Gold Standard for the Global Goals
Key Project Information & VPA Design Document (PDD)

July 2017, Version 1

Gold Standard

KEY PROJECT INFORMATION

Title of Project:	Carbon Emission Reduction Program through CCDB Improved Cook Stove (ICS) in Bangladesh – VPA 1 – Patharghata and Morrelganj 1
Title of the PoA:	Carbon Emission Reduction Program through CCDB Improved Cook Stove (ICS) in Bangladesh
Brief description of Project:	Through its regional office in Patharghata (Barguna district) and in collaboration with its Patharghata and Morrelganj Community Based Organizations (CBOs) CCDB will set up a regional ICS center. In this center members (mostly women) of the aforementioned CBOs will be trained to assemble, promote, sell, distribute, provide maintenance and user training and monitor Banglar Unan cookstoves. Under this VPA 3,000 to 4,000 Banglar Unan cookstoves will be deployed in the project area.
Expected Implemetation Date: Expected duration of Project:	01/04/2019 10 years
Project Developer:	Christian Commission for Development in Bangladesh (CCDB)
Project Representative:	Md. Foezullah Talukder
Project Participants and any communities involved:	- Brot für die Welt, Evangelisches Werk für Diakonie und Entwicklung e.V. (BfdW) (Buyer of GS VERs) - CCDB Community Based Organizations (CBOs) of Patharghata (Barguna district) and Morrelganj (Bagherat district)
Version of PDD: Date of Version:	1.0 13/03/2019
Host Country / Location:	People's Republic of Bangladesh
Certification Pathway (Project Certificatin/Impact Statements & Products	1. Gold Standard Verified Emission Reductions (GS VERs) 2. Gold Standard Certified SDG Impacts under SDG 5
Activity Requirements applied: (mark GS4GG if none relevant)	Community Services Activity Requirements Version 1.1
Methodologies applied:	The Gold Standard - Simplified Methodology for Efficient Cookstoves Version 1.0 (GS-SMEC)
Product Requirements applied:	GHG Emissions Reduction & Sequestration Product Requirements Version 1.1
Regular/Retroactive:	Regular
SDG Impacts:	1 – SDG 13: Climate Action 2 – SDG 5: Gender Equality 3 – SDG 7: Affordable and Clean Energy 4 – SDG 1: No Poverty
Estimated amount of SDG Impact Certified	SDG 13: 46,267 GS VERs over 5 years (9,253 GS VERs annual average)

SECTION A. Description of project

A.1. Purpose and general description of project

>> *(Provide a brief description of the project including the description of scenario existing prior to the implementation of the project.)*

Under this VPA the project developer Christian Commission for Development in Bangladesh (CCDB) In partnership with the German development agency "Brot für die Welt" (Bread for the World, BfdW) will disseminate about 3,000 units of ICS in the Patharghata (Barguna), Morrelganj (Bagerhat) areas in the Ganges tidal floodplains of Bangladesh.

The new ICS to be deployed is the first commercial version of the Banglar Unan stove that has been designed and refined over a period of 2 years by the Institute of Fuel Research & Development (IFRD) of the Bangladesh Council of Scientific and Industrial Research (BCSIR) in collaboration with CCDB. The specific goal during stove development was to create the most user-friendly, durable and at the same time fuel-efficient improved cookstove for low-income households in Bangladesh. At the core of the stove development process have been women from CCDB's community-based organizations in the Patharghata district. They were consulted extensively during the design stage and eventually tested the prototype stoves in their homes for 6+ months, providing invaluable feedback and insights for the further refining of the design. The unique features of the Banglar Unan improved cookstove are:

1. Ultra-high thermal efficiency of 40%, resulting in up to 75% fuelwood savings
2. Two burner design (ease of use for all cooking tasks)
3. Hybrid use: indoors with chimney (during rainy season), outdoors (during dry season)
4. Burns all fuels (not limited to fuelwood, supports the common use of leaves and twigs during dry season)
5. High durability and long life (cast iron burning chamber, stainless steel cover, refractory wool insulation)
6. Designed in Bangladesh, made in Bangladesh

Figure 1: Banglar Unan-CCDB Improved Cookstove (Outdoor and Indoor use)

The program will be implemented through the women of CCDB's community-based organizations (CBOs) in Patharghata and Morrelganj. CCDB will set up an ICS center in Patharghata and train women from the CBO's to run it. Through the ICS center women will assemble, promote and sell Banglar Unan stoves and provide usage training and maintenance services in the two target communities.

Bangladesh is widely recognized as one of the most climate vulnerable countries in the world. It experiences frequent natural disasters that cause loss of life, damage to infrastructures and economic assets, and adversely impact the lives and livelihoods especially of poor and marginal households. Climate change will continue to exacerbate many of the current problems and natural hazards the country faces. It is expected to result in increasingly frequent and severe tropical cyclones, with higher wind speeds and storm surges leading to more damage especially in the coastal areas like the Ganges tidal floodplain where the project area is located.[1]

In the project area most of the households belong to the base of the pyramid of the economic system. Fishing and agriculture are the main income generating activities. Another significant issue is the dependence on seasonal income of the households. Agriculture is severely hindered by permanent water salinity and frequent tropical storms and natural disasters. The literacy rate is extremely low because of poverty and socio-economic instability. Access to clean energy solutions is limited to few upper-middle and upper class households. The rest of the population is dependent on biomass and fossil fuel for cooking and lighting. Women of the households spend a substantial amount of time on fuel wood collection, processing and cooking on traditional three stone fire cookstoves, which causes serious health injuries to the residents especially to the women and children. It is also noteworthy to mention that households depending on purchased fuel wood have to spend a significant amount of their monthly income on fuel wood for cooking. In the course of a pilot project in the project area CCDB conducted a detailed and through baseline household survey, which was complemented with a monitoring survey in early 2018 to compare and analyze the impact of the new ICS on the livelihoods of families after using the stove for a considerable time.

