Planteur													
DATE: d'achat	Depot d' achat (Drop-down list de trater les depots)	Nom de cooperative (Drop-down list COOPAL, COPROMA, CACOPROB, COCOPROBBA)	PRE-NOM de planteur	Nom de planteur	Est le planteur membre de l'association? (Oui/Non)	Quelle association? (Notme: Cette question est seulement applicable si la question antérieur a été respondu avec 'Oui')	Est le planteur membre de la cooperative? (Oui/Non)	No. Téléphone planteur	Territoire	Groupement	Chefferie	Village	Espece de l'arbre	Quantité EcoMakala produit (en sac)	Quantité EcoMakala produit (en kg)	Avez vous utilisez TECHNOLOGIE TRADITIONNELLE (T) OU TECHNOLOGIE AMELIORE (A)? (NOTEZ: l'amélioration de la technologie se caractérise par l'utilisation de la cheminée, l'évent, hermétiquement et suivant moule optimisée comme décrit dans le 'rapport formation_carbonisation...'; SVP EXPLIQUEZ LA DIFFERENCE POUR LES CHARBONNIERS ENTRE TRADITIONNELLE ET AMELIORE ET VISITEZ L'ENDROIT AVEC LE TOUR)	PRE-NOM DE CHARBONNIER	NOM DE CHARBONNIER	Existe-t-il un contrat entre cooperative et charbonnier?	PRIX par sac	Photo de la signature du recu d'achat incluisant renonciation des crédits carbone? (Oui/Non)

[72] A full control over the supply chain from producer to end-user is in many cases difficult due to the complexity of the supply chain and numerous actors involved in the charcoal sales. In the target area (North Kivu) charcoal is often passed on from one intermediary (retailer) to the next one (so called 'détaillants') before it reaches the end-consumers. It is hardly possible to get contracts signed between distributor and retailer or between the different intermediaries since most of them are informal. Since however intermediaries operate in a very limited area, it can be concluded that once the charcoal is sold to distributors operating in the target area and resold to intermediaries based in the same area, the charcoal is finally consumed by end-users who are also living in the target area.

[73] A plantation is not eligible if there was forest on the plantation less than 10 years before the A/R project kicked off or if there are water resources less than 20 metres from the plantation or if the plantation's size is less than 0.5 ha. Plantations being non-eligible for the A/R project are also not eligible to claim carbon credits for the sustainable charcoal production/consumption component (see tool 'Project and leakage emissions from biomass', version 3, paragraph 6(b)).

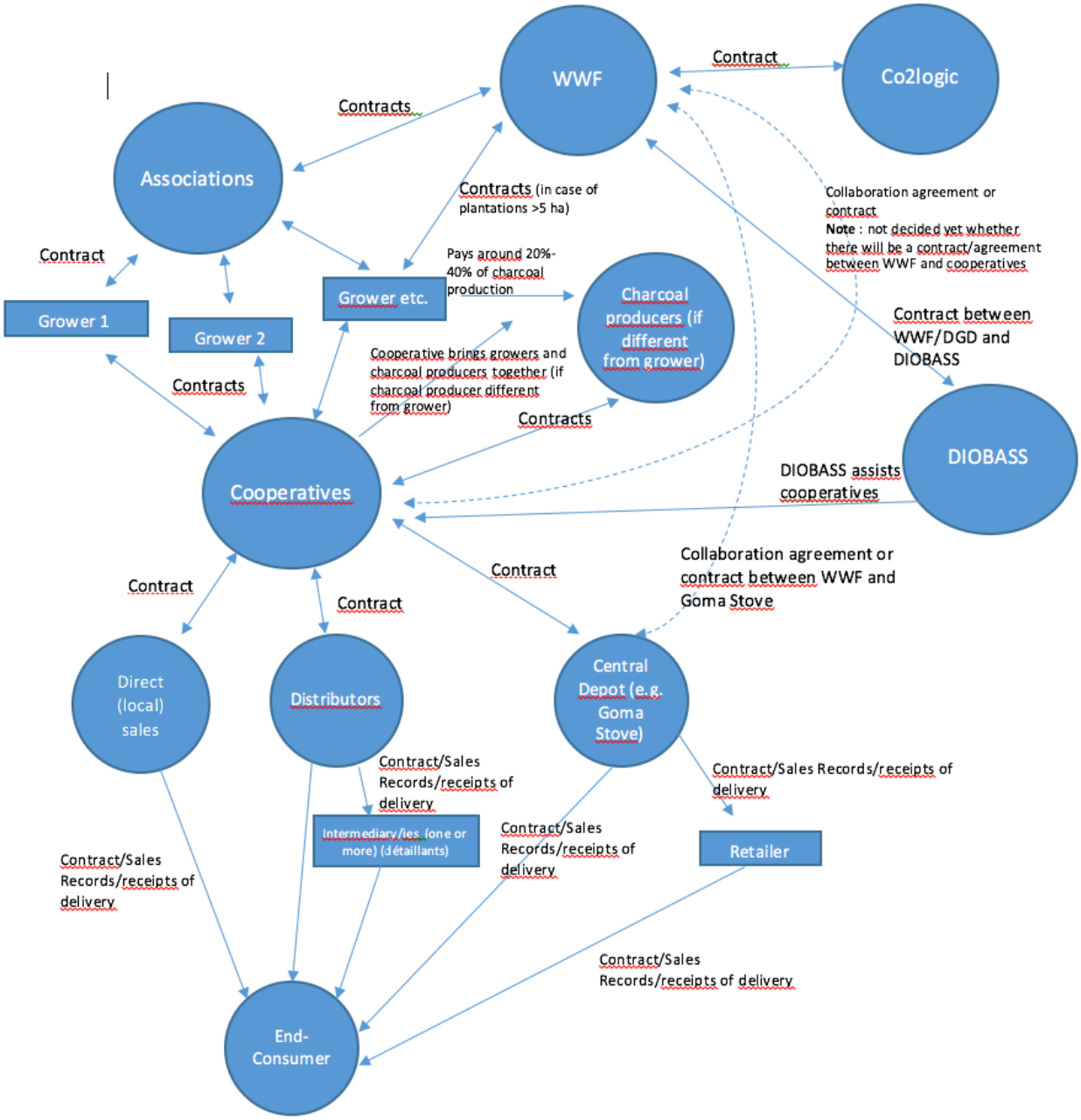
In a similar way as for the charcoal acceptance, cooperatives are responsible for recording certain information when selling the charcoal to end-consumers, distributors and depot (e.g. Goma Stove). This information includes amongst others date of sale, buyers' related data, quantity sold, information about whether a contract between cooperative and buyer exists, photo of the signed carbon waiver etc. (see below preliminary data entry form for sales related data on cooperative level). Again, those data are envisaged to be captured through smartphones (by using e.g. ODK or any other appropriate software tools) and as soon as the user is online transferred to a centralised database for further analysis by the team of WWF DRC. Quality of the data will be checked by the carbon consultant.

