CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for submission of CPAs that apply a small scale approved methodology using the provision of the proposed small scale CDM PoA.

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1,2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

>> Distribution of fuel-efficient improved cooking stoves in Nigeria – CPA [#]

Version 2
8 August,2012

A.2. Description of the small-scale CPA:

This SSC-CPA involves the promotion, distribution and sale of cooking stoves (ICS) in Nigeria. The ICS disseminated through this programme will replace the prevailing inefficient three-stone fires or equivalent with stoves which combust wood more efficiently, and improve thermal transfer to pots, hence saving fuel and lowering greenhouse gas emissions.

ICS result in substantially reduced fuel consumption and emissions for conducting cooking and water heating tasks in homes. The [##] improves the efficiency of combustion and thermal transfer to the pot compared with a traditional stove or three-stone fire and substantially reduces woodfuel consumption compared with a three-stone fire.

Figure 1 below shows the ICS.

[ICS ILLUSTRATION]

The SSC-CPA will be coordinated by C-Quest Capital LLC (CQC). ICS will be sold on a commercial basis. Carbon finance will be used to facilitate the purchase, distribution and marketing of stoves, without which the activities would not take place.

Sales information will be gathered directly from customers, and stored on a database. Registration of stoves will also constitute an informed agreement to transfer CERs generated to CQC.

Implementation
CQC will manage and coordinate the promotion, distribution and sale of the ICS using a 3-channel distribution system.

- The first channel will leverage existing local, experienced commercial distributors, and focus primarily on peri-urban markets. Each of the distributors will have their own established network of retailers. The programme will eventually engage national distributors based in Lagos when the market for the ICS is proven.
- A second channel will primarily utilise smaller, local retailers and community organisations including churches, mosques and NGOs to access more rural markets. Religious bodies have been used in the past to promote and distribute products in Nigeria.
- A third channel will market directly to consumers through direct sales at local markets days and other large community events.

CQC will manage and coordinate activities of the partners, and also provide all necessary marketing and promotion assistants to the businesses. CQC will also coordinate the monitoring of the programme activities.

Destruction of traditional stoves

The number of cooks reverting to cooking on three-stone fires and traditional stoves and three-stone fires may be considered negligible for a number of reasons, as follows.

- 100% of households used the stove during a pilot in March 2010, and all wished to purchase a stove at the end of the pilot and said that they would use the stove in the future. They were motivated by fuel savings, reduced smoke in the home and time savings.
- Stoves, fuels and diets change very little during the year so the impacts of the seasons on usage may also be considered negligible.
- Surveys reveal that the majority of Nigerians purchase firewood so have an incentive to consume less wood and are aware of the fuel savings realised by ICS.

Any incidents of reverting to traditional stoves would be flagged by the ongoing spot checks and annual monitoring.

A switch to fossil fuels may also be discounted, as there is documented preference for firewood[3] even when fossil fuel alternatives are available and affordable, and the last decade has seen a trend away from petroleum-based fuels to wood use.

Contribution of the proposed SSC-CPA to sustainable development

79.6%[4] of the population in Nigeria use wood for cooking, amounting to around 20 million households. There is a very low prevalence of improved technologies for combusting wood cleanly and efficiently. The majority of people use three-stone fires with three stones to support pots, or simple locally-fabricated metal pot supports.

The use of inefficient wood cooking stoves and three-stone fires in homes has been found to cause considerable disease and death, particularly among women and children. The World Health Organisation[5] has found that 40% of all childhood pneumonia can be attributed to exposure to smoke from fires in homes, and exposure to smoke has been found to cause chronic lung disease in women. Approximately 1.5 million people die from smoke inhalation each year; most are women and children in low-income countries. Ill health can result in loss of productivity and costs associated with health care.

In many parts of Africa wood collection is a time-consuming burden that falls mainly on women[6]. Where wood is purchased (particularly in peri-urban areas in Nigeria) it poses a significant financial burden on

---

[3] Maconachie, R, A Tanko, and M Zakariya. 2009. Descending the energy ladder? Oil price shocks and domestic fuel choices in Kano, Nigeria. *Land Use Policy*, no. 26. p1094.

[4] National Bureau of Statistics. 2009. Social Statistics in Nigeria. Table 2.9.

[5] World Health Organisation World Health Report, 2002.

[6] Biran, A., J. Abbot, and R. Mace. 2004. Families and firewood: A comparative analysis of the costs and benefits of children in firewood collection and use in two rural communities in Sub-Saharan Africa. *Human Ecology* 32, no. 1: 1-25.

families. Average annual incomes in Nigeria are said to be around US$330[7], while average household weekly fuel expenditure in Kaduna State is around ₦709 (US4.43)[8]. This equates to 70% of an individual income being devoted to fuel purchase.

The inefficient use of wood also places considerable and unnecessary pressure on local ecosystems and biomass resources, including forests. Reducing consumption of firewood can reduce this pressure.

A.3. Entity/individual responsible for the small-scale CPA:

>> Here the information on the entity/individual responsible of the CPA shall be included, hence forth referred to as CPA Implementer(s). CPA Implementers can be project participants of the PoA, under which the CPA is submitted, provided their name is included in the registered PoA.

Name of Party involved ((host) indicates a host party)	Public or private entities Project Participants	Parties involved wish to considered as project participant?
Netherlands	C-Quest Capital LLC	No
Nigeria (host)	[Name of CPA Implementer]	No

A.4. Technical description of the small-scale CPA:

A.4.1. Identification of the small-scale CPA:

>> CPA [#]

A.4.1.1. Host Party:

>> Government of the Federal Republic of Nigeria

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

>>Geographic reference or other means of identification[9], Name/contact details of the entity/individual responsible for the CPA, e.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

This SSC-CPA will be implemented within the geographical boundary of Kaduna State, Nigeria, indicated in the map below. The Northern point of Kaduna State is latitude 11°29'N and longitude 8° 6'E;

---

[7] Centre for Global Development, http://blogs.cgdev.org/globaldevelopment/2005/04/a-buyback-to-resolve-nigerias-debt-problem.php

[8] Baseline Woodfuel Consumption Survey, Nigeria, Kaduna state: Outline summary and analysis of data. Jonathan Rouse, HED Consulting. For C Quest Capital LLC. August 30 2010

[9] E.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

Southern point is latitude 9° 0'N and longitude 8°33'E; Western point is latitude 10°27'N and longitude 6° 5'E; and Eastern point is latitude 10°20'N and longitude 8°47'E[10].

Map of Nigeria (Kaduna State highlighted in red)
Source: http://en.wikipedia.org/wiki/Kaduna_State (for which permission is granted to copy, distribute and/or modify this document under the terms of the Creative Commons Attribution-Share Alike 3.0 Unported license)

SSC-CPAs will be defined as the sum of fixed locations of stoves sold to consumers using ICS within Kaduna State, Nigeria, based on a detailed sales record. The sum of the location of these households will define the spatial boundary of the SSC CPA.

A list of fixed locations of stoves sold will be provided at the time of first verification.

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

>> [DATE]

A.4.2.2. Expected operational lifetime of the small-scale CPA:

>> 10 years

[10] GPS Coordinates are sourced from Google Earth 6.1.0.5001

A.4.3. Choice of the crediting period and related information:

>> **Fixed Crediting period**

A.4.3.1. Starting date of the crediting period:

>> Date of inclusion

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

>> 10 years (not renewable)

NOTE: Please note that the duration of crediting period of any *CPA* shall be limited to the end date of the *PoA* regardless of when the CPA was added.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

>>
Each CPA will define a limit to the number of stoves based on the specific technology and context, such that each is under the SSC-CPA limit of 180 GWh^{th}/ year.

Year	Annual estimated emissions reductions tCO_2 equivalent
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

A.4.5. Public funding of the CPA:

>> No public funding is used in this SSC-CPA.

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

>>
Paragraph 10 of EB54, Annex 13 'Guidelines on assessment of de bundling for SSC project activities' states that

> *'If each of the independent subsystems/measures (e.g., biogas digester, solar home system) included in the CPA of a PoA is no larger than 1% of the small-scale thresholds defined by the methodology applied, 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.'*

The AMS-IIG threshold is a maximum energy saving of 180 GWhr/ year. The debundling rule does not apply to this SSC-PoA as the ICS (the independent subsystem) being distributed do not exceed 1% of the SSC threshold. Each ICS is in the order of magnitude of [X.XX]% of the SSC threshold.

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

>> This SSC-CPA is not registered as an individual CDM project and is not part of another registered POA. All ICS distributed through this SSC-CPA are identifiable by a unique geographical location, as well as a unique serial number. Except in the case of replacements, ICS will only be registered to homes which previously used three stone fire or equivalent.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

>>
Distribution of fuel-efficient improved cooking stoves in Nigeria

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA :

>>

Eligibility Criteria	*CPA-001*
1. Involves the promotion and distribution of ICS by CQC or entities approved and authorised by CQC.	This CPA will sell the [XXXX] improved cookstove. Only this stove will be supplied as part of this CPA. The stove model has an efficiency of XX%, much better than the typical three-stone fire.
2. Is implemented within the geographical boundary of Kaduna State, Nigeria;	[How this CPA Complies]
3. Have a maximum energy saving of 180 GWHth/ year[11] throughout the CPA's crediting period, and the energy savings of each ICS unit in a CPA is no larger than 5% [or 9000 MWHth/yr] of the small-scale CDM threshold of 180 GWHth/yr in order to demonstrate additionality of each CPA;	This CPA will distribute a maximum of [XXXX] stoves. A spreadsheet included with this CPA shows that each stove will save a tiny fraction of a GWH, and the [XXXX] stoves will equal less than 180 GWH. Energy saving is estimated by taking the estimated biomass saved per stove in tonnes and multiplying that by the net calorific value of the wood (0.015 TJ/tonne or, converted from TJ to

[11] As per Annex 27 of the 68th meeting of the CDM Executive Board, GUIDELINES ON THE DEMONSTRATION OF ADDITIONALITY OF SMALL-SCALE PROJECT ACTIVITIES (version 9), projects are considered additional if ”project activities are solely comprised of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-scale thresholds. Annex 21 of EB 61 established 60GWh per year as the SSC threshold. The conversion from 60 GWHe to 180 GWHth per year was approved in a clarification by the small-scale working group (SSC_233). Footnote 1 of Annex 27 of EB 68 clarifies that the size of each unit (ICS) has to be below 3000 MWh of energy saving per year, equivalent to 9000 MWhth/year. Thus, if the CPA complies with eligibility criterion 3, the CPA is considered additional.

	kWh, which is equivalent to 4,167 kWh/tonne of wood saved). The energy savings per stove is then multiplied by the number of stoves in the CPA to determine the maximum number of stoves that can be included without exceeding the 180 GWH/year limit. Each stove is estimated to save about [X.XXXX] GWHth/yr, far below the 9000 MWhth/yr threshold.
4. Has a database describing uniquely identified and defined households in which ICS have been distributed;	This CPA will have a database that includes the following for each ICS unit: name of the customer, address/ description of location, contact telephone number(s), unique serial number of the stove (including prefacing the serial number with the letters "CQC"), retailer ID, and date of purchase.
5. Comply with the PoA standard Para 14 (e) the eligibility criteria should be the criteria with regard to the *conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPA.* The CPA should comply with all criteria. These applicability criteria include: (1) the project involves the distribution of energy efficient cooking stoves; (2) these new stoves have an efficiency of no less than 20%; (3) non-renewable biomass has been used as a fuel since 1989.	This CPA complies with the Para 14(e) criteria, including: (1) the stove that will be distributed will be the XXXX stove, which is much improved over the traditional 3-stone fire; (2) a WBT indicates that this stove is XX% efficient, well above the minimum requirement of 20%; and (3) literature in Annex III of the PoA-DD indicates that non-renewable biomass has been used in Nigeria since 1989.
6. Does not involve households already involved or covered by any other CPA or CDM project involving the distribution of ICS	CQC has reviewed all on-line materials that might be available from the UNFCCC and GS websites, which list every PoA, CPA and single-project activity and found two projects. There is one registered PoA in Nigeria using AMS IIG. The CME for that PoA is Atmosfair gGmbH and the first and only CPA listed on the UNFCCC website for this PoA is using the Save80 stove model. Thus, the stove model is different than the stove being used in this CPA. In addition, the CPAs can be distinguished by the serial numbers. The Atmosfair CPA will shall have a code for the PoA (PoA registration number; alternatively: atm), followed by a code for the ICS itself. Example: atm00001. The CQC stove serial numbers will start with "CQC…". Thus, it will be easy to distinguish stoves in each CPA and ensure there is no double counting because every stove in the

