PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM PROGRAMMES OF ACTIVITIES (F-CDM-SSC-PoA-DD) Version 02.0

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

Energy Efficiency Program in Rural Bangladesh
Version 06 Date: 20/05/2013

A.2. Purpose and general description of the PoA

1. Policy/measure or stated goal of the PoA

The objective of the Program of Activities is to provide safe drinking water to the people living at the Base of the Pyramid (BoP) in rural[1] Bangladesh.

Zero emission water purification systems (WPS) will be deployed under the PoA with the objective of increasing access to safe drinking water (SDW), reduction of GHG Emissions and improving health conditions.

With the assistance of carbon finance, this project can be economically sustainable throughout the lifetime of the program.

The stated goal of the PoA is to serve at least 1 million rural households in Bangladesh.

2. General operating and implementing framework of PoA

The PoA will be coordinated and managed by **BRAC Impact Ventures Limited (BIVL).** BIVL is a private limited company primarily with focus on investment in projects resulting in environmental and social development impact. **BRAC Impact Ventures Limited** is the coordinating/managing entity (hereafter referred to as "CME") for the PoA

All zero emission water purification technologies complying with relevant standards and the methodology requirements can be part of this PoA.The CME will distribute, or manage the distribution, of all zero emission water purification systems.

The water purification systems will be point of entry (POE) or point-of-use (POU) water purification systems that help people living at the BoP to access safe drinking water at home and outside.. In exchange

[1] Clause 11(1) . "Local Government (Union Parishads) Act, 2009." *Bangladesh Code*. Ministry of Law, Government of Bangladesh (web link: http://bdlaws.minlaw.gov.bd/print_sections_all.php?id=1027) states that the Deputy Commissioner, by notification in the official gazette, will declare some villages or collection of adjacent moujas and villages as wards and collection of nine such wards as a union. The same law in section2 (5) states that union means rural areas and unions declared as union as per the clause 11 of the Act. Hence any area within a union in Bangladesh will be considered as rural. Rural area excludes Urban areas which means Towns (places with municipal corporation, municipal area committee, town committee, notified area committee or cantonment board)_ or as per clause 15 of the Act, area declared as pourashava, municipality or city corporation

for a free or at subsidized cost water purification systems, emissions reductions will be transferred to BIVL and end users will be informed about the assignment of carbon credit rights.

3. Confirmation that the proposed PoA is a voluntary action

There are no laws, policies or mandatory requirements in Bangladesh to ensure the use of low or zero greenhouse gas emitting safe drinking water production systems.

This PoA is a voluntary, coordinated action by **BRAC Impact Ventures Limited (BIVL)**

4. Contribution to sustainable development

Based on the WHO / UNICEF Joint Monitoring Programme (FY 2010)[2] data 27.65 million People in the Bangladesh lack access to safe drinking water out of which 21.4 million people are living in rural Bangladesh..

One of the major health problems in Bangladesh can be traced to water scarcity and a lack of quality water. According to UNICEF, annually 50,800 children die due to diarrhoea in Bangladesh[3]. This number is very high (5.44 %) compared to the global prevalence (2.67%)[4]. According to a survey conducted by BRAC (WASH Program), 54.97% [5]patients of Bangladesh are suffering from water borne diseases (WASH, July, 2008).

The PoA directly addresses several of the United Nations Millennium Development Goals (MDGs)[6] which includes halving, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation; integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; reduce child mortality, improve maternal health, combat disease, ensure environmental sustainability, and develop a global partnership for development.

The PoA will provide numerous benefits besides the direct GHG emission reductions to the concerned rural households and/or communities:

a) Environmental Benefits

The PoA reduces the use and demand for non-renewable biomass, that would have been used to boil water as a means of water purification in the absence of the Programme of Activities (PoA), directly leading towards reduction in greenhouse gas (GHG) emissions.

The project is also reducing the rate of deforestation connected to biomass fuel consumption.

b) Socio-economic benefits

Cheaper access to drinking water: purchasing or collecting firewood or fossil fuels to boil the water constitute a significant expense for the very poorest households and communities. The PoA will provide access to clean drinking water, which will reduce household fuel needs and save household time and

[2] http://www.wssinfo.org/data-estimates/table/.
[3] WHO, U. (2009). *Diarrhoea :Why Childrens are still dying and what can be done.*
[4] (WHO), W. H. (2008). *Safer Water, better health - Costs, Benefits and Sustainability of Interventions to protect and promote health*
[5] Research, B. W. (July, 2008). *WASH program of BRAC: Towards attaining the MDG*
[6] http://www.un.org/millenniumgoals/

income and thereby reduce child and adult morbidity and mortality, improve attendance at school, increase productivity, and more generally provide a sense of hope and opportunity including better living conditions.

Promotion of Micro-entrepreneurs: Zero emission water purification technologies offer scope for micro-entrepreneurs providing support services, thereby creating jobs and supporting families. The CME will assist micro entrepreneurs to establish village/union level small repair and after sales service shop.

Economic sustainability and expansion: under this program, there is a direct incentive to ensure that the project is successful, in that these same projects serve to fund further development.

c) Health benefits

Improved water quality: Providing safe drinking water to households/communities will have a significant impact on child mortality. Families will have reduced exposure to water borne diseases, a leading cause of death for children under the age of five in Bangladesh

Improved indoor quality: improvement in indoor air pollution has been proven to have direct correlation with respiratory illness and mortality rates, especially among women and children, worldwide zero emission water disinfection technologies tackle this problem by reducing the combustion of wood/fossil fuels for boiling water.

A.3. CMEs and participants of PoA

1. **Coordinating or managing entity of PoA as the entity which communicates with the Board**

The Coordinating and Managing Entity (CME) of the PoA that communicates with the Board is **BRAC Impact Ventures Limited (BIVL).**

2. **Project participants being registered in relation to the PoA** (Project participants may or may not be involved in any of the CPAs related to the PoA.)

A.4. Party (ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Bangladesh (host)	BRAC Impact Ventures Limited (Private entity)	No

A.5. Physical/ Geographical boundary of the PoA

The PoA boundary will be the geographical boundary of People's Republic of Bangladesh.

A.6. Technologies/measures

As per small-scale methodology *AMS-III.AV Low greenhouse gas emitting safe drinking water production systems Version 3,EB 69* the technology/measure employed under each CPA in the PoA is a

Zero emission water purification technology[7] involving point-of-use (POU) or point-of-entry (POE)[8] treatment systems for residential or institutional applications[9].

Water purification systems to be deployed under the program will meet the compliance either with (i) at a minimum the performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications (WHO, 2011)" or (ii) a applicable national standard or guideline.

As per AMS III AV version 03, examples of water purification technologies include, but are not limited to, the following:

- Water filters: Ceramic, membrane, activated carbon, ultra filtration, etc.
- Solar energy powered ultra violate (UV) disinfection devices
- Solar disinfection techniques
- Photo catalytic disinfection equipment
- Pasteurization appliances
- Chemical disinfection: (chlorination, chlorine tablets etc.)
- Combined treatment approaches (e.g. flocculation plus disinfection)

The project proponent reserves the right to select alternative zero emission water purification technologies in different CPAs that meet the standards or guidelines as required in the methodology.

A typical CPA will be defined geographically by list of Unions within a same district and will deploy only one type of water purification technology. The CME will work with development partners in each CPA to select the most appropriate technology for the region that also meets the PoA eligibility criteria.

A.7. Public funding of PoA

Currently there is no public funding involved in the PoA. A separate check will be performed at the time of inclusion of CPAs as per the eligibility criterion 13 in section B.2.

In case public funding is involved in future

(a) Information on Parties providing public funding will be provided
(b) The affirmation obtained from such Parties in accordance with applicable provisions related to official development assistance in the Project standard will be attached in Appendix 2.
(c) Such public funding should not be a diversion of Official Development Assistance.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

"*Standard for Demonstration of Additionality, Development of Eligibility Criteria and Application of Multiple Methodologies for Programmes of Activities" version 02.1* is applicable to CMEs to demonstrate the additionality of emission reductions under a PoA; [Refer to Section 4(a)]

[7] Zero emission water purification technology means technologies without project emission. If a typical technology requires heat or electricity or energy (for purification) which is supplied by renewable energy sources will be considered as zero emission technology

[8] As defined in the methodology, Point of Use (POU) devices treat only the water intended for direct consumption, typically at a single tap or limited number of taps, while Point of Entry (POE) treatment devices are typically installed to treat all water entering a single home, business, school, or facility (USEPA, 2006).

[9] For example system installed at a school or a community center

The relevant criteria under paragraph 9, of 3.1, Demonstration of Additionality of the above standard are as follows

"PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the "*Guideline on the Demonstration of Additionality of Small-Scale Project Activities."*

Following EB 68 Annex 27: *Guideline on the Demonstration of Additionality of Small-Scale Project Activities Version 09*, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the barriers specified in the guideline.

However, following paragraph 2 of the guideline, documentation of barriers is 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 positive list comprises of:

a) Grid-connected and off-grid renewable electricity generation technologies;
b) Off-grid electricity generation technologies where the individual units do not exceed the specified threshold;
c) 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 size[10] of each unit is no larger than 5 per cent of the small-scale CDM thresholds;
d) Rural electrification project activities using renewable energy sources in countries with rural electrification rates less than 20 per cent.

As a Type III project[11], each CPA is limited to annual emission reductions of 60,000 tCO_2. Each CPA will demonstrate that annual emissions reductions of each CPA shall not go beyond the limits of 60 ktCO2e/y over the entire crediting period. This is a criterion for inclusion of a CPA under the PoA (Eligibility criteria 8)

As the CPAs under the PoA are deemed small-scale activities, the *Guideline on the Demonstration of Additionality of Small-Scale Project Activities Version 09* applies to the demonstration of additionality for CPAs under the PoA.

The target groups of every CPA included under the PoA are households or communities. This is a criterion for inclusion of a CPA under the PoA (Eligibility criteria 10).

In addition, each CPA will demonstrate it is exempt from a de-bundling check as each subsystem is no more than 1 per cent of the small-scale threshold[12] (Eligibility criteria 15).

The small-scale threshold is 60,000 tCO_2 per annum[13]. Each water purification system saves less than 600 tCO_2 annually (i.e. 1 per cent of 60,000 tCO_2).[14] It follows that each CPA included under the PoA satisfies criterion 8, 10 and 15 and thereby meets the requirements of item c) under the positive list of the *Guideline on the Demonstration of Additionality of Small-Scale Project Activities Version 09*:

[10] That is the size of each unit under 750 kW installed capacity or under 3000 MWh of energy savings per year or 3000 tonnes of emission reductions per year
[11] Annex 23, EB 66 General Guidelines to SSC CDM methodologies
[12] Annex 13, EB 54,Guidelines on Assessment of debundling for SSC project activities
[13] Annex 23, EB 66 General Guidelines to SSC CDM methodologies
[14] Refer to Part II: Section B.6.3. Moreover, each CPA-DD section A 12 will provide detail calculation on estimated ERs per unit to satisfy eligibility criteria 15 stated under Section B.2 of part I of the PoA-DD

- Each CPA is composed solely of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs);
- Each unit under a CPA is no larger than 1 per cent of the small-scale CDM thresholds (i.e. less than the required 5 per cent of the small-scale threshold).

As each CPA under the PoA meets the requirements of item c) under the positive list of the *Guideline on the Demonstration of Additionality of Small-Scale Project Activities Version 09*, it follows that each CPA under the PoA is automatically additional and further documentation of Barriers are not required.

The information presented here constitutes the demonstration of additionality of the PoA as a whole.

B.2. Eligibility criteria for inclusion of a CPA in the PoA

A CPA that is included in the PoA must meet the following criteria in accordance with the applicable provisions in the PoA standards[15]:

	Eligibility criteria		Means of proof	Confir
#	Description	Condition to be met		mation
1	Technology Requirements	Water purification technologies that involve point-of use (POU) or point-of-entry (POE) treatment systems[16] will be employed. The examples include, but are not limited to water filters (e.g. membrane, activated carbon, ceramic filters), solar energy powered UV (ultraviolet) disinfection devices, solar disinfection techniques, photo catalytic disinfection equipment, pasteurization appliances, Chemical disinfection methods, combined treatment approaches etc.	Manufacturer's Specification of water purification technologies to be employed confirming that only point-of use (POU) or point-of-entry (POE) zero emission water purification systems (i.e technologies without project emission) will be deployed.	Yes/No
2	Methodology Applicability:	a) Prior to the implementation of the project activity, a public distribution network supplying safe drinking water (SDW) does not exist.	Any of the following: i) A questionnaire/statement signed by a local government authority or local water authority or community owned water supply organization confirming the absence of a public distribution network of safe drinking water in the area(s) covered by a CPA/ system.	Yes/No

[15] Page 3 Clause14 of "Standard for the demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities", Version 01.0 (EB 65, Annex 3)

[16] Point of Use (POU) devices treat only the water intended for direct consumption, typically at a single tap or limited number of taps, while Point of Entry (POE) treatment devices are typically installed to treat all water entering a single home, business, school, or facility (USEPA, 2006).

			ii) Using Official data such as publicly available statistical data from a government agency or an independently commissioned study by an international organization or a University.	
3		b) The application of the project technology /equipment achieves compliance either with (i.e. anyone of the following) : i) at a minimum the performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications" (WHO, 2011); or ii) Health based targets and microbiological performance specifications of " The Environment Conservation Rules, 1997 ; Schedule 3 (B): Standards for drinking water"[17]	Each CPA shall specify the Standard or Guidelines to which water purification technologies involved in that CPA will comply by means of any of the following: i) Laboratory testing ii) Official Notification (for example notifications from the national authority on health)	Yes/No
4		c) In cases where the life span of the water treatment technologies is shorter than the crediting period of the project activity, there shall be documented measures in place to ensure that end users have access to replacement purification systems of comparable quality.	Section A.5 of the CPA-DD will specify lifetime of the equipment based on manufacturer's specification, define operational unit and indicator of when to replace/repair the water purification system. In cases where the life span of the water treatment technologies is shorter than the crediting period of the project activity, Section D.7.2 of the CPA-DD will specify documented measures that are in place to ensure that end users have access to replacement purification systems of comparable quality	Yes/No
5		It will be assessed whether the CPA will be: 1) Case 1: implemented in rural or urban areas of countries with proportion of	Any one of the following (i) Proportion of populations using an improved drinking-water source for the most	Yes/No

[17] http://www.moef.gov.bd/html/laws/env_law/178-189.pdf

		rural or urban population using an improved drinking-water source equal to or less than 60% or 2) Case 2: implemented in areas not included in Case 1.	recent year for which data is available from WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation shall be used (<http://www.wssinfo.org/data-estimates/table/>) for this purpose. Definition of improved and unimproved drinking water source shall be as per the information provided by JMP; (ii) using official data such as publicly available statistical data from a government agency or an independently commissioned study by an international organization or an university; or (iii) Using survey methods (using 90/10 confidence/precision for sampling)	
6	Start date	The CPA start date shall be after the PoA validation start date which is the Webhosting date of the CDM-POA-DD for Global Stakeholder Consultation, i.e. 22 August 2012)	The start date of the CPA will be specified in each CPA-DD.(Section A.8.1) and it will be ensured that the CPA start date is after the PoA validation start date , i.e. after 22 August 2012 The Start date will be confirmed by any documentary proof of purchase of WPS, e.g. letter of credit (LC) opening, wire transfer, purchase order etc.	Yes/No
7	Boundary and location of the CPA	Each CPA will be located within the physical/geographical boundary of the PoA	The boundary of each CPA will be within the POA boundary and will be stated in the CPA DD (Section A.7)	Yes/No
8	SSC Limit for CPAs	The CPA is under the Type III SSC threshold of 60,000 tCO2e per year. i.e. The annual emissions reductions of each CPA shall not go beyond the limits of 60 ktCO2e/y over the entire crediting period.	Emissions reductions will be estimated in the CPA DD and verified by a DOE.	Yes/No
9	CPA Development,	i) BIVL manages and/or contracts the distribution of	A written approval/attestation will be provided by the CME	Yes/No

	Management and Distribution of WPS	Low GHG Emitting water purification systems (WPS) and ii) Each CPA has to be approved by the CME. if the CME implements the CPA itself no such approval is required.	(BIVL)	
10	Target Group	Water purification systems to be deployed under each CPA shall be for residential or institutional applications such as systems installed at a school or a community centre in rural areas.	Confirmed in CPA-DD (Section D.2 of the CPA-DD)	Yes/No
11	Conditions that avoid double counting	i) Each CPA shall be uniquely Identified via range/list of Unique Identification Numbers of the water purification systems and via geographical coordinates for stationary installations[18]. ii) A confirmation from the CPA implementer /CME that the proposed CPA is neither registered as an individual CDM project activity nor included in another PoA and that no CERs will be claimed for the water purification systems other than those claimed by this PoA's CME	i) Demonstrate that each CPA employs unique identification system for each water purification system in the CPA-DD (D.7.2 of the CPA-DD) or geographical coordinates for stationary installations in the section A.7 of the CPA-DD. ii) Attestation signed by CPA implementer and/or by the CME	Yes/No
12	The conditions that ensure that CPAs meet the additionality requirements	Each CPA has to meet Eligibility Criteria no 8, 10 and 15	Conditions of Eligibility Criteria no 8, 10 and 15	Yes/No
13	Non-diversion of ODA/Non-use of Public Funding	CPA does not lead to a diversion of official development assistance (ODA)	Any of the following: (i) Confirmation from CME and/or CPA implementer that no public funding is involved in the CPA. (ii) In case public funding is involved, confirmation from the public fund provider or the DNA of the Annex I party involved that no ODA is diverted for the	Yes/No

[18] Stationary installation means fixed or immovable installation of water purifications systems. The examples are, including but limited to, Water Treatment Plants, Desalinization plant, fixed installation of POE treatment system etc. Non Stationary means movable WPS.