Fiche de vente de EcoMakala au niveau des cooperatives																
Mois et Année:							Adresse Acheteur									
DATE de vente	Depot de vente *(Drop-down list de toutes les depots)*	Nom de cooperative (Drop-down list: COOPAL, COPROMA, CACOPROB, COCOPROBBA)	TYPE de l'acheteur (Goma Stove, revendeur, consommateur final)	NOM de l'acheteur	Si EcoMakala est vendu à un revendeur/consommateur final, existe t-il un contrat entre cooperative et revendeur/consommateur final? (Oui/Non)	Nr. Téléphone acheteur	Ville	Quartier	Avenue/Rue	N° du Avenue/Rue	Quantité vendu (en sac)	Quantité vendu (en kg)	Mode d'utilisation *(dropdown list: Revente, Consommation final)*	PRIX par sac	Photo de la signature du recu du vente incluant renonciation des credits carbone? (Oui/Non)

Central depots in the city of Goma (managed by the enterprise Goma Stove Sarl) and possibly later on in Butembo and/or Beni are one of the principal off-takers of Ecomakala. Central depots are requested to capture all data on sales in a respective data entry form. This includes data like sales date, name of the cooperative the charcoal is coming from, buyers' related data, quantity sold, information about whether a contract between Goma Stove and retailer exists (in case of indirect sale), photo of the signed carbon waiver etc. (see below preliminary data entry form for sales related data on depot level). Again, those data are envisaged to be captured through smartphones (by using e.g. ODK or any other appropriate software tools) and as soon as the user is online transferred to a centralised database for further analysis by the team of WWF DRC. Quality of the data will be checked by the carbon consultant.

Fiche de vente de EcoMakala au niveau de Goma Stove																			
Mois et Année:											Adresse Acheteur								
DATE de vente	PRENOM du vendeur	NOM du vendeur	Ville de vente *(Drop-down list de Goma, Butembo, Beni)*	Nom de cooperative a partir de laquele le EcoMakala a été acheté? (Drop-down list: COOPAL, COPROMA, CACOPROB, COCOPROBBA)	TYPE de l'acheteur (revendeur, consammateur final)	PRE-NOM de l'acheteur	NOM de l'acheteur	Si EcoMakala est vendu à un revendeur, existe t-il un contrat entre Goma Stove et revendeur? (Oui/Non)	Nr. Téléphone acheteur	Ville	Quartier	Avenue/Rue	N° du Avenue/Rue	Quantité vendu (en sac)	Quantité vendu (en kg)	Mode d'utilisation *(dropdown list: Revente, Consommation final)*	PRIX par sac	Photo de la signature du recu du vente incluant renonciation des credits carbone? (Oui/Non)

The following diagram illustrates the Ecomakala supply chain, involved stakeholders and their relationships to each other. The roles of the major stakeholders are described below the diagram.