	CQC database will list a different stove model and serial number that begins with "CQC". There is another registered CDM project (Project #2711) for the distribution of cooking stoves. This project also uses the Save80 stove model and is again easy to distinguish from the CQC PoA. The PP for that project is the Nigerian Developmental Association for Renewable Energies (DARE), the German Non-Governmental Organisation Lernen-Helfen-Leben e.V. (LHL e.V.) and Atmosfair gGmbH. Thus, the project participants are totally distinct from CQC. This analysis shows that other projects' stoves are separate and distinct from the CQC PoA. Other similar CDM project and programs include [XXXX]
7. Be able to provide documentary evidence of the start date.	[How this CPA Complies]
8. Be able to affirm that no funding is coming from Annex I parties. If any public funding is made available from Annex I parties, affirm there is no diversion of Official Development Assistance (ODA);	Letters provided to the validator show that investment finance is coming from the private sector. This amount of funding matches the cost of the manufacturing, transporting and distributing the stoves for this CPA.
9. Is not registered as an individual CDM project activity nor included in another registered SSC-PoA	CQC has reviewed all on-line materials that might be available from the UNFCCC and GS websites, which list every PoA, CPA and single-project activity and found two projects. There is one registered PoA in Nigeria using AMS IIG. The CME for that PoA is Atmosfair gGmbH and the first and only CPA listed on the UNFCCC website for this PoA is using the Save80 stove model. Thus, the stove model is different than the stove being used in this CPA. In addition, the CPAs can be distinguished by the serial numbers. The Atmosfair CPA will shall have a code for the PoA (PoA registration number; alternatively: atm), followed by a code for the ICS itself. Example: atm00001. The CQC stove serial numbers will start with "CQC…". Thus, it will be easy to distinguish stoves in each CPA and ensure there is no double counting because every stove in the CQC database will list a different stove model and

	serial number that begins with "CQC". There is another registered CDM project (Project #2711) for the distribution of cooking stoves. This project also uses the Save80 stove model and is again easy to distinguish from the CQC PoA. The PP for that project is the Nigerian Developmental Association for Renewable Energies (DARE), the German Non-Governmental Organisation Lernen-Helfen-Leben e.V. (LHL e.V.) and Atmosfair gGmbH. Thus, the project participants are totally distinct from CQC. This analysis shows that other projects' stoves are separate and distinct from the CQC PoA. All of this information will be updated and summarized in a report and provided to the DOE upon verification.
10. Is approved by CQC entity prior to its incorporation into the SSC-PoA	[How this CPA Complies]
11. Is introducing ICS that will have a thermal efficiency of no less than 20%, (using the WBT outlined in AMS IIG. Version 3 approved by the CDM Executive). Efficiency of the ICS shall be established by a national standards body or an appropriate certifying agent recognized by it, or alternatively manufacturers' specification shall be used	The [XXXX] stove has an efficiency of XX% , according to the Water Boiling Test. The CPA is using a stove technology, whose manufacturer specifications are confirmed using this Water Boiling Test.
12. Ensure that the CPA meets the criteria for not being a de-bundled component of a larger project activity (eg: the debundling rule does not apply if the stove, the independent subsystem, does not exceed 1% of the 180 GWh)	[How this CPA Complies]
13. CPAs must include a mechanism that transfers the ownership rights of CERs from the ICS user to the project participants.	[How this CPA Complies]

B.3. Assessment and demonstration of additionality of the small-scale CPA, as per eligibility criteria listed in the Registered PoA:

>> As per Section E5.2 of the PoA DD, this SSC-CPAs meets the following criteria in order to demonstrate additionality and be included in the SSC-PoA:

If the CPA complies with eligibility criterion 3 – ie. achieve energy savings of no more than 180 GWH_{th} per year and the size of each unit (ICS) is below 3000 MWh (equivalent to 9000 MWhth) of energy saving per year (Annex 27 of the 68th meeting of the CDM Executive Board, GUIDELINES ON THE

DEMONSTRATION OF ADDITIONALITY OF SMALL-SCALE PROJECT ACTIVITIES (version 9)), the CPA is considered additional.

The energy savings per ICS in this CPA is estimated at [X.XXXX] GWHth/yr. The energy savings per stove is divided by the small-scale threshold (180 GWHth/year) to determine the number of stoves in the CPA, thus equalling [XX,XXX] stoves. Therefore, the maximum number of stoves in this CPA is equal to the small-scale threshold. In addition, the energy savings per stove (X.XXX GWHth/yr) is far below 5% of the small-scale threshold (9000 MWHth/yr), thus this SSC-CPA is considered additional.

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

>>

>> The table below outlines the greenhouse gas emissions included in the SSC-CPAs under the SSC-PoA.

Source		**Gas**	**Included?**	**Justification/ explanation**
Baseline	Combustion of non-renewable firewood for cooking	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions. Exclusion is conservative assumption.
		N_2O	No	Minor source of emissions. Exclusion is conservative assumption.
Project activity	Combustion of non-renewable firewood for cooking	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions. Exclusion is conservative assumption.
		N_2O	No	Minor source of emissions. Exclusion is conservative assumption.

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

>>

Data / Parameter:	**B_{old} -**
Data unit:	Tonnes / stove / year
Description:	Quantity of woody biomass used in the absence of the project activity in Kaduna State, Nigeria
Source of data used:	Baseline Survey 2010 and Follow-up Survey, June 2011
Value applied:	4.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	A survey was administered in a total of 251 randomly selected kitchens in peri-urban and rural areas in Kaduna in 2010. The survey used questions to investigate woodfuel consumption – asking both about volumes used as well as expenditure, which was then related to prices ascertained from woodfuel vendors. To cross-check findings, typical volumes of wood used daily were also weighed in kitchens. These data collectively gave the annual fuel consumption data per household on 5.29 tonnes/year. The baseline fuel consumption was found to be uniform across rural and peri-urban locations. A follow-up survey in June 2011 was conducted on 97 households in Kaduna state with the aim to capture the average number of stoves used simultaneously for cooking per family unit to further refine woodfuel consumption. Based on this study a baseline adjustment factor has been applied to B_{old} to account for fuelwood used in a second baseline stove for the 60.8% of households in the baseline study who reported using a second stove at least once per week. This baseline adjustment factor is based on the mean number of stoves used per household averaged across the entire baseline sample, calculated to be 1.23 stoves/household, and equates to 1/1.23 = 0.813. The value of B_{old} applied in this PoA-DD for woodfuel baseline stoves (4.21 tonnes/year) incorporates this 0.813 baseline adjustment factor and a 0.97 adjustment factor for the seasonal variation in fuelwood consumption, which takes into account households that switched to other fuels when it rains.
Any comment:	

Data / Parameter:	**$f_{NRB,y}$**
Data unit:	Fraction
Description:	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass
Source of data used:	FAO Forest Resource Assessment 2010 Global Tables: Tables 2, 6, 11 FAO Global Forest Resource Assessment 2000, Table 14 2003 IPCC Good Practice Guidance for Land-Use Change and Forestry, Chapter 3 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4, Table 4.9
Value applied:	0.93

Justification of the choice of data or description of measurement methods and procedures actually applied :	Use of nationally approved sources of data Calculated as provided for in AMS-II.G, version 03, and EB 67 Annex 22
Any comment:	

Data / Parameter:	**ηold**
Data unit:	fraction
Description:	AMS IIG Version 03 default figure
Source of data used:	AMS II.G., ex-ante
Value applied:	0.10
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS-II.G Version 03, Option 2. The 0.10 default value may be used as the replaced systems are three-stone fires or conventional systems lacking improved combustion air supply mechanism and flue gas ventilation system i.e., traditional stoves.
Any comment:	

Data / Parameter:	$EF_{projected\_fossilfuel}$
Data unit:	**TCO2/TJ**
Description:	Emission factor of the fossil fuel most likely to be adopted
Source of data used:	IPCC default value as provided in Version 3 of AMS IIG
Value applied:	**81.6**
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default that AMS IIG states can be used.
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	**TJ/ tonne**
Description:	Net Calorific Value of biomass
Source of data used:	IPCC default value for woodfuel
Value applied:	**0.015**
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default applied
Any comment:	

B.5.2. Ex-ante calculation of emission reductions:

>>

Equations applied

This SSC-CPA will calculate emission reductions through application of the following equations:

$$ER_y = B_{y,savings} \cdot f_{NRBy} \cdot NCV_{biomass} \cdot EF_{projected\_fossilfuel} \cdot L$$

where:

ER_y	Emission reductions during the year *y* in tCO_2e
$B_{y,savings}$	Total biomass that is saved in tonnes during the monitoring year (*y*)
$fNRB_{,y}$	Fraction of biomass saved by the project activity in year *y* that has been established as non renewable biomass
$NCV_{biomass}$	Net calorific value of the non-renewable biomass that is substituted (IPCC default for woodfuel, 0.015 TJ/tonne)
$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable biomass by similar consumers. The substitution fuel likely to be used by similar consumers is 81.6 tCO_2/TJ.
L_y	Leakage factor in year '*y*'.

Calculating $B_{y, savings}$

According to the methodology, $B_{y,savings}$ may be calculated in a number of ways (as per Options 1, 2 and 3 in Paragraph 6) and the PoA for which this SSC-CPA is under will allow the use only of Options 2, thus Option 2 is used in this CPA.

Option 2

$$B_{y,savings} = B_{old} \cdot \left(1 - \frac{\eta_{old}}{\eta_{new}}\right)$$

Where:

B_{old}	Baseline Quantity of woody biomass used in the absence of the project activity in tonnes
η_{old}	Efficiency of the baseline system/s being replaced. The 0.10 default value is used as the replaced systems are three-stone fires or conventional systems lacking improved combustion air supply mechanism and flue gas ventilation system i.e., traditional stoves.
η_{new}	Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol.

In order to account for stoves which have been in operation for fractions of the monitoring period, the following formula is used:

$$Ny,i = \sum_{j=1}^{J_y} n_{y,j} \cdot t_{y,j}$$

Where:

$N_{y,i}$	Total number of stoves of vintage ($_i$) in operation for a full monitoring period equivalent within each SSC-CPA
$n_{y,j}$	Number of ICS operating in monitoring period *y* for j days,
j	days since distribution of the ICS (or start date of monitoring period for ICS distributed in prior monitoring periods, whichever is later), until end of monitoring period
$t_{y,j}$	Fraction of monitoring period *y* that the stove is in operation ($t_{y,j} = j/J_y$). Note, for ICS distributed in prior monitoring periods $t_{y,j} = 1$.
J_y	Total number of days in the monitoring period *y*

The baseline fuelwood consumption report shows an average consumption of 5.29tonnes/household/yr. Note that this household average is later adjusted to fuelwood consumption per appliance by multiplying this number by a baseline adjustment factor, which is based on the mean number of stoves used per household averaged across the entire baseline sample, calculated to be 1.23 stoves/household, and equates to 1/1.23 = 0.813 mean adjustment factor. In addition, 5.29 tonnes/household/yr is further adjustment for seasonal variation applying an adjustment factor of 0.979.

Bold is then valued as 5.29*0.813*0.979= 4.21 tonnes/stove appliance/yr (11.54 kg/day)

In order to efficiently monitor the continued use of baseline fire/stoves, the CME has opted to use a discount factor based on the number of monitored households who are still using a baseline fire/stove simultaneously with the ICS. To calculate the discount factor conservatively, the CME used the mean number of fires/stoves used simultaneously for the 60.8% of respondents that used more than one stove simultaneously during the baseline survey, which is 1.37. This equates to an adjustment of 1/1.37 = 0.73.

During monitoring, the CME will ask the household and also visually inspect the number of baseline fire/stove used simultaneously with the ICS (parameter SSy). If less than 60.8% of the monitored population is found using a second stove, no discount shall be given to Bold – since that discount is already embedded on the original baseline fuel consumption. If over 60.8% is found using a second stove, the difference between SSy and 60.8% is taken and the 0.73 discount is applied.

For example, during monitoring it is found that 70% of households use a second stove. Therefore, 9.2% of households receive a 0.73 adjustment. And no adjustment is applied to the balance, which is 90.8% of households. Therefore the overall adjustment factor in this example is 0.975 and will be applied to Bold (4.21 tonnes/stove/year) = 0 .975 x 4.21 tonnes/ stove /year = 4.11 tonnes/stove/year for the monitoring period.

$$B_{y,savings} = B_{old,adjusted} \cdot \left[\sum_{i=1}^{n} N_{y,i} \left(1 - \frac{\eta_{old}}{\eta_{new,i}} \right) \right]$$

Where:

$N_{y,i}$ Total number of stoves of vintage ($_i$)[12] in operation for a full monitoring period equivalent within each SSC-CPA

η_{old} Efficiency of the baseline system/s being replaced. The 0.10 default value is used as the replaced systems are three-stone fires or conventional systems lacking improved combustion air supply mechanism and flue gas ventilation system i.e., traditional stoves.

$\eta_{new,i}$ Efficiency of the system of vintage (i) being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol.

and

$B_{old,adjusted} = B_{old}*[(SS_y – 0.608) * 0.73 + (1 – (SS_y – 0.608)]$

B_{old} Baseline Quantity of woody biomass used in the absence of the project activity in tonnes = 4.21tonnes/stove/year

SS_y Percentage of households that continue to use baseline stoves simultaneously with ICS at least once per week (see section E.7.1. of the SSC-PoA-DD). If SS_y is less than or equal to 60.8% no discount shall be given to Bold – since that discount is already embedded on the original baseline fuel consumption. If more than 60.8% is found using a second stove, the difference between SS_y and 60.8% is taken and the 0.73 discount is applied.

0.608 Percentage of households in the baseline study that use a second stove simultaneously.

0.73 Adjustment factor for simultaneous second stove use that is based on the mean number of stoves used per household averaged across the 60.8% of households from the baseline sample that use a second stove simultaneously.

As specified in the AMS II.G (version 3) methodology, B_{old} is determined by using one of the following two options:

1. Calculated as the product of the number of systems multiplied by the estimated average annual consumption of woody biomass per appliance (tonnes/year). This can be derived from historical data or a survey of local usage,

Or

[12] Vintage shall be defined as the “age” of the ICS – ie. Number of years it has been in operation. – ie. all stoves below 1 year (or 365 days) of use belong to vintage 1, all stoves between 1 and below 2 years of use to vintage 2 and so on. Note that i will match the efficiency of the stove at a certain “age”; e.g. stoves vintage 2 will be grouped together and WBTs will dictate their $\eta_{new,i}$.

2. Calculated from the thermal energy generated in the project activity as:

$$B_{old} = \frac{HG_{p,y}}{NCV_{biomass} * \eta_{old}}$$

The project proponents select option (a) directly above to determine B_{old}.