The baseline survey suggests that the women living in the project areas have to travel a mean distance of 2.54 km to collect fuel wood which is extremely tedious and laborious. In a household a woman spends 4.78 hours on average per day in the kitchen. A typical household spends around BDT. 525 and BDT. 625 per week, i.e. BDT. 2,250 and BDT. 2,680 per month, respectively in dry and wet season for purchasing fuel wood which is a major share of their monthly income. Average household income is around BDT. 15,500 per month. The monitoring survey suggests that the Banglar Unan cookstoves are helping the households to drastically reduce their fuel wood consumption and save BDT. 300 per week on average, i.e. BDT. 1,290 per month, which is a major socio-economic impact on the improvement of the beneficiaries households.[2]

A.2. Eligibility of the project under approved PoA

>> *(Demonstrate how each VPA meets the eligibility criteria as defined in approved PoA)*

Develop elegibility table simultanously with PoA DD

No.	Description	Possible Evidence[3]	Evidence of the VPA	Comment

A.3. Legal ownership of products generated by the project and legal rights to alter use of resources required to service the project

>> (Justify that project owner has full and uncontested legal ownership of the products that are generated under Gold Standard Certification and has legal rights concerning changes in use of resources required to service the Project for e.g water rights, where applicable.)

Reference to user contracts

A.4. Location of project

A.4.1. Host Country

>>

People's Republic of Bangladesh

A.4.2. Region/State/Province etc.

>>

1. Barisal division, Barguna district
2. Khulna division, Bagerhat district

A.4.3. City/Town/Community etc.

>>

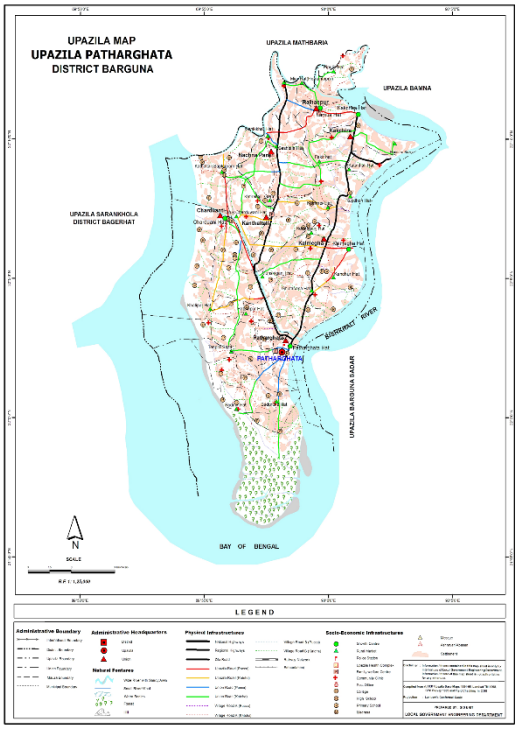
1. Patharghata, Barguna district
2. Morrelganj, Bagerhat district

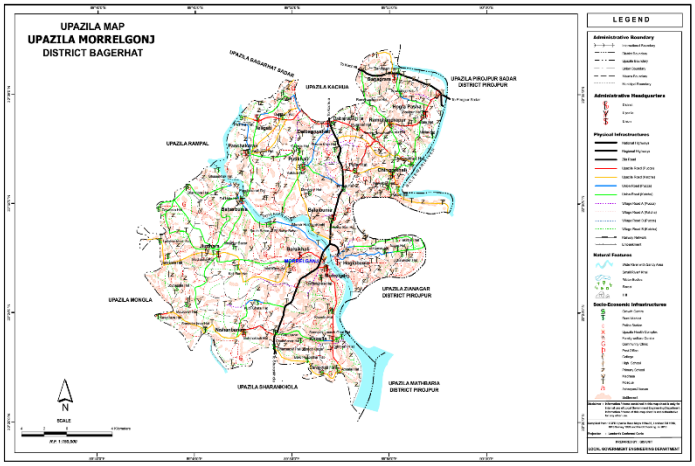
[1] http://bids.org.bd/uploads/publication/BDS/36/36-1/04_Vulnerability%20of%20Livelihoods_Toufique.pdf

[2] CCDB Phase I Pilot Project– Baseline & Monitoring Survey 1 Analysis

[3] The lists of possible evidence for demonstrating the compliance of a VPA with an eligibility criterion are not exhaustive. Other types of evidence are permitted as well, as long as they clearly demonstrate the compliance.

Figure 2: Patharghata and Morrelganj Sub-districts





The project activity will be implemented in households of all rural and peri-urban communities within the project area that are eligible according to the project's design, i.e. that use fuelwood as their primary source of cooking energy in the baseline.

A.4.4. Physical/Geographical location

>> (*Include information allowing the unique identification of this project.)*

The coordinates of CCDB's regional office, located in Patharghata, Barguna district, are used to represent the physical location of the project activity:

Latitude: 4°9'49.18"N
Longitude: 9°14'18.60"E

A.5. Technologies and/or measures

>> *(Describe the technologies and measures to be employed and/or implemented by the project, including a list of the facilities, systems and equipment that will be installed and/or modified by the project. Include information essential to understand the purpose of the project and how it will contribute positively to three SDGs.)*

Over a period of 2 years the Institute of Fuel Research & Development (IFRD) of the Bangladesh Council of Scientific and Industrial Research (BCSIR) and CCDB collaborated to develop an ICS, with the specific goal to create the most user-friendly, durable and at the same time fuel-efficient improved cookstove for low-income households in Bangladesh. At the core of the stove development process have been women from CCDB's community-based organizations. They were consulted extensively during the design stage and eventually tested the prototype stoves in their

homes for 6+ months, providing invaluable feedback and insights for the further refining of the design. The unique features of the first model of this new class of CCDB-BCSIR improved cookstoves – named "Banglar Unan" (the "Bangladesh Stove") – are:

- Ultra-high thermal efficiency of 40%, resulting in up to 75% fuelwood savings
- Two burner design (ease of use for all cooking tasks)
- Hybrid use: indoors with chimney (during rainy season), outdoors (during dry season)
- Burns all fuels (not limited to fuelwood, supports the common use of leaves and twigs during dry season)
- High durability and long life (cast iron burning chamber, stainless steel cover, refractory wool insulation)
- Designed in Bangladesh, made in Bangladesh

Figure 3: The Banglar Unan (indoor use, connected to chimney)

Figure 4: The Banglar Unan (outdoor use, with smoke box)