			Implementation of a CPA.	
14	Sampling requirements	All sampling requirements for a CPA should be based on the POA-DD and in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys.	Confirmed in CPA-DD (Section D.7.2 of the CPA-DD)	Yes/No
15	Debundling Check	Each CPA will demonstrate that it is exempted from a de-bundling check as each water purification system is no more than 1 per cent of the small-scale threshold	Confirmed in CPA-DD (section A.12 of the CPA-DD)	Yes/No
16	Environmental Impact Analysis	Each CPA will demonstrate the CPA is in line with the host Party environmental laws/regulations.	Analysis of environmental impacts based on manufacturer's specification conducted by the CME for the technology employed under the CPA and the summary of which is included in section B.1 of the CPA-DD. For one technology type, one such analysis of environmental impacts will be deemed adequate in this regard. i.e. Analysis will be required if the technology type is deployed for the first time under the PoA. Subsequent CPAs with same technology type will refer to the Analysis already submitted/undertaken. Or EIA exemption letter from relevant government authority.	Yes/No

Paragraph 16 (g) of "*Standard for Demonstration of Additionality, Development of Eligibility Criteria and Application of Multiple Methodologies for Programmes Activities" version 02.1,* requires inclusion of the conditions related local stakeholder consultation .

However, Local Stakeholder Consultation has been carried out at the PoA level. The justification has been provided in Section F. Hence conditions related to local stakeholders consultation has not been included as an Eligibility criteria during CPA inclusion.

Assessment of De-bundling:

Debundling check will be in accordance with "Guidelines on Assessment of Debundling For SSC Project Activities" Version 03, EB 54 (Annex 13)

If each of the independent subsystems/measures (e.g., water purification systems) included in the CPA of a PoA is no larger than 1% of the small-scale thresholds defined by the methodology applied,[19] then that CPA of PoA is exempted from performing de-bundling check i.e., considering as not being a de-bundled component of a large scale activity.

In each CPA-DD section A.12 detail calculation on estimated ERs per unit will be shown to justify exemption of the CPA from de-bundling check.

B.3. Application of methodologies

Methodology to be applied:

AMS-III.AV. Low greenhouse gas emitting safe drinking water production systems, Version 03, EB69

As stated in the methodology, the use of this methodology in a project of activity under a programme of activities is legitimate if the leakage is estimated and accounted for as per the relevant provisions of AMS-I.E under the section for Programme of Activities.

1. *This methodology comprises introduction of low greenhouse gas emitting water purification systems to provide safe drinking water(SDW). Water purification technologies that involve point-of-use (POU) or point-of-entry (POE) treatment systems for residential of institutional applications such as systems installed at a school or a community centre are included. The examples include, but are not limited to water filters (e.g. membrane, activated carbon, ceramic filters), solar energy powered UV (ultraviolet) disinfection devices, solar disinfection techniques, photo catalytic disinfection equipment, pasteurization appliances, chemical disinfection methods (eg. Chlorination), combined treatment approaches (e.g. Flocculation plus disinfection) etc.*

There are a number of different types of zero emission water treatment interventions to be implemented under the PoA. In each CPA most appropriate technology that also meets the PoA eligibility criteria will be selected and clearly described in CPA-DD section A.3

2. *The methodology is applicable under the following conditions:*

(a) Prior to the implementation of the project activity, a public distribution network supplying SDW to the project boundary does not exist. If during the crediting period SDW is made available through a public distribution network, the emission reductions pertaining to the households/buildings supplied by the public system cannot be claimed from that point onwards. This condition should be checked annually during the crediting period;

(b) It shall be demonstrated based on laboratory testing, or official notifications (for example notifications from the national authority on health) that the application of the project technology/equipment achieves compliance either with (i) a minimum the performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications" (WHO, 2011) or (ii) an applicable national standard or guideline;

[19] i.e., 15 kW installed capacity or 0.6 GWh annual energy savings or 0.6 ktCO2e annual emission reductions. In this PoA, the limit to be applied is 0.6 ktCO2e annual emission reductions for each independent subsystem.

(c) In cases where the life span of the water treatment technologies is shorter than the crediting period of the project activity, there must be documented measures in place to ensure that end users have access to replacement purification systems of comparable quality.

Each CPA, during inclusion in the PoA, will confirm in section D.2 of the CPA-DD that a public distribution network supplying SDW does not exist in the CPA area; the application of the project technology/equipment achieves compliance as per the methodology and documented measures in place to ensure that end users have access to replacement purification systems of comparable quality. If during the crediting period SDW is made available through a public distribution network in a CPA, the emission reductions pertaining to the households/buildings supplied by the public system cannot be claimed from that point onwards. This condition will be checked annually during the crediting period. CPA-DD section D.7.1 also includes annual checking of fraction of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network. The following improved sources of SDW will be considered as SDW supplied by Public Distribution Network for the PoA.

1. Piped Water into dwelling
2. Piped Water into yard or plot
3. Public tap or stand pipe

Refer to Appendix 3 for further details.

3. Applicability of this methodology is foreseen in the following types of situations that shall be reassessed at the beginning of each crediting period:

(a) Case 1: Project activities implemented in rural or urban areas of countries with proportion of rural or urban population using an improved drinking-water source equal to or less than 60%, confirmed by

(i) Proportion of populations using an improved drinking-water source for the most recent year for which data is available from WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation shall be used (<http://www.wssinfo.org/data-estimates/table/>) for this purpose. Definition of improved and unimproved drinking water source shall be as per the information provided by JMP;
(ii) Using official data such as publicly available statistical data from a government agency or an independently commissioned study by an international organization or an university; or
(iii) Using survey methods (using 90/10 confidence/precision for sampling)

(b) *Case 2: Project activities implemented in areas not included in Case 1.*

Each CPA will specify in section D.2 of the CPA-DD whether it belongs to Case-1 situation or Case-2 situation and which option of the above was used to determine the proportion of the population which use an improved drinking water source.

The Sampling plan to be applied is described in details in Section B.7.2:

General description of the Sampling Plan:

The Sampling Plan for a all CPAs under the PoA follows the following guidelines, methodologies, or procedures:

AMS-III.AV low greenhouse gas emitting safe drinking water production systems Version 03, EB 69

EB 69 Annex 4 Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities Version 3.0

EB 69 Annex 5 Guideline for Sampling and Surveys for CDM project Activities and Programme of Activities Version 2.0

Ex-post surveys parameters for all CPAs:

- Litres of drinking water consumed per person per day
- Number of persons supplied with purified water from each of the WPS
- Fraction of water purification systems that are operational
- Fraction of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network
- Water quality

The CPAs under the PoA will consists of group/list of unions within a district. A district is constituted by several sub districts and a sub district is constituted by several unions and each union contains several villages which are constituted by several households.

The mean value parameters of (i) Litres of drinking water consumed per person per day and (ii) number of persons supplied with purified water from each of the water purification systems (average household size if 1 WPS is distributed per family) is expected to vary across the districts. However the above parameters are more similar within a CPA or group of CPAs under one District

When the population under study is not homogeneous but instead consists of several subpopulations which are known (or thought) to vary, then it is better to take a simple random sample from each of these sub-populations separately. This is called *stratified random sampling*. The subpopulations are called the strata. Stratified random sampling is most applicable to situations where there are obvious groupings of population elements whose characteristics are more similar within groups than across groups. Stratification helps to ensure that estimates of a population characteristic are accurate; especially if there are differences amongst the strata (e.g. in this case a district will be defined as strata). Sampling within strata will be drawn randomly.

Only CPAs which have deployed same water purification technology and similar models from the same manufacturer can be grouped together for determination of sample size calculation and conducting sampling and survey for monitoring of CDM parameters.

In light of the above Sampling Approach and reliability requirement selection will be as follows

Type	**Approach**	**Reliability Requirement Confidence/Precision**
Single CPA	Simple Random Sampling	90/10
Group of CPAs[20] within same district	Simple Random Sampling	95/10[21]
Group of CPAs from more than one district	Stratified random sampling	95/10

Each of the group of CPAs defined above will separately follow the Sampling Plan described in details in Section B.7.2

[20] In this PoA the definition of Group of CPAs for sampling and survey will be applied as follows ", CPAs under the PoA which have deployed same water purification technology and similar models from the same manufacturer"

[21] Paragraph 20, EB 69 Annex 4

If monitoring of a particular parameter occurs on an annual basis any representative sampling will satisfy the confidence/precision requirement as per the above table. If monitoring occurs every two years any representative sampling will satisfy the 95/5 confidence/precision requirement. If the required level of accuracy (confidence/precision) is not achieved, the sample size can be expanded.

The following Equation may be used for the Calculation of Sample Size:

$$n \geq \frac{Z^2 \times NV}{(N-1) \times 0.1^2 + Z^2 V}$$

Where,

$$V = \left(\frac{SD}{Mean}\right)^2$$

n Sample size
N Total number of WPS supplied

Z *1.645* Represents the 90% confidence required
1.96 Represents the 95% confidence required
0.1 Represents the 10% relative precision
0.05 Representing 5% relative precision

SD Overall Standard deviation
Mean Overall mean

The final sample size will be at least 10% larger[22] than calculated from the above formula, to allow for error in the estimate of coefficient of variance (*cv)* and expected levels of non-compliance.

Detail Sampling Plan with Stratified Random Sampling Approach has been provided in Section B.7.2

SECTION C. Management system

The CME manages the PoA as a whole.

The CME will subcontract following activities to the Partner Organizations

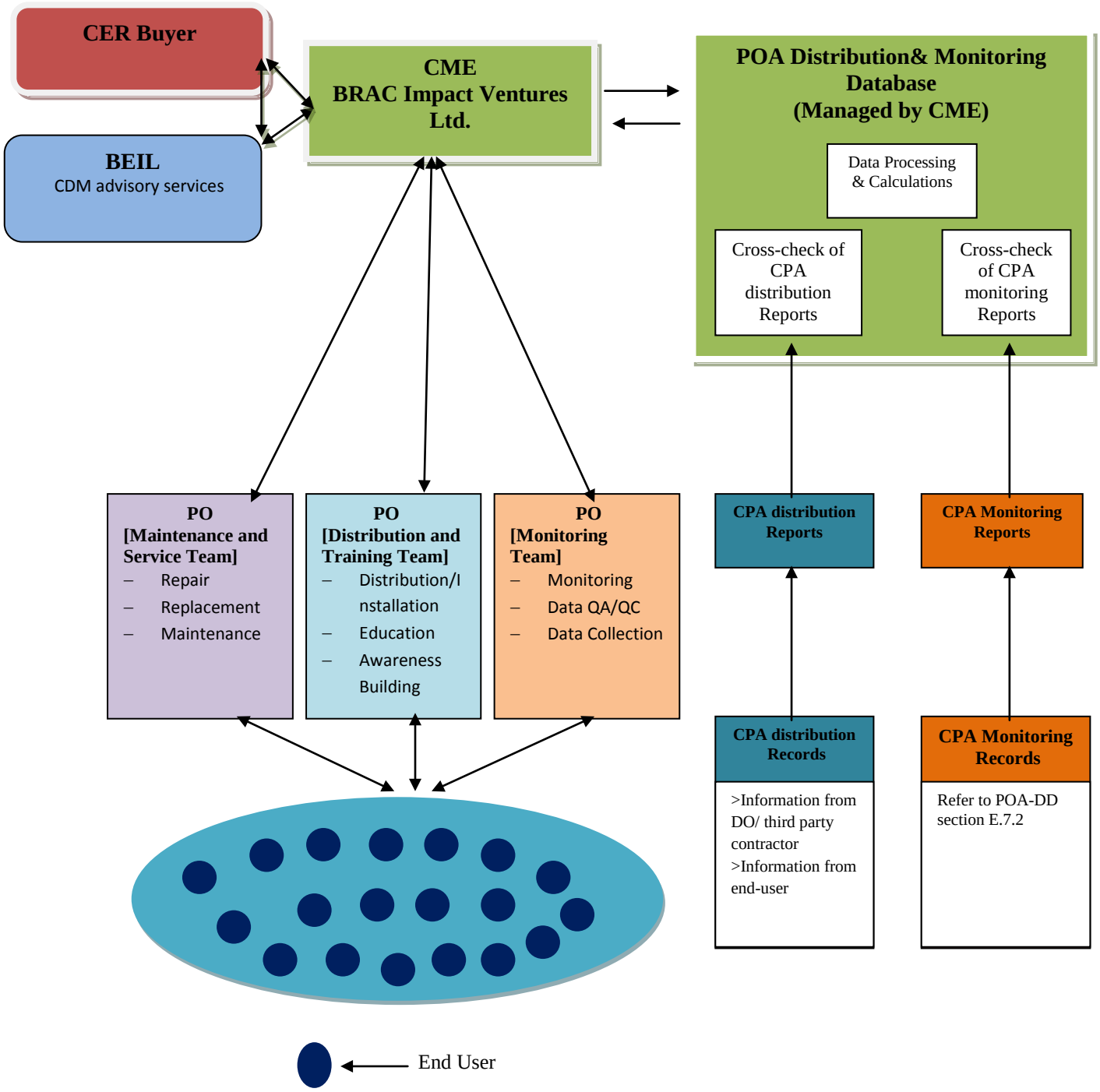
1. Distribution/Installation of water purification systems (WPS)
2. Education and Awareness building campaign including training on use of WPS
3. Monitoring of CDM parameters including surveys
4. Maintenance, repair and replacement activities

BRAC EPL Investment Ltd. (BEIL) is the CDM consultant of the POA and is responsible for the registration of the PoA and technical review during subsequent inclusion of CPAs including preparation of PoA-DD and CPA-DDs. BEIL will also provide advisory services to the CME during the monitoring and verification of the CPAs including preparation of Monitoring Reports.

The CME will operate a data management system that records information for each end-user. The data is collected by Partner Organizations (PO). The CME will ensure through regular check that data is collected sufficiently. Details of this process are described in the Operations Management Plan.

[22] Based on Non response rate of the Pilot Survey

The planned[23] organization structure of the CME is detailed below:



The management system will be govern by the Operations Management Plan prepared based on Para 19 of the "Standard for Demonstration of Additionality, Development of Eligibility Criteria, and Application of Multiple Methodologies for Programmes of Activities", Version 02.1, and is comprised of the following element:

[23] Subject to change

(a) A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;

The CME will assign a Program Manager for review and inclusion of CPAs under the PoA who will be reporting to the CEO. Further information on the responsibilities of the CME staff can be found in the Operations Management Plan section 2.3 and the competency requirements of the CME staff engaged in CPA inclusion process are provided in Appendix-5 of the PoA-DD.

During the initial stages of the PoA's roll-out, staff from the team that has participated in the development of the PoA and prepared the relevant documentation will be involved in ensuring that new SSC CPAs seeking inclusion in the PoA meet all the eligibility and applicability criteria set out in the PoA. The Technical review of inclusion of CPAs will be assisted by the BRAC EPL Investment Ltd, the CDM Consultant of the PoA.

Personnel involved in CPA inclusion process will preferably have a background in any of the following area such as engineering, economics, finance, public health, business administration or natural sciences etc. and experience in CDM project development will be preferable. New staff shall be deemed to be competent to manage the inclusion of CPAs only after having completed the *on the job* training and having included a CPA in this registered PoA as part of such training.

The training and capacity development activities for the CME staff on Technical review and CPA inclusion process shall be carried-out by experienced staff of BRAC EPL Investment Ltd. (The CDM Consultant) and/or by specialist carbon companies if deemed appropriate.

(b) Records of arrangement for training and capacity development for personnel;

The CME is responsible for arranging, with the help of technology providers (manufacturers or suppliers of water purification systems), training any PO staffs and/or contractors used during distribution, education and monitoring and maintenance activities. The CME will ensure training of all on-site staff with respect to adherence to the Monitoring Plan of the project activity. Records of the training will be kept. At the time of validation, the POA training and capacity development activities have not yet commenced. Training records and procedures will be provided to the DOE at the time of verification.

(c) Procedures for technical review of inclusion of CPAs;

The CEO of BIVL will designate appropriately trained technical staff (Program Manager) for technical review of the inclusion of CPAs seeking inclusion in the PoA, to ensure it meets all the relevant eligibility criteria specified in the PoA-DD before including it in the PoA.

The list of eligibility criteria which has to be satisfied by each CPA for inclusion of the CPA within this PoA are provided in section B.2 above. Program Manager will review and ensure that each CPA meets all the eligibility criteria in section B.2 and means of proof provided are adequate.

All documents required for validating the compliance with such eligibility criteria as stipulated in the PoA-DD are to be collected and checked by the Assistant Program Manager. The Assistant Program Manager is also responsible for gathering all the additional information and supporting evidence required to complete the corresponding CPA-DD for related CPAs. Although most CPAs will be directly implemented by the CME itself, if any CPA implementer other than the CME is involved, Assistant Program Manager should liaise with the CPA Implementer for information collection.

After performing a detailed technical review, the Assistant Program Manager will compile the information and the results of the review in the form of a technical report concluding whether the CPA is eligible to be included in the PoA or not. The Program Manager will do a final check and ensure that all necessary documents for the compliance check have been collected and verified. The CEO of BIVL will approve and sign off for the inclusion of CPAs if all conditions are satisfied.

All information pertaining to the CPA is stored in the CPA deployment Record, on the CME's Electronic Database system.

The Program Manager shall then prepare the corresponding CPA-DD package and assemble the set of supporting documents that will be presented to the validating DOE.

