Proposed standardized baseline submission form (Version 03.0)

To be used by a designated national authority (DNA) when submitting a proposed standardized baseline in accordance with the "Procedure: Development, revision, clarification and update of standardized baselines" (CDM-EB63-A28-PROC).

INFORMATION TO BE COMPLETED BY THE DNA	
Title of the proposed standardized baseline:	Standardized baseline on sustainable charcoal production in Rwanda
Name(s) of theParty or Parties to which the proposed standardized baseline applies:	Rwanda
DNAsubmitting this form:	Rwanda DNA
Is the proposed standardized baseline submitted by a single Party or group of Parties? *(If the Party had 10 or fewer registered CDM project activities as of 31 December 2010, or each Party of the group of Parties had 10 or fewer registered CDM project activities as of 31 December 2010, has the Party or each Party of the group of Parties used the option to omit the assessment report more than twice in past submissions of a proposed standardized baseline?)*	☒ Single Party ☐ Group of Parties

Attachments:

☒ Additional documentation supporting the submission (e.g. relevant data,statistics, studies, calculation tables, quality control report, etc.), where applicable

☐ Data used to establish the proposed standardized baseline in a sector-specific data template

☐ Anassessment report prepared by a designated operational entity (DOE)

☐ Letters of approval of all the DNAs of the Parties to which the proposed standardized baseline applies, where the standardized baseline applies to a group of Parties

Name of authorized officer signing for the DNA:	Eng. Coletha U. RUHAMYA Director General Rwanda Environment Management Authority (REMA) and UNFCCC focal Point Tel: +250 252 580 101 E-mail: cruhamya@rema.gov.rw
Date (DD/MM/YYYY) and signature for the DNA:	25/04/2018 For MUHAYAZIKWIYE DDG - REMA
Contact information of the focal point(s) of the DNA: *(Names, e-mail addresses and phone contacts for procedural and technical communication on the*	Ms. Uwimana Immaculée Tel: +250788871527 rwandadna@gmail.com

standardized baseline:	
Affiliation of the proponent(s): *(The definition of "admitted observer organization" can be found athttps://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf)*	☒ Party ☐ Project Participant (PP) ☐ International Industry Organization ☐ Admitted Observer Organization
Contact information of the focal point(s) of the proponent(s): *(Names, e-mail addresses and phone contacts for procedural and technical communication on the submission. This section does not need to be completedif the DNA(s) is(are) the proponent(s) of the proposed standardized baseline.)*	As above
INFORMATION TO BE COMPLETED BY THE SECRETARIAT AND THE PROPONENT(S)	
Further inputs requested from the proponent(s) on the proposed standardized baseline:***(List of additional information and/or modifications that are required to prepare a draft standardized baseline, if applicable.)***	
Response from the proponent(s): ***(If there are changes in the proposed standardized baseline form as a result of changes carried out, submit the changes in the highlighted text).***	

Proposedstandardized baseline submission form CDM-PSB-FORM(Version 03.0)

Title: **Standardized baseline on sustainable charcoal production in Rwanda**

Submission date (*dd/mm/yyyy*): **25/04/2018**

Version number: **00**

Approaches

Check below all the approaches used to develop the proposed standardized baseline and state the version and/orthe reference(number, title, version)if applicable.

☒The approach contained in the "Guidelines for the establishment of sector specific standardized baselines" (Version: **02.0**)

☒A methodological approach contained in an approved, proposed new or revised baseline and monitoring methodology(reference: **AMS-III.BG.: Emission reduction through sustainable charcoal production and consumption --- Version 3.0**)

☒A methodological approach contained in an approved, proposed new or revised methodological tool (reference:**TOOL30: Methodological tool "Calculation of fraction of non-renewable biomass", Version 1.0**)

☐The approach contained in the"Guideline: Establishment of standardized baselines for afforestation and reforestation project activities under the CDM"(version: _____)

Combination of the approaches (if applicable)

Provide a justification for the necessity and the appropriateness of the combination if more than one approach was used for the development of the proposed standardized baseline.

The approaches contained in the "Guidelines for the establishment of sector specific standardized baselines" and in the approved baseline and monitoring methodology "AMS-III.BG Emission reduction through sustainable charcoal production and consumption" are combined as follows:

- The 'Guidelines' approach is applied to standardize additionality and baseline scenario identification, since no charcoal sector methodology-specific additionality or baseline determination provisions apply.
- The 'Methodological' approach is applied to standardize baseline emissions determination, based on the various available choices between default value parameters embodied in methodology AMS-III.BG.
- The methodological tool is applied to standardize the fraction of non-renewable biomass, following the methodology AMS-III.BG.

Therefore, it is deemed that the combination of the above approaches is appropriate since they concern complementary components of the Proposed Standardized Baseline and respectively contribute to a rigorous and detailed standardization process of the sustainable charcoal production baseline in Rwanda.

New or revised methodology or methodological tool (if applicable)

This section is applicable to the following situations:

1. *If there is no approved methodology or methodological tool available that can be used for the development ofthe proposed standardized baseline, and if the proponent wishes develop a new methodological approach by submitting a new methodology or methodological tool orrevise the approach contained in an approved methodology or methodological tool, and/or*

2. *If there is no approved methodology available to be used together with the proposed standardized baseline for the estimation of emission reductions, and the proponents wishes to develop new methodology or revise the existing approved methodology.*

Check belowhow the new or revised methodology or methodological tool is/was submitted for approval by the CDM Executive Board and for what purposein accordance with the "Procedure: development, revision and clarification of baseline and monitoring methodologies and methodological tools".In this case, indicate below the title of the new or revised methodology or methodological tool if applicable:

- *New or revised methodology or methodological tool[1]:*

  ☐New methodology (title:_____)

  ☐ Revised methodology (title: _____)

  ☐ New methodological tool (title: _____)

  ☐ Revised methodological tool (title:_____)

- *Purpose:*

  ☐For using the methodological approach in new/revisedmethodology/methodological toolfor development of the proposed standardized baseline

  ☐For using thenew/revised methodology together with the proposed standardized baseline to estimate emission reductions

- *Process:*

  ☐Methodology(ies)/methodological tool is/was proposed through the bottom-up process

  ☐Request the secretariat to seek a mandate from the CDM Executive Board for its top-down development(if this option is selected, provide justification below)

  (Justification:_____)

  N/A

[1] The proposed new or revised methodology or methodological tool for the purpose of developing a proposed standardized baseline, or the proposed new or revised methodology or methodological tool that will be used together with the proposed standardized baseline, may be submitted to the secretariat at the same time with the proposed standardized baseline in accordance with the "Procedure: development, revision and clarification of baseline and monitoring methodologies and methodological tools".

Elements to be standardized

Check below all the elements to be standardized by the proposed standardized baseline:

☒ Additionality

☒ Baseline/baseline land-use scenario

☒ Baseline emission/removalparameter

☐ Land eligibility (applicable only to afforestation and reforestation project activities)

SECTION A: PROPOSED STANDARDIZED BASELINE DEVELOPED USING THE APPROACH CONTAINED IN THE "GUIDELINES FOR THE ESTABLISHMENT OF SECTOR SPECIFIC STANDARDIZED BASELINES"

Complete this section only when the proposed standardized baseline is developed using the approach contained in the "Guidelines for the establishment of sector specific standardized baselines".

Applicability of the proposed standardized baseline

Provide the following information:

- *The host country(ies) or region(s) within a host country to which the proposed standardized baseline is applicable. In case of disaggregation by region(s) within a host country, document transparently the geographical boundaries of the region (e.g. provinces, electric grids,etc.).*

  Rwanda

- *Other factors for disaggregation (e.g. output capacity, age of facilities) relating to the applicability of the proposed standardized baseline, if applicable.*

  N/A

- *The sector(s) to which the proposed standardized baselines is applied. Note that a sector refers to a segment of a national economy that delivers defined output(s) (e.g. clinker production, domestic/household energy supply). The sector is characterized by the output(s) O_i it generates.*

  Charcoal production

- *The outputto which the proposed standardized baseline is applied, i.e. the goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking).*

  Charcoal

- The measure(s) to which the proposed standardized baseline is applicable is/are:

  ☒Fuel and feedstock switch

  ☒Switch of technology with or without change of energy source (including energy efficiency improvement)

  ☒Methane destruction

  ☐Methane formation avoidance

Additionality standardization

Explain how the "Guidelines for the establishment of sector specific standardized baselines" were applied to standardize theadditionality criterion of project activities or programmes of activities that are deemed additional.Document all underlying data, data sources, assumptions, steps and outcomesin a clear and transparent manner.