In the Banglar Unan fuel is burnt in the first combustion chamber over a grate where cooking is done by direct heat, and cooking in the other pothole is done by the hot flue gases coming from the front chamber. The stove is so designed as to maximize heat transfer to cooking utensils. This model decreases the time of cooking and also makes the kitchen free of smoke and hot air. For better performance and durability, the entire stove is made of Stainless Steel (SS) and Cast Iron (CI). The outer body is made of SS and the inner body or the combustion chamber is made of CI to ensure maximum lifetime of the stove. A layer of insulation material (Ceramic Blanket) is used in between the core and shell to minimize the heat in the outer metallic body.
The specific features of the stove design, in line with the key requirements as stipulated above by rural women, are:

- Single Fed (Single combustion chamber)
- Double burner
- Hybrid: Fixed and Portable (Chimney connector while using inside the kitchen and smoke pot attached to the ICS while using outside the kitchen)
- Fuels: All woody biomass (leaves and twigs, wood, cow dung, agricultural residue and wastage, etc.)
- Efficiency: 40%+
- Life expectancy: min. 5 years
- High durability
- Almost smokeless
- Designed by and for rural Bangladeshi women

The Banglar Unan offers several advantages for the households and environment. The main objective of deploying a technologically superior stove for the communities is to reduce fuel consumption, ensure socio-economic development, empower women group and minimize health hazard occurring from those traditional stoves. As discussed earlier, CCDB has focused on end

user's requirements in the designing phase through long term testing in the pilot phase and several Focus Group Discussions (FGD) and eventually these points stand as stronghold of the product.
The one of a kind advantages of the ICS are the hybrid nature with double burner. Other key advantages of the ICS are as followed:

- Higher efficiency (Tested thermal efficiency is 40%, almost 4 times higher than traditional cookstove)
- Approximately 70-80% fuel wood savings
- Weekly monetary savings around BDT. 300 (recorded from monitoring survey)
- Time savings (Monitoring survey)
- Increased household income (as an indirect impact of time savings, reported by users during focus group discussions)
- CO2+CH4 reduction (ER model)
- Reduced Indoor Pollution (IAP)
    - Improved Health
- Social Upliftment
    - Empowerment of women

A.6. Scale of the project

>> (Define whether project is micro scale, small scale or others. Justify the scale referring to relevant activity requirement.)

The project is a micro scale project, since the expected annual emission reductions are below 10,000 tCO_2e.

A.7. Funding sources of project

>> (Provide the public and private funding sources for the project. Confidential information need not be provided.)

The project is entirely funded through the sales of GS VERs and GS certified SDG impact statements.
The buyer of GS VERs and SDG impact statements of the project is Brot für die Welt, Evangelisches Werk für Diakonie und Entwicklung e.V. (BfdW), who is also a project participant of the PoA.

SECTION B. Application of selected approved Gold Standard methodology

B.1. Reference of approved methodology

>>

The Gold Standard - Simplified Methodology for Efficient Cookstoves Version 1.0 (SMEC)

B.2. Applicability of methodology

>> (Justify the choice of the selected methodology(ies) by demonstrating that the project meets each applicability condition of the applied methodology(ies))

Pending. Will be proven through the fulfilment of the eligibility criteria in section A.2

B.3. Project boundary

>> *(Present a flow diagram of the project boundary, physically delineating the project, based on the description provided in section A.5 above.)*

The ***project boundary*** is constituted by the physical, geographical areas of the use and the collection of non-renewable biomass. I.e., the project boundary is defined through the spatial extension of the compounds of the participating households and the firewood collection areas.

The ***target area*** is comprised of the Ganges tidal floodplane acro-ecological zone. It is delineated through the administrative boundaries of the Barisal, Bhola, Jhalkati, Pirojpur, Barguna, Patuakhali, Khulna, Bagerhat, and Satkhira districts.[4]

Household/village level diagram pending

For the purpose of GHG mitigation/sequestration following table shall be completed (delete if not required)

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Heat delivery	CO_2	Yes	The CO2 emissions from the generation of heat for cooking through the burning of fuelwood are an important emission source.
		CH_4	Yes	The CH4 emissions from the generation of heat for cooking through the burning of fuelwood are an important emission source.
		N_2O	Yes	The N2O emissions from the generation of heat for cooking through the burning of fuelwood are a small emission source but will be accounted for.
Project scenario	Heat delivery	CO_2	Yes	The CO2 emissions from the generation of heat for cooking through the burning of fuelwood are an important emission source.
		CH_4	Yes	The CH4 emissions from the generation of heat for cooking through the burning of fuelwood are an important emission source.
		N_2O	Yes	The N2O emissions from the generation of heat for cooking through the burning of fuelwood are a small emission source but will be accounted for.

B.4. Establishment and description of baseline scenario

>> (Explain how the baseline scenario is established in accordance with guidelines provided in GS4GG Principles & Requirements and the selected methodology(ies). In case suppressed demand baseline is used then same should be explained and justified.)

[4] Quddus, M. A. (2009). Crop production growth in different agro-ecological zones of Bangladesh. *J. Bangladesh Agril. Univ*, *7*(2), 351-360. https://pdfs.semanticscholar.org/60a1/96c8d493d6d440977039c60e9676f5bc4ee7.pdf (last accessed 26/11/2018)

SDG 13: Climate Action

According to the SMEC methodology:
"The baseline scenario is non-renewable fire wood consumption to meet thermal energy requirement for household cooking.
In project activity, all cookstoves are installed at the start of project activity or installed progressively, the baseline is considered by-default fixed till the end of useful life of the cookstoves introduced in the project activity or the registered crediting period, whichever occurs earlier. If the project cookstove is replaced with cookstove of similar efficiency prior to the end of crediting period, the same baseline shall be applicable till the end of useful life of the replaced cookstoves or the registered crediting period, whichever occurs earlier. In all cases, whenever the project proponent applies a renewable crediting period, the baseline must be reassessed as per the latest version of the methodology and Gold Standard rules on renewal of crediting period."

Therefore, the baseline of the project activity is: **The consumption of non-renewable firewood of project households for cooking.**

SDG 5: Gender Equality

The SDG 5 baseline is not developed explicitly but implicitly through the application of the Gender Equality framework and the respective methodological assessment of gender outcomes elaborated in section B.6.2 below.

SDG 7: Affordable and Clean Energy

The SDG 7 baseline is not developed explicitly but implicitly in line with the chosen SDG targets and indicators (see section B.6.1 below). A respective methodological approach is proposed in section B.6.2 below.