(d) A procedure to avoid double accounting (e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another PoA);

The inclusion of each household, water purification systems and each CPA in the record keeping system described below will prevent double counting of each CPA. Furthermore, all CPAs shall be implemented by the CME or a CPA implementer, confirming that:

1. Unique identification for each water purification systems under the CPA (D.7.2 of the CPA-DD) is utilized or geographical coordinates for stationary installations in the section A.7 of the CPA-DD is specified.
2. The implementer is aware of and agrees that the CPA is included in this PoA.
3. The implementer confirms that no emission reduction benefit from the project shall be claimed by it through any other instrument either as a standalone project or as a CPA to any other PoA.

(e) Records and documentation control process for each CPA under the PoA;

A record keeping system for each CPA under the PoA, the monitoring plan for this project is closely derived from the methodology. A database for the project activity will be maintained continuously. The monitoring plan shall consist of checking a representative sample of all appliances at least once every two years to ensure that they are still operating or are replaced by an equivalent in service appliance.

A project database will be maintained recording the distribution/installation of each water purification systems, subsequent replacements, as well as detailed data on the representative sample surveyed for monitoring purposes. The database will be accessible to the project proponent, appropriate partners, and the verification DOE. The database will include at minimum the following:

- Technology Type
- Unique identification numbers (UID) of water purification systems
- CPA ID numbers uniquely identified by range/list of UID of WPS[24]
- Distribution/Installation date
- Name, address, and contact information of the end-user
- Records of replacement or repair of water purification systems
- Monitored parameters as required by the methodology AMSIII AV

The database will be available to select a random, representative sample from for monitoring and verification purposes. This sample set will be integrated into the database to include additional monitoring parameters as required or as appropriate.

[24] CPA ID numbers will be available during CPA inclusion and UID of WPS will be available after deployment of WPS in rural households.

(f) Measures for continuous improvements of the PoA management system

BIVL shall continually improve the effectiveness of the PoA management system through the use of the internal audit, to be carried out once a year, of all the records of the distribution, monitoring and education activities, analysis of data, corrective and preventive actions if any shortcomings are found and management review. If the methodology and standard are updated, the PoA management system should be improved too.

SECTION D. Duration of PoA

D.1. Start date of PoA

22/08/2012. The start date will be determined by date on which Global Stakeholder Consultation of the POA has started through web hosting of POA-DD and specific CPA-DD in UNFCCC website.

D.2. Length of the PoA

28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

Environmental Analysis is done at SSC-CPA level.

E.2. Analysis of the environmental impacts

Not applicable. Environmental Analysis is done at SSC-CPA level.

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

The local stakeholder consultation process is performed at the PoA level.

Before taking the decision on the level of Stakeholder Consultation meeting, the CME identified the stakeholder involved in the Program. The potential stakeholders identified were

- Representatives of BEIL, BIVL, BRAC WASH
- Relevant Ministries: Water, public health, Environment
- DNA Representative (optional)
- Multilateral/Bilateral/Development Agencies such as World Bank, ADB, GIZ and other development Agency
- Country Experts in Water and Sanitation (optional)
- Representatives from rural households (Potential Project Beneficiaries from future CPAs)
- Local government representatives of CPA areas

The CME has identified that if stakeholder consultation was chosen at CPA level, only representatives from local authority and rural households will change across CPA and rest of the stakeholders will remain the same. Hence a Stakeholder Consultation meeting was chosen at POA level ensuring representation

from all type of stakeholders including representations from rural households and local governments from several potential CPA areas.

The stakeholder consultations were announced in several ways. First, a full list of potential stakeholders was compiled by the project participants that included Stakeholders mentioned in the above list. In most cases formal invitation letter was sent to the participants and received copies were obtained. In some cases stakeholders that had email addresses, invitations were sent via email. Many participants were also invited by phone and personal visits.

During the meeting general description of the program concept was delivered to the participants including a PowerPoint presentation on LifeStraw Family unit which will be deployed. Stakeholders were encouraged to provide input, Questions or comments or suggestions regarding the Program.

The consultation meeting was opened with program concept description and power point presentation on LifeStraw® Family unit from Javed Bin Karim , the CEO and Managing Director of BIVL (CME), followed up with remarks from the (1) Abdul Haque, Chairman, Jaintapur, Sylhet ,(2) Md. Hafezur Rahman Dhali, Union Parsishad (UP)[25] Chairman, Chandpur, (3) Alfatunnesa, UP Member, Laxmiprasad. East Kanaighat, Sylhet (4) Mahbub Alam, UP member Lengura, Gowainghat, Sunamganj (5) Masud Miah, UP Chairman, Joykolosh, Sunamgonj South (6) Md. Foyesuddin, UP Chairman, Laxmiprasad. East Kanaighat, Sylhet (7) Ratna Rani Das, WASH officer, Kanaighat, Sylhet (8) Salma Akter, adolescent girl, Chandpur. They expressed their confidence and hopes for a successful and sustainable deployment of LifeStraw® Family units in Bangladesh under the Program "Energy Efficiency Program in Rural Bangladesh", particularly in Sunamganj, Sylhet and Chandpur districts. All participants have acknowledged and expressed that substantial shortage of safe drinking water exists in their respective areas and most of the people cannot afford to collect/purchase firewood for boiling water prior to drinking water. They thanked BIVL for undertaking such a program which will mitigate safe drinking problems in their area and also will improve communities' health and livelihood. After the introductory remarks a comprehensive question and answer (Q&A) session was carried out followed by closing remarks from Dr. Babar Kabir, Senior Director BRAC WASH program stating that BRAC WASH program will extend their support to CME in deployment of LifeStraw® Family unit, conducting training, Education and Awareness Campaign and monitoring.

All stakeholder comments have been compiled and accounted for in the Local Stakeholder Consultation Report and are summarized below

F.2. Summary of comments received

In general, all participated stakeholders in the forum fully support the Sustainable Deployment of LifeStraw® Family units in Bangladesh under the Program "Energy Efficiency Program in Rural Bangladesh"

The comments received from stakeholders could be categorized into three categories as follows: (1) expressing commitment to support the Sustainable Deployment of LifeStraw® Family units; (2) concern on proposed activity; (3) health and environmental impact of the project and; (4) project contribution to local employment and economy. Stakeholder comments and how due account was taken are summarized in section F.3 below.

[25] A Union is the lowest tier of local government system in Bangladesh as defined by the Local Government (Union Parishad) Act, 2009. Union Councils (aka *Union Parishad*s or just *Union*) are the smallest rural administrative and local government units in Bangladesh (http://en.wikipedia.org/wiki/Union_Councils_of_Bangladesh)

F.3. Report on consideration of comments received

Comments Received from Stakeholder's	Was comment taken into Account (Yes/ No)?	Explanation
Md. Hafezur Rahman Dhali, Union Parsishad (UP) Chairman, Chandpur He said that his district is the most highly arsenic affected area of the country and hence access to safe drinking water is low. People who can afford are boiling surface water with firewood but most people cannot boil because they are unable to collect or cannot afford to purchase firewood. He added that cutting down trees to collect firewood has adverse affect to the environment. He also commented that the LifeStraw Family unit has three years life time but the project will be for 10 years. So he has concerns whether the filters will be replaced and what will be the nature of after sales service. Will there be any service centre, if yes at which level. Also whether classification in respect of income will be considered to select the beneficiaries who will receive the filters	Yes	Mr. Javed Bin Karim, CEO and Managing Director of BIVL (CME) confirmed that Service centres would be established once the project is registered and filters are deployed. Service centres will provide free of cost replacement, repair and maintenance services, Service centres will be established at union level, if level of complaint is high then service centres may be further extended to village level. The CME will try to cover most of the households within a particular CPA area. However, CME will consider highest priority to the ultra-poor and poor households.
Ayub Khan, UP Chairman, Jagannathpur, Sunamganj He has commented that deployment of complementary water filter will improve access to safe drinking water of the rural households, most of which are energy strived with low income. He has asked about the timeline of physical implementation of the project, more specifically, when the LifeStraw will be deployed in the rural community?	Yes	Mr. Shaymal Barman, CDM Consultant, BRAC EPL Investment Ltd. has responded that the project will be developed under Clean Development Mechanism of UNFCCC. The project has to follow the CDM procedures as defined by UNFCCC. The deployment can only be done after the successful registration of the project since the cost of the filters and all associated costs of monitoring activities including replacement, repair and maintenance and all education and awareness building activities can be recovered through only CER revenue. It is expected that the Registration of the project may be achieved by January

		2013. Hence the earliest deployment of the filters is expected to start from January 2013.
Abdul Haque, Chairman, Jaintapur, Sylhet He expressed that there are 22 villages in his area and that the inhabitants are suffering from lack of safe drinking water and as a consequence are affected by chronic diarrhea. The places are very remote and it is difficult to hospitalize the diarrhea patients. Peoples are not aware of advantage of boiling and also they do not have adequate income to meet the firewood consumption required for boiling. He opined that awareness campaign at the rural level is highly important.	Yes	Mr. Javed responded that BIVL will undertake Education and Awareness campaign at each village level with the assistance from BRAC WASH program. Through this campaign the CME will increase awareness of health benefits from proper use of the LifeStraw filters and also impart training on how to properly use the LifeStraw Family units.
Mirza Shawkat Ali, Representative from DNA Bangladesh (Deputy Director, Department of Environment) Mr. Shawkat said he was pleased to be informed about the Programmatic CDM project and said that required support from the CDM DNA Secretariat Bangladesh will be provided for the approval of the project. He emphasized the necessity of meeting the sustainability criteria stated by the CME and also he suggested monitoring the benefits specially the health benefits.	Yes	Mr. Javed responded that BIVL has provided all contribution to sustainable development in the POA-DD showing that the project meets all the sustainable development criteria. He also informed the floor that BIVL, in association with BRAC, is developing a health impact monitoring methodology to monitor health benefits.
Syed Anwar, Assistant Director, Department of Environment He asked the CME regarding the Project boundary of the Program and will it only be limited to Sunamganj, Sylhet and Chandpur area. He also suggested that the south part of the country Faridpur, Shariatpur etc are in the flood zone and access to safe drinking water is less. He suggested the CME to also consider deploying of filters in those areas.	Yes	Mr. Javed responded that The boundary of the Program is the geographical boundary of Bangladesh. BIVL is now concentrating on Arsenic affected districts where access to safe drinking water is below 60%. If the methodology allows, the CME wants to scale up their project to all districts of Bangladesh.
Alfatunnesa, UP Member, Laxmiprasad. East Kanaighat, Sylhet She informed that people are suffering due to lack of safe drinking water. Most of the people have no choice but to drink unsafe water from river and other surface water sources and suffering from water borne diseases. She describes a real incident where a mother has died of diarrhea and her five	Yes	Mr. Javed informed her that BIVL will try to reach most of the families in a village. Since the maximum filter per CPA is limited by the small-scale threshold limit. In a typical CPA the filter number can vary from 25,000-35,000. Through Education and Awareness

children is now orphan. She requested BIVL to prevent this kind of unfortunate incidents by deploying LifeStraw filters. She was concerned about how many filters will be distributed per village and per union level.		Campaign BIVL will try to increase awareness on health benefits of using LifeStraw units thus reducing premature deaths.
Nazrul Islam, BRAC Wash Program He suggested that training may be required for the villagers on how to use the filters	Yes	Mr. Javed confirmed that during the deployment phase initial training on how to use the filters will provided to each household. And also once in every two months each household will be visited to check proper use of filters. So there will be a continuous training and feedback process for each household.
Ratna Rani Das, Sylhet She said that her village is very remote and close to river, women travel 2-3 kms to collect water. She thanked BRAC. She also raised his concern that one filter may not be adequate for a large family of 10+ members.	Yes	Javed Bin Karim responded that depending on the family size and based on actual need determined by monitoring data the CME will consider providing more than one filter to a large family.
Anarkoli, Sunamgonj South She was concerned treating river water may clog the filter and after How long it should be washed?	Yes	Mr. Javed told that depending on the quality of the water each day or once in consecutive two days the filter has to back washed and clean. Detail procedure will be shown to each household during training session.
Ajay Kumar Paul, BRAC WASH Mymensingh He wanted to know the difference between purifying tube well water and river water.	Yes	Mr. Javed, responded that depending on the suspended solid matter and turbidity in the water filtration time will vary. So in case of tube well water the filtration time will be much less than river water.
Shafiqur Rahman, BRAC WASH Manager, Sylhet He asked that whether Arsenic could be treated by LifeStraw Family units?	Yes	Mr. Karim responded that LifeStraw Family units only work to eliminate Bacteria and other micro biological substances. It was not designed to treat chemical toxicity or hardened water. The objective of utilizing the filter is to substitute boiling. He confirmed that this will also be communicated during Education campaign. In Arsenic affected areas people will be able to use the filter water from river and pond hence dependency on underground water will be reduced.

SECTION G. Approval and authorization

The CME has received the formal revised Letter of Approval which includes CME authorization from Designated National Authority (DNA) Bangladesh on 1st January 2013.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

The CPA involves the [insert CPA specific info: installation or distribution] of an estimated [insert CPA specific info: No of Units] [insert CPA specific info: type of water purification systems example: LifeStraw® Family units version 2.0] in the following geographical area of Bangladesh

[Insert CPA specific info: Location details of the CPA[26]
Example:

Unions[27]	Sub district	District

]

The CPA will be coordinated and managed by BRAC Impact Ventures Limited, (BIVL) , the CME of the POA.[Insert CPA specific info: The name and role of the CPA Implementer]. [Insert CPA specific info: The name and role of the Partner Organizations]

[Insert CPA specific info: Technology description including the minimum of the following

A. WPS Technology description

i. Type of purification technology,
ii. Type of units,
iii. Working principal,

B. Model description

i. Commercial name of the units,
ii. Short technical description,
iii. Use and maintenance
iv. Capacity or life time,
v. Definition of operational unit,
vi. Indicator of when to replace/repair the water purification system,
vii. Performance and certification (if any)
viii. Target Group
ix. Type of Energy used

SECTION B. Application of a baseline and monitoring methodology

B.1. Reference of the approved baseline and monitoring methodology (ies) selected

Selected Methodology / Methodologies:

AMS-III.AV Low greenhouse gas emitting safe drinking water production systems, Version 03, EB 69

[26] The lowest administrative division(s) of the Host Country where no other CPA will be involved shall be used to described the specific CPA location

[27] A Union is the lowest tier of local government system in Bangladesh as defined by the Local Government (Union Parishad) Act, 2009

Associated Methodologies and/or Tools that the selected methodology refers:

- AMS I.E. Switch from non-renewable biomass for thermal applications by the user, Version 05, EB 68

Since the PoA involves distributing only zero emission WPS, the following tools are not used

- Tool to calculate baseline, project and/or leakage emissions from electricity consumption, Version 01, EB 39
- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, Version 02, EB 41

B.2. Application of methodology (ies)

Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

Each CPA operates under *AMS-III.AV* and is required to satisfy the following criteria from section A (B.2), above:

Sl. no	Applicability condition of the Methodology	Eligibility Criteria	CPA Applicability
1	This methodology comprises introduction of low greenhouse gas emitting water purification systems to provide safe drinking water (SDW). Water purification technologies that involve point-of-use (POU) or point-of-entry (POE) treatment systems for residential of institutional applications such as systems installed at a school or a community centre are included. The examples include, but are not limited to water filters (e.g. membrane, activated carbon, ceramic filters), solar energy powered UV (ultraviolet) disinfection devices, solar disinfection techniques, photo catalytic disinfection equipment, pasteurization appliances, chemical disinfection methods (e.g. Chlorination), combined treatment approaches (e.g. Flocculation plus disinfection) etc	1,10	Each CPA will distribute/install zero emission water purification technologies that involve POU or POE treatment systems for residential or institutional applications.
2 (a)	Prior to the implementation of the project activity, a public distribution network supplying safe drinking water does not exist. If during the crediting period SDW is made available the emission reductions pertaining to the households/buildings supplied by the public system cannot be claimed from that point onwards. This condition should be checked annually during the crediting period;	2	Each CPA will check and provide adequate proof that prior to the implementation of the project activity, a public distribution network supplying safe drinking water does not exist in the CPA area. Current Situation of existence of public distribution network supplying safe drinking water in Bangladesh is described in Appendix 3.
2 (b)	It shall be demonstrated based on laboratory testing	3	Each CPA will employ

	or official notifications (for example notifications from the national authority on health) that the application of the project technology/equipment achieves compliance either with: (i) at a minimum the performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications" (WHO, 2011); or (ii) an applicable national standard or guideline.		water purification systems which will achieve compliance with a water quality standard as defined in section B.2 of part I, Eligibility criteria 3, i.e. Each CPA shall specify the Standard or Guidelines to which water purification technologies involved in that CPA will comply by means of any of the following: i)Laboratory testing ii)Official Notification (for example notifications from the national authority on health)
2 (c)	In cases where the life span of the water treatment technologies is shorter than the crediting period of the project activity, there must be documented measures in place to ensure that end users have access to replacement purification systems of comparable quality.	4	Each CPA will comply with the Monitoring Plan and Operation Management Plan where documented measures will be in place to ensure that end users have access to replacement purification systems of comparable quality
3	Applicability of this methodology is foreseen in the following types of situations that shall be reassessed at the beginning of each crediting period: (a) Case 1: Project activities implemented in rural or urban areas of countries with proportion of rural or urban population using an improved drinking-water source equal to or less than 60%, confirmed by (i) Proportion of populations using an improved drinking-water source for the most recent year for which data is available from WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation shall be used (<http://www.wssinfo.org/data-estimates/table/>) for this purpose. Definition of improved and unimproved drinking water source shall be as per the information provided by JMP; (ii) using official data such as publicly available statistical data from a government agency or an independently commissioned study by an international organization or an university; or	5	Prior to inclusion of the CPA it will be assessed whether the CPA belongs to (Case 1) or (Case 2) situation

	(iii) Using survey methods (using 90/10 confidence/precision for sampling) (b) Case 2: Project activities implemented in areas not included in Case 1.		