Note: Methodology AMS II.G (version 3), requires that monitoring ensures that (a) Either the replaced low efficiency appliances are disposed of and not used within the boundary or within the region; or (b) If baseline stoves continue to be used, monitoring shall ensure that the fuelwood consumption of those stoves is prorated in B_{old}. In the PoA that this CPA is under, option (b) is used, therefore option (b) is used in this CPA. B_{old} will be adjusted ex-post to account for the wood used in any baselines stoves that continue to be in used in addition to the ICS. The baseline survey determined the percentage of households that are currently using more than one wood-burning stove and are likely to use more than one stove after the ICS is provided (See Annex 3). This survey provides an adjustment factor to account for the amount of wood used by that second stove, thus B_{old} is adjusted based on this factor.

The calculations are as follows:

$$B_{y,savings} = B_{old,adjusted} \cdot \left(1 - \frac{\eta_{old}}{\eta_{new}}\right)$$

$\mathbf{B_{y\ savings}}$ = B_{old} * (1- (.10/.XX)) = B_{old} * (1- X.XXX) = $\mathbf{B_{old}}$ ***** X**.**XX

$B_{y,savings}$ = 4.21 * (1-.0.XXX) = 4.21 * 0.XXX = X.XX tonnes of wood saved per stove per year

If we assume there could be as many as XX,XXX stoves, total wood savings would be XX,XXX tonnes of wood. Using the formula below:

$$ER_y = B_{y,savings} \cdot fNRB_y \cdot NCV_{biomass} \cdot EF_{projected\_fossilfuel} \cdot L$$

ER_y = XX,XXX * 0.93 * 0.015 * 81.6 * 0.95
= **XX,XXX tonnes CO2e**

B.5.3. Summary of the ex-ante estimation of emission reductions:

>>

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
Year 1	0		0	
Year 2	0		0	
Year 3	0		0	

Year 4	0		0	
Year 5	0		0	
Year 6	0		0	
Year 7	0		0	
Year 8	0		0	
Year 9	0		0	
Year 10	0		0	
Total (tonnes of CO_2 e)				

B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

>>
The monitoring plan is outlined in Annex 4.

The following parameters will be monitored for this SSC-CPA

Data / Parameter:	***Z***
Data unit:	Number of stoves sold
Description:	Total number of stoves sold and registered in the Project Database Records
Source of data to be used:	Project Database records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Dependent on CPA sales records. For the purposes of ex-ante calculation of expected emission reductions, the maximum number of stoves per this CPA is [XXXX].
Description of measurement methods and procedures to be applied:	Detailed sales information will be collected for each customer, either using electronic or paper-based means. The most likely means by which data will be collected will be by SMS (i.e. mobile phone 'short message service' text). Information that is entered into the database includes the name of the customer, address/ description of location, contact telephone number(s), unique serial number of the stove, retailer ID, and date of purchase. Sales information submitted via SMS will automatically enter the database. Written registration cards will be entered manually into the same database. The unique serial number of each stove sold corresponds to a CPA. The date that the stove is registered in the database shall be utilized to determine vintage of the stove.
QA/QC procedures to be applied:	Where electronically submitted, once a given phone number has been used to submit information for a defined number of stoves, the software will block it from a predetermined number of future submissions. Stove sellers' phone numbers may be exempted from this by prior agreement. Project distribution staff will spot-check end-users to verify that information submitted was factual.
Any comment:	

Data / Parameter:	$\mathbf{n_{yj}}$
Data unit:	Quantity
Description:	Number of ICS in year *y* operating for *j* months
Source of data to be used:	Sales records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	[XXXX]
Description of measurement methods and procedures to be applied:	The percentage of stoves found to be still in operation based on the sampling plan in each monitoring period will be applied to the total number of stoves distributed in each CPA (according to the ICS sales records in the registration database and the applicable sample frame). The proportion of sampled ICS found to be in

	operation during each monitoring period will be applied to the total number of stoves for each CPA when calculating emission reductions. If, based on the sample size selected in any monitoring period, the confidence/precision requirements set out in EB69 Annex 4 are not satisfied, then CPA Implementers will follow the procedures outlined in the Monitoring Plan (E.7.2 of the PoA-DD) and increase the sample size until the required level of confidence/precision is met or appropriate conservative values as defined by AMS II.G Version 3 are used.
QA/QC procedures to be applied:	The unique reference number of each stove sold shall be logged in the monitoring database showing the total number of stoves. Data from the sampling plan will be collected in each monitoring period by trained project staff and applied in the emissions reductions calculations. Internal cross-checks by the CME or CPA Implementer will be undertaken as QC
Any comment:	This parameter will be monitored annually, beginning 1 year after the date of registration. The monitoring will be done by surveys, undertaking a representative sample from the sales records to ensure the stoves are still in place. The process for determining the sample size is described in Annex 4.

Data / Parameter:	SS_y
Data unit:	Percentage
Description:	The percentage of ongoing baseline stove use within the population of in-use ICS during a monitoring period. This is needed to calculate $B_{old, adjusted}$.
Source of data to be used:	Monitoring of ongoing baseline stove use will be undertaken using the sampling approach outlined in section E.7.2 of the PoA-DD (to meet EB69 Annex4 confidence/precision requirements).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This will be a monitored parameter, so will only be available ex-post. As a conservative approach to ex-ante calculations, the percentage of households in the baseline study using a second stove at least once per week (60.8%), resulting in a mean total household stove usage 1.23, has been used to calculate the ex-ante baseline adjustment factor of 1/1.23 = 0.813. This ex-ante baseline adjustment factor has been applied to Bold in order to subtract fuelwood used in these second stoves resulting in the Bold estimate of 4.21 tonnes/year applied for the purpose of calculating expected emission reductions in section B.5.2. of the CPA-DD.
Description of measurement methods and procedures to be applied:	A survey will be conducted asking households if they use a second (baseline) stove at least once per week, as per the monitoring plan outlined in Annex 4. SS_y will be calculated in each monitoring period as follows: the number of sampled households with in-use ICS that also continue to use a baseline stove divided by the total number of in-use ICS in the sample.
QA/QC procedures to be applied:	Data for this parameter will be collected using the same survey for the parameter $n_{y,i}$ (in-use appliances) conducted by trained project staff members. Internal cross-checks by the CME or CPA Implementer will be undertaken as QC.

Any comment:	See Annex 4 for more detail on monitoring procedures This parameter is used to address paragraph 20 (b) of the AMS II.G (Version 3) methodology.

Data / Parameter:	$\mathbf{t_{yj}}$
Data unit:	Fraction
Description:	Fraction of CPA monitoring year (*i*) elapsed since purchase of stove
Source of data to be used:	ICS registration data and data from sampling plan
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Dependent on date of purchase of stoves. Value = *j* weeks since distribution/12 Where stoves were purchased during previous CPA monitoring periods, this value will be set to 1.0.
Description of measurement methods and procedures to be applied:	ICS registration data will provide a simple means to calculate the time elapsed since the registration of ICS in the registration database, and thus the period during a single monitoring period
QA/QC procedures to be applied:	The values will be quality assured by way of the spot-checking undertaken throughout the life of the CPA. This will involve periodic visits to a random subsample of the population.
Any comment:	Purchase date is used as indication of date of commencement of operation of the ICS.

Data / Parameter:	$\boldsymbol{\eta_{new,i}}$
Data unit:	Fraction
Description:	Efficiency of the new stove
Source of data to be used:	Water-boiling test for every year of operation, *ex-post*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	[XXXX]
Description of measurement methods and procedures to be applied:	The tests will be coordinated by the CME and undertaken following WBT protocol 3.0 (or more recent version at the discretion of the CME) by the CPA Implementer or an experienced third party.
QA/QC procedures to be applied:	The WBT Protocol 3.0 or a more recent version will be used at CME discretion.
Any comment:	This monitoring will take place annually using testing procedures described in Annex 4. The process for determining the sample size is described in Annex 4.

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

☑ Please tick if this information is provided at the PoA level. In this case sections C.2. and C.3. need not be completed in this form.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
NA

C.3. Please state whether an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA), in accordance with the host Party laws/regulations:

>>
NA

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

☑ Please tick if this information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>
NA

D.3. Summary of the comments received:

>>
NA

D.4. Report on how due account was taken of any comments received:

>>
NA

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	C-Quest Capital LLC
Street/P.O.Box:	1211 Connecticut Ave., NW - Suite 800
Building:	
City:	Washington
State/Region:	D.C.
Postfix/ZIP:	20036
Country:	USA
Telephone:	+1-202 416 2400
FAX:	+1-202 416 2499
E-Mail:	operations@cquestcapital.com
URL:	www.cquestcapital.com
Represented by:	Isabel Alegre
Title:	Operations Director
Salutation:	Ms.

Last Name:	Maria
Middle Name:	Isabel
First Name:	Alegre
Department:	
Mobile:	+1-202 247-7976
Direct FAX:	
Direct tel:	+1-202 416 2410
Personal E-Mail:	ialegre@cquestcapital.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is used in this SSC-PoA.

Annex 3

BASELINE INFORMATION

Location of baseline

The baseline scenario is identified for Kaduna State, Nigeria, indicated in the map below.

Map of Nigeria (Kaduna State highlighted in red)

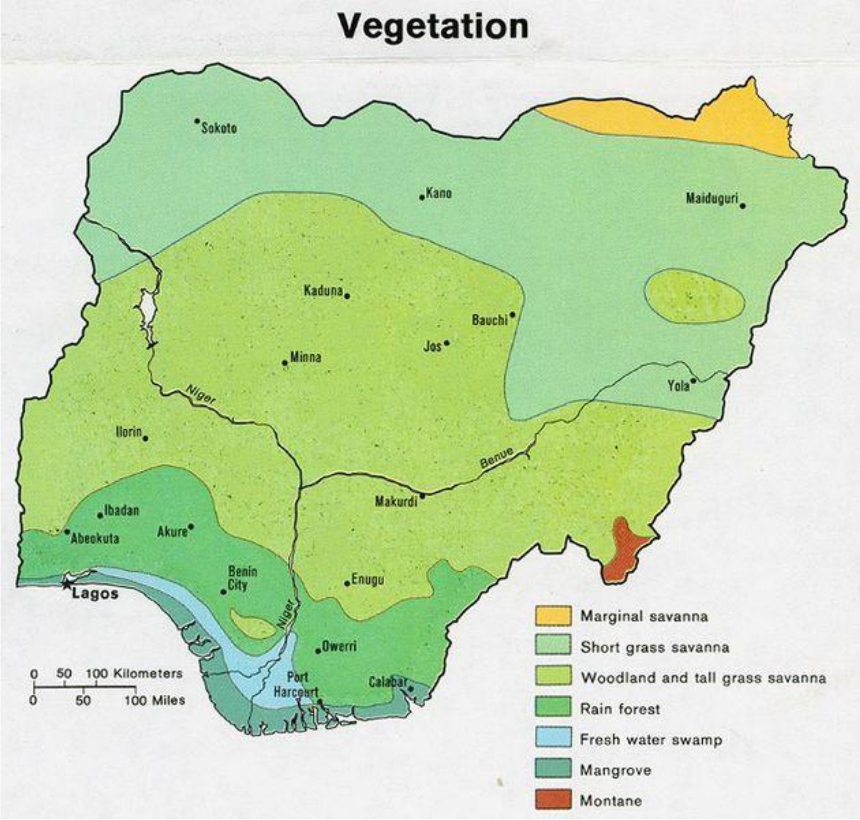
Source: http://en.wikipedia.org/wiki/Kaduna_State (for which permission is granted to copy, distribute and/or modify this document under the terms of the Creative Commons Attribution-Share Alike 3.0 Unported license)

Kaduna State was chosen as the geographic boundary, thus the location for the baseline investigations because of the significant markets for ICS are expected to be found in both urban and rural areas of Kaduna State.

According to the Nigeria National Bureau of Statistics data[13], over 90% of both rural and urban households in Kaduna State rely on wood for cooking. The average household members per urban and rural households are similarly high compared to other states, 9.0 and 10.7 respectively[14]. Kaduna State is located in the Guinea Savannah region, which is an ecologically homogenous region within Nigeria that is characterized by woodlands and tall grasses. The climate is also homogenous across Kaduna and classified as a tropical savanna climate.

[13] National Bureau of Statistics, Social Statistics in Nigeria 2009, Federal Republic of Nigeria.

[14] *Ibid*



Vegetation types of Nigeria
Source: http://en.wikipedia.org/wiki/Geography_of_Nigeria (this image is a work of the US Government and is in the public domain.)

Sampling Design
Objective. A baseline fuel consumption survey was conducted in Kaduna State in July 2010. The objective was to determine the mean weekly fuelwood consumption for households in Kaduna State. To satisfy the conditions for AMS IIG and EB69 Annex 4 standards for sampling, a confidence interval of 90% with a margin of error of $\leq$ 10% must be met.

Target Population. A literature review and consultations revealed that the project area is fairly homogenous and the sampling strategy was designed in such a way as to be representative of the proposed area of dissemination of stoves, which is both urban and rural areas of the state of Kaduna.

Sampling Method. A HED Consulting (HED) team led the planning of this study. Aspects of the study design, such as identification of study locations and questionnaire development, were carried out in collaboration with the team from SOSAI, Nigeria, who also trained and supervised the survey team in Nigeria. Analysis was undertaken using Excel by HED.