SDG 1: No Poverty

The SDG 1 baseline is not developed explicitly but implicitly in line with the chosen SDG targets and indicators (see section B.6.1 below). A respective methodological approach is proposed in section B.6.2 below.

B.5. Demonstration of additionality

>> (If the proposed project is not a type of project that is deemed additional, as stated below, then follow guidelines in section 3.5.1 of GS4GG Principles & Requirements to demonstrate additionality.)

Pending. Will be proven through the fulfilment of the eligibility criteria in section A.2

B.6. Sustainable Development Goals (SDG) outcomes

B.6.1. Relevant target for each of the three SDGs

>> (Specify the relevant SDG target for each of three SDGs addressed by the project. Refer most recent version of targets here .)

SDG 13: Climate Action			
Target		Indicator	
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.3.2	Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions

SDG 5: Gender Equality			
Target		Indicator	
5.1	End all forms of discrimination against all women and girls everywhere	5.1.1	Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex
5.4	Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	5.4.1	Proportion of time spent on unpaid domestic and care work, by sex, age and location

SDG 7: Affordable and Clean Energy			
Target		Indicator	
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	7.B.1	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services

SDG 1: No Poverty	
Target	Indicator

1.4	By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.1	Proportion of population living in households with access to basic services

B.6.2. Explanation of methodological choices/approaches for estimating the SDG outcome

>> (Explain how the methodological steps in the selected methodology(ies) or proposed approach for calculating baseline and project outcomes are applied. Clearly state which equations will be used in calculating net benefit.)

SDG 13: Climate Action

Emission reductions for a given year are calculated based on the formulae below, in line with sections 4. And 5. of the SMEC methodology. Methodological choices for ex-ante parameter values are discussed in the respective parameter tables in section B.6.3.

Equation 1

$$ER_y = \sum_{x=1}^{y} N_{P,x,y} \times P_{x,y} \times U_{P,x,y} \times f_{NRB,y} \times \left(EF_{b,fuel,CO2} + EF_{b,fuel,non\_CO2}\right) \times \left(1 - DF_{b,stove,y}\right) \times 0.95$$

Where:

ER_y	Emission reductions of the project activity in year y
$N_{P,x,y}$	Number of project cookstoves of age group x operational in year y
$P_{x,y}$	Quantity of fire wood that is saved in year y by a household with a project cookstove of age group x (t/HH)
$U_{P,x,y}$	Usage rate for project cookstoves of age group x in year y, based on adoption rate and drop off rate revealed by usage surveys (fraction)
$f_{NRB,y}$	Fraction of biomass, used in year y for baseline scenario, which can be established as non-renewable. The project proponents shall estimate project specific national/ regional value or apply the default fNRB value provided by the CDM Executive Board and endorsed by the host country DNA.
$EF_{b,fuel,CO2}$	CO2 emission factor of fire wood that is substituted or reduced. (Default value for wood fuel 1.747 tCO2/ton of wood)
$EF_{b,fuel,non\_CO2}$	Non-CO2 emission factor of fire wood that is substituted or reduced. (Default value for wood fuel 0.455 tCO2/ton of wood)
$DF_{b,stove,y}$	Usage of baseline cookstove during the year y (fraction) in project scenario
y	Year of the crediting period
0.95	Discount factor for leakages related to non-renewable biomass saved by the project activity, applicable for micro-scale programmes of activities (mPoAs)

Equation 2

$$P_{x,y} = B_{b,y} \times \left(1 - {}^{\eta_b}/_{\eta_{p,y}}\right)$$

Where:

$P_{x,y}$	Quantity of fire wood that is saved in year y by a household with a project cookstove of age group x (t/HH)
$B_{b,y}$	Quantity of fire wood consumed in baseline scenario during year y (tonnes per household per year)
$\eta_{p,y}$	Efficiency of project cookstove in year y (fraction)
η_b	Efficiency of the baseline cookstove being replaced (fraction). A default value of 10% shall be used if the replaced cookstove is a three stone fire, or a conventional device without a grate or a chimney i.e., with no improved combustion air supply or flue gas ventilation.

Equation 3

$$\eta_{p,y} = \eta_p \times DF_\eta{}^{y-1} \times 0.94$$

Where:

$\eta_{p,y}$	Efficiency of project cookstove in year y (fraction)
η_p	Efficiency of project cookstove (fraction) determined at the start of the project activity
DF_η	Discount factor to account for efficiency loss of project cookstove per year of operation (Fraction). The default value for this parameter is 0.99 i.e., 1% efficiency loss/year.
0.94	Adjustment factor to account for uncertainty related to project cookstove efficiency test

Determination of the fraction of non-renewable biomass

fNRB (the fraction of non-renewable biomass) is determined for the entire country of Bangladesh according to the CDM methodological tool "Calculation of the fraction of non-renewable biomass" (Version 01.0[5]).

The overall equation to be applied is:

Equation 4

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

where:

[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-30-v1.pdf/history_view (last accessed 26/11/2018)

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

The quantity of non renewable biomass is derived by the equation given for country-wide analyses:

Equation 5

$$NRB = H - RB$$

Where:

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

No reliable official sources are available for ***H***. The FAO: Global Forest Resources Assessment 2015 for Bangladesh mentions pre-filled (extrapolated) data from FAOSTAT for 2011 (27.287 mio m^3 of fuelwood removal), but the source is not clear.

Therefore, H is calculated according to the provisions of the methodological tool par. 15d). A default value for annual fuelwood consumption of **0.5 t/capita** is applied to the part of the population depending on fuelwood. This value is clearly conservative, as shown by the comparison with two other sources in the table below. No other sources for the entire country are available, but both references underpin the conservativeness of the default value.

Source	Fuelwood consumption	Comment
Methodological tool "Calculation of the fraction of non-renewable biomass" (Version 01.0)	0.5 t per year and person	Default value
Scientific paper of Asik & Masakazu (2017) [6]	0.91 t per year and person	Data for the rural Begumganj Upazila (sub-district) of Noakhali district (lower Meghna river and Estuarine floodplain, continuation of the Ganges tidal floodplain to the east), collected over a period of 4 months on a household level (4.28 t per year per household). Dividing the household level consumption by the average national household size value of 4.68 people/household (Bangladesh

[6] Miah, M. D., Al Rashid, H., & Shin, M. Y. (2009). Wood fuel use in the traditional cooking stoves in the rural floodplain areas of Bangladesh: a socio-environmental perspective. *Biomass and Bioenergy, 33(1), 70-78*.