Small Scale Project Type:

Each CPA emission reduction per year will remain within the small-scale threshold of 60,000 tCO_2e, as defined by Type III methodologies[28]. Hence each CPA qualifies as Small Scale Type III during every year of the crediting period in accordance with applicable provisions for project activity eligibility in the Project standard.

B.3. Sources and GHGs

As defined in the methodology, the project boundary includes the physical, geographical sites of the low greenhouse gas emitting technologies for water purification installed by the project activity and the household/institutional buildings where the consumer of safe water provided by the systems are located. The sources and gases included in the SSC-CPA boundary are shown in the table below:

	Source	Gas	Included?	Justification /explanation
Baseline	Emissions from fossil fuels/NRB utilized or fossil fuels/NRB that would be utilized for obtaining safe drinking water displaced due to project activity	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions
		N_2O	No	Minor source of emissions
Project Emission	Emissions from consumption of fossil fuels and/or electricity for the operation of the project activity	CO_2	No	Technologies with project emissions are not eligible in this PoA.
		CH_4	No	
		N_2O	No	

B.4. Description of baseline scenario

In accordance with the methodology[29], for a simplified and standardized approach it is assumed that fossil fuel or non-renewable biomass (NRB) is used to boil water as means of water purification in the absence of the project activity.

The emissions are calculated based on the energy demand for boiling water, and in case of displacement of NRB the baseline emissions are corrected for the fraction of the biomass that can be demonstrated to be non-renewable.

Section *3.7 Share and purposes of fuels* of the report titled" An Analysis of Cross-sectional Variation in Energy Consumption Pattern at the Household Level in Disregarded Rural Bangladesh"[30] states the following.

- Biomass fuels contributed about 93% in household total primary energy consumption.

[28] Page 17, clause 81(c), Clean development project standard, Version 03.0
[29] AMS-III.AV. Low greenhouse gas emitting water purification systems, Version 03, EB69
[30] http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%202(4)3949-3963,%202012.pdf

- Commercial fuels[31]amounted approximately 7% of household energy supply of which the share of 3.5% from grid electricity and 3% from kerosene, while candle and LPG together constituted nearly 0.5%.[32]
- Except LPG, all commercial fuels are used for lighting purpose. LPG is used for household cooking. The report also stated that the use of LPG as primary cooking fuel was non existence among the rural households in the study areas except in some rich households[33] who exclusively used LPG mainly for tea preparation, milk simmering, and heating of food [34].
- The rural households did not report use of kerosene stove for cooking.
- Nevertheless, all biomass fuels were used for household cooking, rice parboiling and for other uses such as water boiling, jaggery making, and food preparation for livestock.[35]

The methodology states that emissions are calculated based on the energy demand for boiling water and LPG demand for boiling water does not exists in rural Bangladesh, Hence substantially insignificant use of LPG (0.5%) only by some rich households for specific purposes other than boiling is not considered as baseline energy use/demand under the PoA.

No specific survey relating to the usage of energy for the practice of boiling water has been conducted in Bangladesh. In order to identify the pattern of fuel use by rural households for boiling water prior to drinking a Study Report titled "Rural household energy consumption pattern for boiling water prior to drinking in Bangladesh" was prepared by Impact Investment Department of BRAC EPL Investment Ltd., based on data collected by BRAC's Water, Sanitation, & Hygiene (WASH) program. The key finding of the study is as follows:

- Rural households predominantly use Firewood as the primary fuel source for cooking as well as boiling.
- Other forms of biomass such as Tree Branches, Crop Residue, Tree Leaves and Cow dung are also used for albeit in combination with Firewood thus making the later the most popular choice among the surveyed households. However, in comparison to cooking, the use of other biomass types is substantially lower for boiling.
- In addition, Fossil fuels such as Kerosene, LPG/LNG & Natural Gas were amongst the least used fuel indicating a complete zero percent usage for cooking and boiling.

Since, fossil fuel is not available and/or not used for boiling water prior to drinking in the rural areas of Bangladesh, for all CPAs under the PoA to be implemented in rural areas, it is considered that in absence of the project activity, firewood would be utilized. Therefore the baseline scenario is the use of firewood to boil water.

Three primary variables/parameters are identified in establishing the baseline: (1) quantity of purified water (QPWy), (2) the fraction of woody biomass used in the absence of the project activity that is non-renewable ($f_{NRB,y}$), and (3) the efficiency of the water boiling system (η_{wb}).

(1) **QPWy** –

The quantity of purified water is the total amount of water treated by the project activity in year y and should be directly monitored.

[31] Ibid, page 3956, section 3.7 Share and purposes of fuels
[32] Ibid, page 3956, section 3.7 Share and purposes of fuels
[33] Ibid, page 3959, 2nd line of the first paragraph
[34] Ibid, page 3952 section 3.2 Type of fuels, last line
[35] Ibid, page 3956, section 3.7 Share and purposes of fuels

Alternatively,
For Case 1, it should be based on
(a) the population serviced by the project Equipment, estimated using surveys
(b) an average volume of drinking water per person per day estimated using surveys or official data or peer reviewed literature or local expert opinion (a value of 5.5 litres per person per day shall not be exceeded).

For Case 2 Total project population needs to be adjusted for the fraction of the population serviced by the project equipment/households/buildings for which it can be demonstrated through documentation or survey that practice of water purification would have been water boiling.

Case 1 project activities occur in areas where the population using an improved drinking -water source is equal to or less than 60%. Case 2 covers project activities where this percentage is greater than 60%. Some CPAs may apply case 1 and some may apply case 2;

In this generic CPA type, for both Case-1 and Case-2 scenario, alternative to direct monitoring will be used i.e. survey and sampling method will be applied as per the methodology described above.

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

The fraction is 0.9 which is determined as per AMS I E version 04 using the guidance provided by EB 67, Annex 22, "Default values of fraction of non-renewable biomass for least developed countries and small island developing States". For $f_{NRB,y}$ calculation please see Appendix 4

(3) η_{wb} - Efficiency of the water boiling systems being replaced.

Most rural households in Bangladesh use three stone cook stoves or traditional cook stove[36]. This is usually a mud-built cylinder with three raised points on which cooking utensils rest and do not use any grate or chimney. One space in between these raised points is used as fuel feeding port and the other two for flue-gases exits. The stove may be built under or over ground. In some case, two potholes are joined together laterally using a single fuel-feeding port. The stoves perform sub-optimally due to loss of heat and the following reasons:

1. Because of too large distance between the pot and fuel bed, depth ranging from 30-60 cms., heat transfer to the cooking pot is considerably reduced.
2. Because of large size of the flue-gases exits between the cooking pots and the stoves, much of hot flue-gases get out of the stove without coming in contact with the cooking pot and lowering convicting heat transfer.
3. Since air cannot reach the bottom of the stove, considerable amount of cooking fuel accumulate at the bottom as charcoal.

The main problems of traditional stoves are following:

a) The efficiencies of these stoves vary from 5-15% [37] (10% on an average) depending on the depth and diameter of the stove and size of the flue-gas exits.

[36] Inception Report: Bangladesh: Addressing Indoor Air Pollution; Village Education Research Center & Winrock International; Sponsored by World Bank. Weblink: http://www.lged-rein.org/indoor_air_pollution/VERC-Inception-Report.pdf
[37] Page 3; Inception Report: Bangladesh: Addressing Indoor Air Pollution; http://www.lged-rein.org/indoor_air_pollution/VERC-Inception-Report.pdf

b) In the *traditional* stoves because of incomplete combustion of biomass fuels appreciable quantities of *irritants, toxins* and *carcinogens* are released in the Kitchen environment and these pose a major threat to the respiratory system of the users.

In general, the combustion products of wood are *carbon dioxide, water vapour* and *carbon monoxide*, *particulates* and *polycyclic organic matters*. The last three are known to be pollutants hazardous to human health.

Hence choice of a default value of 0.1 for all traditional cook stoves will be appropriate since conventional water boiling systems in Bangladesh for woody biomass is lacking improved combustion air supply mechanism and flue gas ventilation system i.e. without a grate as well as a chimney. This assumption is also consistent with the registered PoA-DD "Improved Cook stoves in Bangladesh"[38]

With a population of approximately 160 million people, Bangladesh is one of the world's most densely populated countries. There are currently 25,535,877 rural households in Bangladesh.[39]

Despite the large numbers projected on potential use of improved cook stoves in Bangladesh, due to existence of significant barriers including resistance to behavioural changes, weak economic drivers' etc. penetration of improved cook stoves in rural Bangladesh is still very low.

Currently, it is estimated that approximately 510,000 [40] efficient cook stoves have been deployed throughout Bangladesh by way of both commercial and philanthropic initiatives. This represents a penetration rate of less than 2% (approximately 1.83%). Moreover, except for the ICS units deployed under the Grameen Shakti CDM PoA, there does not seem to be any credible ongoing monitoring program associated with the various ICS programmes in Bangladesh which prove daily use of the ICS by the recipients. To date; efforts in the sector have not yet attained expected success in creating a sustainable market for stoves. Grameen Shakti and GIZ operate two of the largest ICS programs in the country and have projected further growth in the years to come. However, anecdotal evidence suggests that many other stove producers are still struggling to overcome the market barriers. Major operators in this improved cook stove sector include Grameen Shakti, GIZ, BSCIR, VERC, and UNDP-UN Habitat. [41]

The above mentioned number of cook stoves includes approximately 40,000 [42] cook stoves deployed by UNDP-UN Habitat (Urban Poverty Reduction Program), for urban use only, as it is an urban poverty reduction initiative. Although majority of the rest of the 470,000 cook stoves may be deployed in rural households it may also includes urban households and commercial cook stoves. Only Grameen Shakti (GS) is disseminating ICS units through CDM project. According to the Monitoring Report of GS's PoA CDM project at present they have sold 56,729 [43]cook stoves and the reported average efficiency of the cook stoves were 0.1966[44] (i.e. appx. 20%).

The Bangladesh cook stove market began in the 1970s, with Bangladesh Council of Scientific and Industrial Research (BCSIR). This government organization developed the first improved cooking stove (ICS) design. They deployed the first major deployment of "chulha" stoves, a model created by BCSIR.

[38] 4791:PoA-DD "Improved Cooking Stoves in Bangladesh" Section E.6.3 http://cdm.unfccc.int/ProgrammeOfActivities/poa_db/SE7XIMKF8NYVOTL16BW3U45C9ZDGAP/view
[39] [39] POPULATION AND HOUSING CENSUS 2011 SOCIO-ECONOMIC AND DEMOGRAPHIC REPORT NATIONAL SERIES, VOLUME - 4 http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/BBS/Socio_Economic.pdf
[40] Page 5, *Global Alliance for Clean Cookstoves Bangladesh Market Assessment Sector Mapping*. Rep. Accenture, Apr. 2012. Web. <http://www.cleancookstoves.org/resources_files/bangladesh-market-assessment-mapping.pdf>.
3Ibid, Page 54,
[42] Page 2, Executive summary, of UPPRBD Annual report 2011.pdf
[43] http://cdm.unfccc.int/filestorage/C/P/A/CPA4791-001_MR_version_01.1.pdf/Monitoring%20report.pdf%27%5D?t=RVN8bWt5ajNyfDCcN7LsJS5G66gn4bwfI8LQ
[44] Ibid page 10, Section D3

These "chulha" stove designs are now the blueprint design for almost all biomass ICS models that are currently used in Bangladesh. [45]

According to methodology AMS III AV weighted average value is applied for the PoA for different water boiling systems encountered.

Particulars	Numbers	Efficiency	Source/Reference
Traditional Cookstoves	25,065,877	0.10	AMS III AV
ICS	470,000	0.20	AMS III AV
Rural Households	**25,535,877**	**0.10184**	**Weighted average**

Based on the above arguments, a weighted average efficiency of 0.1018 for the water boiling systems being replaced in the PoA will be considered.

B.5. Demonstration of eligibility for a generic CPA

Each SSC CPA must meet the eligibility criteria and such confirmation has to be documented with evidence before inclusion of the CPA in the Program.

A list of eligibility criteria for each CPA, along with a demonstration of how that criteria is met, is provided in the PoA-DD, section B.2.

Assessment and demonstration of additionality of the small-scale CPA, as per eligibility criteria listed in the Registered PoA:

Clean development mechanism project standard, version 03.0 para 155 states that "The coordinating/managing entity shall consider that a full additionality assessment is not required in the context of CPA. Instead, the confirmation of additionality for CPAs should be conducted by means of the eligibility criteria. Hence, the assessment of additionality of each SSC-CPA to this PoA shall be evaluated on the basis that if the proposed SSC-CPA meets the key criteria (criteria 8, 10 and 15), detailed in POA-DD Section B.2, the SSC-CPA shall be deemed additional.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

Baseline emissions:

The baseline emissions shall be calculated as follows:

$$BE_y = QPW_y \times SEC \times f_{NRB,y} \times EF_{Projected\_fossilfuel} \times 10^{-9} \quad \textbf{(1)}$$

Where:

BE_y Baseline emissions during the year *y* in (tCO2e)

QPW_y Quantity of purified water in year *y* (litres)

[45] Page 1, *Bangladesh: Draft Market Assessment Executive Summary*. Rep. Accenture, n.d. Web. <http://www.cleancookstoves.org/resources_files/bangladesh-executive-summary.pdf>.

	Some CPAs may apply case 1 and some may apply case 2[46]; The quantity of purified water is the total amount of water treated by the project activity in year *y*. It should be directly monitored. Alternatively, For case 1, it should be based on (a) the population serviced by the project equipment, estimated using surveys and (b) an average volume of drinking water per person per day estimated using surveys or official data or peer reviewed literature or local expert opinion (a value of 5.5 litres per person per day shall not be exceeded) For case 2 total project population needs to be adjusted for the fraction of the population serviced by the project equipment at households/buildings for which it can be demonstrated through documentation or survey that the practice of water purification would have been water boiling
SEC	Specific energy consumption required for boiling one litre of water (kJ/L)
$f_{NRB,y}$	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non renewable as per the relevant provisions of AMS-I.E "Switch from Non-Renewable Biomass for Thermal Applications by the User". If the displaced fuel is fossil fuel use a default value of 1.0 If a mixture of woody biomass and fossil fuels is used in the absence of the project activity, a weighted average value (e.g. based on the energy content of the fuels consumed) should be used. All CPAs implemented in rural areas will use a fraction 0.9 as $f_{NRB,y}$, Justification is provided in section B.4 and Appendix 4.
$EF_{projected\_fossilfuel}$	Emission factor as per AMS-I.E procedures when NRB is displaced or the emission factor of the fossil fuel substituted (tCO2/TJ)

Specific energy consumption required to boil one litre of water is to be calculated as follows:

$$SEC = \left[WH \times \left(T_f - T_i\right) + 0.01 \times WHE\right] / \eta_{wb} \quad \textbf{(2)}$$

Where:

WH	Specific heat of water (kJ/L °C) Use a default value of 4.186 kJ/L °C
T_f	Final temperature (°C) Use a default value of 100 °C[47]

[46] Definition of Case 1 and Case 2 has been defined in AMS-III.AV. Low greenhouse gas emitting water purification systems, Version 02, EB62
[47] Boiling point of water at standard conditions

T_i Initial temperature of water (°C)
Use annual Average ambient temperature;[48] or
Use a default value of 20 °C

WHE Latent heat of water evaporation (kJ/L)
Use a default value of 2260 kJ/L

The latent heat required to boil one litre of water for five minutes is assumed to be equivalent to latent heat for the evaporation of 1% of the water volume (WHO recommends a minimum duration of five minutes of water boiling)[49]

$\acute{\eta}_{wb}$ Efficiency of the water boiling systems being replaced

The options are as below:

(1) The efficiency of the water boiling system shall be established using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of systems are encountered;

(2) 0.10 default value may be optionally used if the replaced system or the system that would have been used is a three stone fire or a conventional system for woody biomass lacking improved combustion air supply mechanism and flue gas ventilation system i.e. without a grate as well as a chimney; for the rest of the systems using woody biomass 0.2 default value may be optionally used

(3) 0.5 default value may be used if the replaced system or the system that would have been used is a fossil fuel combusting system

All CPAs implemented in rural areas will choose weighted average value of 0.1018 as per option (1) and using default values (2) above, Justification is provided in section B.4

Calculation of QPWy will be as follows

$$QPW_y = (QPW_{lppd,y} \times N \times 365) \quad \textbf{(3)}$$

Where,

$QPW_{lppd,y}$ = Average quantity of purified drinking water consumed by per person per day in litre which is capped at 5.5 litre per person per day (lppd)
N = Total population serviced by the project equipments

$$N = \left(WPS_{n.y} \times FRAC_{OC}\right) \times (n \times FRAC_{PDN} \times FRAC_{WB}) \quad (4)$$

Where,

WPS n,y = Total number of water purification systems in year y
$FRAC_{OC}$ = Fraction of water purification systems that are operational requirements of the

[48] Ambient temperature data must be from globally accepted data sources, e.g. data published by the National Aeronautics and Space Administration (NASA) or the National Renewable Energy Laboratory (NREL).Data can be used only if they are for a location that can be demonstrated to be representative of the project location.
[49] WHO guidelines for Emergency Treatment of drinking water at point of the use http://www.searo.who.int/LinkFiles/List_of_Guidelines_for_Health_Emergency_Emergency_treatment_of_drinking_water.pdf>.

methodology

$FRAC_{PDN}$ = Fraction of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network

n = Average Number of persons supplied with purified water from each of the Water Purification Systems

$FRAC_{WB}$ = Fraction of total population serviced by the project equipments for which the practice of water purification would have been water boiling (For Case 1 a value of 1 will be applied)

Project emissions

In case the operation of the project water purification system does not involve consumption of fossil fuels and/or electricity (i.e. for zero emission water purification technologies) therefore project emissions is considered zero.