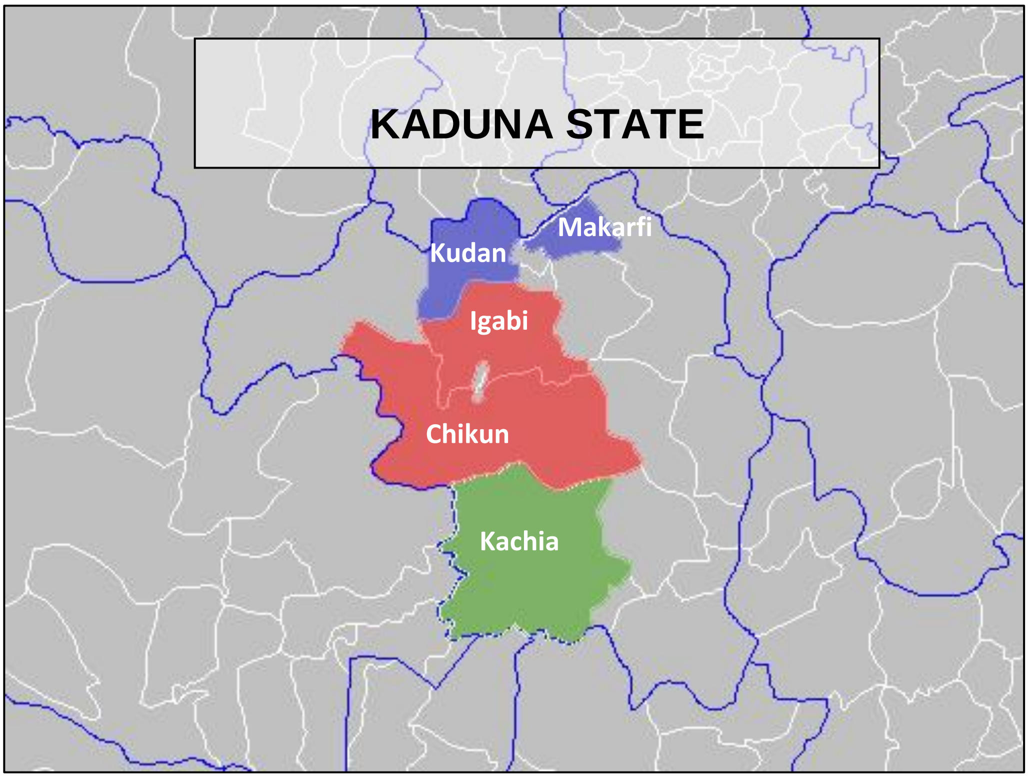
At the time of the survey, an acute religious crisis between Christians and Muslims was prevailing in northern Nigeria, which includes Kaduna State, and distrust of outsiders was and remains an acute problem. Therefore, areas deemed unsafe by the survey team were excluded from the areas to be sampled, thus limiting the sample frame. Logistical conditions of the survey team also put limitations on areas to

be visited: surveyors were required to return before the government curfew in the absence of secure lodging options outside the city of Kaduna.
CQC and HED relied on local knowledge by the survey team from SOSAI, Nigeria as well as consultations with Dr. Salisu Mohammed (PhD), Department of Geography, Bayero University, Kano to determine areas to be sampled that are representative of fuelwood users from both urban and rural areas in Kaduna.

The final sample included a total of 13 rural and urban villages from 5 local government areas (LGAs) covering the north, central and southern regions of the State. These are presented below.

Sampled Villages

	REGION OF KADUNA	**LGA**	**Village**	**# HHs SURVEYED**
RURAL	Central	Igabi	Kutungare	20
	Central	Chikun	Kujama	20
	North	Kudan	Bagadi	9
	North	Kudan	Bagadi Tashan Dauda	9
	North	Makarfi	Ruma	25
	Central	Chikun	Dutse	26
			Subtotal	***109***
URBAN	North	Kudan	Likoro	20
	Central	Igabi	Jaji	21
	North	Makarfi	Makarfi	26
	South	Kachia	Katari	26
	Central	Chikun	Buruku	30
	Central	Chikun	Kidunu - Rido	9
	Central	Chikun	Rido	10
			Subtotal	***142***
			TOTAL	**251**



Local Government Areas where baseline survey was conducted
Modified from the following source:
http://en.wikipedia.org/wiki/File:Nigeria_Local_Government_Areas.png (This work has been released into the public domain by its author, I, Rarelibra.)

Household-level random sampling strategy. Fieldworkers were instructed to identify a central point in selected areas and to spin a bottle (or some similar way of randomly selecting a direction in which to travel) and to begin identifying homes for surveys in that direction. When one survey was completed, the surveyor would move to the next-but-one household until a new suitable household was identified.

Sample size determination. The number of households were selected to satisfy the conditions for AMS IIG, which also meets EB69 Annex 4 standards for sampling, i.e. the baseline study must meet or exceed the confidence interval of 90% with a margin of error of $\leq$ 10% of sample mean.

A previous woodfuel household consumption study undertaken earlier in 2010 in neighbouring Kano gave a COV (coefficient of variation) of 0.55. To achieve 90/10 precision, the following sample size would be required at this level of variation: (1.645 * 0.55/0.1)^2 = 82

Therefore, based on the assumption that data variability would be similar in Kaduna, to allow for some loss the survey team was requested to survey at least 100 households across Kaduna.

When the data from 100 households in Kaduna was reviewed, the variability was somewhat higher (COV = 0.81). This indicated a sample size of 178 was required to achieve 90/10 precision: (1.645 * 0.81/0.1)^2 = 178

In order to ensure the precision requirement were satisfied in the second round of data collection, fieldworkers were requested to return to the field to conduct a further 140 HHs to allow for any further loss, ultimately surveying a total 251 households.

Establishing the precision of the final dataset. The data generated from the 251 households surveyed for this baseline survey can be shown to have met the precision requirements of AMS IIG and EB69 Annex 4 standards for sampling (90/10), using the following equation:

$$n = [\frac{Zscore * COV}{\Pr}]^2$$

Where:

Z score for 0.9 confidence interval = 1.645
COV = Coefficient of Variation = standard deviation / mean = s / μ
Pr = Precision = 0.1 (i.e. 10%, as per AMS IIG Version 03)

Re-arranged and substituted, we see that:

$$\mu = \bar{x} \pm \left[1.645 * \left[\frac{s}{\sqrt{n}} \right] \right]$$

Where

μ = actual mean
$\bar{x}$ = sample mean (101.7 kg/week/hh)
s = standard deviation
n = sample size (251 households)

The AMS-IIG Version 03 methodology requires a precision of 90% confidence (z-score 1.645) with a 10% margin of error.

If $\left[1.645 * \left[\frac{s}{\sqrt{n}} \right] \right] \leq 0.1 * \bar{x}$

Inserting values we see that

$$\left[1.645 * \left[\frac{70.9}{\sqrt{251}} \right] \right] \leq 0.1 * 101.7$$

Resolved: 7.36 < 10.17

This demonstrates that for 90% confidence, the margin of error is less than 10%. Therefore, this baseline fuel consumption figure exceeds the precision requirements of AMS-IIG Version 03 and EB 69 Annex 4.

Accuracy of the survey. The survey used to determine baseline fuel consumption employed a series of techniques to ensure accuracy, including asking respondents to visually show how much wood was used daily and weighing this using digital scales; as well as asking how much money respondents spent on fuelwood each week and translating this into quantities based on prices determined from local wood vendors.

Follow-up Survey. A follow up survey of 100 households in urban and rural areas in Kaduna was conducted during June 2011 to establish number of stoves used simultaneously for cooking, and seasonal variation. This study contributes a refinement to the baseline developed during the previous study. In order to provide more accurate estimates of emission reductions this study aimed to capture the average number of stoves used *simultaneously* for cooking per family unit. The survey was carried out on a sample of 60 urban and 40 rural households in Kaduna State, Nigeria. These 100 households were randomly selected from the study population of the July 2010 Kaduna survey. If the original households could not be located a replacement household was identified within the same community using the same inclusion criteria for the July 2010 survey; i.e. locating a central point in the selected area and spinning a bottle (or using some way of randomly selecting a direction in which to travel) and begin identifying homes for surveys accordingly, as in the original study. HED defined the sample size and provided guidance to the field team on sample selection. Analysis was undertaken using Excel and SPSS 16.0 by HED.

Key findings
The baseline fuel consumption from the July 2010 survey was found to be uniform across rural and urban locations. After basic data cleaning (removal of top and bottom 5% of outliers) the baseline fuel consumption was calculated as 101.7 kg/ week/ stove. This is equivalent to 5.29 tonnes woodfuel / year/ stove.

The follow-up survey indicated that:

- 85% of cooks usually cook for guests in addition to their family, which is likely to explain why the average number of eaters per household identified in the baseline exceeded the average household size data for Nigeria.
- 55% of cooks live in households where more than 1 family unit cooks separately. This is likely to explain why multiple stoves are sometimes seen – often burning at the same time – in individual households; they are being used by individual family units living in the same household.
- 60.8% of respondents used more than one stove simultaneously more than once per week, however the majority used them for only a fraction of cooking; for example when they were rushed or had extra guests. The mean number of fires/ stoves used simultaneously is 1.23 (n=97; SD 0.27; 95% CI 1.18-1.29). This equates to an adjustment being applied to the baseline of 1/1.23 = 0.813.
- 15% of households switched to other fuels during rain, which accounts for approximately 33% of the ‘rainy season’ (i.e. one meal per day), itself 5 months long. To account for this an adjustment of 0.979 is made to the baseline collected during the dry season. This is conservative in light of baseline consultations which identified negligible seasonal variation among respondents.

Adjustments: The baseline survey concluded that 5.29 tonnes of woodfuel are consumed by each cook cooking for her family unit. The follow up survey enable this figure to be refined to account for minor seasonal variation, and occasional multiple stove use, as follows:

Adjusted conservative baseline woodfuel consumption = 5.29 * 0.813 * 0.979 = 4.21 tonnes / year. This is equivalent to 81.0 Kg wood consumed per family cooking unit per week.

Note: This is an ex-ante estimate of discounting the wood usage baseline. Households that use a second stove simultaneously with an ICS at least once per week will be a monitored parameter and adjustments will be made to woodfuel consumption (B_{old}) during each monitoring period.

The baseline fuel consumption data closely agrees with findings from other studies undertaken in Nigeria, such as one undertaken in neighbouring state Kano[15] in 1987 which concluded fuel consumption of 83Kg/ week/ stove or 4.316 tonnes/appliance/HH/year. In addition, the registered PoA developed by Atmosfair titled "Improved Cooking Stoves for Nigeria Programme of Activities" determined the national mean baseline woodfuel consumption using historical data, resulting in 5.536 tonnes/appliance/HH/year[16]. Atmosfair's registered small-scale CDM project activity titled "Efficient Fuel Wood Stoves for Nigeria" conducted a baseline household survey representative of the Guinea Savanna Region, for which Kaduna State is located, resulting in a mean fuelwood consumption of 4.6534 tonnes/HH/year[17].

Thus 4.21 tonnes/appliance/HH/year is a conservative Bold value compared to historical surveys and other registered CDM projects in Nigeria applying the same methodology (AMS.IIG).

Non-renewable biomass assessment
The UNFCCC methodology defines demonstrably renewable biomass (DRB) as (paraphrased) that which:

1. Originates from forests which remain forests, where sustainable management practices are in place and followed, and where national forestry and conservation measures are followed.

2. Originates from non-forest areas which remain as non-forest or become forest, where sustainable management practices are in place and followed, and where national forestry and conservation measures are allowed.

Non-renewable biomass (NRB) is described as the total biomass used at baseline, minus DRB, providing at least two of the following indicators of non-renewability are in place:

1. A trend showing an increase in time spent or distance travelled for gathering fuelwood, by users (or fuelwood suppliers) or alternatively, a trend showing an increase in the distance the fuelwood is transported to the project area;

2. Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area;

---

[15] ClineCole, R, JA Falola,, HAC Main, MJ Mortimore, JE Nichol, and FD O'Reilly. 1987. Woodfuel in Kano. Bayero University, Kano.

[16] PoA-DD: http://cdm.unfccc.int/filestorage/4/5/L/45LJ08PE3T9MH27ZVFQNA6IYDOGWSX/5067%20CDM-POA-DD.pdf?t=SHZ8bWJ5MWdnfDAMS6Q5NxWCWhyCOSYnhful PAGE 35

[17]PDD: http://cdm.unfccc.int/filestorage/E/P/I/EPIU9032FNX7DHRK4VBTGW5LQMZ1C8/Nigeria%20PDD.pdf?t=MFJ8bWJ5MmNlfDBtiQKo3T6ClUcXMYIaYGts PAGE 30

3. Increasing trends in fuelwood prices indicating a scarcity of fuelwood;

4. Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.

In turn, we see that there is little *evidence of demonstrably renewable biomass* in the Kaduna State which lies in the center of the Guinea Savannah ecological region of Nigeria.

Supporting evidence is the trend in loss of forest from 1990 to 2010. The Global Forest Resources Assessment 2010[18] (FAO) indicates that total forest area declined by 48% from 1990 to 2010, as summarized in the following table.

Trends in extent of forest 1990-2010

Country/area	Forest area (1 000 ha)				Annual change rate					
					1990-2000		2000-2005		2005-2010	
	1990	2000	2005	2010	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Nigeria	17234	13137	11089	9041	-410	-2.68	-410	-3.33	-410	-4.00

In relation to this forest loss over time, the trend in carbon stock in living forest biomass has also reduced by approximately 46% over the 1990 to 2010 time period as summarized in the following table[19].

Trends in carbon stock in living forest biomass 1990-2010

Country/area	Carbon stock in living forest biomass (million tonnes)					Annual change (million tonnes/yr)			Annual change per hectare (t/ha/yr)		
	1990	2000	2005	2010	Per hectare 2010 (tonnes)	1990-2000	2000-2005	2005-2010	1990-2000	2000-2005	2005-2010
Nigeria	2016	1550	1317	1085	120	-47	-47	-46	n.s.	n.s.	n.s.