INTRODUCTION

Charcoal production in Rwanda

As per Rwandan Nationally Determined Contribution (NDC), the forestry sector is the primary provider of the energy needs (97% of cooking energy) of the population(Ministry of Natural Resources, 2015). The demand for biomass is higher than the supply leading to non-renewability of Rwandan firewood(AESG, 2012).

In Rwanda, under the current forest law, natural forests have special conservation status and removal of wood products, including fuelwood gathering is prohibited. Despite this, many studies have indicated that these forests are exploited and remain an important source of fuelwood and other products for people living around them(Ndayambaje & Mohren, 2011).

Historical data for eastern Africa, including Rwanda, shows an exponential increase in charcoal production from 1962 to 2012, which is recorded as maximum among all the African regions(Neufeldt H, 2015). Charcoal demand is further projected to increase and provide main source of livelihood to 12 million people in rural and urban areas by 2030, up from 2013 figures of 7 million in sub-Saharan Africa(Mwampamba TH, 2013).

In Rwanda, around 80% of the firewood and charcoal comes from privately operated plantations of eucalyptus trees and other small-scale agro forestry programs(Ministry of Infrastructure, 2015). Growing forests in Rwanda doesn't intentionally target charcoal production and firewood. However, the lack of affordable alternative source of energy makes predominance of use of forest for charcoal production and firewood. Rwanda has an extension of 26,338 km^2, which correspond to 2,633,800ha. Approximately 17% of the land is covered by forests, i.e. around 450,000 ha. A proportion of 46% of the forest cover is classified as natural forests, i.e. 207,000 ha, and the rest is classified as public and private plantations(Ministry of Infrastructure, 2015). The State of Rwanda owns around 277,000 ha of forest, of which 30% is reserved for protection, i.e. approximately 83,000 ha, while 194,000 ha of state owned forests could be harvested(Ndegwa, Breuer, & Hamhaber, 2011). Natural forest areas declined by 65% during the period from 1960 to 2007(Ministry of Forestry and Mines, Republic of Rwanda, 2010). The annual deforestation rate between 1960 and 1970 was found to be 2.9% and still continues to be 1.8% between 1990 and 2010 despite various conservation measures(Ndayambaje & Mohren, 2011).

According to a 2014 field survey finding on sustainable charcoal production(Camco Advisory Services, ClimateCare, Tractebel Engineering, 2014), in Rwanda the two main biomass sources for charcoal are:

- Purchased from supplier: 91%
- Charcoal producers' own farms: 9%

The totality of Rwandan charcoal is produced from private woodlots with an overdependence on eucalyptus species. The field survey has also confirmed that the biomass resources are diminishing, indicated by the increasing distances that charcoal producers need to travel from their homesteads to obtain biomass for carbonization(Camco Advisory Services, ClimateCare, Tractebel Engineering, 2014).

MEASURE 1: FUEL AND FEEDSTOCK SWITCH

Non-renewable vs renewable biomass

According to the glossary of CDM terms (Version 09.1)[2], biomass is renewable if ONE of the following condition applies:
(a) Biomass is originating from land areas that are forests
Where:

[2]https://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf

- Land area remains forest.
- Sustainable management practices are enforced to maintain carbon stock level.
- In compliance with forest regulations.

(b) Biomass is woody biomass and originates from croplands and/or grasslands
Where:

- Land area remains cropland and/or grasslands or is reverted to forest.
- Sustainable management practices are enforced to maintain carbon stock level.
- In compliance with forest regulations.

(c) Biomass is non-woody biomass and originates from croplands and/or grasslands
Where:

- Land area remains cropland and/or grasslands or is reverted to forest.
- Sustainable management practices are enforced to maintain carbon stock level.
- In compliance with forest regulations.

(d) Biomass is a biomass residue (i.e. biomass by-products, residues and waste streams from agriculture, forestry, and related industries)
Where:

- Its use in the project activity does not involve a decrease of carbon pools.

(e) Biomass is the non-fossil fraction of an industrial or municipal waste (e.g. cardboard & paper waste and garden waste)
Biomass is non-renewable where none of the above conditions applies.

Charcoal produced in managed forests

This biomass is renewable in theory, because it meets condition prescribed above, being woody biomass taken from land areas that are forests that will remain forests and that are "officially" under sustainable management practices. However, the enforcement of the sustainable management practices in managed forests to maintain the same level of carbon stock remains a question mark.

Nevertheless, as a conservative approach, it could be presumed that the woody biomass being sourced from the charcoal producers' own farms is a renewable source.

Therefore, the charcoal produced in managed forests is considered to be using renewable biomass, and amounts to 9 % of the total production, as per field survey finding on sustainable charcoal production(Camco Advisory Services, ClimateCare, Tractebel Engineering, 2014).

Charcoal produced using alternative feedstocks (i.e. mixed agricultural wastes)

The charcoal produced using alternative feedstocks (i.e. mixed agricultural wastes), as described above is renewable for the most part as it meets condition prescribed under point (d) above, being biomass residues such as charcoal residues, sawdust, rice husks, peanut shells and clay which in these cases, do not involve a decrease of carbon pools.

However, inRwanda, the data on the amount of charcoal produced from alternative feedstocks (i.e. other than the purely woody biomass), such as mixed agricultural wastes, is negligible. Furthermore, the production of this charcoal has always been the result of supported efforts from international donors, as observed in other African countries (Camco Advisory Services, ClimateCare, Tractebel Engineering, 2014).

Thus, the proportion of charcoal produced using alternative feedstocks (i.e. mixed agricultural wastes) is considered to be0 %.

Charcoal produced in the informal sector

In Rwanda, the charcoal production is part of the informal sector. The fuel/feedstock used is woody biomass leading to deforestation. This biomass is non-renewable, because it does not meet any of the five conditions described above.

Given that the forest cover has been depleting in the country since 31 December 1989, it can be construed that the woody biomass being used for charcoal production is non-renewable (further details are presented in Section C).

As mentioned above, the proportion of charcoal produced in the managed forests is 9%, the proportion of bio-charcoal is 0%. Consequently, the rest of the charcoal produced in Rwanda, which is therefore in the informal sector, amounts to91%.

Table 1: Proportion of non-renewable vs renewable biomass in Rwanda

Charcoal production type	Using renewable biomass	Using non-renewable biomass
Produced in the managed forests	**9%**	-
Produced using alternative feedstocks (i.e. mixed agricultural wastes)	-	-
Produced in the informal sector	-	**91%**
Total	**9%**	**91%**

Source: Camco Advisory Services, ClimateCare, Tractebel Engineering. (2014)

In accordance with the Guidelines for the establishment of sector specific standardized baselines, version 02.0, the cumulative percentage of the output "Charcoal production", based on the available fuels/feedstocks, is arranged in descending order of carbon intensity of the fuels/feedstocks.

Fuels/feedstocks which have a lower carbon intensity than all the fuel/feedstock used to produce aggregately more than the approved additionality threshold Xa of 80% for the energy for households and energy generation in isolated systems, but facing barriers or that are less commercially attractive should be included in the positive list of fuels/feedstocks. A switch to any of the fuels/feedstocks in the positive list is deemed to be additional.

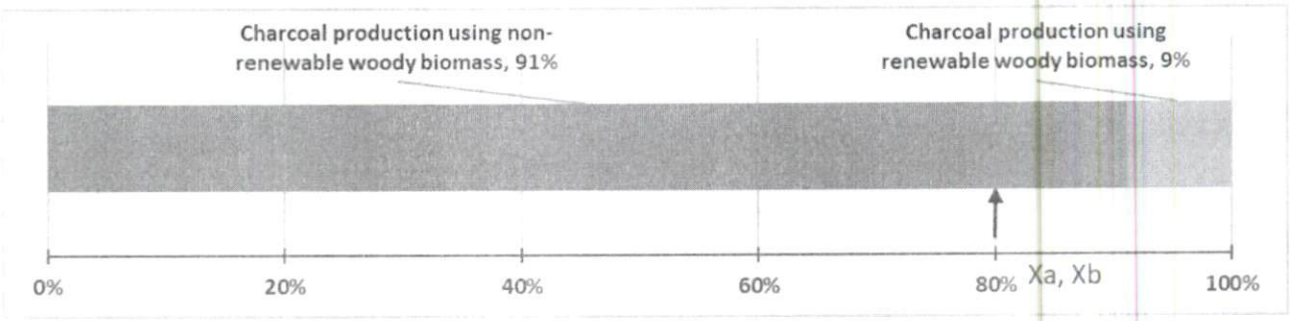

Figure 1:Proportion of charcoal produced by type of feedstock

Source: Adapted based on data from Camco Advisory Services, ClimateCare, Tractebel Engineering. (2014).