		Health Bulletin 2012) yields the per capita value.
BIDS baseline study for Ganges tidal floodplain (Districts of Barisal, Barguna, and Bagerhat)	0.59 t per year and person	Average of urban and rural areas and wet and rainy season, weighted for population sizes.

There are accurate data on population and fuelwood use available for Bangladesh:

Total population of Bangladesh on July 4th 2018	Source
166,373,362 people	Worldometers.info[7]

Distribution of the population and use of solid fuels for cooking			
	% Urban	% Rural	Source
Total population	23.3%	76.7%	Population Monograph of Bangladesh[8]
Fuelwood users	33.4%	35.1%	Socio-economic and Demographic Report, page 62[9]

According to the Socio-economic and Demographic Report, another 59.1% of the rural population is using straw, leaves or cowdung as fuel. For reasons of conservativeness, we only consider fuelwood use, and not the use of other solid biomass, although it may also affect forest resources.

The overall percentage of fuelwood users based on the data given above is calculated as:

76.7% X 35.1% + 23.3% X 33.4% = **34.7%**

This value is multiplied with the default factor of 0.5 tons of fuelwood consumed per person and year and the population size of Bangladesh as indicated above.

Annual fuelwood consumption is thus determined as **28.869 million tons**.

This result is conservative because:

- No other wood uses beyond fuelwood use are included (thus no furniture etc.)
- Population growth after 2018 is not considered

The equation to determine the quantity of renewable biomass (*RB*) is:

[7] http://www.worldometers.info/world-population/bangladesh-population (last accessed 04/07/2018)

[8] Bangladesh Bureau of Statistics (2015): Population Distribution and Internal Migration in Bangladesh, Population Monograph of Bangladesh Volume 6. Ministry of Planning, Government of Bangladesh. http://203.112.218.65:8008/WebTestApplication/userfiles/Image/PopMonographs/Volume-6_PDIM.pdf (last accessed 04/07/2018)

[9] Socio-economic and Demographic Report 2011, Population and Housing Census, National Series, Volume 4, http://203.112.218.66/WebTestApplication/userfiles/Image/BBS/Socio_Economic.pdf (last accessed 04/07/2018)

Equation 6

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

Where:

$MAI_{forest,I}$: Mean Annual Increment of woody biomass growth per hectare in sub-category i of forest areas (t/ha/yr)
$MAI_{oother,I}$: Mean Annual Increment of woody biomass growth per hectare in sub-category 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_{orther} : 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

Parameter values in Equation 6 are taken from the sources mentioned in the methodological tool applied.

Parameter	Value	Source	Comment
$MAI_{forest,primary}$	2 tons / (ha*yr)	2006 IPCC Guidelines, Table 9	Tropical moist deciduous forest, Asia continental >20 years
$MAI_{forest,regenerated}$	2 tons / (ha*yr)		Tropical moist deciduous forest, Asia continental >20 years[10]
$MAI_{forest,plantations}$	8 tons / (ha*yr)	2006 IPCC Guidelines, Table 10 (plantations)	Tropical moist deciduous forest, Asia
$MAI_{other\ wooded\ land}$	1.3 tons / (ha*yr)	2006 IPCC Guidelines, Table 9	Value for shrubland Asia, see FAO Global Forest Resources Assessment 2015, Bangladesh
$F_{forest,primary}$	411.000 ha	FAO Global Forest Resources Assessment 2015, Bangladesh[11]	See page 38
$F_{forest,regenerated}$	744.000 ha		
$F_{forest,plantations}$	274.000 ha		
$F_{other\ wooded\ land}$	294.000 ha		See page 32
P_{forest}	271.000 ha		Forests in protected areas, table 6, p.72 Primary and regenerated forest not distinguished, but same MAI for both

[10] Since forest area is relatively stable in Bangladesh, regenerated forest can be expected to be older than 20 years.

[11] http://www.fao.org/3/a-az161e.pdf (last accessed 04/07/2018)

$P_{forest,plantations}$	83.560 ha		Plantations for protective purposes, p. 37

Note: The total area considered sums up to 1.429 mio ha. fNRB default values for LDCs (EB meeting 35, annex 20) used the same data source with 1.442 mio ha for 2010. Other wooded land was not included there.

Inserting these parameter values into Equation 6 leads to:

$RB =$
$MAI_{forest,primary} \; X \; (F_{forest,primary} - P_{forest}) + MAI_{forest,regenerated} \; X \; (F_{forest,regnerated}) + MAI_{forest,plantation} \; X \; (F_{forest,plantation} - P_{forest,plantation}) + MAI_{other\ wooded\ land} \; X \; (F_{other\ wooded\ land})$
= 3.67 mio t/yr

The value can be deemed conservative since no protected areas were taken into account for "other wooded land".

NRB can then be calculated according to Equation 5, using the values for H and RB determined above:

$NRB = H - RB$
= 28.87 mio t/y - 3.67 mio t/y
= 25.2 mio t/y

This finally allows to quantify fNRB by applying Equation 4:

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

= 25.2 / 28.87
= 87.27%

Determination of quantity of fire wood consumed in the baseline ($B_{b,y}$)

For determining $B_{b,y}$ we follow option a. of section 4.2 of the SMEC methodology:

"a. Historical data"

The additional guidance provided by the methodology for baseline option a. is:

"For option a, the project proponents shall make sure that historical data is relevant to the target population and appropriately justified."

The *historical data* source applied is a survey conducted by the Bangladesh Institute of Development Studies (BIDS).[12] During the survey Kitchen Performance Tests (KPTs) where

[12] Bangladesh Institute of Development Studies (2018): Fuel Wood Consumption in Four Districts of Bangladesh

conducted in a total of 652 rural and sub-urban households in 4 of the 9 districts of the Ganges tidal floodplains in the period from September 2016 to August 2017. Two measurement campaigns were conducted in the same households, one for the dry season and one for the rainy season. Two high-level findings of the survey are:

1. Fuel wood consumption is higher in the wet season as compared to the dry in all districts and for both rural and urban areas.
2. Fuel wood consumption does not vary much between the three districts Barisal, Bagerhat and Barguna in both seasons. However, consumption levels in Satkhira district are significantly lower than in the other three districts.