We see strong evidence that much of the biomass used in the Guinea Savannah region of Nigeria is *derived from non-renewable sources*.

1. There is considerable evidence that there is a strong trend towards increased distance travelled by fuelwood dealers. Hyman[20] reports that demand outstripped supply across the country and that the deficit is met through long-distance transportation of fuelwood.
2. FAO 2003[21] presents data on demand and supply of biomass within the Guinea and Sudan Savannah regions of Nigeria. Its data indicate a combined deficit of 38.9 million m^3 firewood. Of

[18] http://www.fao.org/forestry/fra/fra2010/en/ GLOBAL TABLES, Table 3

[19] http://www.fao.org/forestry/fra/fra2010/en/ GLOBAL TABLES, Table 11

[20] Hyman, E. 1994. Fuel substitution and efficient woodstoves: Are they the answers to the fuelwood supply problem in Northern Nigeria? *Environmental Management* 18, no. 1. http://www.springerlink.com/content/4q86106135738360/

[21] FAO. 2003. Experience of Implementing National Forest Programmes in NIGERIA. EC-FAO PARTNERSHIP PROGRAMME (2000-2003), p42.

total demand within these areas, only 17% is met by supply. These data are presented in the following table.

Comparison of production and demand of fuelwood in Nigeria. (‘000m^3) (FAO 2003)

Ecological zones	1994	1995	2000	2005	2010
A. Production					
Guinea Savannah	7,861	7,635	6,500	6,149	5,797
Sudan Savannah	3,163	3,267	2,767	2,748	2,359
Total production	**11,024**	**10,902**	**9,267**	**8,897**	**8,156**
B. Demand					
Guinea Savannah	22,464	22,808	25,033	26,271	26,417
Sudan Savannah	16,054	17,054	19,577	20,118	20,660
Total demand	**38,518**	**39,862**	**44,610**	**46,389**	**47,077**
Summary					
Net deficit (B – A)	**-27,494**	**-28,960**	**-35,343**	**-37,492**	**-38,921**
NRB % (= 100*(B-A/B)	**71**	**73**	**79**	**81**	**83**

Woodfuel collection in both the forest and savanna regions has been described scientific journals as “unsustainable”[22] and this sentiment is also reflected in the National Energy Policy of Nigeria, which notes that demand for woodfuel is unsustainable and significantly greater than annual woodfuel supply.

It is unlikely that trends in loss of carbon stocks and the time it takes to collect firewood are influenced by enforcement of rules and regulations, given the widespread challenges to implementing forestry laws in Nigeria. On the contrary, the lack of enforcement of forestry management has exacerbated widespread depletion of forest resources across Nigeria[23]. The Federal Ministry of Environment sets national policies, but responsibility for the implementation of forest management lies with each of the country’s 36 states, each of which has its own forestry laws guided by those at federal level. At the state level, management capacity of the state forestry departments and local organizations is mostly low, with poor funding, low staff morale, limited technical training and often high levels of government corruption. Across the board at the state level, forest laws are often obsolete, and weakly enforced[24]. Management strategies are generally considered insufficient to maintain forest cover and conserve biodiversity[25, 26, 27, 28].

---

[22] Gbadegesin, A. and Olorunfemi, F. (2011) Socio-economic aspects of fuelwood business in the Forest and Savanna Zones of Nigeria: Implications for Forest Sustainability and Adaptation to Climate Change. Global Journal of Human Social Science 11(1). PAGE 55

[23] Chemonics International. (2008) Nigeria Biodiversity and Tropical Forestry Assessment: Maximising Agricultural Revenue in Key Enterprises for Targeted Sites (Markets). Available from: http://pdf.usaid.gov/pdf_docs/PNADN536.pdf. PAGE 37

[24] National Programme Document- Nigeria. Available on the UN-REDD website at: http://www.un-redd.org/PolicyBoard/7thPolicyBoard/tabid/54129/Default.aspx PAGE 22

[25] Chemonics International. (2008) Nigeria Biodiversity and Tropical Forestry Assessment: Maximising Agricultural Revenue in Key Enterprises for Targeted Sites (Markets). Available from:

Therefore it is highly unlikely that enforcement of regulations is causing collection further away from areas where villagers would collect in the absence of any such regulations. Rather, collection from further distances is a result of deforestation.

The above provides evidence that forested areas (including those with protected status) are vulnerable to encroachment; that traditional supplies of firewood around cities have been depleted; that demand for firewood continues to grow and exceed supply by a factor of 4; that wood is transported many hundreds of kilometres within Nigeria; that prices have increased in recent years; and that there is a net reduction in forested and wooded areas across Nigeria and that this is particularly pronounced within the project area.

Together, this may be used to conclude that 100% of fire wood consumed in the project area is from non-renewable sources.

To be conservative, the fraction of non-renewable biomass (f_{NRB}) has been calculated in accordance with the approach presented in the Information Note "Default values of fraction of non-renewable biomass for least developed countries and small-island developing states, version 01.0 (EB 67 Annex 22)[29], resulting in a national level *fNRB* value of 0.93.

The fraction of non-renewable biomass (f_{NRB}), in %, is calculated from the equation below:

$$fNRB = \frac{NRB}{NRB + DRB} \qquad \textbf{(1)}$$

Where,

NRB	Non-renewable biomass (t/yr)
DRB	Demonstrably renewable biomass (t/yr)

The Total Annual Biomass Removals (R) from Nigeria has been calculated as a proxy for the quantity of woody biomass used in the absence of the project activity (B_y) and estimating the proportion of R that is demonstrably renewable (DRB) and non-renewable (NRB) using equations below:

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

http://pdf.usaid.gov/pdf_docs/PNADN536.pdf. PAGE 37

[26] Aruofor, R. (2001) Forestry outlook study for Africa: Nigeria. Food and Agriculture Organisation of the United Nations. Available from: http://www.fao.org/DOCREP/004/AB592E/AB592E00.htm#TOC. Section "Forestry policy, legislation and institutions"

[27] Usman, B.A. and Adefalu, L.L. (2010) Nigerian forestry, wildlife and protected areas: Status report. Biodiversity 11(3), 44 – 52. PAGE 50

[28] ITTO. (2009) Encouraging Industrial Forest Plantations in the Tropics - Report of a Global Study. International Tropical Timber Association. Available from: http://www.itto.int/direct/topics/topics_pdf_download/topics_id=2165&no=0&disp=inline. PAGE 68

[29] The approach is applicable to Nigeria as a party since it had fewer than 10 registered clean development mechanism project activities as of 31 December 2010.

Where,

R	Total annual biomass removals (t/yr)

The Total Annual Biomass Removals (R) for Nigeria 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) is calculated as the sum of the two as follows:

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

Where,

MAI	Mean Annual Increment in biomass growth (t/yr)
ΔF	Annual Change in Living Forest Biomass stocks (t/yr)

The Mean Annual Increment of biomass growth (MAI) is calculated in equation 4 below as the product of the Extent of Forest (F) in hectares and the Nigeria Growth Rate (GR) of the Mean Annual Increment as follows:

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

Where,

F	Extent of Forest (ha)
GR	Annual Growth rate of biomass (t/ha-yr)

The demonstrably renewable biomass (DRB) is calculated in equation 5 below 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)
GR	Annual Growth rate of biomass (t/ha-yr)

The parameters used and the data sources are summarised in the table below:

Nigeria fNRB Estimation (based on EB67, Annex 22)

Parameter	Description	Equation	Value	Data Source	Considerations
f_{NRB},%	Fraction of non-renewable biomass	NRB/ (NRB+DRB)	93%	Calculated as per equation 1 (EB 67, Annex 22)	
NRB, t/yr	Non-renewable woody biomass	R-DRB	114,417,824	Calculated as per equation 2 (EB 67, Annex 22)	Proportion of Total Annual Biomass Removals (R) that is not demonstrably renewable
DRB, t/yr	Demonstrably renewable biomass	PA*GR	8,610,888	Calculated as per equation 5 (EB 67, Annex 22)	Calculated as equivalent to the total annual biomass growth in protected areas
R, t/yr	Total Annual Biomass Removals	MAI+ΔF	123,028,712	Calculated as per equation 3 (EB 67, Annex 22)	Used as a national-level proxy for B_y. Accounts for all removals (not only woodfuels), which is equivalent to the sum of Mean Annual Increment of biomass growth and the Annual change in living forest biomass.
MAI, t/yr	Mean Annual Increment of biomass growth	F*GR	31,028,712	Calculated as per equation 4 (EB 67, Annex 22)	Country-specific MAI calculated from extent of forest and its growth rate.
ΔF, t/yr	Annual change in living forest biomass		-92,000,000	Annual change in living stock 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 Change and Forestry,	The annual change in carbon stock in living biomass 2005-2010 (t-carbon/yr) from Table 11 (-46,000,000 t-carbon/yr for Nigeria) is converted to Annual Change in Living Forest Biomass 2005-2010 (t/yr) by

				Chapter 3): 0.5 is used as a default for carbon fraction of dry matter	dividing with 0.5, the default value for conversion. See http://foris.fao.org/static/data/fra2010/FRA2010GlobaltablesEnJune29.xls and http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Chp3_2_Forest_Land.pdf
F, ha	Extent of forest		9,041,000	FAO Forest Resource Assessment (FRA) 2010 Global Tables, Table 2	See http://foris.fao.org/static/data/fra2010/FRA2010GlobaltablesEnJune29.xls
GR, t/ha-yr	Annual growth rate of biomass		3.43	Distribution of total forest area by ecological zone (FAO Global Forest Resource Assessment 2000, Table 14; http://www.fao.org/docrep/004/Y1997E/y1997e21.htm 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) http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf	Annual growth rate of biomass has been calculated as the weighted average based on FAO reporting on distribution of total forest area by ecological zone and IPCC above ground-ground biomass growth rates for different ecological zones: Tropical rainforests at 22%, tropical most forest at 36%, tropical dry forest at 38%, tropical shrubland at 2%, and topical mountain forest at 2%.
PA, ha	Protected area extent of forest		2,509,000	FAO Forest Resource Assessment (FRA) 2010 Global Tables, Table 6	See http://foris.fao.org/static/data/fra2010/FRA2010GlobaltablesEnJune29.xls
	Annual change in carbon stocks in living forest biomass (2005-2010)l		-46,000,000	FAO Forest Resource Assessment (FRA) 2020 Global Tables, Table 11	See http://foris.fao.org/static/data/fra2010/FRA2010GlobaltablesEnJune29.xls

	t/yr				
	Carbon stock/biomass conversion rate		0.5	Default value (2003 IPCC Good Practice Guidance for Land-Use Change and Forestry, Chapter 3 and EB 67, Annex 22)	

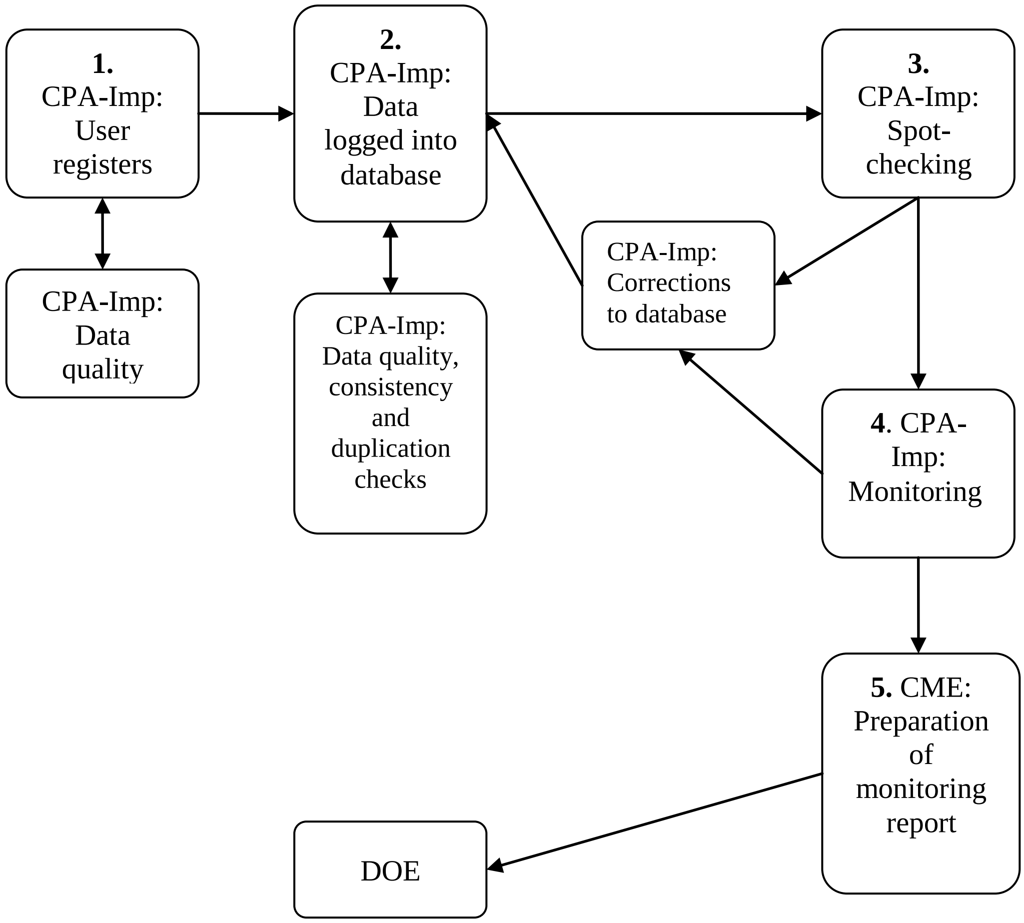
Annex 4

MONITORING INFORMATION

The Monitoring Plan applied in this SSC-PoA involves a number of key elements that ensure that the CME and CPA-Implementer have high-quality, unbiased and reliable information regarding the performance of the project in terms of implementation and outcomes, and for the purposes of calculating Certified Emission Reductions (CERs) following AMS II.G version 3.0 on the basis of the mass of non-renewable biomass saved by the ICS in the project activity.

