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

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

Promoting Efficient Stove Dissemination and Use in West Africa

Version 11
30/04/2013 (dd/mm/yyyy)

A.2. Purpose and general description of the PoA

a) General operating and implementing framework of PoA

This CDM Programme of Activities seeks to reduce greenhouse gases emissions by disseminating fuel-efficient charcoal and wood stoves throughout West Africa. The offsets will be realized by a reduced consumption of wood fuel by households, commercial entities and institutions in the region.

Fuelwood and charcoal (together referred to as wood fuel) meet an overwhelming majority of fuel requirements in West Africa. Although wood continues to dominate energy consumption, charcoal use in both rural and urban areas is increasing. Fuel-switching from wood to charcoal in city centers is primarily due to changes in the socioeconomic characteristics of urban households that make charcoal a more attractive fuel. The PoA's aim is not to promote fuel switching, as this may result in higher emissions when wood users turn to charcoal, but to use both fuels efficiently. Improved wood stoves will be promoted in areas where wood dominate and charcoal in areas where charcoal is predominantly used. Indeed the project will monitor wood to charcoal switching and account for any increase in emissions.

Multiple categories of stoves will be marketed and sold on a large-scale under the programme:

a. improved fuel-efficient household charcoal stoves
b. improved fuel-efficient commercial/institutional charcoal stoves
c. improved fuel-efficient household wood stoves
d. improved fuel-efficient commercial/institutional wood stoves

E+Carbon is the coordinating and managing entity of the project. It will contract with CPA implementers in each of the 5 countries. CPA implementers are in charge of importing or manufacturing project stoves, selling them to end users, tracking sales and reporting them back to E+Carbon using tools developed together with E+Carbon.
E+Carbon is responsible for drafting project documents, aggregating sales, calculating emissions reductions, hiring DOE for validation and verification and hiring an independent third party to conduct monitoring tasks as outlined in the monitoring plan. E+Carbon will also manage the sale of CER and the allocation of revenues among CPA.

b) Policy/measure or stated goal of the PoA

In addition to mitigating greenhouse gas emissions, these stoves provide co-benefits to users and families in the form of relief from high fuel costs, reduced exposure to health-damaging airborne pollutants, faster cooking (resulting in time-savings), and increased cleanliness and convenience.

Currently inefficient and polluting cooking regimes are deeply entrenched throughout West Africa. Using carbon finance, this project aims to break this trend and move large populations away from conditions that emit large quantities of GHG emissions and cause harmful health effects for the women and children spending long hours each day in traditional kitchens.

Cooking practices are culturally specific, and successful dissemination of fuel efficient stoves requires far more than simply manufacturing them for sale in markets. Users must be convinced from people whom they trust that such stoves can cook the same traditional food that has been cooked for generations. In some cases, advertising and retail sales will be sufficient to disseminate stoves. Yet in other cases, door-to-door sales, including partnering with women's associations to gain trusted champions of the technology is required. This program, and the carbon revenues that it generates, will champion culturally specific and appropriate sales models to ensure widespread stove dissemination and use.

The performance of efficient stoves can also be greatly affected by manufacturing quality, and therefore quality controls are a central component of such a program. Carbon finance will introduce a quality guarantee and an ongoing monitoring and evaluation component that is central to successful stove dissemination. The quality assurance strategy is a major benefit of carbon finance. It has the potential to introduce a new set of quality expectations among consumers, thereby shifting the critical mass of prevailing practice away from inefficient cooking, to prevailing practice involving significantly reduced GHG emissions and less-polluted kitchens. The quality assurance system will extend the working life-times of the stoves and in some cases, offer warranties that help ensure long term use in the field. The project proponents expect this strategy to help secure customer loyalty and promote a shift of customer preference toward high-efficiency stoves. The effect will be to galvanize competition in the same direction.

Finally, upfront cost of efficient stoves is a major inhibitor to widespread stove dissemination. Therefore, carbon finance will, in some cases, be used to subsidize the sale price of stoves to end users, allowing manufacturers to sell stoves below cost so that they are cost competitive with their inefficient counterparts. This will enable even the poorest members of society to access the technology.

Although these stove dissemination measures will often be consistent with national government development priorities, the program will not be implemented in any areas where such technology is mandated by law. Indeed, there are currently no host countries in this PoA that mandate the use of efficient stove technology.

c) Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

E+Carbon, the coordinating and managing entity, is a project developer and is therefore not obligated to undertake the proposed PoA. Additionally, all host parties are voluntarily participating in the project activity as there is no law in any of them that mandate the use of efficient cooking technology. This was confirmed during discussions with the respective Designated National Authorities.