Nota Bene : Contracts and receipts of delivery between the different stakeholders involved (WWF, associations, growers, charcoal producers, cooperatives, DIOBASS, distributors, retailers, intermediaries) will include the carbon transfer clause, transferring all rights on the carbon credits generated by the project to CO2logic (carbon consultant).

Roles :

WWF : Is the project implementer and executes the overall supervision of the operational and carbon related activities on the ground.

CO2logic : Consultancy company designated by WWF responsible for carbon project certification and commercialization of carbon credits.

Growers : Establish forest plantations on their own lands or on lands which they are entitled to use.

Associations : Major players in the project. The project will finally work with several thousands of landowners (growers), which would be extremely difficult to work with directly. Local associations are thus an essential intermediary between WWF and the growers.

Coo*peratives:* Responsible for the exploitation and commercialisation of wood products (in particular for production of charcoal) coming from the plantations. Further, cooperatives serve as link between growers and charcoal producers in case that the grower is not at the same time the charcoal producer.

DIOBASS: Assist the cooperatives in building up the structures for the commercialisation of wood products (in particular charcoal). DIOBASS will continuously check that requirements are followed by the cooperatives. A partner agreement between DIOBASS and WWF exists.
Charcoal producers: Responsible for all works related to the carbonisation process. Often, charcoal producers take over the harvesting of the wood, too.
Distributors: Wholesalers who buy the charcoal from the charcoal collection centres (cooperatives) and resell it either to retailers/intermediaries ('détaillants') or to the end-consumers directly.
C*entral Depots:* Entities like e.g. 'Goma Stove' which are responsible for the sale of charcoal to either retailers or end-consumers in the bigger cities like e.g. Goma, Butembo, Beni. A central depot may receive Ecomakala from different cooperatives at the same time.
End-consumers: Those who finally consume the charcoal (mainly for cooking). This may include households, small and medium enterprises or a group of households served by a charcoal market (e.g. charcoal consuming urban areas).

Improved cookstove component

All ICS sales will be recorded through smartphones or in exceptional cases through paper records (if smartphones are not available).

Smartphones use ODK software or any other appropriate software tool and capture all required data related to sale, ICS and end-users to the largest extent possible[74]. Data are automatically transferred to a centralized database whenever the vendor is online. See in the following the preliminary data entry form for ICS sales which includes the following information:

-Sales date
-Name of the vendor
-Location of sale
-End-user related data (name, phone number, address)
-Name/model of the ICS
-Quantity of ICS sold
-Serial number of the ICS
-Mode of use: domestic or commercial
-Price of ICS
-Question about whether leaflet has been received containing amongst others information in regards to the transfer of carbon credit ownership, request to discontinue with the baseline stoves, instructions how to use the stove and how to save charcoal
-Photo of the signed leaflet ('depliant')

GOMA STOVE SARL

Fiche de vente des foyers améliorés

Mois et Année: XX/2017

								Adresse Utilisateur												
DATE de vente	**PRENOM du vendeur**	**NOM du vendeur**	**Ville de vente** (Drop-down: Goma, Butembo, Beni)	**PRENOM de l'utilisateur** *(Notez: ca fait reference a la femme qui est responsible dans la cuisine)*	**NOM de l'utilisateur** *(Notez: ca fait reference a la femme qui est responsible dans la cuisine)*	**N° 1 téléphone l'utilisateur**	**N° 2 téléphone** *(Notez: ca peut etre le N° téléphone d'autre personne du menage, p.e. mari, fils, fille, parents)*	**Ville**	**Quartier**	**Avenue/Rue**	**N° du Avenue/Rue**	**NOM DE FOYER/ JINA LA JIKO** *(Dropdown list: Goma stove, Jiko Bora, Nguvu Nyusi)*	**NOMBRE de Goma stove, Jiko stove, Nguvu Nyusi**	**Vous avez déjà un FA avec numéro de série?** (Oui/Non)	**Si oui, avez vous deja utilisez le FA 2 ans ou plus?** (Qui/Non) *(Seulement applicable se la question anterieur a ete repondu avec Oui)*	**Numéro de série** (GS -2017-Mois-00000)	**Mode d'utilisation** *(dropdown list: Domestique Commerciale)*	**PRIX**	**Dépliant reçu ?** (Oui/Non)	**Photo de la signature de dépliant incluant renonciation des credits carbone**

The data entry form further checks if the household has already an ICS with serial number in use and if yes, if this ICS is more than 2 years in use. If both questions are affirmative, the additionally purchased ICS can be credited since the lifetime of the ICS is assumed to be 2 years and ICS being older than 2 years are removed from the carbon calculation. On another hand if the

[74] As per the applied TPDDTEC methodology, the number of end user names and addresses (and phone numbers where possible) within sales record shall be large enough so that surveys and tests can be based on representative, purely randomly selected samples. In all cases data records with end users names and addresses shall be at least 10 times the survey and field test sample size in order to ensure an adequate end user pool to which random sampling can be applied.

household responds not to have an ICS with serial number in use yet, the purchased one with serial number can be credited.[75]

The database will be continuously checked for possible double-entries or implausible data entries. Though a household may own more than one ICS at the same time, only one ICS with serial number and being within the age of 2 years per household can claim carbon credits.