In Rwanda, non-renewable biomass is used to produce 91% of charcoal production, consequently the lower carbon incentive feedstocks (i.e. renewable woody biomass and alternative renewable sources, such as agricultural wastes), are included in the positive list of fuels/feedstocks.

A switch to renewable woody biomass or alternative renewable sources is therefore deemed to be additional.

MEASURE 2: SWITCH OF TECHNOLOGY WITH OR WITHOUT CHANGE OF ENERGY SOURCE (INCLUDING ENERGY EFFICIENCY IMPROVEMENT)

In Rwanda, wood carbonization is dominated by traditional technologies. As per the second national communication from Rwanda to UNFCCC, in 2005 100% of the charcoal production was through traditional kilns with 11% efficiency(REMA, 2012). There have been only limited improvements;most of the charcoal used in Rwanda is still produced using the traditional earth mound kilns with an efficiency of merely 12%(Ndegwa, Breuer, & Hamhaber, 2011). As per a detailed field survey, it was found that about 86% of the charcoal producers use traditional earth mound kiln; 13% of respondents used a form of improved kiln; andonly 1% use the improved earth mound kiln(Camco Advisory Services, ClimateCare, Tractebel Engineering, 2014). Charcoal production in Rwanda uses traditional techniques consuming 23% of the country's energy(GTZ, 2009). A study in the Southern province of Rwanda compared the traditional and improved kilns to conclude that improved techniques can increase the charcoal production and reduce the air pollution, including tar collected from the chimney containing the major elements responsible for GHG emission(Nahayo, Ekise, & Mukarugwiza, 2013).

A traditional kiln for burning charcoal – they are quite inefficient using a lot of wood contributing to deforestation

Photo credit: REMA

Figure 2:Traditional kiln

The traditional mound commonly used in Rwanda produces between 25 and 35 standard[3] bags of charcoal. A World Bank commissioned study estimated that traditional mound produces between 825 and 1,155kgs.

[3] According to a feasibility study on Establishing a green charcoal value chain in Rwanda, 2012: a standard bag of charcoal weights 33kgs and a traditional kiln produces between 825 and 1,155 kg.

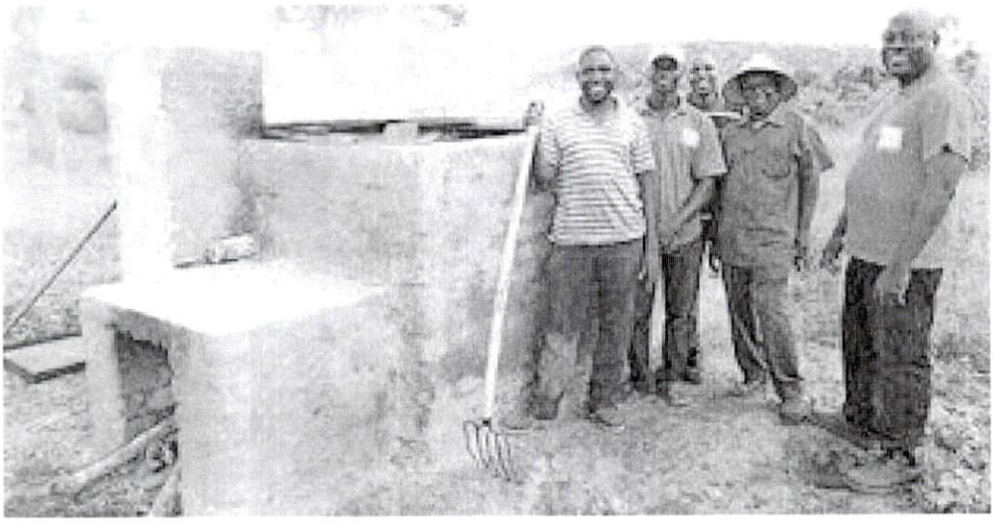

Figure 3:Rectangular kiln

Source: The Newtimes, Rwanda 2012

Table 2: Percentage of charcoal produced by each of the technologies

Technology	% of the total production
Traditional earth mound kilns	**86%**
Other improved kilns	**13%**
Improved earth mound kilns	**1%**

Source: Camco Advisory Services, ClimateCare, Tractebel Engineering. (2014)

In accordance with the Guidelines, the cumulative percentage of the output "Charcoal production", based on the available technologies, is arranged in descending order of carbon intensity of the technologies.

The technologies which have a lower carbon intensity than all the technologies used to produce aggregately more than the approved additionality threshold Ya of 80% for the energy for households and energy generation in isolated systems, and are less commercially viable as these, are additional.

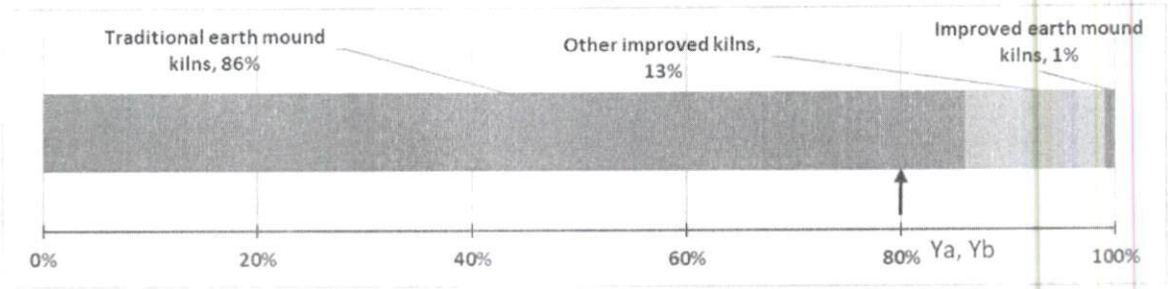

Figure 4:Proportion of charcoal produced by technology

Source: Adapted based on data from Camco Advisory Services, ClimateCare, Tractebel Engineering. (2014).

In Rwanda, the traditional earth mound kiln is the single technology which produces more than the additionality threshold Ya (80%) of the total output, producing 86% of the country's charcoal.

The Casamance kilns and other improved kilns are less carbon intensive than the traditional kilns, and therefore are additional.

MEASURE 3: METHANE DESTRUCTION

In many charcoal-dependent developing countries, comprehensive policies, strategies or legal frameworks governing charcoal are non-existent. Where they do exist, they are often unclear, conflicting, unrealistic and ineffective. Biomass energy is often governed by different sectors, ministries and agencies across forestry, energy and environment portfolios at national and sub-national levels, leading to conflicting responsibilities, overlaps and complex governance structures(Neufeldt H, 2015). Such weak governance frameworks result in the uncontrolled use of resources, limited regulation and enforcement, price distortions and corruption (The World Bank, 2010) as demonstrated by the failed 2006 ban on charcoal in Tanzania(Owen M, 2013).

Charcoal production in Rwanda is subject to legal requirements under a Ministerial Order. The current Ministry of Lands and Forestry order (004/MINIRENA/2015) entered into force on 06th July 2015, date of its publication in official gazette. The ministerial order regulates generally the issuance of license used for activities relating to a District (public) or Private forest. Specifically, the ministerial order covers the following main topics: (1) District forest harvesting license, (2) license of private harvesting forest, (3) forest products transportation license (4) forest products exportation license, and (5) forest clearing license.

Harvesting a district forest requires a stepwise-process:

(i) Decision of District Executive Committee to harvest a district forest based on (1) the forest management plan, (2) a report of a professional in charge of forest in the district, and (3) a note of the Mayor of the district describing how the harvest from the forest will be used and the post harvesting activities.
(ii) Decision of the District Mayor to harvest a District forest
(iii) Decision of Director General of the authority in charge of forests
(iv) Open tender process

The ministerial order doesn't determine a minimum size of district forest for harvest.