A.3. CMEs and participants of PoA

a) Coordinating or managing entity of the PoA as the entity which communicates with the Board

E+Carbon is the coordinating entity for this SSC PoA and will also be a participant. E+Carbon is a project developer headquartered in New York, USA. E+Carbon will communicate with the CDM Executive Board on matters related to the PoA. Its contact information is as follows:

E+Carbon, LLC
5 Hanover Square
Suite 401
New York, NY 10004
USA

b) Project participants to the PoA (project participants may or may not be involved in one of the component project activities (CPAs) related to the PoA

E+Carbon is the only project participant

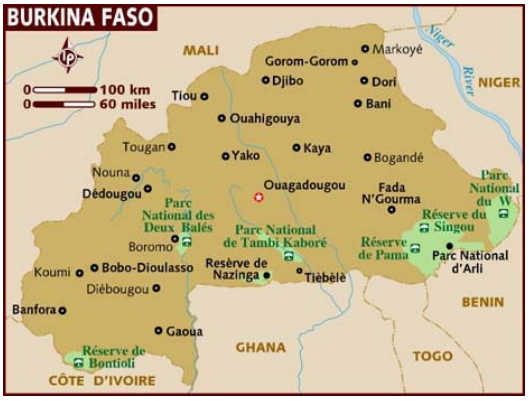
A.4. Party(ies)

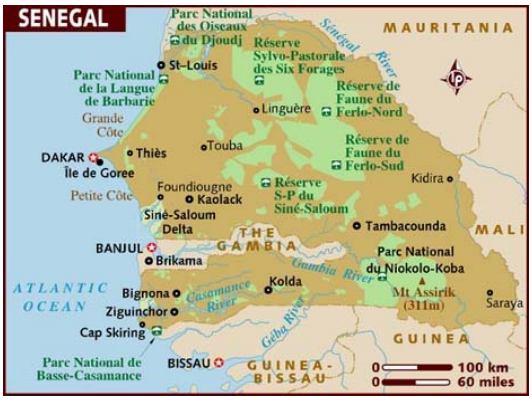
Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Togo (host)	E+Carbon (private entity)	no
Burkina Faso (host)	E+Carbon (private entity)	no
Senegal (host)	E+Carbon (private entity)	no
Mali (host)	E+Carbon (private entity)	no
Ghana (host)	E+Carbon (private entity)	no

A.5. Physical/ Geographical boundary of the PoA

The PoA will be located in urban, peri-urban and rural areas of Burkina Faso, Mali, Senegal, Togo and Ghana.

The PoA boundary is the physical, geographical site within the host countries where the improved biomass cook stoves will be used.





Source of maps: Lonely Planet

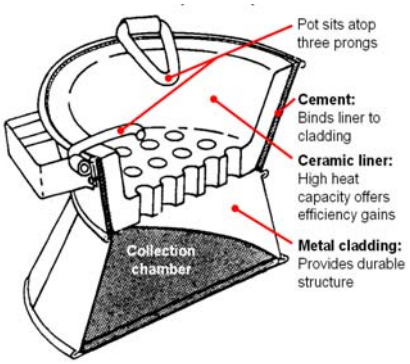
Coordinates

	Latitude	Longitude
Burkina Faso	12.1204° N	1.7841° W
Mali	14.8128° N	5.5030° W
Senegal	14.6943° N	15.5953° W
Togo	8.3357° N	1.0495° E
Ghana	7.4490° N	0.9056° W

A.6. Technologies/measures

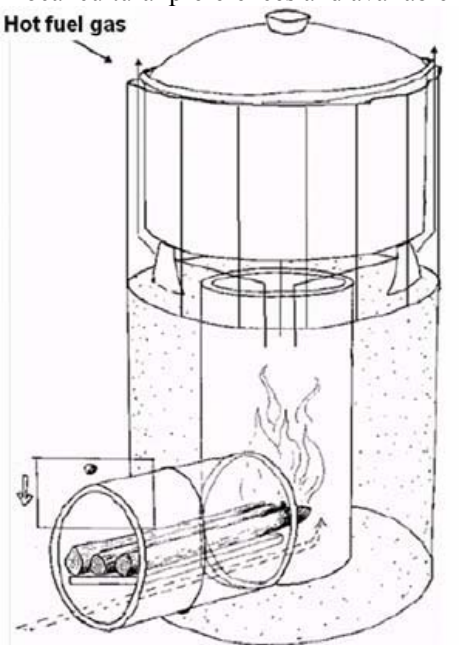
This project will disseminate charcoal and firewood stoves that are more efficient than traditional stoves and as a result, reduce emissions of GHG. The efficient stoves can be portable or stationary. Some of them are described herein and others will be added in their specific CPA as the PoA expands.