The Project emissions shall be as follows:

$PE_y = 0$

Leakage emissions

Where relevant leakage relating to the non-renewable woody biomass shall be assessed as per the relevant procedures of AMS-I.E. In accordance with that methodology, option (a), ER_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

All equipment to be used in the proposed project activity will be purchased new, and will not be transferred from another activity. There is currently no existing equipment at the sites (relating to water treatment) that can be transferred to another activity. Moreover, there is no incentive for the end users to sell their water boiling systems since they will continue to use them for cooking purposes. Thus, leakage from baseline equipment transfers does not apply. Furthermore, in accordance with the decision made at EB44, this issue no longer needs to be considered in SSC methodologies.

Emission Reduction Calculation

$$ER_y = (BE_y - PE_y) \times L_y \quad (5)$$

Where,

ER_y = Emission Reduction in year y in (tCO2e)

L_y = Leakage Emission adjustment factor in year y
= 0.95

B.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	$f_{NRB,y}$
Unit	[fraction]
Description	Fraction of biomass used in the absence of the project activity in year y that can be established as non renewable
Source of data	Source of data is provided in Appendix 4
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	In line with the Information Note "Default values of fraction of non-renewable biomass for least developed countries and small island developing States", version 01.0 and the procedure to determine the non-renewability of biomass contained in AMS-I.E. Please see the Appendix 4
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	WH
Unit	kJ/L °C
Description	Specific heat of water
Source of data	AMS.III.AV , Version 03, EB69
Value(s) applied	4.186
Choice of data or Measurement methods and procedures	Default value from the methodology AMS.III.AV
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	T_f
Unit	°C
Description	Final temperature of water
Source of data	AMS.III.AV , Version 03, EB69
Value(s) applied	100
Choice of data or Measurement methods and procedures	Default Value as stated in AMS.III.AV, this is the boiling point of water at standard conditions.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	T_i
Unit	°C
Description	Initial temperature of water
Source of data	AMS.III.AV , Version 03, EB69
Value(s) applied	20
Choice of data or Measurement methods and procedures	Default value, as stated in AMS.III.AV, this is the ambient temperature of water at standard conditions.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	WHE
Unit	kJ/L
Description	Latent heat of water evaporation
Source of data	AMS.III.AV , Version 03, EB69
Value(s) applied	2260
Choice of data or Measurement methods and procedures	Default value as stated in the methodology. The latent heat required to boil one litre of water for five minutes is assumed to be equivalent to latent heat for the evaporation of 1% of the water volume as per AMS.III.AV Version 03, EB69
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	η_{wb}
Unit	%
Description	Efficiency of the baseline water boiling systems
Source of data	AMS-III.A.V Version 03, EB69
Value(s) applied	0.1018
Choice of data or Measurement methods and procedures	Weighted average value is calculated using default values for different water boiling systems as per the Methodology AMS III AV. Refer to Section B.4 of the PoA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	*EF projected _ fossilfuel*
Unit	tCO2/TJ
Description	Emission factor as per AMS-I.E procedures when NRB is displaced or the emission factor of the fossil fuel substituted
Source of data	AMS-I.E for NRB displacement, IPCC for other fossil fuel displaced
Value(s) applied	81.6
Choice of data or Measurement methods and procedures	As per AMS-I.E, this value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. Refer to section B.4 of the PoA-DD, only NRB is displaced in the baseline and hence emission factor for NRB displacement is used.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$FRAC_{wb}$
Unit	Fraction
Description	The fraction of the population serviced by project equipment at household/buildings for which the practice of water boiling would have been water boiling.
Source of data	Using survey methods (using 90/10 confidence/precision for sampling)
Value(s) applied	Default value of 1.0 is applied for Case 1 CPAs; For Case 2 CPAs, value is based on ex ante baseline surveys.
Choice of data or Measurement methods and procedures	According to AMS-III.AV, Version 03, EB69 for Case 1 CPAs, no adjustment to total project population is required and therefore is set to 1.0. For Case 2 CPAs ex-ante surveys will be carried out to determine what percentage of the population would boil water prior to drinking
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	Ly
Unit	Fraction
Description	Leakage Emission
Source of data	Default Value from AMS-I.E Version 05
Value(s) applied	0.95
Choice of data or Measurement methods and procedures	ER_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.
Purpose of data	Emission Reduction Calculation
Additional comment	

B.6.3. Ex-ante calculations of emission reductions

Emissions reductions Calculation
Emissions reductions will be calculated as:

$ER_y = (BE_y - PE_y) \times L_y$

Where

ER_y = Emission Reduction in Year y
BE_y = Baseline Emission in Year y
PE_y = Project Emission in Year y
L_y = Leakage

$$SEC = \left[WH \times \left(T_f - T_i\right) + 0.01 \times WHE\right] / \eta_{wb}$$

= [4.186 × (100-20)+0.01× 2260]/0.10184
= 3510.21 kJ/L

$$N = \left(WPS_{n.y} \times FRAC_{OC}\right) \times (n \times FRAC_{PDN} \times FRAC_{WB})$$

= (CPA Specific data)

$$QPW_y = (QPW_{lppd,y} \times N \times 365)$$

= (CPA Specific data) in liters

$BE_y = QPW_y \times SEC \times f_{NRB,y} \times EF\ projected\_fossilfuel \times 10^{-9}$

= (CPA Specific data) in liters × 3510.21 kJ/L × 0.9 × 81.6 tCO2/TJ × 10^{-9}
= CPA Specific data in tCO2

PE_y = Project Emission in Year y
= 0 (assumed for CPA with no project emission)
L = 0.95 (default value as per AMS I E)

$ER_y = (BE_y - PE_y) \times L_y$
= (CPA Specific data in tCO2 – 0) × 0.95
= CPA Specific data in tCO2

The above calculations are summarized in the table below:

Variable	Unit	Value to be applied	Source	Comment/Reference
WPS n,y	number	CPA Specific data	Distribution database	number of water purification systems
$FRAC_{OC}$	fraction	CPA Specific data	Monitored by sampling	fraction of operating WPS
n	number	CPA Specific data	Monitored by sampling	Average Number of persons supplied with purified water from each of the Water

$FRAC_{PDN}$	fraction	CPA Specific data	Monitored by sampling	fraction of project population that still do not have access to SDW supplied by public distribution network.
$FRAC_{WB}$	fraction	CPA Specific data	Default Value Or Established by Ex ante survey	For Case 1 value of 1 is applied, for CASE 2 value established by ex ante survey will be applied
N	number	CPA Specific data	Calculated	Equation 4
$QPW_{lppd,y}$	liter/person/day	CPA Specific data	Monitored by sampling	Average quantity of purified drinking water consumed by per person per day in litre which is capped at 5.5 liter per person per day (lppd) as per AMS III AV
QPWy	liter	CPA Specific data	Calculated	Equation 3
SEC	kJ/L	3510.21	Calculated	Equation 2
WH	kJ/L^{o}C	4.186	Default Value	AMS III AV
T_f	^{o}C	100	Default Value	AMS III AV
T_i	^{o}C	20	Default Value	AMS III AV
WHE	kJ/L	2260	Default Value	AMS III AV
η_{wb}	fraction	0.10184	Calculated (weighted average value)	Weighted average value is calculated using default values for different water boiling systems as per the Methodology AMS III AV. For biomass use in traditional cook stoves without any chimney or grate a default value of 0.1 efficiency factor is considered and for the rest of the systems using woody biomass 0.2 default value was used.
$f_{NRB,y}$	fraction	0.9	Calculated	Please see fNRB,y calculation in Appendix 4
EF	tCO2/TJ	81.6	Default Value	AMS III AV
Multiplier	n/a	10^{-9}	Default Value	AMS III AV
Baseline Emission	tCO2	CPA Specific data	Calculated	Equation 1
Project Emission	tCO2	0		
Leakage	fraction	0.95	Default	AMS III AV

			Value	
Emission Reduction	tCO2	CPA Specific data	Calculated	Equation 5

Sampling efforts:

Estimates for the parameters that was used as per the value contained in the table in section B.7.1 below and the estimates has been determined by a sampling approach are provided in the above table (column denoting the sources of data),

The sampling effort is described in Sampling Plan. Please refer to section B.7.2 of Part II of the PoA-DD.

B.7. Application of the monitoring methodology and description of the monitoring plan

B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter	**$QPW_{lppd,y}$**
Unit	Litres per person per day
Description	Quantity of purified water consumed for drinking per person per day in year y
Source of data	Survey results from representative sampling
Value(s) applied	[CPA specific info: for example a value of 5.5 is applied for calculation in section B.6.3]
Measurement methods and procedures	The amount of water treated and consumed for drinking will be monitored by the Project Sample Group Survey. Sampling procedures of 90/10 confidence/precision will be applied for a single CPA and 95/10 confidence/precision will be applied for group of CPAs.
Monitoring frequency	Semi annual (twice a year) or annual
QA/QC procedures	Spot-check of data collection process during on-going monitoring to ensure accuracy and transparency. Training on monitoring, survey and sampling will be provided and record of such training session will be documented.
Purpose of data	Calculation of baseline emissions (Validate quantity of water treated by the project)
Additional comments	Per the methodology, this value is capped at 5.5 lppd.

Data / Parameter	**WPS_n,y**
Unit	number
Description	Total number of water purification systems in year y
Source of data	Distribution database
Value(s) applied	[CPA specific data]
Measurement methods and procedures	Total number of water purification systems deployed under the CPA will be counted
Monitoring frequency	Semi annual (twice a year) or annual
QA/QC procedures	To be crosschecked with End User Agreements and distribution records
Purpose of data	Calculation of baseline emissions
Additional comments	

Data / Parameter	**$FRAC_{OC}$**
Unit	Fraction
Description	Fraction of water purification systems that are operational
Source of data	Survey results from representative sampling
Value(s) applied	1
Measurement methods and procedures	To be checked at least every two years (biennial) using a 95/5 confidence/ precision statistical sampling method. In case of annual survey, for a single CPA 90/10 confidence/ precision shall be used and for a group of CPAs 95/10 confidence/ precision shall be used.
Monitoring frequency	To be checked at least every two years (biennial).
QA/QC procedures	Spot-check of data collection process during on-going monitoring to ensure accuracy and transparency. Training on monitoring, survey and sampling and operational check will be provided and record of such training session will be documented
Purpose of data	Calculation of baseline emissions (Confirm operability of project equipment.)
Additional comments	Emission reductions shall be discounted by the fraction of operational water purification systems (WPS). WPS that are found to be out of operation in the course of sampling shall be Repaired or replaced, and the project database shall be updated to reflect this in order to avoid double-counting. After repair, the WPSs will be considered as operational and emission reductions pertaining to the number of days it was not in operation will be discounted. In this regard the number of non operational days will be counted from last record of the WPS being operational to the date on which repaired WPS was provided to the household,

Data / Parameter	$FRAC_{PDN}$
Unit	Fraction
Description	Fraction of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network
Source of data	Survey results from representative sampling
Value(s) applied	1
Measurement methods and procedures	Household survey using a 90/10 confidence/precision statistical sampling method of CPA households . 95/10 confidence/precision will be applied for group of CPAs.
Monitoring frequency	Annual
QA/QC procedures	Spot-check of data collection process during on-going monitoring to ensure accuracy and transparency. Training on monitoring will be provided and record of such training session will be documented
Purpose of data	Applicability of the Methodology.
Additional comments	

Data / Parameter	Water quality
Unit	NA
Description	NA
Source of data	Laboratory test results
Value(s) applied	NA
Measurement methods and procedures	A representative sample of all systems included in the CPA, will be taken at least every two years and the samples of purified water will be laboratory tested to ensure compliance either with (i.e. anyone of the following) : i. the performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications" (WHO, 2011); or ii. Health based targets and microbiological performance specifications of " The Environment Conservation Rules, 1997 ; Schedule 3 (B): Standards for drinking water"
Monitoring frequency	At least once in two years
QA/QC procedures	Testing will be done at a nationally recognized laboratory
Purpose of data	Applicability of the Methodology
Additional comments	

Data / Parameter	n
Unit	Number
Description	Average number of persons supplied with purified water from each of the Water purification systems
Source of data	Survey results from representative sampling
Value(s) applied	[CPA specific info: a value of 4.7 is used for the calculation in B.6.3]
Measurement methods and procedures	Household survey using a 90/10 confidence/precision statistical sampling method of CPA households. 95/10 confidence/precision will be applied for group of CPAs
Monitoring frequency	Semi annual or annual
QA/QC procedures	Spot-check of data collection process during on-going monitoring to ensure accuracy and transparency. Training on monitoring will be provided and record of such training session will be documented
Purpose of data	Calculation of baseline emissions (Validate quantity of water treated by the project)
Additional comments	

B.7.2. Description of the monitoring plan for a generic CPA

The monitoring plan for a generic CPA under the PoA follows the following guidelines, methodologies, or procedures:

- *AMS-III.AV low greenhouse gas emitting safe drinking water production systems Version 03, EB 69*
- *EB 69 Annex 4 Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities Version 3.0*
- *EB 69 Annex 5 Guideline for Sampling and Surveys for CDM project Activities and Programme of Activities Version 2.0*

The following parameters are determined during monitoring for all CPAs

Parameter	Description	Monitoring method
$QPW_{lppd,y}$	Average quantity of purified water consumed for drinking per person per day in year *y*	The amount of water treated and consumed for drinking will be monitored by the Project Sample Group Survey. Sampling procedures of 90/10 confidence/precision will be applied for a single CPA and 95/10 confidence/precision will be applied for group of CPAs.
WPS_n,y	Total number of water purification systems in year y	Total number of water purification systems deployed under each CPA will be counted
$FRAC_{OC}$	Fraction of water purification systems that are operational	To be checked at least every two years (biennial) using a 95/5 confidence/ precision statistical sampling method. In case of annual survey, for a single CPA 90/10 confidence/ precision shall be used and for a group of CPAs 95/10 confidence/ precision shall be used.
$FRAC_{PDN}$	Fraction of total population serviced	Annual check through household survey using a

	by the project equipments that still do not have access to supply of SDW by public distribution network	90/10 confidence/ precision statistical sampling method for a single CPA. 95/10 confidence/ precision will be applied for group of CPAs.
	Water quality	On a sample basis. 90/10 confidence/ precision shall be used for a single CPA and for a group of CPAs 95/10 confidence/ precision shall be used
n	Number of persons supplied with purified water from each of the Water purification systems	Household Survey using a 90/10 confidence/ precision statistical sampling method for a single CPA and for a group of CPAs 95/10 confidence/ precision shall be used

The monitoring Plan will not vary between Case 1 or Case 2 situation since all the monitoring parameters are same in both situations. $FRAC_{WB}$ i.e. Fraction of total population serviced by the project equipments for which the practice of water purification would have been water boiling will be established ex ante and is periodical monitoring is not required. Case 1 CPA will use a default value of 1 for $FRAC_{WB.}$

A project database will be maintained recording the distribution of each initial water purification system distributed/installed, subsequent replacements, as well as detailed data on the representative sample surveyed for monitoring purposes. The database will be accessible to the project proponent, appropriate partners, and the verification DOE. The database will include at minimum the following:

- Technology Type
- Unique identification number (UID) of each water purification systems(WPS)
- CPA id numbers uniquely identified by range/list of UID of WPS
- Distribution/Installation date
- Name, address, and contact information of the end-user
- Records of replacement or repair of water purification systems to avoid double counting of emission reductions.
- Monitored parameters as required by the methodology AMSIII AV (refer to B.7.1)

The database will be available to select a random, representative sample from for monitoring and verification purposes. This sample set will be integrated into the database to include additional monitoring parameters as required or as appropriate.

Each distribution will be logged, a sample will be spot-checked, and after the initial distribution a representative sample will be periodically checked, while on-going education, operation, maintenance and replacement activities occur.

According to the definition of operational unit and indicator of when to repair/replace a WPS specified in CPA-DD section A.5, the repair/ replacement services will be provided by the CME. Each time a water purification system is replaced/repaired, the record is updated in the database to reflect the new date of issue to the particular recipient

The parameter $QPW_{lppd,y}$ is determined by conducting a survey on a representative sample of households.
The amount of treated water consumed only for drinking purpose will be considered for determination of $QPW_{lppd,y}$ which will be average liter per person per day for the household capped at 5.5 liter per person per day. $QPW_{,y}$ will be calculated using Equation 3 of Section B.6.1

Quality Assurance and Quality Control

Supervisors will verify a minimum of 1% sample of the household records by comparing the records with a visit to the households.

Distributors and Education and awareness campaign team are responsible for approximately 100 household distributions and education activities per day during the initial deployment campaign under each CPA.

Supervisors are responsible for approximately 8 distributors and 14 Education and Awareness building campaign staff. During follow up survey, supervisors will spot-check approximately 20% of the distributions conducted, verifying that the water purification units is in place, and that the recipient can show proper operation of the unit. The results of this spot check are recorded electronically and compared against the initial distribution logs.

Operations Management Plan contains a section on Monitoring Plan and include as a minimum provisions to guarantee appropriate accuracy of data and data management systems, cross-check routines as well as sufficient training by relevant staff.

Training Plan:

The CME shall be responsible for training any PO/contractors used during distribution, education and monitoring activities. The CME will ensure training of all on-site staff with respect to adherence to the Monitoring Plan of the project activity. Records of the training will be kept.