Harvesting of private forest is also subject to a process with the following steps:

(i) Application addressed to the District Mayor requesting to harvest a private forest
(ii) Decision of the District Mayor to harvest a private forest
(iii) Decision of Authority in charge of forest to harvest a private forest

A private forest requesting a harvesting license must exceed 2 hectares (2ha). A forest harvesting license is valid for 3 months after its issuance.The forest products transportation license mainly targets charcoal but also timber and planks are concerned. Charcoal exceeding 10 bags with hundred kilograms each must apply for a forest product transportation license. The transportation license has 3 month-validity.

On top of forest harvesting and forest product transportation license, a license for exportation is required for charcoal, planks and timber. The application for charcoal, planks or timber exportation licence is addressed to Director General in charge of forest. The license has a validity of 30 days.

License fees vary from one to another in accordance to a presidential order establishing the list of fees and other charges levied by decentralized entities and determining their thresholds (No: 004/MINIRENA/2015).

Currently, there is no special legal framework to regulate charcoal production or biomass consumption. The long process of license issuance for charcoal production stands as a big challenge that charcoal producers tend to skip. There is no particular requirement for use of any technology for charcoal production or curbing the methane release during charcoal production.

In Rwanda, there is neither a mandate, nor enforced destruction of methane associated with any technology.

Without the CDM, there is no economic incentive for the destruction of methane associated with the production of charcoal.

The Rwandan DNA confirms in an official letter, that there is no legal requirement for capture and destruction of methane in charcoal production facilities.

Consequently, any capture and destruction of methane emitted during the pyrolysis process is additional.

Baseline identification

Explain how the "Guidelines for the establishment of sector specific standardized baselines" were applied to identify the baseline.Document all underlying data, data sources, assumptions, steps and outcomes in a clear and transparent manner.

MEASURE 1: FUEL AND FEEDSTOCK SWITCH

In accordance with "Guidelines for the establishment of sector specific standardized baselines, version 02.0", the cumulative percentage of the output "Charcoal production", based on the available fuels/feedstocks, is arranged in descending order of carbon intensity of the fuels/feedstocks.

The fuels/feedstocks with the highest carbon intensity and contributing to produce aggregately more than the approved baseline threshold Xb of 80% for the energy for households and energy generation in isolated systems are identified.

The fuel/feedstock with the lowest carbon intensity among them is the baseline fuel.

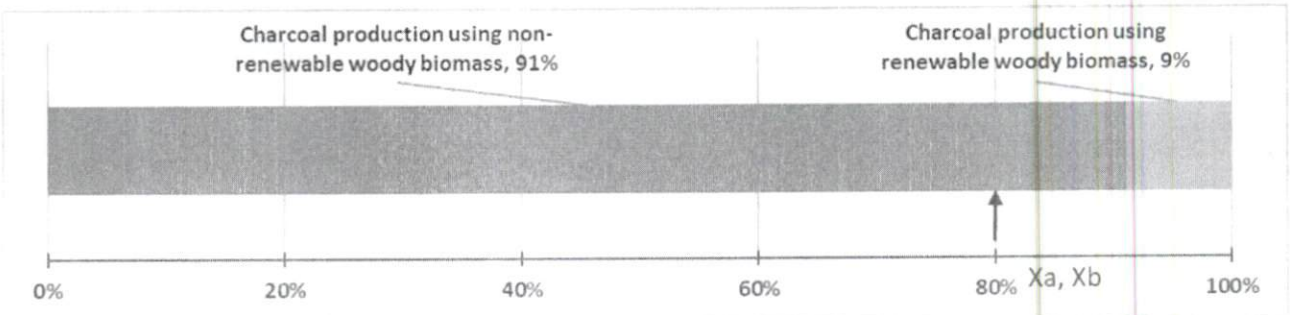

Figure 5:Proportion of charcoal produced by type of feedstock

Source: Adapted based on data from Camco Advisory Services, ClimateCare, Tractebel Engineering. (2014).

In Rwanda, the fuel/feedstock used to produce more than 80% of the charcoal production is non-renewable biomass at 91%.

Since it is the only fuel/feedstock to do so, non-renewable woody biomass is the baseline fuel.

MEASURE 2: SWITCH OF TECHNOLOGY WITH OR WITHOUT CHANGE OF ENERGY SOURCE (INCLUDING ENERGY EFFICIENCY IMPROVEMENT)

In accordance with the Guidelines, the cumulative percentage of the output "Charcoal for residential cooking", based on the available technologies, is arranged in descending order of carbon intensity of the technologies.

The technologies with the highest carbon intensity and contributing to produce aggregately more than the approved baseline threshold Yb of 80% for the energy for households and energy generation in isolated systems are identified.

The technology with the lowest carbon intensity among them is the baseline technology.

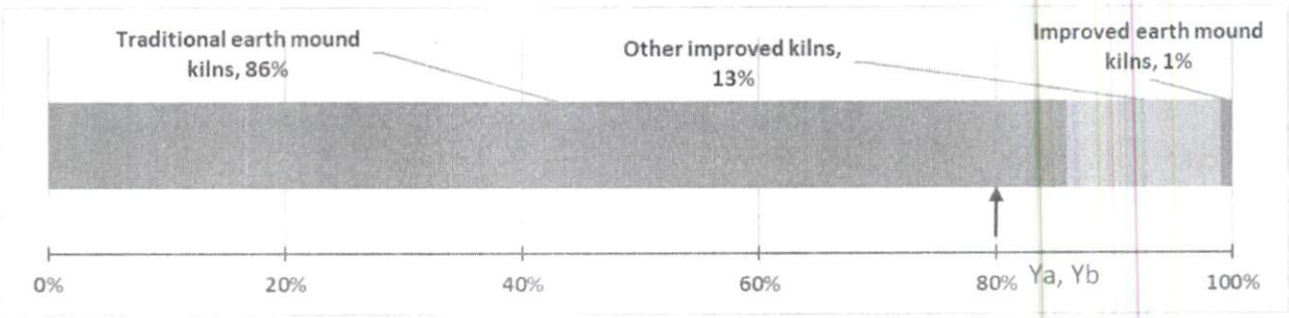

Figure 6:Proportion of charcoal produced by technology

Source: Adapted based on data from Camco Advisory Services, ClimateCare, Tractebel Engineering. (2014).

In Rwanda, the traditional earth mound kiln is the single technology which produces more than the additionality threshold Ya (80%) of the total output, producing 86% of the country's charcoal.

The traditional kiln therefore is the baseline technology.

MEASURE 3: METHANE DESTRUCTION

In Rwanda, there is neither a mandate, nor enforced destruction of methane associated with any technology.

Without the CDM, there is no economic incentive for the destruction of methane associated with the production of charcoal.

The Rwandan DNA confirms in an official letter, that there is no legal requirement for capture and destruction of methane in charcoal production facilities.

Consequently, the baseline is the lack of destruction of methane emitted during the pyrolysis process.

Baseline parameter standardization

Explain how the "Guidelines for the establishment of sector specific standardized baselines" were applied to standardizea baseline parameter (e.g. baseline specific energy consumption, baseline fuel emission factor, baseline emission factor).Document all underlying data, data sources, assumptions, calculation steps and outcomesin a clear and transparent manner.

N/A

Use of the proposed standardized baseline with approved or proposed new or revised methodology(ies)

Explain how the proposed standardized baseline will be used together with the validversion(s) of a relevant approved methodology(ies) or proposed new/revised methodology(ies).[4]*Describehow a standardized baseline derived from the "Guidelines for the establishment of sector specific standardized baselines" will replace the sections ofdemonstration of additionality, identification of the baseline scenario and/or the determination of baseline emissions in the methodology.*

N/A

Validity of the proposed standardized baseline

State the period of time for which the proposed standardized baseline is validtaking into account the provisions ofthe "Standard for determining coverage of data and validity of standardized baselines" and Appendix I to the "Guidelines for the establishment of sector specific standardized baselines".

This standardized baseline shall be valid for a period of 3 years from the date of approval by the EB. The standardized baseline thereafter will be updated every three years, based on the most recently available data at the time of making the updates, as well as the relevant methodological tool and guidelines.