Most improved charcoal stoves reduce fuel consumption by introducing a ceramic liner that increases combustion efficiency and retains heat. In many countries, the stove consists of hourglass shaped metal cladding with perforated interior ceramic liner that allows ash to fall into the collection chamber at the base. A thin layer of cement is placed between the cladding and the liner. During use, a single pot rests at the top of the stove. Most stoves in the region are variants of the Kenya Jiko stove. They include the Asuto stove in Togo, the Diambar stove in Senegal, the Sewa in Mali and the Toyola Coalpot in Ghana. All these are portable stoves.Other variations of this stove will be employed in other West Africa nations.



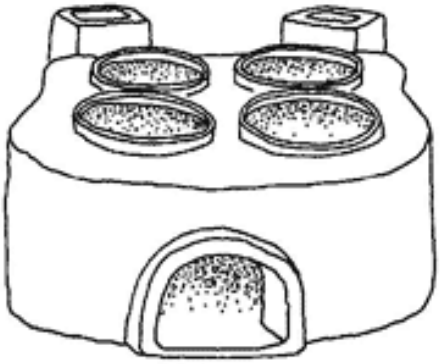
Cross section of the Toyola Asuto stove

Other wood stoves use efficient design that enables complete combustion of biomass fuels, thereby dramatically improving efficiency. An example of this is the rocket stove, which has been used on a pilot basis in various parts of Africa and elsewhere. A rocket stove features a tall cylinder and an elbow joint at the bottom. Wood fuel is fed into the elbow joint and fuel is burned in a controlled fashion in the tall combustion cylinder, atop which the pot rests. Variations of this portable stove will be employed throughout West Africa based on local cultural preferences and available fuels.



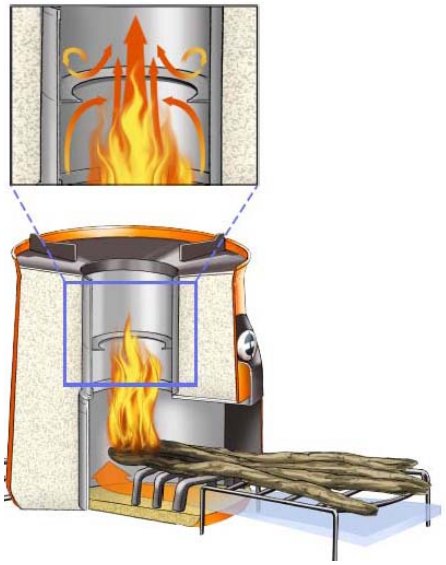
Technical Drawing of the Rocket Stove

Commercial wood stoves that are used to brew millet beer or process shea butter will be disseminated to replace 3-stone open fires. These stationary stoves, commonly known as improved "dolo" stoves, are made out of mud bricks that form a circular "wall" that allows an efficient burning of wood. Improved "dolo" stoves use about 50% less fuel than 3-stone open fires.



Technical Drawing of "dolo" stove

The Envirofit G3300 wood stove is a specific type of rocket stove. A detachable pot skirt replaces the built in pot skirt on many rocket stoves.
Envirofit uses a metal alloy in its combustion chamber that maximizes heat transfer and ensures durability.



Technical Drawing of the Envirofit Stove G3300

A.7. Public funding of PoA

There is no public funding to implement the PoA.

SECTION B. Demonstration of additionality and development of eligibility criteria
B.1. Demonstration of additionality for PoA

Firewood and charcoal meet an overwhelming majority of the energy needs of households, businesses and institutions in West Africa while the regeneration rate of forests in this region does not sustain this need. This leads to acute deforestation as well as loss of biodiversity and significant emissions of greenhouse gases. Moreover, the burning of firewood and charcoal in rudimentary cooking appliances leads to smoke inhalation, which causes respiratory diseases. Nonetheless, there is no policy or regulations that mandate the use of improved and clean burning biomass cook stoves in any of the host countries of this PoA.

The proposed PoA is a voluntary coordinated action;

The proposed PoA is a voluntary action by the coordinating entity, the project participants and the host countries. There are no mandatory policies in Togo, Burkina Faso, Senegal, Mali and Ghana that require the use of improved cook stoves

The voluntary coordinated action would not be implemented in the absence of the PoA;

A dissemination of improved cook stoves at the scale envisioned by the PoA would not occur in the host countries in the absence of the PoA because of investment and technological barriers faced by improved cook stoves in the host countries (detailed below). As described above, the use of rudimentary cooking appliance such as the 3-stone fire and traditional metal and clay stoves is predominant in the host countries because they are widely available, easy to manufacture and very affordable. Yet, their use results in high emissions of green house gases. Improved cookstoves on the other hand require a specialized skill set, special infrastructures and raw materials and are significantly more expensive. The intervention of different governmental and non-governmental agencies in building human capacity around the improved cook stove sector and in providing subsidies to the sector attest to the existence of these barriers and to a need for more coordinated and more sustained action. The PoA will provide financial and technical resources to sustain the production and maintenance of improved cookstoves as well as subsidies to end-users.
To date, no program has been put forth to undertake the voluntary action at the geographical and time scale proposed by the PoA. Therefore, it would not be implemented without the PoA.