Technology Provider and CME and Partner Organization staff will support Training of Regional Training Coordinators (a TOT), Sub district level Coordinators and Program Organizers:
The TOT shall include the following

- Trained on general implementation plan
- Targets for each day and each CPA
- Proper use and maintenance of the water purification system
- Proper inventory management skills
- Utilization of the databases for inventory and monitoring
- Education that will be conducted in the households
- Data that will be collected in the households
- Survey that will be conduct as part of the monitoring plan

During the distribution of the water purification systems households representatives will be trained on proper installation, use, and maintenance of the devices, and as well as how to avail after sales services and contact information of the repair and replacement facilities and the CME.

All records will be kept in electronic format until at least 2 years after the last issuance of emission reductions.

Sampling efforts:

The following parameters monitored in section B.7.1 above are determined by a sampling approach,

Ex-post surveys:

- Litres of drinking water consumed per person per day
- Number of persons supplied with purified water from each of the Water purification systems
- Fraction of water purification systems that are operational
- Fraction of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network
- Water quality

The key of the monitoring plan is to develop a sampling plan in accordance with the applicable provisions in the "Standard for sampling and surveys for CDM project activities and programme of activities" Version 03 to be followed during the monitoring and verification of the project activity.

General description of the Sampling Plan and Sampling Approach and reliability requirement selection is provided in Section B.3 of Part I.

A detailed sampling plan, as per recommended outline of the above standard, for each of the above parameter for a group of CPAs from more than one district is provided below

Sampling Plan:

A. **Sampling Design:**

A.1 Sampling Design for Monitoring Parameter $QPW_{lppd,y}$

1. Sampling Objectives and Reliability requirements:

The Objective of the sampling plan is to obtain mean value parameter of liter of drinking water consumed per person per day (lppd) during the crediting period and with 95/10 confidence/precision.

2. Target Population:

All households or institutions who received WPS under all of the CPAs that are grouped together for Verification will constitute the target population.

3. Sample Method:

Stratified Random Sampling method is selected as the Sampling approach.

The mean value parameters of Litres of drinking water consumed per person per day is expected to vary across the districts. However the above parameters are more similar within a CPA or group of CPAs under one District. Hence, each District will be considered as strata. Total households number who received water purification units will be combined together at district level (i.e. total households in group of CPAs within the same district).

4. Determination of sample size:

Each District has the following estimated number of households given water purification systems. A pilot sample of minimum 30 from all districts will be drawn to determine the expected mean and expected standard deviation. For the calculation estimated values and expert opinion from BRAC Water, Sanitation and Hygiene Program (BRAC WASH) [50] were used as follows:

[50] http://wash.brac.net/

District	Group of CPAS	Number of households received WPS in district (g_i)	Mean (lppd) in district (m_i)[51]	Standard deviation
A	CPA 01 – CPA08	185,500	3.46	2.50
B	CPA 09 – CPA14	155,600	3.19	2.25
C	CPA 15 – CPA22	197,300	3.11	2.45
D	CPA 22 – CPA35	362,000	3.14	2.35
E	CPA 36 – CPA 40	99,800	3.68	2.30

The Total sample size of households across all 5 districts (40 CPAs) is as follows

$$n \geq \frac{Z^2 \times NV}{(N-1) \times 0.1^2 + Z^2 V}$$

Where,

$$V = (\frac{SD}{Mean})^2$$

n Sample size
N Total number of households received WPS (1,000,200)
Z 1.96 Represents the 95% confidence required
0.1 Represents the 10% relative precision

SD Overall Standard deviation
Mean Overall mean

Using the data in the table above the Overall mean and standard deviation can be estimated. Both equations are weighted according to the total number of households in each district.

$$SD = \sqrt{\frac{(g_a \times SD^2{}_a) + (g_b \times SD^2{}_b) + (g_c \times SD^2{}_c) + (g_d \times SD^2{}_d) + (g_e \times SD^2{}_e)}{N}}$$

SD Weighted Average standard deviation
g_i Size of the i^{th} group where i= a,.....k

$$SD = \sqrt{\frac{(185000 \times 2.5^2) + (155600 \times 2.25^2) + (197300 \times 2.45^2) + (362000 \times 2.35^2) + (99800 \times 2.3^2)}{1000200}}$$

= 2.3785

$$Mean = \frac{(g_a \times m_a) + (g_b \times m_b) + (g_c \times m_c) + (g_d \times m_d) + (g_e \times m_e)}{N}$$

[51] To be capped at 5.5 liter for ER calculation, however for calculation of sample size it will not be capped.

Where
Mean Weighted overall mean
m_i mean lppd of the i^{th} group where i= a,.....k

$$Mean = \frac{(185000 \times 3.46) + (155600 \times 3.19) + (197300 \times 3.11) + (362000 \times 3.14) + (99800 \times 3.68)}{1000200}$$

= 3.255

$$V = (\frac{SD}{Mean})^2 = (\frac{2.3785}{3.255})^2 = 0.5339$$

Hence,

$$n \geq \frac{1.96^2 \times 1000200 \times 0.5339}{(1000200 - 1) \times 0.1^2 + 1.96^2 \times 0.5339} = 205$$

Corrected sample size assuming 10% non response rate[52] is 228.

Hence, sample sizes for the districts are as follows

$$n_i = \frac{g_i}{N} \times n$$

District	Sample Size
A	42
B	35
C	45
D	83
E	23

Sampling Frame:

The list of households or institutions who received WPS under all of the CPAs that are grouped together under a district (strata) will be considered as the Sampling frame.

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A.2 Sampling Design for Monitoring Parameter n

1. Sampling Objectives and Reliability requirements:

The Objective of the sampling plan is to obtain mean value parameter of number of persons supplied with purified water from each of the water purification systems during the crediting period and with 95/10 confidence/precision.

2. Target Population:

[52] Non response rate will be based on pilot survey and at least 10%

All households or institutions who received WPS under all of the CPAs that are grouped together for Verification will constitute the target population.

3. Sample Method:

Stratified Random Sampling method is selected as the Sampling approach. Justification is provided in sub section A.1.3 Sampling Design for Monitoring Parameter $QPW_{lppd,y}$

4. Determination of sample size:

Each District has the following estimated number of households given water purification systems. A pilot sample of minimum 30 from all districts will be drawn to determine the expected mean and expected standard deviation. For the calculation estimated values and expert opinion from BRAC WASH were used as follows:

District	Group of CPAS	Number of households received WPS in district(g_i)	Mean (no of people serviced by each filter)in district (m_i)	Standard deviation
A	CPA 01 – CPA08	185,500	4.7	2.75
B	CPA 09 – CPA14	155,600	5.6	3.5
C	CPA 15 – CPA22	197,300	5.2	3.25
D	CPA 22 – CPA35	362,000	5.1	3
E	CPA 36 – CPA 40	99,800	4.6	2.5

The Total sample size of households across all 5 districts (40 CPAs) is as follows

$$n \geq \frac{Z^2 \times NV}{(N-1) \times 0.1^2 + Z^2 V}$$

Where,

$$V = (\frac{SD}{Mean})^2$$

n Sample size
N Total number of households received WPS (1,000,200)
Z 1.96 Represents the 95% confidence required
0.1 Represents the 10% relative precision

SD Overall Standard deviation
Mean Overall mean
Using the data in the table above the Overall mean and standard deviation can be estimated. Both equations are weighted according to the total number of households in each districts.

$$SD = \sqrt{\frac{(g_a \times SD^2{}_a) + (g_b \times SD^2{}_b) + (g_c \times SD^2{}_c) + (g_d \times SD^2{}_d) + (g_e \times SD^2{}_e)}{N}}$$

SD Weighted Average standard deviation
g_i Size of the i^{th} group where i= a,.....k

$$SD = \sqrt{\frac{(185000 \times 2.75^2) + (155600 \times 3.5^2) + (197300 \times 3.25^2) + (362000 \times 3.0^2) + (99800 \times 2.5^2)}{1000200}}$$

= 3.0

$$Mean = \frac{(g_a \times m_a) + (g_b \times m_b) + (g_c \times m_c) + (g_d \times m_d) + (g_e \times m_e)}{N}$$

Where
Mean Weighted overall mean
m_i Size of the i^{th} group where i= a,.....k

$$Mean = \frac{(185000 \times 4.7) + (155600 \times 5.6) + (197300 \times 5.2) + (362000 \times 5.1) + (99800 \times 4.6)}{1{,}000{,}200}$$

= 5.073

$$V = (\frac{SD}{Mean})^2 = (\frac{3.0}{5.073})^2 = 0.360$$

Hence,

$$n \geq \frac{1.96^2 \times 1000200 \times 0.360}{(1000200 - 1) \times 0.1^2 + 1.96^2 \times 0.360} = 138$$

Corrected sample size assuming 10% non response rate is 154.
Hence, sample sizes for the districts are as follows

$$n_i = \frac{g_i}{N} \times n$$

District	Sample Size
A	29
B	24
C	30
D	56
E	15

Sampling Frame:

The list of households or institutions who received WPS under all of the CPAs that are grouped together under a district (strata) will be considered as the Sampling frame.

A.3 Sampling Design for Monitoring Parameter $FRAC_{OC}$

1. Sampling Objectives and Reliability requirements:

The Objective of the sampling plan is to obtain proportion of water purification systems that are operational during the crediting period and with 95/10 confidence/precision.

2. Target Population:

All households or institutions who received WPS under all of the CPAs that are grouped together for Verification will constitute the target population.

3. Sample Method:

Stratified Random Sampling method is selected as the Sampling approach. Justification is provided in sub section A.1.3 Sampling Design for Monitoring Parameter $QPW_{lppd,y}$

4. Determination of sample size:

Each District has the following estimated number of households given water purification systems. A pilot sample of minimum30 from all districts will be drawn to determine the estimates of the proportion of WPS still in operation. For the calculation estimated values and expert opinion from BRAC WASH were used as follows:

District	Group of CPAS	Number of households received WPS in district (g_i)	Proportion of WPS still in operation in district (p_i)
A	CPA 01 – CPA08	185,500	0.60
B	CPA 09 – CPA14	155,600	0.65
C	CPA 15 – CPA22	197,300	0.70
D	CPA 22 – CPA35	362,000	0.75
E	CPA 36 – CPA 40	99,800	0.80

The Total sample size of households across all 5 districts (40 CPAs) is as follows

$$n \geq \frac{Z^2 \times NV}{(N-1) \times 0.1^2 + Z^2 V}$$

Where,
n Sample size
N Total number of households received WPS (1,000,200)
Z 1.96 Represents the 95% confidence required
0.1 Represents the 10% relative precision

$$V = (\frac{SD}{p})^2$$

SD Overall Standard deviation
p Overall proportion

Using the data in the table above the Overall standard deviation and Overall proportion of water purification systems that are operational can be estimated. Both equations are weighted according to the total number of households in each district.

$$SD = \sqrt{\frac{(g_a \times p_a\,(1-p_a)) + (g_b \times p_b\,(1-p_b)) + (g_c \times\ p_c\,(1-p_c)) + \cdots + (g_k \times p_k\,(1-p_k))}{N}}$$

SD Weighted Average standard deviation
g_i Size of the i^{th} group where i= a,.....k

$$SD = \sqrt{\frac{(185000 \times 0.6 \times 0.4) + (155600 \times 0.65 \times 0.35) + (197300 \times 0.7 \times 0.3) + (362000 \times 0.75 \times 0.25) + (99800 \times 0.8 \times 0.2)}{1000200}}$$

= 0.4529

$$p = \frac{(g_a \times p_a) + (g_b \times p_b) + (g_c \times p_c) + \cdots + (g_k \times p_k)}{N}$$

Where
p_i proportion of the i^{th} group where i= a,.....k

$$p = \frac{(185{,}000 \times 0.6) + (155{,}600 \times 0.65) + (197{,}300 \times 0.7) + (362{,}000 \times 0.75) + (99{,}800 \times 0.8)}{1{,}000{,}200}$$

= 0.702

$$V = (\frac{SD}{Mean})^2 = (\frac{0.4529}{0.702})^2 = 0.4166$$

Hence,

$$n \geq \frac{1.96^2 \times 1000200 \times 0.4166}{(1000200 - 1) \times 0.1^2 + 1.96^2 \times 0.4166} = 160$$

Corrected sample size assuming 10% non response rate is 178.
Hence, sample sizes for the districts are as follows

$$n_i = \frac{g_i}{N} \times n$$

District	Sample Size
A	33
B	28
C	35
D	64
E	18

Sampling Frame:

The list of households or institutions who received WPS under all of the CPAs that are grouped together under a district (strata) will be considered as the Sampling frame.

A.4 Sampling Design for Monitoring Parameter $FRAC_{PDN}$

1. Sampling Objectives and Reliability requirements:

The Objective of the sampling plan is to obtain proportion of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network during the crediting period and with 95/10 confidence/precision.

2. Target Population:

All households or institutions who received WPS under all of the CPAs that are grouped together for Verification will constitute the target population.

3. Sample Method:

Stratified Random Sampling method is selected as the Sampling approach. Justification is provided in sub section A.1.3 Sampling Design for Monitoring Parameter $QPW_{lppd,y}$

4. Determination of sample size:

Each District has the following estimated number of households given water purification systems. A pilot sample of minimum 30 from all districts will be drawn to determine the estimates of the proportion of of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network. For the calculation estimated values and expert opinion from BRAC WASH were used:

District	Group of CPAS	Number of households received WPS in district (g_i)	Proportion of of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network in district (p_i)
A	CPA 01 – CPA08	185,500	0.70
B	CPA 09 – CPA14	155,600	0.75
C	CPA 15 – CPA22	197,300	0.85
D	CPA 22 – CPA35	362,000	0.90
E	CPA 36 – CPA 40	99,800	0.95

The Total sample size of households across all 5 districts (40 CPAs) is as follows
Using same equation as sub section A.2.4 above

$$n \geq \frac{Z^2 \times NV}{(N-1) \times 0.1^2 + Z^2 V}$$

$$V = (\frac{SD}{p})^2$$

Using the data in the table above the Overall standard deviation and Overall proportion of total population serviced by the project equipments that still do not have access to supply of SDW by public distribution network can be estimated. Both equations are weighted according to the total number of households in each district.

$$SD = \sqrt{\frac{(g_a \times p_a\,(1-p_a)) + (g_b \times p_b\,(1-p_b)) + (g_c \times\ p_c\,(1-p_c)) + \cdots + (g_k \times p_k\,(1-p_k))}{N}}$$

= 0.3614

$$p = \frac{(g_a \times p_a) + (g_b \times p_b) + (g_c \times p_c) + \cdots + (g_k \times p_k)}{N}$$
$$= 0.835$$

$$V = (\frac{SD}{Mean})^2 = (\frac{0.3614}{0.835})^2 = 0.1874$$

Hence,

$$n \geq \frac{1.96^2 \times 1000200 \times 0.1874}{(1000200 - 1) \times 0.1^2 + 1.96^2 \times 0.1874} = 72$$

Corrected sample size assuming 10% non response rate is 80.
Hence, sample sizes for the districts are as follows

$$n_i = \frac{g_i}{N} \times n$$

District	Sample Size
A	15
B	12
C	16
D	29
E	8

A.5 Sampling Design for Monitoring Parameter Water Quality

1. Sampling Objectives and Reliability requirements:

The Objective of the sampling plan is to obtain proportion of WPS, water quality of which is in compliance with the WHO or national standard during the crediting period and with 95/10 confidence/precision.

2. Target Population:

All WPS distributed and in operation under all of the CPAs that are grouped together for Verification will constitute the target population.

3. Sample Method:

Stratified Random Sampling method is selected as the Sampling approach. Justification is provided in sub section A.1.3 Sampling Design for Monitoring Parameter $QPW_{lppd,y}$

5. Determination of sample size:

Different zero emission WPS technology may have different proportion of compliance with required water quality standard. For demonstration of sample size calculation, examples of LifeStraw units (to be deployed under CPA 001) are provided below. Expected proportion of compliance with required water quality standard for LifeStraw units is used for demonstration of sample size calculation below.

Although according to expert opinion from Manufacturer of LifeStraw units, due to the technology design it is expected that 100% of the filter will be in compliance with the required water quality standards, To

be in compliance with the methodology AMS III AV, CME will conduct water quality testing on a sample basis. To determine sample size conservative values from 91% to 95% is assumed for the initial verification periods. During later phases, data from previous year may be used for determination of sample size.

District	Group of CPAS	Number of households received WPS in district (g_i)	Proportion of water filters in districts which are in compliance with required water quality standard(p_i)[53]
A	CPA 01 – CPA08	185,500	0.91
B	CPA 09 – CPA14	155,600	0.92
C	CPA 15 – CPA22	197,300	0.93
D	CPA 22 – CPA35	362,000	0.94
E	CPA 36 – CPA 40	99,800	0.95

The Total sample size of households across all 5 districts (40 CPAs) is as follows

Using same equation as sub section A.2.4 above and us*ing the data in the table above the* Overall standard deviation and Overall proportion of WPS, water quality of which is in compliance with the WHO or national standard can be estimated. Both equations are weighted according to the total number of households in each district.

$$SD = \sqrt{\frac{(g_a \times p_a(1-p_a)) + (g_b \times p_b(1-p_b)) + (g_c \times p_c(1-p_c)) + \cdots + (g_k \times p_k(1-p_k))}{N}}$$

= 0.2542

$$p = \frac{(g_a \times p_a) + (g_b \times p_b) + (g_c \times p_c) + \cdots + (g_k \times p_k)}{N}$$

= 0.930

$$V = \left(\frac{SD}{p}\right)^2 = \left(\frac{0.2542}{0.930}\right)^2 = 0.0747$$

Hence,

$$n \geq \frac{1.96^2 \times 1000200 \times 0.0747}{(1000200-1) \times 0.1^2 + 1.96^2 \times 0.0747} = 29$$

Corrected sample size assuming 10% non response rate[54] is 32.
Hence, sample sizes for the districts are as follows

$$n_i = \frac{g_i}{N} \times n$$

District	**Sample Size**

53

[54] Non response rate will be based on pilot survey and at least 10%

A	6
B	5
C	6
1. D	12
E	3

Sampling Frame:

The list of UIDs of all WPS distributed and in operation under all of the CPAs that are grouped together under a district (strata) will be considered as the Sampling frame.