Deviations from the guidelines (if applicable)

Provide descriptions of and justifications for the necessity and the appropriateness of any deviations from the "Guidelines for the establishment of sector specific standardized baselines" to develop the proposed standardized baseline.

N/A

References and any other relevant information

AESG, A. E. (2012). *Biomass survey in urban and rural areas in Rwanda.* Energy Water and Sanitation Authority, Rwanda.

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DFS Deutche Forstservice GmbH, Enterprise Multiservice EMS. (2016). *Final Report and Action Plan for improvement of charcoal value chain in Rwanda.* Rwanda: Ministry of Infrastructure, Republic of Rwanda.

Global Environment Facility, GEF. (2013). *Africa will import – not export – wood.* Maryland, USA.

GTZ, M. (2009). *Biomass Energy Strategy (BEST), Rwanda Volue 2: Background and Analysis.* Rwanda. Retrieved from http://cleancookstoves.org/resources_files/best-volume-2background.pdf

[4] The "Guidelines for completing the proposed new baseline and monitoring methodologies form" provide guidance on the sections of the proposed new baseline and monitoring methodologies form that should be filled to develop a methodology that will only be used together with a standardized baseline.

Ministry of Forestry and Mines, Republic of Rwanda. (2010). *National Forest Policy.* Rwanda.

Ministry of Infrastructure, M. (2015). *Energy Sector Strategic Plan.* Rwanda. Retrieved August 25, 2017, from http://mininfra.gov.rw/fileadmin/user_upload/new_tender/Energy_Sector_Strategic_Plan.pdf

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SECTION B: PROPOSED STANDARDIZED BASELINE DEVELOPED USING A METHODOLOGICAL APPROACH CONTAINED IN AN APPROVED OR PROPOSED NEW OR REVISED METHODOLOGY

Complete this sectiononly when the proposed standardized baseline is developed using a methodological approach contained in thevalid version of an approvedmethodology orin a proposed new or revised methodology(ies). An example of this is "AM0070: Manufacturing of energy efficient domestic refrigerators" to standardize the specific energy consumption of domestic refrigerators in the host country.

Applicability of the proposed standardized baseline

State the host country(ies) or region(s) within a host country to which the proposed standardized baseline is applicable. In case of region(s) within a host country, document transparently the geographical boundaries of the region (e.g. provinces, electric grids, etc.).

Rwanda

Additionality standardization(if applicable)

Explain how the methodological approach contained in the valid version of theapproved methodology(ies)or in the proposed new or revised methodology(ies) was applied to standardize additionalitycriterion for project activities or programmes of activities using the methodology. Document all the underlying data, data sources, assumptions, steps and outcomesin a clear and transparent manner.

As stipulated in the methodology (AMS-III.BG), theproposed standardised baseline has followed the "Guidelines on the demonstration of additionality of small-scale project activities". Clause 2 of this guideline declares that documentation of barriersis not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds.

The sustainable charcoal production will fall under the project category in clause 2 part (c) of this guideline stating that "*Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the sizeof each unit is no larger than 5% of the small-scale CDM thresholds*", and therefore do not need to provide documentation to demonstrate additionality.

In Rwanda, most of the charcoal producers are unskilled rural people using traditional earth mound kilns.

The tables below provide sample calculation of the charcoal production unit to breach the 5% threshold as defined above.

Table 3: Demonstration of the 5% rule for type III projects

Parameter	Unit	Value	Source /Remark
5% of the small-scale CDM threshold for Type III projects (ER_y)	tCO_2e	3000	-
Default wood to charcoal conversion factor (CF)	-	7.7	Based on 14% efficiency of traditional Rwandan Kiln efficiency
Net calorific value of wood (NCV_{wood})	TJ/t	0.015	AMS-III.BG

Net calorific value of the charcoal type i produced during the project($NCV_{charcoal,i}$)	TJ/t	0.0295	AMS-III.BG Option 2
Default net calorific value of charcoal ($NCV_{charcoal,default}$)	TJ/t	0.0295	AMS-III.BG
Fraction of non-renewable biomass ($f_{NRB,BL,wood}$)	-	0.84	Refer section C
Emission factor for the substitution of non-renewable woody biomass ($EF_{projected\ fossilfuel}$)	tCO_2/TJ	81.6	AMS-III.BG
Global warming potential of Methane (GWP_{CH4})	-	25	IPCC
Specific methane generation for the baseline charcoal generation process in the year y ($SMG_{y,b}$)	tCH_4/t charcoal	0.030	AMS-III.BG
Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility (M_d)	-	0	No such legal requirement exists
Project emissions	tCO_2	0	Conservatively assumed to arrive at quantity of charcoal produced
Quantity of charcoal produced (corresponding to the 5% threshold)	t	373	Calculated using equation (1) of AMS-III.BG

Although the size of a kiln is not standard, accounting for the carbonisation time, the kiln size is expected to be much lower than the threshold calculated. In Rwanda, most are small scale charcoal producers making on average only 21 bags of charcoal per month, corresponding to around 10 tons per annum (Camco Advisory Services, ClimateCare, Tractebel Engineering, 2014).

Therefore, sustainable charcoal production interventions are deemed additional.

Baseline identification(if applicable)

Explain how the methodological approach contained in the valid version of the approved methodology(ies)or in the proposed new or revised methodology(ies) was applied to identify the baseline. Document all the underlying data, data sources, assumptions, steps and outcomes in a clear and transparent manner.

As per the methodology, AMS-III.BG, Version 03:

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.

Baseline emission parameter standardization(if applicable)

Explain how the methodological approach contained in the valid version of theapproved methodologyor in the proposed new or revised methodologywas applied to standardizethe baseline emission parameter (e.g. baseline specific energy consumption, baseline emission factor) of a project activity or programme of activities. Document all underlying data, data sources, assumptions, calculation steps and outcomes in a clear and transparent manner.

For the project technology equipped with capture and destruction of the pyrolysis gases, including micro-gasifier, emission reductions are calculated as follows:

$$ER_y = \sum_i Q_{CCP,i_y} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal,i}}{NCV_{charcoal,default}} \times f_{NRB,BL,wood} \times EF_{projected_fossilfuel}\right) + \left(SMG_{y,b} - M_d\right) \times \left(1 - f_{NRB,BL,wood}\right) \times GWP_{CH4,y}\right] - PE_{y,fugitive} - PE_{y,flaring} - PE_{FF,y} - PE_{El,y} - PE_{BC,y}$$

Where:

ER_y	=	Emission reductions in year y[5] (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)
$NCV_{charcoal,i}$	=	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)
$f_{NRB,BL,wood}$	=	Fraction of biomass of type i used in the absence of the project activity that can be established as non-renewable biomass; determined as per the procedure found in the latest version of "AMS-I.E: Switch from non-renewable biomass for thermal applications by the user" or on the basis of the published DNA endorsed default values available on the UNFCCC website[6]
$EF_{projected_fossilfuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers (t CO_2/TJ)
$GWP_{CH4,y}$	=	Global warming potential of methane applicable to the crediting period (t CO_2e/t CH_4)
$SMG_{y,b}$	=	Specific methane generation for the baseline charcoal generation process in the year y (tonnes CH_4/t charcoal product); a default value of 0.030 t CH_4/t charcoal may be used. Alternatively, the value can be determined in accordance with the procedure provided in the latest version of "AMS-III.K: Avoidance of methane release from charcoal production"
M_d	=	Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility (tonne of CH_4/tonne of raw material)

[5] Project emissions on account oftransport are assumed to be negligible.

[6] Default values of fraction of non-renewable biomass can be retrieved at: <http://cdm.unfccc.int/DNA/fNRB/index.html>.