According to the EB 68 Report Annex 27, if the energy savings of each project stove is less than 5% of the small-scale CDM threshold then the project activity is automatically additional. The small-scale threshold being 180 GWh thermal, 5% would be 9GWh thermal.
Below is the calculation of energy savings for one of the smallest and one of the largest stoves indentified for the PoA so far. The energy savings are between 0.006 GWh and 0.36 GWh which are well below the 9 GWh limit. Therefore, the PoA and each of its CPA are automatically additional.

Ceramic-lined stove: small household size

Energy savings= $B_{y,\ savings}$ (per stove)*$NCV_{biomass}$
$= B_{old}*(1- \eta_{old} / \eta_{new}) *NCV_{biomass}$

Parameter	Unit	Description	Value	Source
B_{old}	Tonne/year	Quantity of woody biomass used in the absence of the project activity in tonnes	6.06	Baseline study for CPA 1

η_{old}	fraction	Efficiency of the system being replaced	0.211	WBT for CPA 1
η_{new}	fraction	Efficiency of the system being deployed by the project activity	0.278	WBT for CPA 1
$NVC_{biomass}$	TJ/tonne	Net calorific value of the non-renewable woody biomass that is substituted	0.015	Methodology
$NVC_{biomass}$	GWh/tonne	Energy Equivalent of Net calorific value of the non-renewable woody biomass that is substituted	0.00417	Calculated

$B_{y,savings}$ = 6.06 * (1-0.211/0.278)
= 1.46

Energy savings =1.46 * 0.00417
=0.0060 GWh/year

Institutional Rocket Stove

Energy savings= $B_{y,\ savings}$ (per stove)*$NCV_{\ biomass}$
= B_{old}*(1- η_{old} / η_{new}) *$NCV_{\ biomass}$

Parameter	Unit	Description	Value	Source
B_{old}	Tonne/year	Quantity of woody biomass used in the absence of the project activity in tonnes	121	Estimates from E+Carbon stove project in South Africa
η_{old}	fraction	Efficiency of the system being replaced (3 stone fire)	0.10	Methodology
η_{new}	fraction	Efficiency of the system being deployed by the project activity	0.367	WBT on Rocket Stove[1]
$NVC_{biomass}$	TJ/tonne	Net calorific value of the non-renewable woody biomass that is substituted	0.015	Methodology
$NVC_{biomass}$	GWh/tonne	Energy Equivalent of Net calorific value of the non-renewable woody biomass that is substituted	0.00417	Calculated

$B_{y,savings}$ = 121 * (1-0.10/0.367)
= 88.029

Energy savings =88.029 * 0.00417
=0.36 GWh/year

[1] "Characterisation of Domestic Biomass Combustion Technologies Used in Setswetla, Alexandra Township, Gauteng"

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

Reference to requirement in PoA Standard (paragraph 16)	**Eligibility Criteria**	
	Category	*Description*
(a)	Geographical Boundary	be implemented within the geographical boundaries of one of the host countries: Togo, Burkina Faso, Senegal, Mali and Ghana. An individual CPA will not cross country borders.
(b)	Double-counting	have procedures in place to avoid double counting with other CPA and other CDM projects. These procedures include having "second-tiers" ERPA with stove manufacturers who work under the main manufacturer to ensure that the rights to the ER are all attributed to the CME, and having the CME logo, the manufacturer name and a serial number on every stove.
(c)	Technology	involve the sale or distribution of an improved biomass cooking technology that is proven to have a minimum specified efficiency of 20%
(d)	Start date	document very clearly the start date of the CPA and evidence that the start date of the CPA is not prior to the date the PDD was first published for global stakeholder consultation
(e)	Methodology	Comply with the applicability criteria of the Methodology AMS II G: - deploy appliances involving the efficiency improvements in the thermal applications of non-renewable biomass and -demonstrate that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.
(f)	Additionality	Have project stoves that save no more than 5% of the small-scale CDM thresholds: CPA-DD section B.1 shows that the energy saved by the project stoves is less than (180GWh$_{th}$/year * 0.05 =) 9GWh$_{th}$/year.
(g 1)	Stakeholder meeting	hold a local stakeholder consultation that meets these minimum requirements: -be a physical meeting -invite parties that will be impacted by the projects or who are involved in the cook stove sector (end-users, NGO, government agencies) -provide an overview of the project -collect comments from participants -take account of the comments A single stakeholder consultation can be held for multiple CPA located in the same host country provided that the type