Therefore, it is clear that the data of the BIDS survey of the three districts Barisal, Bagerhat and Barguna is "*relevant to the target population*", i.e. rural and sub-urban households in the Ganges tidal floodplains, whereas the Satkhira data has to be treated as an outlier. The research methodology (multi-stage random sampling, KPT, consideration of seasonal effects), size of the sample (652 households) and analytical methods (statistical testing for relevance) meet the highest scientific standards and the results are hence *"appropriately justified"*.

The seasonal household fuel wood consumption data of the three similar districts reported by BIDS and the respective number of households are:

Table 1: Fuelwood consumption of households in three districts of the Ganges tidal floodplains (kg/HH/day), sample sizes and weighted averages for dry and rainy season

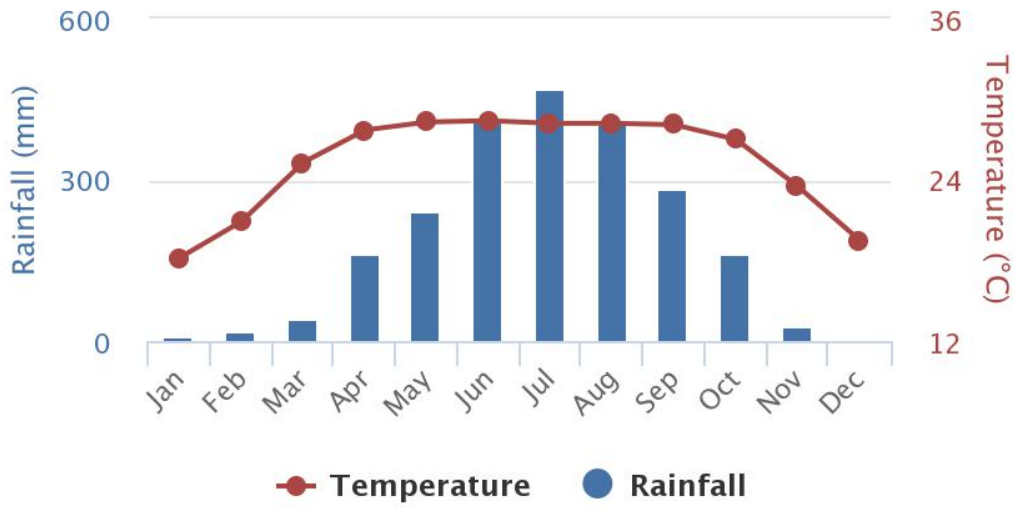
District	Dry season	Wet season	No. of HHs in sample
Barisal	7.47	8.53	148
Barguna	7.05	9.35	214
Bagerhat	5.89	6.7	131
Weighted Average	6.87	8.40	

Finally, in order to arrive at the yearly fuel wood consumption per household in the target area the daily averages have to be multiplied by the respective number of days of each season. The length of the seasons was assessed during the baseline survey of the PoA in the Barguna district. The mean start of rainy season (i.e. the time when people start cooking inside) was reported to be the month of Bôishakh, which corresponds to April in the Gregorian calendar. The mean start of dry season (i.e. the time when people start cooking outside) was reported to be the month of Ôgrôhayôn, which corresponds to November in the Gregorian calendar.[13] The baseline survey results neatly reflect historic average rainfall patterns for Bangladesh:[14]

[13] CCDB Phase I Pilot Project– Baseline & Monitoring Survey 1 Analysis

[14] The World Bank (2018), http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisCCode=BGD (last accessed 28/11/2018)

Figure 5: Average Monthly Temperature and Rainfall for Bangladesh from 1991-2015 (The World Bank, 2018)



Thus, the length of the dry season during which people mostly cook outside their homes is 5 months and the length of the rainy season during which cooking takes place inside is 7 months.

Applying a normalized 30.4 days per month (365 days / 12 months) to the seasonal average fuel wood consumptions above yields a yearly fuel wood consumption per household in the baseline of the target area ($B_{b,y}$):

$$\boldsymbol{B_{b,y}} = 7\ months \times 30.4\ \frac{days}{month} \times 8.40\ \frac{kg}{HH \times day} + 5\ months \times 30.4\ \frac{days}{month} \times 6.87\ \frac{kg}{HH \times day}$$
$$= \mathbf{2.83}\ \frac{t}{HH}$$

SDG 5: Gender Equality

Step 4.a Develop an applied gender analysis to gather evidence for the project baseline, design and development

Pending

Step 4.b Align the Project with SDG targets

Pending

Step 4.c Raise the bar: gender commitment statement

Pending

Step 5.a Establish Project gender goals (actions)
Step 5.b Establish meaningful gender performance indicators for the Project

	No.	Empowerment Goal	Project Action	Indicator	Target
Economic	1	Income and expenditures	Closing of gender gaps in earnings and income generation opportunities	Qualitative increase in earning and income generation opportunities for both women and men expressed as absolute income of women	
	2	Quality employment	Closing of gender gaps in labour market segregation and paid and unpaid employment	a. Quantifiable increase in targeted and diversified employment opportunities for women and men (expressed as a ratio) b. Number and percentage of women who report time-savings and increased ability to engage in economic activities	c.
Social	3	Applied skills and training	Closing of gender gaps and stereotypes in women's and men's access to applied skills and training	Qualitative and verifiable increase in women's (and men's) relative confidence, skills and know-how	
	4	Secure access to health, reproductive health and rights	Closing of gender gaps with regard to a healthy work environment	Quantifiable improvement in women's overall health	
	5	Access to infrastructure services and technologies	Closing of gender gaps in access to infrastructure services	a. Time saved in collecting fuelwood b. Capacity building of women to use, maintain and manage low-carbon technologies (improved cookstoves)	c.

SDG 7: Affordable and Clean Energy
SDG 1: No Poverty

Pending

B.6.3. Data and parameters fixed ex ante for monitoring contribution to each of the three SDGs

(Include a compilation of information on the data and parameters that are not monitored during the crediting period but are determined before the design certification and remain fixed throughout the crediting period like IPCC defaults and other methodology defaults. Copy this table for each piece of data and parameter.)