$PE_{y,flaring}$	=	If applicable, emissions due to the flare inefficiency in the project charcoal manufacturing plant in the year *y* (t CO_2e) determined in accordance with the procedure provided in AMS-III.K. In case captured pyrolysis gas is gainfully used (e.g. as fuel for pre-heating the facility, or for wood drying, or used for production of heat and/or power as in the case of micro-gasifier), then it can be taken as zero
$PE_{FF,y}$	=	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)

For $PE_{y,fugitive}$ is calculated as follows:

$$PE_{y,fugitive} = \sum_{i} Q_{CCPi,y} \times GWP_{CH4,y} \times SMG_{y,b} \times f$$

Where:

$PE_{y,fugitive}$	=	Fugitive emissions from operation of charcoal producing facility (physical leakage) in the year *y* (t CO_2e)
f	=	A fraction attributed to project charcoal production technology, use a default value of 0.1

For the project activity not equipped with capture and destruction of the pyrolysis gases, emission reductions are calculated as follows:

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

PROPOSED STANDARDIZED PARAMETER VALUES TO BE USED IN THE CALCULATION OF EMISSION REDUCTIONS

CF

Where CF is the default wood to charcoal conversion factor. As per the methodology, a factor of six kg of firewood (wet basis) per kg of charcoal (dry basis) could be used.Alternatively, local conversion factors determined from a field study or literature may be applied.

As per the feasibility study by World Bank on 'Establishing a Green Charcoal Value Chain in Rwanda', carbonization efficiency of traditional Rwandan Kilns ranges from 12% to 14%. For producing 100 kg of charcoal around 1.1 m^3 of wood would be required presuming the higher range of 14% kiln efficiency.

Accordingly, with an average wood density of 0.7 t/m3, the wood to charcoal factor (CF)comes out to be 7.7 for Rwanda.

$f_{NRB,BL,wood}$

Where $f_{NRB,BL,wood}$ is the fraction of biomass of type i used in the absence of the project activity that can be established as non-renewable biomass.

This parameter value can be determined in accordance with the procedure provided in the approved UNFCCC methodology "AMS-I.E: Switch from non-renewable biomass for thermal applications by the user" or on the basis of the published DNA endorsed default values available on the UNFCCC website.

On the basis of the published DNA endorsed default values available on the UNFCCC website, the previous value for Rwanda was 0.98. However, it is also noticed that this default value expired on 20 May 2017. Therefore, for standardization of this parameter the methodological tool Tool30: Calculation of the fraction of non-renewable biomass has been applied.

The standardized value of the parameter f_{NRB} in Rwanda is 84%, following the methodological tool, as presented in following Section C.

M_d

Where M_d is the factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility.

The standardized value (unit: t CH_4/ t of raw material) of the parameter M_d is 0 in Rwanda, and is based on an official letter from the Rwandan DNA, which confirms that there is no legal requirement for capture and destruction of methane in charcoal production facilities.

$SMG_{y,b}$

Where $SMG_{y,b}$ is the specific methane generation for the baseline charcoal generation process in the year y.

This parameter value can be determined in accordance with the procedure provided in the approved UNFCCC methodology "AMS-III.K: Avoidance of methane release from charcoal production" or on the basis of the default value mentioned in the approved UNFCCC methodology "AMS-III.BG - Emission reduction through sustainable charcoal production and consumption, version 03.0".

The standardized value (unit: tonnes CH_4/t charcoal product) of the parameter $SMG_{y,b}$ is 0.030 in Rwanda, and is based on the default value included in AMS-III.BG.

$NCV_{charcoal,default}$

Two default NCVs for charcoal, as seen in AMS-III.B.G., are applied. One NCV is for charcoal produced from woody sources and the other NCV is charcoal produced from other, non-woody, sources.

Woody sources

Where $NCV_{charcoal,default}$ is the net calorific value of charcoal produced from coconut husks, bamboo and other purely woody source of biomass.

The standardized value (unit: Gigajoule/t charcoal (GJ/t)) of the parameter $NCV_{charcoal,default}$ for charcoal produced from coconut husks, bamboo and other purely woody source of biomass in Rwanda, is the

IPCC NCV default value for charcoal of 29.5 GJ/tonne, as shown in table 1.2 of the IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 – Energy (IPCC, 2006).

Other sources

Where $NCV_{charcoal,default}$ is the net calorific value of charcoal produced from other sources (e.g. mixed agricultural wastes: agricultural residues and plant waste).

The standardized value (unit: Gigajoule/t charcoal (GJ/t)) of the parameter $NCV_{charcoal,default}$ for charcoal produced from other charcoal sources (e.g. mixed agricultural wastes: agricultural residues and plant waste) in Rwanda, is the UNFCCC default NCV value of 19.47GJ/tonne, as shown in the approved UNFCCC methodology "AMS-III.BG - Emission reduction through sustainable charcoal production and consumption, version 03.0".

Use of the proposed standardized baseline with the approved or proposed new or revised methodology

Explain how the proposed standardized baseline will be used with the valid version of theapproved methodology(ies) or proposed new or revised methodology(ies) to estimate emission reductions. Explain which parts of the methodology(ies) are replaced by the proposed standardized baseline.

Under this standardized baseline, the key standardized parameter values, shown in the table below, are proposed in order to "facilitate the calculation of emission reduction for clean development mechanism project activities, while providing assistance for assuring environmental integrity":

As per AMS.III.BG, parameters such as NCV, conversion factor, Emission Factor among others have fixed default values, and for Rwanda the value of f_{NRB} (fraction of non-renewable biomass) is also available. The standardization of remaining elements for baseline emission estimation is therefore targeted.

The default and standardized parameters are summarized in the following table:

Table 4. Default and standarized parameters

Parameters	Description	Value	Source
CF	Default wood to charcoal conversion factor	7.7 kg of firewood per kg of charcoal	http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf and World Bank. 2012. Establishing a Green Charcoal Value Chain in Rwanda: A Feasibility Study[7]
NCV_{wood}	Net calorific value of wood(TJ/t)	0.015 TJ/t	Default value as per AMS-III.BG, Version 3.0
$NCV_{charcoal,default}$	Default net calorific value of charcoal (TJ/t)	29.5 GJ/tonne	For the charcoal from coconut husks, bamboo and other purely woody source of biomass.
		19.47 GJ/tonne	For the charcoal from other sources such as mixed agricultural wastes.

[7]http://documents.worldbank.org/curated/en/938251468027639371/Executive-summary

$f_{NRB,BL,wood}$	Fraction of biomass of type *i* used in the absence of the project activity that can be established as non-renewable biomass.	0.84	Refer Section C
$EF_{projected_fossilfuel}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers (t CO_2/TJ)	81.6 tCO_2/TJ	Default value as per AMS-III.BG, Version 3.0
$GWP_{CH4,y}$	Global warming potential of methane applicable to the crediting period (t CO_2e/t CH_4)	25 tCO_2e/t CH_4	CMP 7/decision 4, based on IPCC AR4 WG1 Ch2S2-10-2 Table 2.14
$SMG_{y,b}$	Specific methane generation for the baseline charcoal generation process in the year *y* (tonnes CH_4/t charcoal product)	0.030 t CH_4/t	Default value as per AMS-III.BG, Version 3.0
M_d	Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility (tonne of CH_4/tonne of raw material)	0	National law

Validity of the proposed standardized baseline

State the period of time for which the proposed standardized baseline is valid in accordance withthe requirements contained in the "Standard for determining coverage of data and validity of standardized baselines".

This standardized baseline shall be valid for a period of 3 years from the date of approval by the EB. The standardized baseline thereafter will be updated every three years, based on the most recently available data at the time of making the updates, as well as the relevant methodological tool and guidelines.

Deviations from the approved methodology (if applicable)

Provide a description of and justification for the necessity and the appropriateness of any deviation from the valid version of theapproved methodology to develop the proposed standardized baseline. Also justify why a revision of the valid version of the approved methodology is not necessary.

N/A

References and any other relevant information

Nahayo, A., &Mukarugwiza, A. (2013). Comparative Study on Charcoal Yield Produced by Traditional andImproved Kilns: A Case Study of Nyaruguru and Nyamagabe Districtsin Southern Province of Rwanda. *Energy and Environment Research; Vol. 3, No. 1; 2013,* www.ccsenet.org/journal/index.php/eer/article/viewFile/24006/15252

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UNFCCC. (2015). *Procedure: Development, revision, clarification and update of standardized baselines ver. 4.* Retrieved August 28, 2017, from CDM: https://cdm.unfccc.int/filestorage/e/x/t/extfile-20150603142041555-Meth_Proc07.pdf/Meth_Proc07.pdf?t=OEJ8b3ZkbTR0fDBGnpxz9B2qbg9xUQv4ANJy

World Bank. 2012. Establishing a green charcoal value chain in Rwanda: a feasibility study. Washington DC; World Bank Group. http://documents.worldbank.org/curated/en/603321468026133861/pdf/830370WP0v20P10Box0379822B00PUBLIC0.pdf

SECTION C: PROPOSEDSTANDARDIZED BASELINE DEVELOPED USING A METHODOLOGICAL APPROACH CONTAINED IN AN APPROVED OR PROPOSED NEW OR REVISEDMETHODOLOGICAL TOOL

Complete this section only when the proposed standardized baseline is developed using a methodological approach contained in the valid version of an approvedmethodological tool orin a proposed new or revisedmethodological tool(an example of this is the application of the "Tool to calculate the emission factor for an electricity system" to estimate the CO2 emission factor ofan electricity grid).