B. Data to be Collected

Field Measurements:

The variables to be measured and their timing and frequencies are listed above in the monitoring plan. Field staffs of Partner Organization (PO) will collect data on daily basis throughout the year. Method of data collection will be through interviewing project households with pre defined questionnaires. Each Monitoring field staff is planned to interview at least one rural household each day selected at random.

In water quality sampling, all WPSs distributed and in operation are the target population whereas all households received WPS are the target population for all other parameters. A combined survey will include all monitoring parameters except water quality monitoring. The sample size of the combined survey will be the largest sample size amongst the sample size determined in Section B.7.2 of part II of the PoA-DD for all parameters excluding the water quality sample size. i.e. the sample size for water quality testing would be 32 and sample size for all other parameters would be 228.

Survey conducted by Field staffs on daily basis will be recorded in the Program database. Survey data from a particular household will be tagged with Unique Identification Number (UID) of the water purification systems received by that household and accordingly will be recorded in the Program database. Each CPA will have identification number and range/list of UIDs will be tagged with each CPA. Hence, household surveys can be grouped under a CPA or group of CPAs as required by the Sampling Method.

Household survey results from the database will be used for the determination of Monitoring Parameters for the relevant CPAs under a specific crediting period

Quality Assurance and Quality Control

The procedures for conducting the data collection and/or field measurements including training of field personnel, provisions for maximizing response rates, documenting out-of population cases, refusals and other sources of non-response, and related issues. An overall quality control and assurance strategy will be documented in the Monitoring plan section of the Operations Management Plan (OMP). The Plan also include a procedure for defining outliers and under what circumstances outlier data/measurements may be excluded and/or replaced.

Analysis: The data handling process is described in the OMP. Collected data will be checked to ensure that it meets confidence/precision requirements in case the required confidence/precision level is not achieved sample size will be increased to achieve the required confidence/precision level.

C. **Implementation**

The data collection will be on daily basis and as per a pre defined number of survey per day. The key skills required are previous experience of survey and data collection process and resource requirement is field level work force (i.e. close interaction with rural households). Details are provided in OMP

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Appendix 1: Contact information on entity/individual responsible for the PoA

Organization	BRAC Impact Ventures Limited
Street/P.O. Box	75 Mohakhali C/A
Building	BRAC Centre (14th floor)
City	Dhaka
State/Region	Dhaka
Postcode	1212
Country	Bangladesh
Telephone	+88-02-8829241, +88-02-8829253
Fax	+88-02-8829445
E-mail	javed@bracivl.com
Website	
Contact person	Javed Bin Karim
Title	Chief Executive Officer
Salutation	Mr.
Last name	Karim
Middle name	Bin
First name	Javed
Department	N/A
Mobile	+8801730703960
Direct fax	+88-02-8829445
Direct tel.	+88-02-8829271 (Direct) +88-02-8829253 Ext. 310 (PABX)
Personal e-mail	

Appendix 2: Affirmation regarding public funding

Currently there is no public funding involved in the PoA.

Appendix 3: Application of methodology (ies)

Definition of Public Distribution Network supplying SDW:

*A **water supply system** or **water supply network** is a system of*
engineered hydrologic and hydraulic components which provide water supply. A water supply system typically includes[55]:

1. A drainage basin (see water purification - sources of drinking water).
2. A raw water collection point (above or below ground) where the water accumulates, such as a lake, a river, or groundwater from an underground aquifer. Raw water may be transferred using uncovered ground-level aqueducts, covered tunnels or underground water pipes to water purification facilities.
3. Water purification facilities. Treated water is transferred using water pipes (usually underground).
4. Water storage facilities such as reservoirs, water tanks, or water towers. Smaller water systems may store the water in cisterns or pressure vessels. Tall buildings may also need to store water locally in pressure vessels in order for the water to reach the upper floors.
5. Additional water pressurizing components such as pumping stations may need to be situated at the outlet of underground or above ground reservoirs or cisterns (if gravity flow is impractical).
6. A pipe network for distribution of water to the consumers (which may be private houses or industrial, commercial or institution establishments) and other usage points (such as fire hydrants).
7. Connections to the sewers (underground pipes, or aboveground ditches in some developing countries) are generally found downstream of the water consumers, but the sewer system is considered to be a separate system, rather than part of the water supply system.

Sources of SDW to be considered as SDW supplied by Public Distribution Network in this PoA:

The following improved sources of SDW[56] will be considered as SDW supplied by Public Distribution Network for the PoA

1. Piped Water into dwelling
2. Piped Water into yard or plot
3. Public tap or stand pipe

Existence of Public Distribution Network in rural Bangladesh:

There is no reliable public distribution network of safe drinking water in rural Bangladesh. Local government owned water utilities known as WASA[57] and DPHE[58] operate in major cities and rural areas respectively, most with less than 5% household connections[59].

[55] http://en.wikipedia.org/wiki/Water_supply_network
[56] Page 111, Multi Indicator Cluster Survey 2009, http://www.unicef.org/bangladesh/MICS-PP-09-v10.pdf
[57] www.d**wasa**.org.bd/
[58] www.**dphe**.gov.bd

DPHE have proven to be ineffective due to too few connections, deteriorating infrastructure, lack of investment, reliance on government subsidies and poor management.

Though there may be some government owned tube well available in few rural areas, firstly, the water delivered to the point of consumption, is fresh water since it receives no treatment, secondly the water is point of use or so is not a "network"[60] per se and, thirdly, water quality can be unreliable in most cases and contaminated with faecal coli forms, E. Coli or other pathogens.

Tube-well water is used primarily as a source of drinking water by the vast majority (95.7%) [61]of the rural population in Bangladesh. A tube-well is a small-diameter cased well fitted with a cast iron suction hand pump. These tube-wells have been installed in Bangladesh at various depths, depending on availability and the level of groundwater. In many cases, immediate environmental conditions are unfavorable; e.g., the distance of tube-wells from latrines or sewage-contaminated ponds or tanks may be insufficient to avoid contamination of the well water with human-pathogenic bacteria. Tube-wells have failed to protect against gastrointestinal diseases in Bangladesh, despite regular use of tube-well water for drinking
Recent studies have demonstrated that underground water systems are increasingly vulnerable to both microbiological and heavy metal contamination, especially by arsenic, in Bangladesh.

The contamination of (under) groundwater by arsenic in Bangladesh is the largest poisoning of a population in history, with millions of people exposed. Tube-wells were installed to provide ''pure water'' to prevent morbidity and mortality from gastrointestinal disease. The water from the millions of tube-wells that were installed was not tested for arsenic contamination. Studies in other countries where the population has had long-term exposure to arsenic in groundwater indicate that 1 in 10 people who drink water containing 500 mg of arsenic per litre may ultimately die from cancers caused by arsenic, including lung, bladder and skin cancers.

A study[62] Published online 17 January 2011 "*Arsenic sinks to new depths*" stated that

"It may only be a matter of time before the toxic element also permeates deep aquifers in other Asian countries that follow the practice of over exploitation of ground water, such as those around the Bengal Basin. With deeper aquifers so far thought to be arsenic-free, some municipal authorities in Bangladesh, and many in Vietnam, are drilling into lower sediments in the region. The implications of the finding could be serious for countries around the Bengal Basin in South Asia. In Bangladesh, where some 35-77 million people[63,64] are exposed, the use of deep aquifers is a more recent phenomenon. Decades ago, aid agencies introduced tube wells as a reliable and clean water source, only to find that the top-most sediment layers, formed in the 12,000 years since the start of the current Holocene epoch, contain naturally occurring arsenic that leaches into the groundwater. To avoid contamination, wells in the Bengal Basin can be drilled into deep layers that were oxidized during the last ice age, in which the water is free of arsenic, As per reference in footnote 12, these aquifers were created during the Pleistocene epoch, between 12,000 and 2.5 million years ago, and lack the organic carbon that is needed for arsenic to leach into water. But if people in the Bengal Basin continue to exploit their water supplies at the current rates, arsenic-laden water from the upper layers may find its way into Pleistocene aquifers, the study suggests."

[59] Table 18, http://www.unicef.org/bangladesh/MICS-PP-09-v10.pdf
[60] Networks means interconnected channels or lines.
[61] Table 2.4, Bangladesh Health and Demographic Survey 2007; http://www.measuredhs.com/pubs/pdf/FR207/FR207[April-10-2009].pdf
[62] Winkel, L. H. E. et al. Proc. Natl Acad. Sci. USA doi:10.1073/pnas.1011915108 (2011). http://www.nature.com/news/2011/110117/full/news.2011.20.html
[63] Burgess, W.G. *et al. Nature Geosci.* 3, 83-87 (2010). Stollenwerk, K. G. *et al. Sci. Tot. Environ.* 379, 133-150 (2007). http://www.bgs.ac.uk/research/groundwater/health/arsenic/Bangladesh/reports.html
[64] http://download.thelancet.com/pdfs/journals/lancet/PIIS0140673610604813.pdf

It has been generally believed in Bangladesh that groundwater is relatively free of microorganisms and, therefore, fit for human consumption without treatment. However, the results of a study[65] show clearly that all samples of tube-well water in rural Bangladesh that were examined contained high counts of bacteria and zooplankton, as well as fungi. The findings of that study are also in agreement with those of Kinner et al.[66]concerning plankton populations in groundwater.

A Study titled *"Effect of deep tube well use on childhood diarrhoea in Bangladesh"*[67] published on 20 May 2011in the Bulletin of the World Health Organization2011;89:521-527. doi:10.2471/BLT.10.085530 Stated the following:

Diarrhoeal diseases are the second leading cause of death in children aged under 5 years worldwide. An estimated 2.5 million cases of diarrhea occur annually in these children, with Asia and southern Africa accounting for more than half. Diarrhoeal diseases are endemic in countries where the water and sanitation infrastructure is deficient, such as Bangladesh.

In Bangladesh, efforts by the United Nations Children's Fund, the Bangladesh Department of Public Health Engineering and nongovernmental organizations have led to an almost universal shift from the consumption of surface water to groundwater. These efforts were in response to the severe burden of diarrhoeal disease in the country and the widespread contamination of surface water with human pathogens. Currently over 90% of households in Bangladesh obtain drinking water from a total of approximately 10 million, mostly shallow, tube wells typically < 45 m deep. While the proliferation of tube wells has provided access to drinking water, the high level of arsenic frequently found in groundwater has generated a new health problem. A survey carried out in the late 1990s showed that one third of the population of 130 million at the time was drinking water that did not meet the Bangladeshi standard for arsenic in drinking water of 50 µg/l and nearly half the population was exposed to levels that exceeded the guideline of the World Health Organization (WHO) of 10 µg/l. In addition to causing the early signs of arsenicosis, such as skin lesions, exposure to arsenic by drinking tube well water has increased all-cause mortality and cancers of the lung, liver and bladder in adults.

It has recently been shown; however, that groundwater pumped from shallow low-arsenic wells, in addition to arsenic contamination, is more likely to be contaminated with human waste than groundwater from shallow high arsenic wells because of the nature of local hydrogeology combined with the high population density and poor sanitation. More generally, faecal contamination of shallow groundwater may be one reason for the persistence of diarrhoeal disease in Bangladesh. After switching to a nearby low-arsenic household well, the next most effective means of reducing arsenic exposure from drinking water is to use one of the approximately 165 000 deep wells installed throughout the country by the Bangladesh Department of Public Health Engineering and nongovernmental organizations over the past decade.

However, during validation site visit the Upazilla Chairman (representative of the local government) and local DPHE representative raised the following concerns about deep tube-wells

1. Most of the deep tube wells do not work properly. A percentage of 10% was mentioned to be active. This is due to may be the fact that contract (through government Tender) of deep tube well installation and distribution is done at political consideration and often contractors often do not install tube wells properly
2. DPHE do not have maintenance fund for repair and replacement of the installed deep tube wells. Also DPHE do not have fund for periodical testing of drinking water supplied from tube-well.

[65] Microbiological Analysis of Tube-Well Water in a Rural Area of Bangladesh published by ICDDRB, Center of Marine Biotechnology, University of Maryland Biotechnology Institute. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC93023/pdf/am003328.pdf
[66] Kinner, N. E., R. W. Harvey, and M. Kazmierkiewicz-Tabaka. 1997. Effect of flagellates on free-living bacterial abundance in an organically contaminated aquifer. FEMS Microbiol. Rev. **20:**249–259
[67] http://www.who.int/bulletin/volumes/89/7/10-085530.pdf

During installation only Arsenic testing is done. The regional DPHE laboratories do not even have provision or infrastructure of microbiological testing of supplied drinking water for tube wells.

3. In many cases although deep tub wells are free from Arsenic, heavy iron content exists in the water and thus is unusable for any purpose.
4. As a local practice cow dung is in the soil before drilling holes for the deep tube well. Many household prefer not to use them for this reason
5. Even some deep tube wells at present are contaminated with Arsenic.

The conclusion is that tube-well water in rural Bangladesh cannot be considered safe for drinking unless properly treated. The salient point, however, is that those tube-wells by themselves do not provide a source of microbiologically or chemically safe drinking water.

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

Determination of the share of non-renewable woody biomass in Bangladesh

Applied methodology AMS III AV recommends to (Paragraph 6) use the relevant provisions of AMS-I.E. to determine the fraction of non-renewable biomass for Bangladesh.

EB 67, Annex 22, "Default values of fraction of non-renewable biomass for least developed countries and small island developing States" provides defaults values of non-renewable woody biomass in Bangladesh. This document describes the materials and methods used to develop the default values referred to above for inclusion in AMS-I.E and AMS-II.G

Although as per paragraph 2 of the Note states that "Project proponents have an option to use these conservative country-specific default values or determine project-specific values by undertaking a study in the project region as prescribed in the methodology.

Hence project proponent is using the description and equations provided by the EB 67, Annex 22: Information note to determine project-specific values by undertaking a study in the project region as prescribed in the methodology

In line with AMS-I.E. version 05, the share of non-renewable woody biomass $f_{NRB,y}$ is determined using the following principles:

$$f_{NRB,y} = \frac{NRB}{NRB+DRB} \quad \textbf{(1)}$$

Where:

$f_{NRB,y}$	Fraction of non-renewable biomass (fraction or %)
NRB	Non-renewable biomass (t/yr)
DRB	Demonstrably renewable biomass (t/yr)

As per EB 67, Annex 22, on a project-specific basis, project participants can determine the shares of renewable (DRB) and non-renewable woody biomass (NRB) in the total biomass consumption (i.e. By - the quantity of woody biomass used in the absence of the project activity). A national-level default value for fNRB can be derived by calculating Total Annual Biomass Removals (R) from each country as a proxy for By and estimating the proportion of R that is demonstrably renewable (DRB) and non-renewable (NRB).

$$NRB = R - DRB \quad \textbf{(2)}$$

Where:

R is total annual biomass removals (t/yr)

Total Annual Biomass Removals (R) for each country is inferred by calculating the sum of the Mean Annual Increment in biomass growth (MAI) and the Annual Change in Living Forest Biomass stocks (ΔF). Given biomass growth (MAI) and change in stock (ΔF) are both known, the balancing removals (R) can be calculated as the sum of the two:

$$R = MAI + \Delta F \quad \textbf{(3)}$$

Where:

R	Total annual biomass removals (t/yr)
MAI	Mean Annual Increment of biomass growth (t/yr)
ΔF	Annual change in living forest biomass (t/yr)

Mean Annual Increment of biomass growth (MAI) is calculated in equation 4 as the product of the Extent of Forest (F) in hectares and the country-specific Growth Rate (GR) of the Mean Annual Increment:

$$MAI = F \times GR \quad \textbf{(4)}$$

Where:

MAI	Mean Annual Increment of biomass growth (t/yr)
F	Extent of forest (ha)
GR	Annual Growth rate of biomass (t/ha-yr)

Demonstrably renewable biomass (DRB) is calculated in equation 5 as the product of Protected Area Extent of Forest (PA) in hectares and the country-specific Growth Rate (GR) of the Mean Annual Increment:

$$DRB = PA \times GR \quad \textbf{(5)}$$

Where:

PA	Protected Area Extent of Forest (ha)

The above information was used by the Information Note, EB 67, Annex 22, "Default values of fraction of non-renewable biomass for least developed countries and small island developing States" and derived default value of Non renewable Biomass for Bangladesh as 0.83.

During undertaking the study to establish project-specific values for the PoA, it has been identified that in the calculation of fNRB for Bangladesh in EB 67, Annex 22, two changes are necessary and the justification of such changes are provided below:

1. **Annual Change in Living Forest Biomass (t/yr) or (*ΔF)***

Refer to EB 67, Annex 22 for Bangladesh Annual Change in Living Forest Biomass (t/yr) was considered 0[68].

Table 1, page 4 of EB 67, Annex 22, describes the source of Annual Change in Living Forest Biomass (*ΔF) as follows*

[68] Appendix 2, page 8 of EB 67, Annex 22

" Annual change in carbon stock in living forest biomass 2005-2010 (FAO Forest Resource Assessment 2010 Global Tables, Table 11) Carbon stock/Biomass Conversion rate (2003 IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry): 0.5 is used as a default for the carbon fraction of dry matter"

Refer to TABLE 11, Trends in carbon stock in living forest biomass 1990–2010, page 273 of the FAO Forest Resource Assessment 2010 Global Tables[69], it is found that Carbon stock in living forest biomass in Bangladesh in 2005 was 82,000,000 tons and in 2010 it was 80,000,000 tons.