- Data collection procedures
- Distribution and Monitoring Database
- Spot Checking of ICS (ongoing)
- Sample Plan for the Monitoring Survey
- Data Quality, Consistency and Duplication Checks
- Monitoring Reporting

The below flow-chart illustrates the roles and responsibilities of the parties during the implementation of the monitoring plan for the SSC-CPA. In the below flowchart, the CPA Implementer is abbreviated to "CPA-Imp", and can be the CME or another party authorized by the CME.



Below is the description of the above steps on the flow-chart.

1. **CPA-Imp: User registers stove:** CPA Implementer will collect/receive the necessary information requested on the Registration Card from the user. Means of collecting this information may be through a physical Registration Card filled by CPA-Imp staff, retailers, end-users or partner organization's staff, or through the use of ICTs or SMS. CPA Implementers' staff shall double check the accuracy of information provided, and request for field staff additional clarifications if needed;
2. **CPA-Imp: Data logged into database:** CPA Implementer trained staff will input the data in the database either manually (if data collected from physical Registration Card) or this will be automatically input if data was collected using ICTs or SMS. CPA Implementer staff shall double check the information included on the database and check for duplications. Any duplicate information shall be investigated and errors corrected or excluded from the database if it is a true duplicate entry.
3. **CPA-Imp: Spot- checking (ongoing):** CPA Implementer field staff will continually randomly select households included in the database and visit them to cross-check the information on the database with the factual evidence in the field. Any inconsistencies found (eg. change in the address of a user) will be updated on the database , and in the case ICS are found to be no longer in use, they will be clearly marked as such and excluded from emission reductions calculations.
4. **CPA-Imp: Monitoring:** CPA Implementer will follow the requirements as per SSC-POA-DD to collect the necessary information for a monitoring report.
5. **CME: Preparation of monitoring report:** the CPA Implementers or the CME will prepare the final monitoring report to be provided to the verifier DOE for verification of emission reductions. A copy of the monitoring report will remain with the CME

The CME will coordinate and manage each CPA Implementer and assist them in implementing each element of the monitoring plan. The monitoring plan shall be elaborated per CPA an in accordance with the Sampling Plan below.

Sampling Plan
As described in "Appendix 3: Recommended outline for Sampling Plan" of Annex 2 of the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities* [30] the sampling plan is the following:

<u>*(a) Sampling Design*</u>

Due to the large number of ICS envisioned to be distributed as part of the CPAs to be included in the SSC-PoA, it is not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling will be undertaken as part of a SSC-PoA-wide (by grouping and sampling across CPAs) Sampling Plan that is designed in line with the requirements of the "Standard for sampling and surveys for CDM project activities and programme of activities" from EB69, Annex 4 (the *Sampling standard*).

(i) Objective and Reliability Requirements:

[30] EB 69 Report Annex 4

The objective is to obtain an unbiased and reliable estimate of the proportion or mean value of the following key variables over the course of the crediting period, and with 95/10 confidence/prevision (as per paragraph 20 of EB 69 Annex 4) for annual and 95/5 for biennial sampling across CPAs. In case a single CPA is sampled or sampling is not done across CPAs, 90/10 precision for annual and 95/5 precision shall be required for biennial sampling.

Monitored Parameters:

Parameter	Description of Parameter
$n_{y,j}$	Proportion of ICS still in operation
SS_y	Percentage of continued baseline stove use among ICS households in the database
$\eta_{new,i}$	Thermal Efficiency of operational ICS

(ii) Target Populations:

- The target population for the proportion of ICS still in operation ($n_{y,j}$) and for percentage of continued baseline stove use among ICS households in the database (SS_y) of this SSC-POA are all households in the SSC-POA database which are using fuelwood in ICS distributed under the SSC-POA for cooking.
- The target population for efficiency of new appliances ($\eta_{new,i}$) is the set of stoves (same model and manufacturer) distributed of vintage *i* across CPAs that are working and are in the database.

(iii) Sampling Frame

Two sampling frames shall be defined:

1) Sampling frame for proportion of ICS still in operation ($n_{y,j}$) and percentage of continued baseline stove use among ICS households in the database (SS_y)

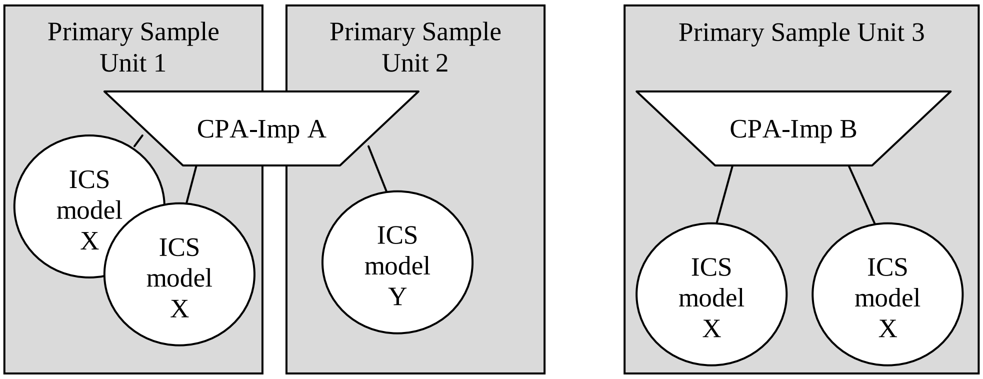
The sample frame refers to all the information sources on the Database. There are two primary mechanisms for data collection: the SMS system and paper registration card for newly distributed ICS and the Monitoring Survey (which includes a household questionnaire and visual inspection of ICSs) that will be used throughout the lifetime of the SSC-PoA. The SMS data and/or paper registration card (or equivalent) is used to populate the stoves Database and the Monitoring Survey follows the EB69 Annex 4 “Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities”.

The SSC-POA is open to different CPA Implementers and different models of ICS. As explained below (on section “sampling method”), to take the different characteristics of different CPA Implementer and ICS models into consideration, CPAs shall be grouped together to create a Primary Sampling Unit which is homogenous. As per EB 69 Annex 4, section V, paragraph 20, footnote 18 allows for the use of a single sampling plan covering a group of CPAs, provided the homogeneity of population can be demonstrated, or differences are taken into account in the sample size calculation, a 95/10 confidence/precision is applied for annual and 95/5 for biennial sampling. In case a single CPA is sampled or sampling is not done across CPAs, 90/10 precision for annual and 95/5 precision shall be required for biennial sampling.

The first step is to identify the Primary Sampling Units. Primary sampling units are CPAs which have:

1. The same CPA Implementer
2. The same ICS model

Ie. CPAs with the same CPA Implementer and same ICS model can therefore be grouped together and form a Primary Sampling Unit. In the event the SSC-POA has two different CPA Implementers using the same ICS model, these form two different Primary Sampling Units. Same is true if the same CPA Implementer has two different ICS models being implemented – this will form two Primary Sampling Units.
The below schematics illustrates the example used above. This is justified by the fact that CPA Implementer might vary in terms of performance and it is important for the CME to collect and monitor accurate data for each CPA Implementer distributing each stove model.



Populations or towns where ICSs are distributed in Primary Sampling Units will form Secondary Sampling Units.

2) Thermal Efficiency of operational ICS ($\eta_{new,i}$)

The thermal efficiency of operational ICSs shall vary in accordance with its model, but not within different CPA Implementers. Hence for parameter $\eta_{new,i}$ the Primary Sampling Unit shall be defined as the group of ICSs of the same model and same vintage. Ie. Take the example of different CPA Implementers are implementing CPAs using an ICS model “Y” for the past 3 years. In order to evaluate the thermal efficiency of the different vintages of the same stove “Y”, the primary group shall consist of all ICSs under the POA (regardless of CPA Implementer) which are of the same vintage and same model – in this example this would be ICSs of vintage 2 (over one year old and under two years old) and vintage 3 (over two years old and below 3 years old).

(*iv) Sampling Method*

The sampling method for both monitored parameters $n_{y,j}$ and $\eta_{new,i}$ is multi-stage sampling (as per EB 69 Annex 5 Section E). This is the most appropriate method as it allows to reduce costs of sampling by reducing travel costs and staff time when doing sampling in a certain number of villages as opposed to other methods where the location cannot be taken into consideration and household are spread across a very large area. This method is justified by the fact that though the baseline of the SSC-POA is homogenous, the ICS models and CPA Implementer may vary for different CPAs, hence it is appropriate to use a two step approach so to take these variations into consideration.

A multi-stage sampling combines the cluster and simple random sampling approaches in a multi-stage sampling approach, and can be thought of as sampling from a group of CPAs, and then going on to sample units within each group (paragraph 73 of EB 69 Annex 5). In a first stage, all CPAs that have been included in the monitoring period are grouped into Primary Sampling Units - following the 2 sampling frames described above (ie. Primary Sample Units for $n_{y,j}$ and SS_y are CPAs with same CPA Implementer and ICS model; and Primary Sample Units for $\eta_{new,i}$ are CPAs with the same ICS model regardless of CPA Implementer). Each Primary Sampling Unit will be comprised of a number of towns, local government areas (LGAs) or population centres (hereafter towns) – the Secondary Sampling Unit – and the number of households/ICS within each sampled town which will be visited/sampled. Once the number of towns to be sampled is defined, these will be selected using a simple random sampling approach from a list of all towns present in each Primary Sampling Unit[31]. Once the towns are defined, ICS/households present in each town will be randomly selected.

To ensure a random selection of towns and ICS, random number generators shall be applied. Each ICS in the target population is uniquely identifiable by its unique ID number. Each ICS can thus be allocated a Sample Selection Number in each monitoring period, starting at 1 and increasing up to the total number of ICS in the Database for that pre-defined sampling frame. Applying the random number generators, the ICS can then be randomly chosen from the defined population up to the required sample size as calculated by the CME. This is also applicable to towns, as the database will contain all the towns where ICSs are located and therefore each town can be assigned a number at 1 and increasing up to the total number of towns in the Database for that pre-defined sampling frame.
To determine the parameters, sampling will involve the following approaches (outcome in brackets):

$n_{y,j}$:	Visual inspection of the premises to see if ICS is operational and in use. Interview with end user if required to verify that ICS is still in use (Yes/No)
SSy::	Interview with end user and visual inspection to determine if a baseline (replaced) stove is still being used in addition to ICS (Yes/No)
$\eta_{new,i}$:	ICS will be tested using WBTs (ICS thermal efficiency)

The efficiency of ICS ($\eta_{new,i}$) as determined by the water boiling test evaluated during the monitoring period. The results from previous monitoring periods shall be used provided that they meet the confidence/precision requirements and that they are applicable to the stove model and vintages included in the monitoring period of interest. For example, during the previous monitoring period, the thermal efficiencies of vintages 1 and 2 (corresponding to ICSs that have been used for one and two years respectively) are tested. The following year, new ICS are distributed and the ICS previously distributed are still in operation. The next monitoring period, which in this example occurs a year after the previous monitoring period, there will be ICS from vintage 1 (recently distributed over the past year), ICS of vintage 2 (which in the previous monitoring period belonged to vintage 1) and ICS from vintage 3 (belonging to vintage 2 of the previous monitoring period). In this case, the stove vintage 1 and 2 have been tested during the previous monitoring period. Thus, the monitoring shall ensure that ICS from vintage 3, which were not tested previously, are tested. To ensure that the efficiency of the recently

[31] ICS whose location cannot be identified within a town (e.g. ICS found in isolated locations) or which access have been restricted (ie. household is not present) will be assigned to the closest town to ensure that no ICS is excluded from the sampling procedures

distributed ICS remains comparable to the stoves distributed during the previous years, stoves from vintage 1 (or those distributed during the monitoring period of interest) shall also be tested.

The monitoring shall thus sample ICS distributed over the monitoring period of interest ("new" vintage ICS) as well as for any ICS vintages from which there is no previous information and that are included in the target population of the period of interest ("oldest" vintage ICS).

To ensure that the ICSs distributed during the monitoring period ("new ICS") are comparable to ICSs distributed in other vintages, the mean thermal efficiency of the sampled new ICS will be compared with a 90/5 confidence/precision to the thermal efficiency of the stoves in a reference vintage, when the reference vintage was tested being in operation for a year or less. However, if the new vintage thermal efficiency is above the reference vintage efficiency, any level of precision would be applicable. This results in conservative thermal efficiency values for the "new" vintage in subsequent monitoring periods. The "new ICS" thermal efficiency shall also be tested for a relevant sample[32] of stoves when the stoves have been in operation for a year or less. The comparison shall be evaluated using the formulas below.

Precision:

$$-0.05 \leq \frac{\eta_{new,X} - \eta_{new,reference}}{\eta_{new,reference}}$$

Where:
$\eta_{new,\ reference}$ = thermal efficiency of reference vintage when the reference vintage was tested being in operation for a year or less

$\eta_{new,\ X}$ = thermal efficiency of "new" ICS vintage when the "new" vintage sample is tested before being in operation for a year

The above equation implies that the mean thermal efficiency of the "new" vintage of stoves cannot be lower than 95% the mean thermal efficiency of the reference vintage when both of these vintages are tested before they have been in operation for one year.