Applicability of the proposed standardized baseline

State the host country(ies) or region(s) within a host country to which the proposed standardized baseline is applicable. In case of region(s) within a host country, document transparently the geographical boundaries of the region (e.g. provinces, electric grids, etc.).

Rwanda

Baseline parameter standardization

Explain how the methodological approach contained in the valid version of the approvedmethodologicaltool or in the proposed new or revisedmethodological toolwas applied to standardizethe baseline parameter (e.g. baseline emission factor).Document all underlying data, data sources, assumptions, calculation steps and outcomes in a clear and transparent manner.

The guidance and step-wise procedure/method as provided in the Methodological tool: Calculation of the fraction of non-renewable biomass, version 1.0, has been applied to calculate the value of fNRB. As per the tool, the fraction of woody biomass that can be established as non-renewable, is:

$$fNRB = \frac{NRB}{NRB + RB}$$

Where:

fNRB Fraction of non-renewable biomass (fraction or %)

NRB Quantity of non-renewable biomass (t/yr)

RB Quantity of renewable biomass

On a country basis, quantity of NRB is determined by calculating the total consumption of wood (H) in the country and then deducting the quantity of renewable biomass (RB) from it.

$$NRB = H - RB$$

Where:

H Total annual consumption of wood in the absence of the project activity

Therefore, the fraction of non-renewable biomass can be presented, as follows:

$$fNRB = 1 - \frac{H}{RB}$$

Procedure to estimate consumption of woody biomass

The estimate of overall consumption for woody biomass can be done using one of the following options:

a) Official statistics or reports or peer-reviewed literature; or
b) Based on the number of households and other consumers of woody biomass in the country

The calculation of H, accounting for all consumptions within the country (not only woodfuel but also timber and industrial consumption) is as follows:

1. $H = HW_{region} \times N_{region} + Tl_{re}$

Where:

HW_{region} Average household woodfuel consumption, including fuelwood and charcoal

Tl_{region} Non-domestic wood consumption for energy applications and all wood consumption for non-energy applications that are extracted from forests or land areas in the country for which the estimate of fNRB is made

N_{region} Number of households consuming woodfuel for thermal applications within the country

Average household consumption of woody biomass can be determined using one of the followingoptions:

- Official statistics or reports or peer-reviewed literature; or
- Default values adopted within CDM framework valid for the country/region/area (e.g. a default value of 0.5 tonnes/capita per year under AMS-II.G).

wherever charcoal is used for domestic or non-domestic applications, the quantity of woody biomass related to it shall be determined by using a default wood to charcoal conversion factor of 6 kg of firewood (wet basis) per kg of charcoal (dry basis).

In Rwanda, woodfuel is the primary provider of the energy needs (97% of cooking energy) of the population(Ministry of Natural Resources, 2015). The demand for wood fuel has been in the range of 0.7 – 0.77 tonnes/capita as calculated based on data from Ministry of Lands, Environment, Forestry, Water and Mines, National Forestry Policy, May 2004, as depicted in the following table:

Table 5. Rwanda wood fuel needs 1960-2002

	1960	1970	1980	1990	1996	1999	2000	2002
Total population (millions)	2.695	3.763	4.832	7.158	6.168	7.165	7.498	8.163
Estimate of woody biomass consumption (million tonnes)	1.887	2.634	3.382	5.011	4.749	5.517	5.773	6.285
Calculated per capita wood consumption (tonnes/capita/year)	0.70	0.70	0.70	0.70	0.77	0.77	0.77	0.77

With the growth of Rwandan population, the wood consumption too is increasing. As per the fourth population and housing census conducted in 2012, the Rwandan population is projected to increase from 10.5 million in 2012 to 16.9 million (high scenario) to 16.3 million (medium scenario) or 15.4 million (low scenario) by 2032. As per a 2011 paper, per capita demand of wood is around 0.7 tonne/capita/per year combining the for fuelwood and charcoal consumption[8]. Therefore, the corresponding wood consumption for 2012 population would be 7.35 million tonnes.

[8]In Rwanda, the combined per capita demand of wood (both for fuelwood and charcoal) is 1.93 kg/person/day. Source: Woodfuels in Kenya and Rwanda: powering and driving the economy of the rural areas. Available at: http://unf.mediapolis.com/binary-data/RESOURCE/file/000/000/117-1.pdf

Further, as per a recent study on projection scenario of supply/demand of woody biomass in Rwanda from 2015 to 2026, conducted byMinistry of Natural Resource of Rwanda (MINIRENA), the estimate of overall consumption of woody biomass are provided as follows:

Table 6. Rwanda wood fuel needs projections 2015-2026

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Total population (millions)	11.101	11.371	11.643	11.917	12.192	12.469	12.747	13.027	13.307	13.588	13.869	14.151
Estimate of woody biomass consumption (million tonnes)	5.923	6.104	6.286	6.471	6.659	6.850	7.044	7.240	7.439	7.641	7.844	8.050
Calculated per capita wood consumption (tonnes/capita/year)	0.53	0.54	0.54	0.54	0.55	0.55	0.55	0.56	0.56	0.56	0.57	0.57

Based on the projection of size of the resident population for 2017, as provided by the National Institute of Statistics of Rwanda[9] as 11,809,205 and per capita wood consumption of 0.54 tonnes per year, the revised estimate of wood consumption for 2017 would be 6.37 million tonnes.

Procedure to estimate RB

Renewable biomass (RB) in the country is estimated using the equation below.

$$RB = \sum \left(MAI_{forest,i} \times \left(F_{forest,i} - P_{forest} \right) \right) + \sum \left(MAI_{other,i} \times \left(F_{other,i} - P_{other} \right) \right)$$

Where:

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

For estimation of the extent of forest areas, other wooded land areas, and protected areas, the following data source may be used:

(a) Global Forest Resources Assessment 2015 by the Food and Agriculture Organization of the United Nations (FAO)

For estimation of Mean Annual Increment, the following data source may be used:

(a) Global Forest Resources Assessment 2000 by the FAO for "Distribution of total forest area by ecological zone" (Table 14); and/or

(b) 2006 IPCC Guidelines for National Greenhouse Gas Inventories for "Above-ground biomass growth rates (t/ha-yr) for different ecological zones" (Chapter 4, Table 4.9).

[9] http://www.statistics.gov.rw/publication/size-resident-population

The demand for biomass is higher than the supply leading to non-renewability of Rwandan firewood(AESG, 2012). This is also evident in the reduction in the natural forest over the years depicted in the following table based on data from FAO report of Rwanda.

Table 7. Rwanda forest cover 1960-2012

	1960	1970	1980	1990	1996	1999	2000	2002
Natural forest area (1000 ha)	634	591.8	513.6	451.16	383.66	221.2	221.2	221.2
Manmade forests (1000 ha)	24.5	27.16	80	247.5	232.5	252	282.563	282.563
Total forest area (1000 ha)	658.5	619.0	593.6	698.7	616.2	473.2	503.8	503.8

	2005	2006	2007	2008	2009	2010	2011	2012
Natural forest area (1000 ha)	221.6	235.7	235.7	236	236	258.2	258.2	258.2
Manmade forests (1000 ha)	323.4	326.5	329.4	332.9	337.4	359.5	379	404.2
Total forest area (1000 ha)	545.0	562.2	565.1	568.9	573.4	617.7	637.2	662.4

As per Global Forest Resources Assessment 2000 by the FAO, in case of Rwanda 100% of the total forest area is under tropical Mountain ecological zone[10]. The above-ground biomass growth rate (t/ha-yr) for tropical mountain system in Africa is 2.0 – 5.0 [for <=20 y] and 1.0 – 1.5 [for >20 y][11].