Relevant SDG Indicator	SDG 13: Climate Action
Data/parameter	$EF_{b,fuel,CO2}$
Unit	tCO_2/tonne of fire wood
Description	CO2 emission factor arising from use of fire wood in baseline scenario
Source of data	IPCC default values, table 1.4 of chapter 1 of Vol. 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1.747
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Emission reduction calculation
Additional comment	n/a

Relevant SDG Indicator	SDG 13: Climate Action
Data/parameter	$EF_{b,fuel,non\_CO2}$
Unit	tCO_2/tonne of fire wood
Description	Non-CO2 emission factor arising from use of fire wood in baseline scenario
Source of data	IPCC default values, Table 2.9 of Chapter 2 of Vol. 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.455
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Emission reduction calculation
Additional comment	n/a

Relevant SDG Indicator	SDG 13: Climate Action
Data/parameter	η_b
Unit	Fraction

Description	Efficiency of the cookstove being used in the baseline scenario
Source of data	Default value
Value(s) applied	10%
Choice of data or Measurement methods and procedures	According to the SMEC methodology: *"A default value of 10% shall be used if the replaced cookstove is a three stone fire, or a conventional device without a grate or a chimney i.e., with no improved combustion air supply or flue gas ventilation."* This is the case for households under this VPA as per eligibility criterion NUMBER in section A.2 above.
Purpose of data	Emission reduction calculation
Additional comment	n/a

Relevant SDG Indicator	SDG 13: Climate Action
Data/parameter	η_b
Unit	Fraction
Description	Efficiency of the cookstove being used in the project scenario
Source of data	Certified laboratory test by the Institute of Fuel Research & Development (IFRD) of the Bangladesh Council of Scientific and Industrial Research (BCSIR)
Value(s) applied	40%
Choice of data or Measurement methods and procedures	The Water Boiling Test Version 4.2.3, as published by the Clean Cooking Alliance (http://cleancookstoves.org/technology-and-fuels/testing/protocols.html, last accessed 26/11/2018)
Purpose of data	Emission reduction calculation
Additional comment	n/a

Relevant SDG Indicator	SDG 13: Climate Action
Data/parameter	$f_{NRB,y}$
Unit	Fractional non renewability
Description	Non-renewability status of wood fuel during year y
Source of data	Own assessment (see section B.6.2 above)
Value(s) applied	87.27%
Choice of data or Measurement methods and procedures	CDM methodological tool "Calculation of the fraction of non-renewable biomass" (Version 01.0)
Purpose of data	Emission reduction calculation
Additional comment	The project activity may choose to update the fNRB during the crediting period.

Relevant SDG Indicator	SDG 13: Climate Action

Data/parameter	$B_{b,y}$
Unit	Tonnes fire wood per household per year
Description	Fire wood consumption for cooking in the baseline
Source of data	Baseline Survey conducted by Bangladesh Institute of Development Studies (BIDS) in the target area (see section B.6.2 above)
Value(s) applied	2.83
Choice of data or Measurement methods and procedures	KPT version 3.0 protocol developed by the Partnership for Clean Indoor Air (PCIA)
Purpose of data	Emission reduction calculation
Additional comment	n/a

B.6.4. Ex ante estimation of outcomes linked to each of the three SDGs

>> (Provide a transparent ex ante calculation of baseline and project outcomes (or, where applicable, direct calculation of net benefit) during the crediting period, applying all relevant equations provided in the selected methodology(ies) or as per proposed approach. For data or parameters available before design certification, use values contained in the table in section B.6.3 above. For data/parameters not available before design certification and monitored during the crediting period, use estimates contained in the table in section B.7.1 below)

SDG 13: Climate Action

For the ex ante estimation of baseline emissions, project emissions and emission reductions we apply values from sections B.6.3 and B.7.1 into the formulae provided in section B.6.2. for the respective 5 years of the crediting period.

Equation 7

$$ER_y = \sum_{x=1}^{y} N_{P,x,y} \times P_{x,y} \times U_{P,x,y} \times f_{NRB,y} \times \left(EF_{b,fuel,CO2} + EF_{b,fuel,non\_CO2}\right) \times \left(1 - DF_{b,stove,y}\right) \times 0.95$$

Where:

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5
ER_y	6,939	9,887	9,851	9,814	9,776
$N_{P,x,y}$	x: 1, N: 2,100	x: 1, N: 900; x: 2, N: 2,100	x: 2, N: 900; x: 3, N: 2,100	x: 3, N: 900; x: 4, N: 2,100	x: 4, N: 900; x: 5, N: 2,100
$P_{x,y}$	2.08	2.07	2.06	2.05	2.05
$U_{P,x,y}$	93%	93%	93%	93%	93%
$f_{NRB,y}$	87.27%	87.27%	87.27%	87.27%	87.27%
$EF_{b,fuel,CO2}$	1.747 tCO2/ton of wood	1.747 tCO2/ton of wood	1.747 tCO2/ton of wood	1.747 tCO2/ton of wood	1.747 tCO2/ton of wood

$EF_{b,fuel,non\_CO2}$	0.455 tCO2/ton of wood	0.455 tCO2/ton of wood	0.455 tCO2/ton of wood	0.455 tCO2/ton of wood	0.455 tCO2/ton of wood
$DF_{b,stove,y}$	11%	11%	11%	11%	11%

Equation 8

$$P_{x,y} = B_{b,y} \times \left(1 - {}^{\eta_b}/_{\eta_{p,y}}\right)$$

Where:

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5
$P_{x,y}$	2.08	2.07	2.06	2.05	2.05
$B_{b,y}$	2.83 ton of wood /HH/year	2.83 ton of wood /HH/year	2.83 ton of wood /HH/year	2.83 ton of wood /HH/year	2.83 ton of wood /HH/year
$\eta_{p,y}$	37.60%	37.22%	36.85%	36.48%	36.12%
η_b	10%	10%	10%	10%	10%

Equation 9

$$\eta_{p,y} = \eta_p \times DF_\eta{}^{y-1} \times 0.94$$

Where:

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5
$\eta_{p,y}$	37.60%	37.22%	36.85%	36.48%	36.12%
η_p	40%	40%	40%	40%	40%
DF_η	0.99	0.99	0.99	0.99	0.99