The emission reduction calculation for the *improved cookstove component* will be carried out separately for Goma, Beni and Butembo.

The carbon consultant (mentioned in section B.8.) supervises all carbon certification related activities and is responsible amongst others for the coordination of the verification activities, elaboration of the Monitoring Report, ER calculation (ex-post).

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date: 25/05/2017	CO2logic Contact: Herman Noppen , Email: herman@co2logic.com and Antoine Geerinckx, Email: antoine@co2logic.com mkaarbon safari GmbH Contact: Johann Thaler Email: johann.thaler@mkaarbonsafari.com

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

Sustainable charcoal production component: 19/09/2015[76]

Improved cookstove component: July 2009[77]

[75] The household might have other ICS in use which were previously distributed by WWF however being without serial number and without having communicated the transfer of ownership on carbon credits, hence have not been credited in this carbon activity.

[76] The project start date of the sustainable charcoal production component is marked as the date when the 1st transport contract was signed for transporting sustainably produced charcoal from COOPAL cooperative to the city of Goma.

[77] The project start date of the improved cookstove component is marked as the date when the first 43 ICS were sold in July 2009. However no sales sheet is available for the sales conducted in July 2009 since the ICS were sold during an awareness raising campaign. The first sales sheet of stove sales is available for August 2009. Anyway those stoves as well as all other stoves sold in the follow up years until mid of 2017 will not be credited since the same have no serial numbers and the transfer of ownership on carbon credits has not been communicated to end-users.

C.1.2. Expected operational lifetime of project activity

21 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>> Renewable (3 x 7 years)

C.2.2. Start date of crediting period

>> 01/08/2017

C.2.3. Length of crediting period

7 years crediting period (renewable)

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Benefits:
By providing an alternative source of charcoal and improved cookstoves with less charcoal consumption, the EcoMakala Energy project will limit deforestation in Virunga National Park, reducing the impact on the park's remarkable biodiversity and on the climate. The availability of an alternative fuel source will allow park authorities to clamp down on illegal logging.

Besides, improved cookstoves allow a more efficient combustion of charcoal, hence the project will reduce indoor air pollution compared to the less efficient baseline technology. Households will save money since less charcoal on the ICS is needed to cook the same amount of food.

The project will generate employment and income for people manufacturing the ICS in the workshop, service providers, sales staff.

D.2. Environmental impact assessment

No environmental impact assessment is necessary for this type of project.

An authorization for the clay extraction has been provided by the local government of Bahunde.[78]

In regards to sustainable charcoal production, no authorization or permit is necessary, since all charcoal production occurs on lands which are owned by growers or those are entitled to use the lands. On the contrary, the project tries to decrease or even halt the illegal logging of biomass in the Virunga National Park and produces charcoal from renewable biomass coming from dedicated plantations.

[78] The clay extraction authorization has been signed on 10/06/2009 by the chief of the chiefdom Bahunde (unique site for clay extraction) and is available upon request.

The stove manufacturer(s) is/ar officially registered and has/have the necessary permit for conducting all necessary activities related to stove manufacturing.[79]

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

The PP carried out 2 local stakeholder consultation meetings, one in Goma on 14/10/2016[80] and another one in Butembo on 07/12/2016. A wide range of different groups of stakeholders have been invited comprising of growers, stove producers, stove sellers, end-users, national and local policy makers, DNA representative, local NGOs, international development organisations, other carbon project developers active in the host country, research institutes, representatives of civil society, GS representatives and GS international NGO supporters.

E.2. Summary of comments received

See LSC report uploaded to GS registry

E.3. Report on consideration of comments received

See LSC report uploaded to GS registry

SECTION F. Approval and authorization

This project activity does not need a host country LoA being a GS VER project.

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[79] Documents are available upon request

[80] Both A/R and energy projects were presented in the LSC meeting in Goma.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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Appendix 2. Affirmation regarding public funding

Not applicable

Appendix 3. Applicability of methodology and standardized baseline

Not applicable

Appendix 4. Further background information on ex ante calculation of emission reductions

Not applicable

Appendix 5. Further background information on monitoring plan

Not applicable

Appendix 6. Summary of post registration changes

Not applicable

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