Applying the growth rate of 1.5 t/ha-yr for natural forests of 258.2 and part of manmade forest with more than 20 years (taken as 232.5) and for the remaining manmade forest (404.2 – 232.5) applying the higher growth rate of 5 t/ha-yr, the renewable biomass corresponding to 2012 forest area comes to around 1.59 million tonnes.

Due to the high demand pressure, increasing gap between supply and demand will lead to over-exploitation of the remaining stock. This over-exploitation will cause both a decrease of trees inside and outside forests area and a decrease of stock and productivity.

The fNRB value based on 1960-2002 data was calculated as 75% in registered CDM Project 4799 : Rwanda Natural Energy Project: Water Treatment Systems for Rural Rwanda (MugoneroEsepan, Rwesero, Nyagasambu). Also, fNRBcalculated based on 1.59 million tonnes of 'RB' and 6.37 million tonnes of 'H' too comes to 75% and expected to increase further, as is evident based on the supply/demand projections by MINIRENA.

As per recent study on projection scenario of supply/demand of woody biomass in Rwanda from 2015 to 2026, conducted by MINIRENA, the estimate of sustainable supply of woody biomass are provided as follows:

Table 8. Rwanda sustainable wood fuel supply projections 2015-2026

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Sustainable supply, RB (million tonnes)	2.290	2.040	1.753	1.360	0.974	0.797	0.691	0.598	0.542	0.512	0.527	0.518

Based on these projections of supply/demand of woody biomass, fNRB over the years is as follows:

Table 9. Fraction of non-renewable biomass based on supply/demand projections 2015-2026

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Sustainable supply, RB (million tonnes)	2.290	2.040	1.753	1.360	0.974	0.797	0.691	0.598	0.542	0.512	0.527	0.518
Estimate of woody biomass consumption, H (million tonnes)	5.923	6.104	6.286	6.471	6.659	6.850	7.044	7.240	7.439	7.641	7.844	8.050
fNRB	61.34%	66.58%	72.11%	78.98%	85.37%	88.37%	90.19%	91.74%	92.72%	93.31%	93.28%	93.57%

It is reasonable to consider that with the observed increase in population and thereby increase of demand of woody biomass outpacing the supply leading to reduction of natural forests has resulted in increase of non-renewable biomass fraction.

[10]Table 14. Distribution of total forest area by ecological zone, Available at: http://www.fao.org/docrep/004/Y1997E/y1997e21.htm

[11]Table 4.9, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

The average fNRB calculated as 84% based on the aforesaid projections from 2015-2026 is a clear indication of increase of non-renewable fraction, as against the value of 75% calculated based on 1960-2002 dataset. However, at the same time it is conservatively lower when compared to the previous default of 98% for Rwanda.

The standardized parameter of fNRB is accordingly presented in the following table:

Table 10. Standardized parameter

Parameters	Description	Value	Source
$fNRB$	Fraction of non-renewable biomass	84%	As derived above

Validity of the proposed standardized baseline

State the period of time for which the proposed standardized baseline is valid in accordance withthe "Standard for determining coverage of data and validity of standardized baselines".

This standardized baseline shall be valid for a period of 3 years from the date of approval by the EB. The standardized baseline thereafter will be updated every three years, based on the most recently available data at the time of making the updates, as well as the relevant methodological tool and guidelines.

Deviations from the approved methodological tool (if applicable)

Provide descriptions of and justifications for the necessity and the appropriateness of any deviations from the valid version of the approved methodological tool to develop the proposed standardized baseline.Also justify why a revision of the valid version of the approved methodological tool is not necessary.

N/A

References and any other relevant information

FAO, Assessment of forest resources world 2015, National report – Rwanda, 2014, http://www.fao.org/3/az317f.pdf

IPCC, Volume 4: Agriculture, Forestry and Other Land Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, 2006

MINIRENA RNRA-DFNC, Projection scenario of supply/demand of woody biomass in Rwanda, from 2015 to 2026, Summary report, June 2016

Rwanda Natural Resources Authority, Support Program to the Development of the Forestry Sector in Rwanda - Phase II, Execution of a National Forest Inventory, Technical Report 07, October 2016, http://www.repository.rnra.rw/xmlui/bitstream/handle/123456789/4299/NFI%202015_Inventory%20Methodology_Volume_1.pdf?sequence=1&isAllowed=y

UNFCCC, CDM PDD, Project 4799: Rwanda Natural Energy Project: Water Treatment Systems for Rural Rwanda (MugoneroEsepan, Rwesero, Nyagasambu), 2011, http://cdm.unfccc.int/Projects/DB/RWTUV1305453175.2/view

UNFCCC,Methodological tool, TOOL30: Calculation of the fraction of non-renewable biomass, version 1.0, November 2017, https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-30-v1.pdf

Woodfuels in Kenya and Rwanda: powering and driving the economy of the rural areas, 2011, http://unf.mediapolis.com/binary-data/RESOURCE/file/000/000/117-1.pdf

SECTION D: PROPOSED STANDARDIZED BASELINE DEVELOPED USING THE APPROACH CONTAINED IN THE "GUIDELINE: ESTABLISHMENT OF STANDARDIZED BASELINES FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES UNDER THE CDM"

Complete this section only when the proposed standardized baseline is developed using the approach contained in the guideline "Establishment of standardized baselines for afforestation and reforestation project activities under the CDM".

Applicability of the proposed standardized baseline

Provide the information on the host country(ies) or region(s) within a host country to which the proposed standardized baseline is applicable. In case of region(s) within a host country,document transparently the geographical boundaries of the region(s) (e.g. administrative units, geo-referenced coordinates).

N/A

Additionality standardization

Explain how the "Guideline: Establishment of standardized baselines for afforestation and reforestation project activities under the CDM" was applied to standardize theadditionality criterion forafforestation and reforestation CDM project activities undertaken in the areas of land included under the scope of the proposed standardized baseline. Document all relevant data sources, assumptions, steps and outcomes in a clear and transparent manner.

N/A

Baseline land-use scenario identification

Explain how the "Guideline: Establishment of standardized baselines for afforestation and reforestation project activities under the CDM" was applied to identifythe baseline land-use scenario of afforestation and reforestationCDM project activities undertaken in the areas of land included under the scope of the proposed standardized baseline. Document all relevant data sources, assumptions, steps and outcomesin a clear and transparent manner.

N/A

Standardization of baseline carbon stocks and GHG removalsestimation(if applicable)

Explain how the "Guideline: Establishment of standardized baselines for afforestation and reforestation project activities under the CDM" was applied to standardize the estimation of baseline carbon stocks and GHG removalsof applicable afforestation and reforestationCDM project activities undertaken in the areas of land included under the scope of the proposed standardized baseline. Document all relevant data sources, assumptions, calculation steps and outcomes in a clear and transparent manner.

N/A

Land eligibility demonstration (if applicable)

Explain whether eligibility of the lands included under the scope of the proposed standardized baseline for the CDM is confirmed by the proposed standardized baseline. If not, explain whether well-defined approaches for demonstrating eligibility of lands for the CDM have been provided which will help the project participants in demonstrating eligibility of the lands under their projects. In either case, document all relevant data sources, assumptions, calculation steps and outcomes in a clear and transparent manner.

N/A

Validity of the proposed standardized baseline

State the period of time for which the proposed standardized baseline is valid.

N/A

Deviations from the guideline (if applicable)

Provide descriptions of and justifications for the necessity and the appropriateness of any deviations from the "Guideline: Establishment of standardized baselines for afforestation and reforestation project activities under the CDM" to develop the proposed standardized baseline.

N/A

References and any other relevant information

N/A

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Document information

Version	*Date*	*Description*
03.0	1 September 2015	Revision to: • Reflect updated requirements in the version 04.0 of "Procedure: Development, revision, clarification and update of standardized baselines" (CDM-EB63-A28-PROC); • Include editorial improvement.
02.0	1 December 2013	The document title has changed from "Proposed standardized baseline form" (F-CDM-PSB) to "Proposed standardized baseline submission form" (CDM-PSB-FORM). Revision to: • Reflect updated requirements in the "Procedure: Development, revision, clarification and update of standardized baselines" • Include editorial improvement
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