Hence **Annual change in carbon stock from 2005-2010 =** - [(82,000,000 - 80,000,000)/5] t-carbon/yr
= - 400,000 t-carbon/yr

Converting **Annual change in carbon stock from 2005-2010 (t-carbon/yr) to Annual Change in Living Forest Biomass** (t/yr) by dividing with default factor 0.5 gives

Annual Change in Living Forest Biomass = = - (400,000 /0.5) = - 800,000 ton/yr

In this connection it is mentionable that Annual change in carbon stock from 2005-2010 for Bangladesh is considered not significant (n.s.) in the FAO Forest Resource Assessment 2010 Global Tables. Hence a zero value was put in the Information Note. However, incorporating Annual Change in Living Forest Biomass as - 800,000 ton/yr in the fNRB calculation, it is found that the change is significant and increases the fNRB by 2%.

Hence the project Proponent has revised the fNRB calculation using the value for Annual Change in Living Forest Biomass as (800,000) ton/yr.

2. **Protected Areas Extent of Forest (ha)**

For Bangladesh protected Areas Extent of Forest was considered in total 247,000 hectare[70].

From many research and secondary sources it has been adequately justified that many of the protected areas are protected only in papers and in reality there has been land encroachment for agriculture, housing and industry and also illegal tree cutting is evidenced.

Protected Areas, for which evidence of land encroachment for agriculture, housing and industry and illegal tree cutting etc. has been found, are excluded from the calculation of fNRB. The Protected areas as listed below with evidence.

Table A.4.1:

Name	Area (ha)	District	Forest Type	Evidence of Protection not enforced
Chunati Wildlife Sanctuary	7761	Chittagong and Cox's Bazar	Tropical Semi-Evergreen	Forest land inside the sanctuary has been encroached for agriculture, betel leaf cultivation, and building brickfields and settlements. The local political leaders are directly or indirectly associated with the forest grabbing.[71] Land encroachment has increased by 80% compared to 1970 level. Betel leaf cultivation is a huge activity within the sanctuary area and presently it is the

[69] http://www.fao.org/docrep/013/i1757e/i1757e.pdf
[70] Appendix 2, page 8 of EB 67, Annex 22
[71] http://archive.thedailystar.net/newDesign/news-details.php?nid=268855

				main form of temporary land encroachment. There are 6 brickfields in and around Chunati range of the sanctuary, owned by very influential people, of which 4 are within the sanctuary area. In an average, each brickfield consumes about 300 maunds of fuel wood everyday during their operation period of 6-8 months.[72]. Although a few conservation programmes are taking place, the sanctuary has now a few scattered patches of garjan trees[73].
Teknaf Game Reserve	11,615	Cox's Bazar	Hill Forest	It is estimated that there are more than 100,000 refugees living in Teknaf outside the official refugee camps[74]. In a study conducted by Salim Uddin and Khan (2007), it was revealed that 100% of the Rohingya refugees (Arakanese Muslims forced to migrate from Myanmar to Bangaldesh in 1991) and 60% of the locals are landless and are forced to encroach upon land in the game reserve. On average, locals and refugees encroach on a 0.45 ha and 0.15 ha of the reserve per household, respectively. It was also found that 7% of the local people engage in betel-leaf cultivation on encroached forest land. The Teknaf range had almost 100% forest cover in 1980. By 1990 it had dropped to 55%. Current data shows only 8% of natural forest remaining in the reserve (Nishorgo, 2006)[75]
Pablakhali Wildlife Santuary	42087	Rangamati	Tropical Evergreen and Semi-Evergreen	The sanctuary is under threat from encroachment by nearby settlements that practice slash-and-burn (jhum) agriculture practice, among other detrimental practices. Heavy dependency on forest products for livelihood purposes like fuel-wood and other forest products including construction materials and bamboo cane collection puts intensive pressure on the forest resources. Non-sustainable felling for commercial uses is another contributor towards its depletion[76]. The Daily Star (2011) reports that new settlers in the Pablakhali Wildlife Santuary are illegally clearing the reserve forests and occupancies of elephant corridors. Elephant food in this sanctuary has largely been wiped out. The wildlife section under the Department of Forestry is supposed to look after the wildlife and their habitat. However, as Pablakhali wildlife sanctuary and Teknaf game reserves are not under the jurisdiction of the wildlife division of the Department of Forestry,

[72] http://nishorgo.org/tbltd/upload/pdf/0.73200700%201354825931_2.4_Site-Level%20Field%20Appraisal%20Chunori%20Wildlife%20Sanctuary.pdf
[73] http://archive.thedailystar.net/newDesign/news-details.php?nid=268855
[74] http://www.nishorgo.org/tbltd/upload/pdf/0.21143000%201357821346_Issues%20Affecting%20the%20Nishorgo%20Project%20Areas.pdf
[75] http://www.eastwestcenter.org/fileadmin/stored/pdfs/makingconservationwork10teknaf.pdf
[76] http://www.nishorgo.org/tbltd/upload/pdf/0.58170600%201354652103_NN%20SOPA.pdf

				proper care is not being given resulting in habitat loss.[77]
Madhupur National Park	8432.71	Tangail	Tropical Moist Deciduous Sal Forests	In the Modhupur forest, patches after patches of sal coppices have been cleared and converted to banana, papaya and pineapple plantation[78]. In a short period of time, thousands of acres of forestland have been cleared and converted to single banana, pineapple, lemon and papaya gardens. As a result, most of the forest land has gone under the control of local banana, pineapple, lemon and papaya traders.[79].Encroached land in the central National Park is 3819.60 acres, whereby 2247.78 acres has been taken up the indigenous people and the remaining by the Bengalis. 1-3% of the forest is being depleted each year due to anthropogenic disturbances, political abuse, encroachment of forest by locals/local leaders, illegal cutting of Sal trees, and agro-forestry[80].
Satchari National Park	243	Hobiganj	Tropical Evergreen and Semi-Evergreen	Satchari National Park has been suffering from forest resource depletion as a result of resource exploitation (such as the collection of fuel wood from the forests as well as wood for building purposes) by populations who habit the area or surrounding area. There are many sawmills and brickfields (total of 18 sawmills in Satchari) who purchase timber from locals who gather it as an income source from the national forest. There are also timber merchants who illegally source timber from the national forest in order to sell it in other regions of Bangladesh. The presences of several brickfields have also been found in close proximity of the national park, these brickfields have been using fuel wood sourced from the forest for burning bricks. The government has also imposed the fragmentation of the forest as a result of building new transportation networks through the forest. [81]
Kaptai National Park	5464	Rangamati	Tropical Evergreen and Semi-Evergreen	There are about 35 villages in and around the Kaptai National Park, with nine in the immediate area next to the park and two inside the park boundary itself.[82] The interior villages (Bangchari and Kalabuniapara) support a large number of

[77] http://archive.thedailystar.net/newDesign/news-details.php?nid=181937
[78] "Modhupur Forest. Demise Is Imminent", June 2004, Philip Gain, Society for Environment and Human Development (SEHD), E-mail: sehd@citechco.net , http://www.sehd.org
[79] http://www.jbes.ir/doc/2012-v2-i1/2012-V2-I1-9.pdf
[80] http://www.bdresearch.org.bd/home/attachments/article/845/11570-42625-1-PB.pdf
[81] Sharif Ahmed, Mukul. *Bridging Livelihoods and Forest Conservation in Protected Areas: Exploring the Role and Scope of Non-timber Forest Products.* Rep. N.p.: Department of Forestry School of Agriculture and Mineral Sciences Shahjalal University of Science and Technology, n.d. Print
[82] http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/22219/rurallivelihoods.pdf?sequence=1

				tribal communities whose livelihoods mostly depends on jhum cultivation (a type of swidden agriculture or slash and burn) and forest resources[83].
Bhawal National Park	5,022	Gazipur	Hill Forest	There are about 202 ha of private land in the identified core area and about 650 people live within this core area. Bhawal National Park is suffering from depletion as its total area has slowly decreased over the decades. The park is 45.4% hill forest, 43.7% mangrove forest, and 10.9% Sal forest. The Sal forest is currently in bad condition. The depletion of its resources are the result of human settlement, industrialization, agricultural activities, logging, cattle ranching, the building of brick fields, saw mills, fragmentation of forest land by road construction, as well as pressure from existing populations. [84] As a result of this forest depletion many animal and plant species that are dependent on the forest are in danger.

The Total Protected Areas as claimed by Forest Department of Bangladesh and Area where Protection may have been actually enforced are provided below.

Table A.4.2:

Name	Protected Area Claimed (000 Ha)	Protection Enforced (000 Ha)
Himchori National Park	1.73	1.73
Lawachara National Park	1.25	1.25
Rema-Kalenga WS	1.8	1.8
Hazarikhil	2.91	2.91
Chunati WS	7.76	
Teknaf Game Reserve	11.62	0.9296[85]
Kaptai National Park	5.46	
PablaKhali Wildlife Sanctuary	42.09	
Medha Kachapia National Park	0.4	0.4
Sathchari National Park	0.24	
Khadim Nagar National Park	0.68	0.68
Fashiakhali Wildlife Sanctuary	1.3	1.3
Bhawal National Park	5.02	
Modhupur National Park	8.44	
Ramsagar National Park	0.05	0.05

[83] http://www.nishorgo.org/tbltd/upload/pdf/0.85599800%2013553403333_57223022-Rural-livelihoods-and-protected-landscapes-Co-management-in-the-Wetlands-and-Forests-of-Bangladesh.pdf
[84] Ashraful, Islam. "Protect Bhawal Sal Forest." *The Daily Star* [Dhaka] 5 Apr. 2008: n. pag. Print.
[85] Only 8% is protected as per Table A.4.1

Sundarbans East WS	31.23	31.23
Sundarbans South WS	36.97	36.97
Sundarbans West WS	71.5	71.5
Nijum Dweep National Park	16.35	16.35
Char Kukri-Mukri Wildlife Sanctuary	0.04	0.04
Total	**246.84**	**167.14**

Based on the above observation, the fNRB is calculated as follows

Table A.4.3: Calculation of Non Renewable Biomass Factor in Bangladesh

Parameter	Units	Description	Source	Considerations	Value
fNRB	%	Fraction of non renewable Biomass	Equation 1		90%
NRB	t/yr	Non-renewable Biomass	Equation 2	Proportion of Total Annual Biomass Removals (R) that is not demonstrably renewable	7,088,886
DRB	t/yr	Demonstrably Renewable biomass	Equation 5	Calculated as equivalent to the total annual biomass growth in protected areas	824,500
R	t/yr	Total annual biomass removals	Equation 3	Used as a national-level proxy for By. Accounts for all removals (not only wood fuels), which is equivalent to the sum of Mean Annual Increment of biomass growth and the Annual change in living forest biomass	7,913,386
MAI	t/yr	Mean Annual Increment in biomass growth	Equation 4	Country-specific MAI calculated from extent of forest and its growth rate	7,113,386
GR	t/ha-yr	Growth Rate of biomass	Distribution of total forest area by ecological zone (FAO Global Forest Resources Assessment 2000, Table 14; http://www.fao.org/DOCREP/004/Y1997E/y1997e21.htm#bm73) Above-ground biomass growth rates (t/ha-yr) for different ecological zones (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4, Table 4.9)	Country-specific growth rate calculated as a weighted average based on FAO reporting on distribution of total forest area by ecological zone and IPCC above-ground biomass growth rates for different ecological zones	4.93
F	ha	Extent of forest	FAO Forest Resource Assessment (FRA) 2010 Global Tables, Table 2		1,442,000

PA	ha	Protected area extent of forest	Based on the discussion above and Table A.4.1 and Table A.4.2	Protected Areas, for which evidence of land encroachment for agriculture, housing and industry and illegal tree cutting etc. has been found, are excluded from the calculation of fNRB . Only Protected areas where protection might have been enforced is considered.	167,140
ΔF	t/yr	Annual change in living forest biomass	Annual change in carbon stock in living forest biomass 2005-2010 for Bangladesh (FAO Forest Resource Assessment 2010 Global Tables, Table 11) Carbon stock/Biomass Conversion rate (2003 IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry): 0.5 is used as a default for the carbon fraction of dry matter	Calculated by converting: Annual Change in Carbon Stock in Living Forest Biomass 2005- 2010 (t-carbon/yr) of Bangladesh as stated in the FAO Forest Resource Assessment 2010 Global Tables, Table 11 to Annual Change in Living Forest Biomass 2005-2010(t/yr) for Bangladesh using a Carbon stock/Biomass Conversion rate 0.5 (as per 2003 IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry)	(800,000)

Table A.4.4: Non Renewable Biomass Factor of Bangladesh

F	GR	MAI	ΔF	R	PA	DRB	NRB	fNRB
Extent of Forest (ha)	Growth Rate of biomass (t/ha-yr)	Mean Annual Increment (t/yr) [MAI= F*GR]	Annual Change in Living Forest Biomass (t/yr)	Total Annual Biomass Removals (t/yr) [R=MAI-ΔF]	Protected Areas Extent of Forest (ha)[86]	Biomass Growth in Protected Areas (t/yr) [= PA*GR]	Total Annual Removals - Protected Area Growth (t/yr) [= R-DRB]	fNRB = NRB/(NRB+DRB)
1,442,000	4.93	7,113,386	(800,000)	7,913,386	167,140	824,500	7,088,886	**90%**

The above calculation and justification is more conservative to the $f_{NRB,y}$ determination under the registered PoA 4791 "Improved Cooking Stoves in Bangladesh" registered on 19 July 2011[87].

The baseline development under the ICS PoA in Bangladesh stated the following

"The HED NRB Bangladesh 2008 study found unanimous agreement from a range of experts in the country, that despite the existence formally of Protected Areas, there are no examples of sustainably managed forest areas. It estimated that 70% of areas designated officially as forested are in fact severely denuded and used for non-forest purposes. The methodology requires that renewable biomass is identified on the basis of sustainable management of resources, while non-renewable biomass is identified on the basis of deforestation in collection areas evidenced by increasing collection distances. The study found clear evidence of this sort for deforestation in collection areas, mainly in the dramatic transition in recent years from almost universal "free" collection to a situation where 50% of wood fuel is now purchased. Interviews with wood sellers indicated that collection distances have been increasing radically, with many trucks nowadays travelling more than 100km with wood fuel cargoes. The study also found that wood fuel prices have been rising sharply in recent years, and that the mixing in of secondary fuels (dung, leaves, crop residue) is partly a result of difficulties in procuring wood. With regard to assessment of a fraction for NRB, the absence of any evidence for renewable resources sustainably managed, in other words, a DRB (demonstrably renewing biomass) value of zero, together with strong evidence that land across the country is deforesting rapidly (more than two of the indicators of non-renewability prescribed by the methodology being identified), indicates that the NRB fraction is defined by the equation NRB/(DRB+NRB), and is 1."

Based on the above justification, the fraction of non renewable biomass for Bangladesh is set at the PoA level as 0.9.

[86] UNFCCC project Reference: **POA 4791 "**Improved Cooking Stoves in Bangladesh", POA-DD Section E.6.3; Page 22
[87] 4791: http://cdm.unfccc.int/ProgrammeOfActivities/poa_db/SE7XIMKF8NYVOTL16BW3U45C9ZDGAP/view

Appendix 5: Further background information on the monitoring plan

The Monitoring Plan is detailed above in the PoA-DD section E.7.1

Detailed roles & responsibilities and qualification of the Program Manager and Assistant Program Managers (CME Staff engaged in CPA inclusion)

Staff	Responsibilities	Qualification
Program Manager	▪ Coordinate and Manage all CME activities ▪ Responsible for supervising PO's activity regarding Monitoring, Education and Awareness building campaign, maintenance and service facilities. ▪ Coordination amongst the stakeholders ▪ Manage operation of the CME directly reporting to CEO ▪ Responsible for internal Audit ▪ Technical review for CPA inclusion in the PoA and CPA DD Development ▪ Reviews competencies of Assistant Program managers and Monitoring officers ▪ Set Targets for Assistant Program managers and Monitoring officers ▪ Quality control of implementation Work ▪ Addresses issues raised by Assistant Program managers and Monitoring officers ▪ Is responsible for the design and continuous improvement of Database management systems ▪ Ensures staff is updated with latest EB rules via training information sessions, meetings etc. ▪ Continuously improves on the information and project management procedures ▪ Has overall responsibility for the audit process	▪ University degree (Master's) in finance, business administration, economics or a relevant technical discipline (such as engineering or Natural sciences, public health etc.) ▪ Three to five years' relevant work experience in relevant fields, preferably CDM and project management. ▪ Knowledge of and experience in carbon markets will be preferable. ▪ Strong technical skills and experience in, or familiarity with PoAs ▪ Strong commercial and managerial Skills.
Asst Program Manager	▪ Assist Program Manager in all activities including CPA inclusion Process ▪ Manage all Records including arrangement for training and capacity development for personnel and Monitoring and Verification	▪ University degree in finance, business administration, economics or a relevant technical discipline (such as engineering or natural sciences, public health etc.) ▪ One to three years 'work experience in relevant fields.

	Reports etc. ▪ Responsible Monitoring and other report preparation ▪ Communications with the CPA Implementer. ▪ Compiles the monitoring information and develops the monitoring report from data provided by the CPA Implementer. ▪ Ensures the validity of the data provided by the CPA Implementer by means of consistency checks ▪ Identification of opportunities to improve work process and propose solutions to CME upper management. ▪ Deployment of any improvements and monitoring of their impact.	▪ Relevant technical or financial background. ▪ Familiar with the laws and regulations of the host country.

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History of the document

Version	Date	Nature of revision(s)
2.0	EB 66 13 March 2012	Revision required in order to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
1.0	EB33, Annex43 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		