Confidence:

$$1.645 \geq \frac{\left|\eta_{new,reference} - \eta_{new,X}\right|}{\sigma_{\min} / \sqrt{n_{\max}}}$$

[32] A sample that meets a 95/10 confidence/precision requirements for annual monitoring or 95/5 confidence precision for biennial monitoring according to EB 69 Annex 4, section V, paragraph 20 and footnote 18 for sampling across CPAs. In case the resulting sample size to achieve the desired confidence/precision levels is smaller than 30 ICS, then the sample size shall increase to 30 ICS tested in accordance with EB 69 Annex 4, Section IV, paragraph 12 and footnote 15 to approximate normal distribution.

Where:

1.645 = confidence (z) value corresponding to a level of confidence of 90%.

σ_{min} = the standard error of the vintage with the lowest standard error. The use of the lowest standard error results in a conservative estimate, as it implies that the population with the highest variability has a lower variability in its own, and therefore that the values in the sample are closer to the mean of the population. In turn, this indicates that the population is statistically more different than others with different means.

n_{max} = the maximum sample size among the two vintages. This would also result in a conservative estimate, as a larger sample increases the resulting confidence value to test the sample differences.

If the resulting value in the above equation is greater than 1.645 it means that the samples are different with a 90% confidence. If the "new" vintage sample is statistically different from the reference, then stoves corresponding to the "new" vintage shall be tested every monitoring period for thermal efficiency to ascertain their thermal efficiency in different periods of their operational lifetime.

The efficiency of ICS will be determined across CPAs using the same stove model and same vintage (Primary Sample Unit). Using the formulas below, the CME will randomly sample the required number of ICS from a certain (dictated by the calculations below) number of towns. Eg. In the below calculations, in order to meet the minimum sampling size, the CME will randomly sample 3 ICS in each of the 6 towns. It is important to note that $\eta_{new, i}$ and hence the thermal efficiency test must take into consideration --and be conducted for-- each ICS vintage. As an illustrative example, consider a PoA that distributed a single ICS manufacturer/model but had two vintages: 75% of the total ICS distributed have been in use for less than 365 days (ie. vintage 1) and 25% have been in operation for over 365 days but less than 730 days (ie. vintage 2). For each vintage, a number of towns and ICSs are to be randomly selected and sampled and the appropriate number of towns and households are to be determined using the below equations. The mean thermal efficiency of each vintage shall be used for calculating emission reductions for all stoves of vintage *i*. Ie. if $\eta_{new,i}$ for stoves vintage 1 is 26% and vintage 2 is 24%, then all ICS which have been in use for less than a year will use a thermal efficiency of 26% in its calculations, while stoves vintage 2 will use 24%. In the event the monitoring period is over one year (let's use the example of 2 years) and a ICS have began its operation on the first day of the monitoring period, the stove shall apply the equivalent number of days in operation under vintage 1 and the equivalent number of days of operation under vintage 2.

(v) Sample Size

For the estimation of the proportion or mean value of the parameters investigated, the minimum sample size for each sample frame has to achieve the 95/10 threshold for annual and 95/5 for biennial monitoring periods). In case a single CPA is sampled or sampling is not done across CPAs, a 90/10 confidence/precision is required for annual sampling and 95/5 confidence/precision shall be required for biennial sampling.

The procedure to determine the sample of households will ensure that they adequately represent the broader project population, minimizing sampling error. Using a 95 per cent confidence level, and a 10 per cent margin of error, a random sample of towns will be selected from each Primary Sampling Unit. Households within the selected towns will therefore be randomly selected among the population in the

selected towns. There are two key parameters that will be estimated through sampling: the number of stoves still in operation during the monitoring period as determined by the monitoring survey ($n_{y,j}$) and the average ICS efficiency, ($\eta_{new,i}$). The parameter $n_{y,j}$ will be sampled in a single survey with a random sample of households and towns using the above described confidence/precision levels depending on annual or biennial monitoring frequency.

An overview of the estimated sample sizes for a hypothetical population of 100,000 ICS units applying a level of 95/10 is provided below. It is likely that all of the sample frames for each parameter will include fewer than 100,000 ICS in the first monitoring period, so this is a conservative approach. Of the two parameters to be monitored, one is proportions/percentages ($n_{y,j}$) and one is a mean value $\eta_{new,i}$.

The proposed multi-stage sampling approach requires the estimation of one sample size for each sampling stage. All Primary Sampling Units or unique combinations of ICS models and CPA Implementer will be sampled. Therefore, the selection of a sample of Primary Sampling Units will not be required. However, given the multitude of Secondary Sampling Units (towns) and Tertiary Sampling Units (ICS) envisaged to make part of the proposed SSC-PoA, using a sampling approach for these sampling units is considered appropriate. The selection of samples in the second and third sampling stage will follow a simple random sampling approach.

In order to calculate the required sample size estimates, values for the proportions and the mean values are required. Furthermore, the standard deviation needs to be assumed in case of sampling for a mean value. For the first monitoring period, the values as described below are applied. For the following monitoring periods, the estimates shall be adjusted taken the results of the previous monitoring period(s) into account.

To estimate the number of towns to be sampled for parameters $n_{y,j}$ and SS_y the following equation[33] is used:

$$c \geq \frac{\frac{SD_B^2}{\bar{p}^2} \times \frac{M}{M-1} + \frac{SD_W^2}{\bar{p}^2} \times \frac{(\bar{N}-\bar{u})}{(\bar{N}-1)}}{\frac{precision^2}{z} + \frac{1}{M-1} \times \frac{SD_B^2}{\bar{p}^2}}$$

Where

c	= number of towns that should be sampled
M	= total number of towns in the population
$\bar{u}$	= number of households/ICS to be sampled within each town
$\bar{N}$	= average number of households with ICS per town
SD_B^2	= Unit variance (variance between towns)

[33] Equation 16 *Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities (EB69, Annex 5, Version 2.0)*

SD_W^2 = average of group variances (average within town variation)
p = overall proportion
z = Constant (z-score) referring to the level of confidence (e.g. 1.96 for 95% confidence).
Precision = Required precision (e.g. 10% = 0.1)

The following assumptions are made to exemplify the sample size calculation for parameters $n_{y,j}$ and SS_y;

- The unit variance (SD_B^2) is 20% of the overall proportion (p) of the parameter of interest (ny,j or SS_y)
- The total number of towns in the Primary Sampling Unit is 1,000 (also applicable to η_{new})
- The number of households to be sampled within each town is 20
- The average number of households with ICS per town is 60 (also applicable to η_{new})

In cases where the sample size required for a town is larger than the number of ICS available for monitoring in that location,[34] the sample will be complemented by selecting the next closest ICS to the town until the proposed number of households with ICS is obtained. The determination of the closest ICS to the town will be estimated using GPS coordinates, and measured from a midpoint of the chosen town[35].

The sample size equation will be updated with the values obtained during monitoring from previous years or with pilot data collected by CPA Implementers or the CME. If the number of towns is determined to be insufficient based on actual monitoring data, additional towns will be randomly selected from the Database until the desired level of confidence/precision is attained for a specific Primary Sampling Unit.

In cases where for any reason (eg. Physical access impaired by natural conditions such as flooding; or political instability leading to insecure conditions, etc) a town cannot be sampled, another town will be randomly selected from the database.

Sample size calculation:
The calculation of the required sample size for each parameter in the first monitoring period is illustrated below for a 95/10 level of confidence and precision (for biennial monitoring periods the sample sizes will be recalculated using 95/5 values). In all cases a conservative approach is taken, however if for any parameter the required 95/10 confidence/precision is not met then the CME will randomly select an additional sample and collect further data from this sample to ensure the pooled data meet or exceed the required thresholds.

Parameter $\mathbf{n_{y,j}}$:
For exemplifying the sample size calculations for parameter $n_{y,i}$, it is assumed that the average of group variances (SD_W^2) is similar to the variance of the overall proportion of the stoves still in operation (p_n) in the first monitoring period. If p_n is 0.95, then its variance would be calculated as 0.95 x (1-0.95), resulting in a value of 0.0475. Following the assumption mentioned above, the average of group variances (SD_W^2) would also be 0.0475.

[34] The ICS available for monitoring are the number of households with ICS in that town that are willing to respond to monitoring surveys and inspections.

[35] The midpoint of any given town shall be defined as the average GPS coordinates (longitude and latitude) of all ICS in that town contained in the CME Database.

The unit variance (SD_B^2) is assumed to be 20% of overall proportion of stoves still in operation (p_n) or 0.95. In this case, the unit variance (SD_B^2) would thus be 0.95 x 0.2, or 0.19.

Based on the above assumptions, the resulting sampling size for a 95/10 confidence/precision is calculated as:

$$c \geq \frac{\frac{0.19}{0.95^2} \times \frac{1,000}{1,000-1} + \frac{1}{20} \times \frac{0.0475}{0.95^2} \times \frac{(60-20)}{(60-1)}}{\frac{0.1^2}{1.96^2} + \frac{1}{1,000-1} \times \frac{0.19}{0.95^2}} = 75.53$$

Therefore, in this case a sample size of 76 towns where 20 stoves are sampled in each town is sufficient to achieve the required confidence/precision for the $\mathbf{n_{y,j}}$ value.

In case the resulting sample size to achieve the desired confidence/precision levels is smaller than 30 ICS, then the sample size shall increase to 30 accordance with EB 69 Annex 4, Section IV, paragraph 12 and footnote 15 to approximate normal distribution. The increase shall be made in the number of ICS sampled per town.

Parameter $\mathbf{SS_{y:}}$

The anticipated[36] value of $\mathbf{SS_y}$ in the first monitoring period is in the order of 0.61, Project proponents should use the larger of the two proportions in the sample size calculation i.e. p or (1-p) [37].

As in the case of parameter $\mathbf{n_{y,i}}$, it is assumed that the average of group variances (SD_W^2) is similar to the variance of the overall proportion of second stove use ($\mathbf{SS_y}$) in the first monitoring period. $\mathbf{SS_y}$ variance is 0.61 x (1-0.61) or 0.238, so following the above assumption the average of group variances (SD_W^2) would also be 0.238.

The unit variance (SD_B^2) is assumed to be 20% of overall proportion of second stove use (SS_y) or 0.61. In this case, the unit variance would thus be 0.61 x 0.2, or 0.122.

Based on the above assumptions, the sample size calculation for a 95/10 confidence/precision would thus be:

---

[36] It is expected that the majority of end users will not use the baseline stoves after they have received the new and more efficient stoves (in order to make the decision to purchase the new stove, the end user has perceived an opportunity to reduce fuel costs/labour by making an investment that will only pay off if they stop cooking with their inefficient stove).

[37] It was noted in *Responses to Public Comments on the Draft Best Practice Examples: Focusing on Sample Size and Reliability Calculations* (EB67, Annex 5, Version 1.0, paragraph 6 (b)) that "project proponents should use the larger of the two proportions in the sample size calculation i.e. p or (1-p)".

$$c \geq \frac{\frac{0.122}{0.61^2} \times \frac{1{,}000}{1{,}000-1} + \frac{1}{20} \times \frac{0.238}{0.61^2} \times \frac{(60-20)}{(60-1)}}{\frac{0.1^2}{1.96^2} + \frac{1}{1{,}000-1} \times \frac{0.122}{0.61^2}} = 119.36$$

The resulting sample size in this case is 120 towns where 20 stoves are sampled in each town.

As in the case of parameter $n_{y,i}$, if the resulting sample size based on the above equation is smaller than 30 ICS, then the sample size shall increase to 30 in accordance with EB 69 Annex 4, Section IV, paragraph 12. The increase shall be applied to the number of ICS sampled per town.

Parameter $\boldsymbol{\eta_{new,i}}$ **:**

For the purposes of determining sample size in the first monitoring period, the performance of ICS is characterized by the range of likely mean efficiency and the likely values of SD relative to the mean, according to the type of ICS. The ICS models that are manufactured in modern factories tend to be very highly efficient (30-50% thermal efficiency) and have been designed to meet stringent efficiency specifications so the standard deviation is expected to be relatively low.

To estimate the number of towns to be sampled for parameter η_{new} the following equation[38] is used:

$$c \geq \frac{\frac{SD_B^2}{Clustermean^2} \times \frac{M}{M-1} + \frac{1}{\bar{u}} \times \frac{SD_W^2}{Overallmean^2} \times \frac{(\bar{N}-\bar{u})}{(\bar{N}-1)}}{\frac{precision^2}{z^2} + \frac{1}{M-1} \times \frac{SD_B^2}{Clustermean^2}}$$

Where:

c	= number of towns that should be sampled
M	= total number of towns in the population
$\bar{u}$	= number of households/ICS to be sampled within each town
$\bar{N}$	= average number of households with ICS per town
SD_B^2	= Unit variance (variance between towns)
SD_W^2	= average of group variances (average within town variation)
Clustermean	= average efficiency of ICS across towns
Overallmean	= average efficiency of all ICS monitored
z	= Constant (z-score) referring to the level of confidence (e.g. 1.96 for 95% confidence).
Precision	= Required precision (e.g. 10% = 0.1)

[38] Equation 33, *Guidelines for Sampling and Surveys in CDM Project Activities and Programme of Activities (EB69, Annex 5, Version 1.0)*

Given that the same number of stoves will be tested in each town, the weight of each ICS to the Clustermean and to the Overallemean is the same. Hence the Clustermean is equal to the Overallmean – ie. the average of efficiency of ICSs across towns is the same of the average efficiency of all ICSs monitored. The above equation shall, therefore, be simplified as:

$$c \geq \frac{\frac{SD_B^2}{mean^2} \times \frac{M}{M-1} + \frac{1}{\bar{u}} \times \frac{SD_W^2}{mean^2} \times \frac{(\bar{N}-\bar{u})}{(\bar{N}-1)}}{\frac{precision^2}{z^2} + \frac{1}{M-1} \times \frac{SD_B^2}{mean^2}}$$

Where:
Mean = mean thermal efficiency of the monitored ICSs

Given that variability is mostly dependent on the inherent characteristics of the units (ICS) and is not expected to be affected by local conditions, the variation in efficiency across localities is assumed to be low. For the example below, it is assumed that the unit standard deviation is 5% of the mean thermal efficiency mean value. Likewise, the average group (within town) standard deviation is assumed to be 20% of the overall thermal efficiency mean value. The number of ICS to be sampled from each town is set at 3 for the purposes of exemplifying the calculations and the thermal efficiency of the ICS model is 38%[39].

$$c \geq \frac{\frac{0.019^2}{0.38^2} \times \frac{1{,}000}{1{,}000-1} + \frac{1}{3} \times \frac{0.076^2}{0.38^2} \times \frac{(60-3)}{(60-1)}}{\frac{0.1^2}{1.96^2} + \frac{1}{1000-1} \times \frac{0.019^2}{0.38^2}} = 5.90$$

Under this approach, the number of towns where 3 stoves will be sampled is 6 to achieve the required 95/10 confidence/precision. As a conservative measure, if the resulting sample data is found not to meet the 95/10 threshold then additional towns will be randomly selected to test ICS until the required 95/10 threshold is met.