		of cook stove promoted by each CPA is well presented and all the CPA are included within 5 years of the date the meeting was held.
(g 2	Environmental Impact Analysis	Conduct an Environmental Impact Analysis if required by the host country. One EIA can be applicable to several CPA if located in the same host country provided that local laws on EIA do not differ.
(g 3)	Monitoring	have procedures in place to track distribution of stoves. The tracking system will involve the recording of stove type, stove size, date of sale, contact information of purchaser and any other information that is deemed useful to locate the stove.
(g 4)	Approval of CPA by CME	have a project implementer that is either the Coordinating Entity or another entity that has signed a contractual agreement with the Coordinating Entity
(g 5)	Inclusion of CPA	be reviewed by a DOE
(h 1)	Funding from Annex I countries	State clearly in the CPA-DD the source of public funding, if any.
(h 2)	No diversion of ODA	If public funding is used, the relevant Annex I party will confirm that the funding is not a diversion of ODA.
(i)	Target Group and distribution mechanism	serve households, commercial entities and institutions in the host countries either in urban, peri-urban or rural areas. Distribute the stoves through direct or indirect sale
(j)	Sampling	Provide a sampling method (e.g. in the monitoring plan and baseline studies) that follows the "Standard For Sampling And Surveys for CDM Projects and Programmes of Activities (Version 2.0) The sampling plan contains information relating to: (a) sampling design; (b) data to be collected; and (c) implementation plan. The CPA complies with the following confidence interval and error requirement: - When biennial inspection is chosen a 95% confidence interval and a 10% margin of error requirement for the sampling parameter. - When annual inspection is used, a 90% confidence interval and a 10% margin of error requirement is achieved for the sampled parameters. - In cases where survey results indicate that 90/10 precision or 95/10 precision (above) is not achieved, the lower bound of a 90% or 95% confidence interval of the parameter value is chosen as an alternative to repeating the survey efforts to achieve the 90/10 or 95/10 precision. If leakage related to the non-renewable woody biomass saved by the project activity is found to be true, an adjustment factor of 0.95 will be applied to B_{old} as an alternative to conducting surveys.

		Sampling across CPA is possible if the CPA are located in the same country and are disseminating the same type of cook stove
(k)	SSC Limit for CPA	show annual energy savings data that demonstrate that the CPA does not exceed the small scale threshold of 180 GWh/year, for each year of the CPA crediting period
(l)	De-bundling	demonstrate that the stoves do not realize more than 1.8 GWh of energy savings annually each as a proof that a de-bundling check is not required.

B.3. Application of methodologies

The methodology being applied is the SSC baseline and monitoring methodology AMS II.G.Version 04, *"Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass."*

Each SSC-CPA comprises the application of biomass stoves that provide efficiency improvements in thermal applications of non-renewable biomass. Indeed, AMS II. G. Version 04 cites efficient biomass cook stoves as an example of the technologies that are directly applicable to this methodology.

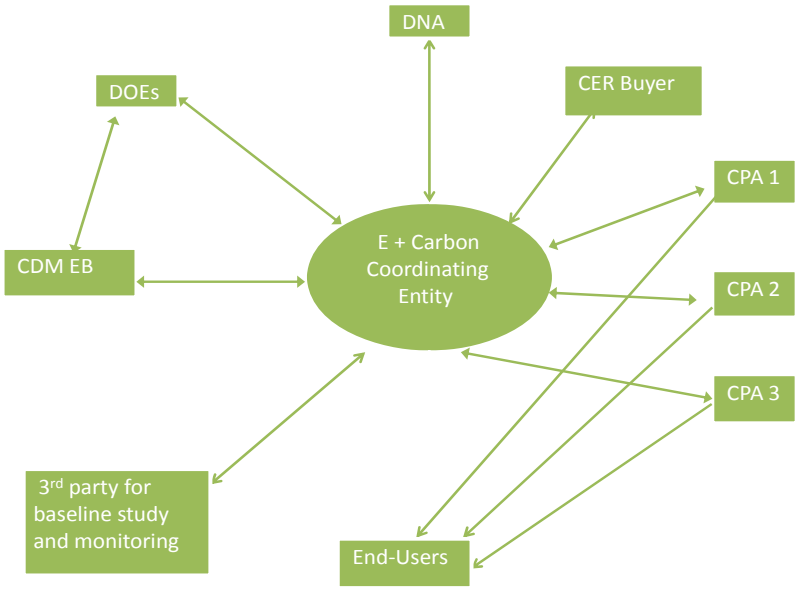
There are no similar registered CDM project activities in the host countries, therefore, the CPAs are not saving the non-renewable biomass accounted for by other registered project activities.