SDG 5: Gender Equality

SDG 5 ex-ante calculation

SDG 7: Affordable and Clean Energy
SDG 1: No Poverty

SDG 7 and 1 ex-ante calculation

B.6.5. Summary of ex ante estimates of each SDG outcome

SDG 13: Climate Action

Year	Baseline estimate	Project estimate	Net benefit

Year 1	n/a[15]	n/a[15]	6,939
Year 2	n/a[15]	n/a[15]	9,887
Year 3	n/a[15]	n/a[15]	9,851
Year 4	n/a[15]	n/a[15]	9,814
Year 5	n/a[15]	n/a[15]	9,776
Total	n/a[15]	n/a[15]	**46,267**
Total number of crediting years			
Annual average over the crediting period	n/a[15]	n/a[15]	**9,253**

SDG 5: Gender Equality

Year	Baseline estimate	Project estimate	Net benefit
Year A			
Year B			
Year C			
Year …			
Total			
Total number of crediting years			
Annual average over the crediting period			

SDG 7: Affordable and Clean Energy
SDG 1: No Poverty

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

(Include specific information on how the data and parameters that need to be monitored in the selected methodology(ies) or proposed approaches or as per mitigation measures from

[15] The SMEC methodology does not differentiate between baseline and project emissions but rather directly calculates emission reductions through applying efficiency gains of the new technology to the baseline fire wood consumption.

safeguarding principles assessment or as per feedback from stakeholder consultations would actually be collected during monitoring. Copy this table for each piece of data and parameter.)

Relevant SDG Indicator	SDG 13: Climate Action
Data / Parameter	$U_{P,x,y}$
Unit	Percentage
Description	Usage rate for project cookstoves of age group x in year y
Source of data	Annual usage survey/Monitoring survey
Value(s) applied	93%[16]
Measurement methods and procedures	A usage survey for each age-group is conducted once during the crediting period, in line with the guidelines of Section III. 1. C. i. of the methodology.
Monitoring frequency	Annual
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Emission reduction calculation
Additional comment	A usage parameter is derived for each age group of project cookstove being credited.

Relevant SDG Indicator	SDG 13: Climate Action
Data / Parameter	$N_{P,x,y}$
Unit	Number of project cookstove credited (units)
Description	Number of project cookstoves of age group x operational in year y
Source of data	Total sales record
Value(s) applied	Stove sales target of the VPA[17] **Year 1** | **Year 2** 2,100 | 1,300
Measurement methods and procedures	End user agreements
Monitoring frequency	Continuous
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Emission reduction calculation
Additional comment	The total sales record is divided based on project scenario to create the project database. Under this VPA there is a single project scenario.

Relevant SDG Indicator	SDG 13: Climate Action
Data / Parameter	DF_{η}
Unit	Fraction
Description	Discount factor to account for efficiency loss of project cookstoves
Source of data	Default value: 0.99 i.e., 1% efficiency loss per year

[16] CCDB Phase I Pilot Project– Baseline & Monitoring Survey 1 Analysis

[17] CCDB Cookstove Business Plan v2.1

Value(s) applied	0.99
Measurement methods and procedures	The condition of stoves will be assessed as par of the annual usage survey for each age-group conducted for parameter $U_{P,x,y}$.
Monitoring frequency	Annual
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Emission reduction calculation
Additional comment	This default can be used if stoves are found in good condition during annual surveys. For each year, the stoves of the age-group x-y should be physically verified. In the case of progressive installations, stove of age-group 0-1 shall also be physically verified each year through random sampling approach.

Relevant SDG Indicator	SDG 13: Climate Action
Data / Parameter	$DF_{b,stove,y}$
Unit	Fraction
Description	Usage of baseline cookstove during the year y (fraction) in project scenario
Source of data	Monitoring survey
Value(s) applied	11%[18]
Measurement methods and procedures	The usage of baseline stoves will be assessed as part of the annual usage survey for each age-group conducted for parameter UP,x,y .
Monitoring frequency	Annual
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Emission reduction calculation
Additional comment	The discount factor for baseline-stove use may be determined based on number of meals cooked using baseline stove. The required information shall be captured through sample surveys carried out following random sampling approach for each age-group of the project stove.

B.7.2. Sampling plan

>> (If data and parameters monitored in section B.7.1 above are to be determined by a sampling approach, provide a description of the sampling plan.)

Develop Sampling plan according to SMEC, etc.

B.7.3. Other elements of monitoring plan

>>

Elaborate on elements from Section III. of SMEC

[18] CCDB Phase I Pilot Project– Baseline & Monitoring Survey 1 Analysis

SECTION C. Duration and crediting period

C.1. Duration of project

C.1.1. Start date of project

>> (Specify start date of the project, in the format of DD/MM/YYYY. Describe how this date has been determined as per the definition of start date provided in section 3.4.3 of GS4GG Principles & Requirements document and provide evidence to support this date.)

01/04/2019

C.1.2. Expected operational lifetime of project

>> (Specify in years)

10 years

C.2. Crediting period of project

5 years renewable

C.2.1. Start date of crediting period

>> (Specify in dd/mm/yyyy. This can be start of project operation or two years prior to the date of Project Design Certification, whichever is later.)

01/04/2019

C.2.2. Total length of crediting period

>> (Specify the total length of crediting period sought in line with GS4GG Principles & Requirements or relevant activity requirements.)

2 x 5 years = 10 years

SECTION D. Safeguarding principles assessment

The safeguarding principles assessment is performed at the PoA level.

D.1. Analysis of social, economic and environmental impacts

>> (Refer the GS4GG Safeguarding Principles and Requirements document for detailed guidance on carrying out this assessment.)

n/a

SECTION E. Local stakeholder consultation

The local stakeholder consultation is performed at the PoA level.

E.1. Solicitation of comments from stakeholders

>> (Describe how stakeholder consultation was conducted in accordance with GS4GG Stakeholder Procedure Requirements and Guidelines.)

n/a

E.2. Summary of comments received

>> (Provide a summary of key comments received during the consultation process.)

n/a

E.3. Report on consideration of comments received

>> (Describe how the comments have been addressed by providing a clarification to the stakeholder or by altering the design of the project or by proposing to monitor any anticipated negative impacts etc.)

n/a

Appendix 1. Contact information of project participants

Organization name	Christian Commission for Development in Bangladesh (CCDB)
Registration number with relevant authority	NGOAB reg. no: 008; Dated 22/04/1981
Street/P.O. Box	Senpara Parbatta, Mirpur-10
Building	House- 88
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State/Region	Dhaka
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Salutation	Mr
Last name	Talukder
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Appendix 2. Summary of post registration design changes

n/a