In this case, the resulting sample size is of 18 ICS. However, according to EB 69 Annex 4, Section IV, paragraph 12, the minimum sample size for shall be 30. Since the number of stoves to be tested for η_{new} is lower than 30, the sample size in this example will increase to 30. The increase in sample size will be applied to the number of ICS tested per town; thus, in this example, the ICS to be tested in each town shall increase from 3 to 5.

In order to reduce costs and time for the monitoring, the surveys and tests for $n_{y,j}$, SS_y, and $\eta_{new,i}$ will be conducted in the same towns and the same household will be used for as many parameter as possible. E.g. say it has been established that 20 households in each of 76 towns have to be sampled for $n_{y,j}$ and 20

[39] 38% is the thermal efficiency (η_{new}) of the ICS used in the first CPA

households in 95 towns for SS_y. However, only 5 households in 6 towns have to be sampled for $\eta_{new,i}$. In this case, the CME will randomly choose from the Primary Sampling Unit, 76 towns among the SS_y sample in order to monitor $n_{y,i}$. The same 20 households where SSy sampling takes place will be used to sample $n_{y,i}$. From these 76 towns, the CME will then randomly chose 6 which will be used for $\eta_{new,i}$. 5 households will then be randomly selected among the 20 households selected to sample SS_y and $n_{y,i}$ to test ICSs for thermal efficiency. So the end result is that some of the households will be used for the 3 parameters while others just for 2 parameters, and others for only one parameter. In instances when the towns chosen for $n_{y,j}$, SS_y do not have the vintage for $\eta_{new,i}$ (eg. Say the that all ICSs from vintage 3 are located in towns which were not randomly selected for $n_{y,j}$, SS_y) then the CME will have to randomly select from the Primary Sample Unit for $\eta_{new,i}$. Water Boiling Tests for portable stoves may be conducted *in situ* or elsewhere, but using stoves whose users are located in the selected towns. In the same fashion, the surveys for $n_{y,j}$ and SS_y will be conducted in the same households – ie. using the above example, both parameters will be assessed in 20 households for each town.

(b) Data:

(i) Field Measurements:
To monitor the number of stoves that continue to be in use (***$n_{y,j}$***) and the percentage of continued baseline stove use among ICS households in the database (***SS_y***), the data collected will be a representative number of stoves in the database that are in use for the monitoring period. The scope is a representative sample of stoves only across CPAs with the same CPA Implementer and same ICS model in this SSC-PoA. The method of collecting data will be field surveys of required sample size of ICS users in the database. Frequency of data collection is one survey per monitoring period. Data will be collected from the field surveys, entered in the database and included in the monitoring report. To monitor the efficiency of the stove at least every two years (as required by the AMS II.G version 3 methodology) a new test will be conducted to determine the rate at which a sample of stoves from a given vintage year deteriorate in efficiency. The method to collect the efficiency data will be the Water Boiling Test.

The table below summarizes field measurement data requirements

Parameter	**Timing (indicative)**	**Frequency (required by AMS II.G –Version 3)**	**Methods to be applied**	**Comments on seasonal fluctuation**
$n_{y,j}$	Monitoring will likely occur every 12 months	No less frequently than every two years	Visits to the premises, visual inspection and interview with ICS end-user	Unlikely to be due to any seasonal fluctuation.
SS_y	Monitoring will likely occur every 12 months	No less frequently than every two years	Visits to the premises, visual inspection and interview with ICS end-user.	Unlikely to be due to any seasonal fluctuation.
$\eta_{new,i}$	Monitoring will likely occur every 12 months,	No less frequently than every two years	Water Boiling Test (WBT) Protocol Version 3.0 (or	Not due to any seasonal fluctuation.

	but will include ICS of "new vintage[40] as well as the oldest vintage in the sampling frame (sample allocated proportional to size)		more recent at the discretion of the CME).	

(ii)Quality Assurance/Quality Control

The CME will apply measures to ensure the required confidence/precision for each sampled parameter is met, allowing for non-response and the possible removal of outliers from the sample, as part of a Quality Control/Quality Assurance system. The choice of measure applied to each parameter will depend on the cost of each data collection approach and logistics required. The CME will determine the most effective measure for each parameter from the following list (illustrated using a required sample size of 20 and an effect of non-response of 2 to 4 ICS):

- Oversampling: Randomly draw a sample of minimum 24 ICS and collect data from each
- Buffer Group: Randomly draw a sample of at minimum 24 ICS and collect data from only 22 ICS. If this would not result in the required sample size data would be collected from the additional 2 ICS that were selected in the sample.
- Draw an additional sample: Randomly draw a sample of 22 ICS and collect data from these. If the required sample size is not achieved, an additional sample of 2 elements will be drawn and included in the sample.
- Use lower confidence bound (of $\boldsymbol{n_{y,j}}$. or $\boldsymbol{\eta}_{new,i}$) or, with a conservative approach according to the parameter definitions, the upper confidence bound of $\boldsymbol{SS_y}$.

The CME may choose to stop monitoring a particular parameter once the required level of confidence/precision has been reached, as long as the calculated minimum number of samples has been achieved. As an example, the following steps could logically be followed for the case of applying a 30% buffer:
1. Visit first 10% of premises required for the 30% buffer. If the number of responses is sufficient to achieve the required reliability level, then stop sampling.
2. If step 1 is not sufficient to achieve the required reliability level, then visit the next 10% of premises (increases the additional sampling to 20% of the 30% buffer). If this additional sampling is sufficient, then stop sampling.
3. If step 2 is not sufficient to achieve the required reliability level, then complete the final 10% of the additional sampling buffer (bringing the total to 30%).

The sampling plan has the following procedures in place to ensure good quality data. The CME will ensure that field personnel have reviewed, understand and have signed the monitoring plan, including provisions for maximizing response rates, documenting out-of-population cases, refusals and other

[40] Vintage shall be defined as the "age" of the ICS – ie. number of years it has been in operation.

sources of non-response. A quality control and assurance strategy will be documented. Quality control and assurance strategies include addressing non-sampling errors, such as non-response or bias from interviewer. The monitoring plan will explain how to properly survey households to prevent bias from interviewer. In the case a household refuses to participate, another household will be chosen at random. To reduce interviewer bias, good questionnaire design and well-tested questionnaires will be used.

The calculation of the sample size will be carried out using estimates for parameter proportions, mean values and standard deviations, as the actual characteristics of the population/sampling frame are unknown. In order to ensure the quality of the sampling results, the CME can draw on the provisions for reliability calculations as provided by the *Guidelines for Sampling and Surveys in CDM Project Activities and Programme of Activities* (EB 69, Annex 5). In the event that the sampling results do not fulfil the required level of confidence and precision, the CME can undertake additional samples. If the reliability is still not sufficient after additional samples or other measures, the sampling may be repeated with an increased sample size. Alternatively, the CME may choose to apply the lower bound (or higher bound according to the more conservative approach, as for example in the proportion of end-users who continue to use a baseline stove, SS_y) of the sampling results as is allowed for by the methodology (AMS II G v3, paragraph 22).

As the continued use of ICS and the incidence of baseline stove usage among ICS users are binary parameters, there can be no outliers in the sampled data and no treatment for outliers is required. The sample data for $\boldsymbol{\eta}_{\mathbf{new,i}}$ is continuous and therefore the presence of outliers is possible. The following approach will be used to identify and address outliers for the parameter $\boldsymbol{\eta}_{\mathbf{new,i}}$.

Outliers for parameter $\boldsymbol{\eta}_{\mathbf{new}}$ will be defined as those data points with values greater than three standard deviations from the mean of the sample.

Data points identified as outliers according to the above analysis will be examined further to correct for possible transcription and data entry errors, but will be omitted from the analysis if no such administrative errors exist.

(i) Data archiving

Hard copies of the surveys will be kept and the registration database will have back up. Original stove purchase contracts (SMS data and/or paper registration card or equivalent) or other means of acceptance by the users will be stored in the main office for the coordinating entity. A back-up of the registration database will also be stored on an electronic medium by the CME. All data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever is later.

(ii) Analysis

The CME will manage a project database that includes the following data that can be directly attributable to each CPA within the SSC-PoA, thereby allowing unambiguous determination of the emission reductions attributable to each CPA:

- A list of households participating in each CPA, including name, community/location, distribution date and unique serial number;

- Testing to ensure that the stoves are still operating above the minimum 20% efficiency required by the AMS II.G (version 3) methodology, by the CPA Implementer, CME or a third party certified by a national standards body or an appropriate certifying agency recognized by it.
- Where replacements are made, assurance that the efficiency of the new ICS is similar to the specified.

Data obtained from the samples will be used to estimate proportions and mean values for the parameters described above. The values will then be factored into the emissions reduction calculations and result in the request for issuance of CERs for that group of CPAs – the primary sampling Units[41]. The parameters are applied for emission reduction calculations as outlined in E.6.2 of the SSC-PoA-DD. The stoves that are not in use will be excluded from emissions reductions calculations and will not be counted towards the total number of ICS in operation during the monitoring period. The thermal efficiency of new stoves ($\eta_{new,i}$) will be used in the calculation of the per stove emission reduction, which will be multiplied by the number of stoves in operation in the CPA to obtain the emission reductions per CPA.

(c)Implementation
Sampling for the purpose of emission reduction calculation and elaboration of the monitoring report will occur at the end of each monitoring period. This sampling will be conducted by trained personal either part of the CPA Implementer or CME team, or an experienced third party entity. The maximum length of one monitoring period will be two years (duration, not calendar years), as AMS II.G., version 3, provides the option for annual or biennial (every two years) monitoring. The CPA Implementer will be responsible for managing household data collection and entry into the project database. Field personnel will receive training on how to properly deal with surveying techniques and reduce errors and sign a document certifying that there is no conflict of interest of those involved in data collection and analysis. If there is conflict of interest, the personnel will not be allowed to participate in data collection and analysis. The project database will record the start and end dates of each monitoring period, and record the emission reductions attributable to each monitoring period. Appropriate record keeping procedures will be implemented to ensure that each monitoring period data set can be transparently attributed to its corresponding CPA, preventing any occurrences of double counting. An internal review of the project database will be able to determine the current status of each SSC-CPA—the duration of previous monitoring periods, the households delivering monitoring data, and current verification activities.

(i) Assessment for Leakage
See Section E.2. According to methodology II.G, version 3, leakage related to the non-renewable woody biomass saved by the project activity shall be assessed on *ex-post* surveys of users and the areas from which the woody biomass is sourced. The methodology offers the alternative that if B_{old} is multiplied a net to gross adjustment factor of 0.95 to account for leakages, surveys are not required. This SSC-PoA will use the 0.95 leakage adjustment factor instead of *ex-post* surveys.

The other source of leakage occurs if equipment currently being utilised is transferred from outside the boundary to the project activity. All ICS in the SSC-PoA will be newly manufactured/assembled. Where second-hand/used ICS are distributed to an end-user the ICS will be from within the project (ie previously

[41] For avoidance of doubt, each CPA will produce a monitoring report using the appropriate monitoring parameters.

newly manufactured/assembled and either a demonstration model or transferred from one end-user within the project to another new or existing end-user). In both of these cases there will no equipment (ICS) being utilized outside the project area (any project non-participant) that is transferred to the project area (included as an ICS in the database) so leakage defined in paragraph 14 of the AMS II.G (version 3) methodology is not considered. Where second-hand/used ICS are transferred within the project area (between end-user project participants) the database will be updated to reflect this change to ensure there is no double counting of ICS.

(ii) Disposal of Low Efficiency Appliances and Use of Baseline Stoves

When an ICS is distributed the end user receives information explaining that the conventional open fire appliance must no longer be used. Follow-up meetings with end users will ensure that those who have received an ICS are using it properly and that the conventional open fire is no longer in use. As per methodological condition 20 (b), if it is determined that the conventional open fire is still in use and the ICS is also in use, the wood used in conventional open fire will be subtracted from B_{old}. The number of households continuing to use a baseline stove in addition to their ICS (SS_y), will be monitored throughout the project lifetime. This will be achieved using a single sample for in-use appliances ($n_{y,i}$) described above, and will meet EB69 Annex 4 confidence/precision requirements.

(iii) Monitoring Reporting

The CME will assess all monitoring data and produce a monitoring report for each CPA for the DOE to verify corresponding to the preceding monitoring period of all CPAs. This report will present the data relating to the emission reductions generated by those CPAs included in the SSC-PoA at the time of the monitoring period.

- - - - -