Each SSC-CPA will show that non-renewable biomass has been used in the project boundary since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.

A sampling plan that meets the requirements of the "Standard for sampling and surveys for CDM project activities and programme of activities" is detailed in Part II Section B.7.2

SECTION C. Management system

E+Carbon is the Coordinating Entity and the project developer of this PoA. It is responsible for recruiting CPA implementers; for contracting with 3rd party organizations to perform baseline studies and monitoring tasks; for hiring DOE to conduct validation and verification; for communicating with the CDM Executive Board; for finding CER buyers and for distributing CER revenues to CPA implementers. CPA implementers will primarily be stove manufacturers and distributors or non-governmental organizations that are interested in promoting efficient cooking appliances.
CPA implementers are legally obligated to fulfil certain duties by an Emissions Reduction Purchase Agreement with E+Carbon that gives E+Carbon rights to sell CER on their behalf, and by a Memorandum of Understanding that outlines the conditions of participation in the PoA.



Roles and responsibilities for inclusion of CPA
The CME is responsible for assessing each CPA prior to submitting it for inclusion. This includes evaluating manufacturing and distribution capacity of the CPA implementer, ordering efficiency test for the stoves (if applicable) and ordering baseline studies for the CPA (if applicable). The CME will also do a technical review on each CPA prior to inclusion. This includes ensuring that the CPA is not registered as its own CDM project activity or included in another PoA, ensuring that the CPA meets the eligibility criteria of the PoA, reviewing PDDs, etc. The CME staff is comprised of seasoned carbon finance professionals who have the credentials to undertake this role.

Training and maintenance process
In CPAs that promote locally manufactured stoves, training of new manufacturers will be performed by the CPA implementer or a partner organization. Sales staff for both locally manufactured and imported stoves will be trained by the CPA implementer. Information related to the use and maintenance of the stoves will be delivered to end users through demonstrations or included in a user guide that accompanies the stove. Each CPA will develop training and maintenance processes that are appropriate to the type of stove it promotes and to its target market.

Record keeping system for each CPA under the PoA
CPA implementers will maintain records on end user contact information, stove sales data and other inventory information in a manner that enables E+Carbon and DOE to verify that sales are indeed occurring and stoves are being used in businesses, institutions and households within the border of the host countries that results in a decrease in greenhouse gas emissions. This data will be collected by CPA implementers with assistance from the Coordinating Entity to ensure that data is collected correctly and organized in a useable fashion. Each CPA will have its own database that is periodically transferred to E+Carbon via e-mail. Data to be collected include:

-Stove size
-Stove type
-Date of sale
-Stove serial number
-Name of customer
-Address

-Phone number

For stationary stoves, in addition to sale data mentioned above, the following information will be collected:

-date of installation
-name of installer

In addition to the sales database, E+Carbon will store results of surveys and stove tests in a secure server for monitoring purposes and will keep the records until 2 years after the end of the crediting period or the last issuance of CER for the PoA, whichever occurs later.

Internal audit of all the records of the distribution, monitoring and education activities will be carried out once a year. During these audits all the data and parameters that need to be monitored as per the monitoring plan will be checked and shortcomings if any will be reported and addressed. The CME will respond to all DOE Forward Action Requests during the validation and verification periods.

Avoiding double counting
Emission reductions purchase agreements (ERPAs) between the Coordinating Entity and CPA Implementers will be complemented with "second-tier ERPAs." These are contracts between CPA implementers and secondary industry players that ensure that these players are not selling rights to emissions reductions for the same stoves. In this way, each CPA will be able to provide a paper trail down to the end user level that shows transfer of ownership rights to emission reductions, which will avoid any instances of double counting.

Moreover, every stove will carry the name of the CME (E+Carbon) and the brand or logo of the manufacturer as well as a unique identification that indicates the CPA it belongs to. Each stove sold will be recorded in a database and identified by its brand, size and serial number. Finally, each stove's identification will be cross referenced to guarantee that no double counting has occurred. The database will be populated by the CPA implementer and managed by the CME.

Monitoring process
3rd party experts will be in charge of monitoring all parameters outlined in B.7.1 except for parameter N_{sold} and $N_{installed}$ (number of stoves sold and installed) and other parameters that are calculated. Specifically, the 3rd party will test the efficiency of project stoves, visit household to assess the usage rate the project stoves as well as the portion of project stove owners that still use their baseline stoves and all other form of leakage. The sales database and the end user database will serve as sampling frame for all these studies. The 3rd party will compile its findings in a report which is submitted to E+Carbon. These findings form the basis of the Monitoring Report drafted by E+Carbon and presented to a DOE for verification. The involvement of E+Carbon and the CPA implementers in this process will be kept to a minimum to avoid influencing the 3rd party.

SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity

According to EB 47 Report, Annex 32, Paragraph 9, "Guidelines on assessment of de-bundling for SSC project activities" "If each of the independent subsystems/measures (e.g. biogas digester, solar home system) included in the CPA of a PoA is no greater than 1% of the small scale thresholds defined by the methodology applied, than that CPA of PoA is exempted from performing de-bundling check i.e. considered as being not a de-bundled component of a large scale activity. " The threshold defined by AMS II.G. Version 04, *"Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass"* is 180GWh in annual energy savings per CPA. None

of the stoves to be disseminated in the CPAs are expected to save more than 1.8 GWh/year. Energy savings for the smallest and largest stoves identified for the PoA so far are 0.0060 GWh/year and 0.36 GWh/year (see calculation in Section B.1 above)

SECTION D. Duration of PoA
D.1. Start date of PoA

24 February 2011

D.2. Length of the PoA

28 years

SECTION E. Environmental impacts
E.1. Level at which environmental analysis is undertaken

Environmental Analysis is done at SSC-CPA level.
Due to the geographically diverse nature of this PoA, the Coordinating Entity proposes to perform environmental analyses at the CPA level. In addition to there being variations of national environmental laws that should be considered at the CPA level, raw materials harvesting and effects on local forest resources will also vary, making it more appropriate to conduct environmental analyses at the CPA level. One EIA can be done for a group of CPA if they are located in the same host country are subject to the same environmental laws.

E.2. Analysis of the environmental impacts

See CPA

SECTION F. Local stakeholder comments
F.1. Solicitation of comments from local stakeholders

Local stakeholder consultation is done at SSC-CPA level.
Due to the geographically broad nature of this PoA, the Coordinating Entity proposes to conduct stakeholder consultations at the CPA level. A single stakeholder consultation can be held for multiple CPA located in the same host country provided that the type of cook stove promoted by each CPA is well presented and all the CPA are included within 5 years of the date the meeting was held.

F.2. Summary of comments received
See CPA

F.3. Report on consideration of comments received
See CPA

SECTION G. Approval and authorization

Letters of Approval and Authorization of CME coordination from the five host countries, Togo, Burkina Faso, Mali, Senegal and Ghana have been submitted to the DOE.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

A typical SSC CPA under this PoA will be comprised of measures to facilitate increased dissemination and use of efficient cook stoves in rural, peri-urban and urban West African communities. The measures will be targeted to overcome barriers to efficient cooking technology's application that are specific to each CPA. In some cases, there may be capacity barriers in manufacturing, distribution, marketing or other key areas. In other cases, market players may lack access to sufficient capital to grow distribution channels. Some communities and prospective users may be unwilling to adopt new and unfamiliar technology. Cooking technology is culturally specific and infiltration into the community is often needed to present sufficient evidence that efficient technologies can produce the same or superior results to more traditional methods.

A typical CPA would result in the manufacture, distribution and sale of tens of thousands of new efficient stoves in a given region or nation, resulting in dramatic decreases in greenhouse gases, fuel wood harvesting from forests and indoor air pollution. Target groups can be households, commercial entities or institutions or a mix of all.

Each CPA will be differentiated with other CPA by a serial numbering protocol that identifies the host country and the CPA number. The first two characters on stove's serial number are related to the country and the order of the CPA. For instance, for the first CPA in Togo, the serial number starts with T1 (T=Togo; 1=CPA 1). If the second CPA is in Burkina Faso, the serial number will start with B2 (B=Burkina Faso; 2= CPA 2). Each stove will also carry the Coordinating Entity name (E+Carbon) as a way of identifying the PoA. The CPA-DD will clearly identify the host country and describe the general area where the CPA will be implemented.

SECTION B. Application of a baseline and monitoring methodology

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

SSC baseline and monitoring methodology AMS II.G.Version 04, *"Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass."*

B.2. Application of methodology(ies)

Methodology requirement	CPA compliance
Appliances involving the efficiency improvements in the thermal applications of non-renewable biomass	Each SSC-CPA will promote biomass stoves that provide efficiency improvements in thermal applications of non-renewable biomass
High efficiency stoves as certified by a national standards body or an appropriate certifying agent recognized by it. Alternatively manufacturers' specifications may be used.	Each CPA will provide efficiency specifications from stove manufacturer or have the stoves tested by a nationally recognized agent.
Single pot or multi pot portable or in-situ cook	Each CPA will provide efficiency document from

stoves with specified efficiency of at least 20%.	the stove manufacturer or from tests results showing that the project stoves have a specified efficiency of at least 20%
Show that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.	According to FAO data, non-renewable biomass has been in use in all the host countries since 31 December 1989[2].

Each SSC-CPA will remain a Type II project during the entire crediting period as the number of project stoves operating in any given year will not result in energy savings exceeding the small-scale threshold of 180 GWh.

B.3. Sources and GHGs

Since the approved methodology assumes that in the absence of the PoA, the baseline scenario is the use of substitution fuels likely to be used by similar users, emissions abatement in each SSC-CPA is achieved through savings of CO_2 emitted in the burning of a mix of solid fuel, liquid fuel and gaseous fuel. The default emissions factor provided by the methodology is 81.6 tCO2/TJ

Source		Gas	Included?	Justification / Explanation
Baseline	Combustion of firewood for cooking	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification.
		N_2O	No	
	Combustion of charcoal for cooking	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification.
		N_2O	No	

Source		Gas	Included?	Justification / Explanation
ect Acti	Combustion of firewood for	CO_2	Yes	Main source of emissions

[2] Global Forest Resources Assessment 2010 Country Report : Ghana (page 6), Burkina Faso (page 15), Senegal (page 11), Togo (page 12), Mali (page 11)

	cooking	CH_4	No	Excluded for simplification.
		N_2O	No	
	Combustion of charcoal for cooking	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification.
		N_2O	No	

B.4. Description of baseline scenario

This project will put efficient biomass cook stoves in households, commercial entities and institutions that are currently using inefficient cooking methods. In the case of charcoal stoves, the appliance being replaced will be the traditional metal stove which is most widely used in the host countries for cooking with charcoal or other stoves that are less efficient than the project stoves. In the case of firewood, the baseline will be the 3-stone cooking method or other wood stoves that are less efficient than the project stoves. In Togo the baseline scenario is the use of the Malgache stove and the clay stove for charcoal consumer and the 3-stone method for firewood consumers[3]. The Malgache and/or the 3-stone also dominate the market in Burkina Faso[4], Mali, Senegal and Ghana among biomass users and are expected to be the baseline stoves for CPA in these countries, however a baseline study will be conducted in each of these countries to confirm this fact.

The methodology assumes that in the absence of the project activity, the baseline scenario would be the use of a mix of fuels consisting of a "solid fossil fuel (lowest in the ladder of fuel choices), a liquid fossil fuel (represents a progression over solid fuel in the ladder of fuel use choices) and a gaseous fuel (represents a progression over liquid fuel in the ladder of fuel use choices). Thus a 50% weight is assigned to coal as the alternative solid fossil fuel (96 tCO_2/TJ) and a 25% weight is assigned to both liquid and gaseous fuels (71.5 tCO_2/TJ for Kerosene and 63.0 tCO_2/TJ for Liquefied Petroleum Gas (LPG)." The methodology gives an emission factor value of 81.6 tCO2/TJ to represent this mix of fuels.

B.5. Demonstration of eligibility for a generic CPA

To be eligible for inclusion in the PoA, a CPA must meet the following criteria

	Eligibility Criteria		**CPA Eligibility**
Reference to requirement in PoA Standard (paragraph	*Category*	*Description*	*Evidence/documentation*

[3] Enquêtes Consommation des Energies Domestiques au Togo pages 66-67, tables 41 and 42
[4] Etablissement de la Situation de Référence pour la Production et la Diffusion à Grande Echelle des Foyers Améliorés au Burkina Faso- page 19

16)			
(a)	Geographical Boundary	be implemented within the geographical boundaries of one of the host countries: Togo, Burkina Faso, Senegal, Mali and Ghana	The CPA DD will clearly describe the country where the CPA is being implemented and will provide GPS Coordinates of the areas.
(b)	Double-counting	have procedures in place to avoid double counting with other CPA and other CDM projects. These procedures include having "second-tiers" ERPA with stove manufacturers who work under the main manufacturer to ensure that the rights to the ER are all attributed to the CME, and having the CME logo, the manufacturer name and a serial number on every stove.	Each stove will carry the Coordinating Entity name (E+Carbon) as a way of identifying the PoA, and a serial number that identifies the host country, the CPA number and the stove itself. The serial number protocol is described in section A.4.2. Pictures of stoves with the Coordinating Entity name and the serial number will serve as evidence. Furthermore, the serial numbers will be listed in the CPA database.
(c)	Technology	involve the sale or distribution of an improved biomass cooking technology that is proven to have a minimum specified efficiency of 20%	Tests conducted according to the standards provided in the methodology, or manufacturer specifications.
(d)	Start date	document very clearly the start date of the CPA and evidence that the start date of the CPA is not prior to the date the PDD was first published for global stakeholder consultation	The start date of each CPA will be evidenced by a proof of sale of the first stove, a contractual agreement between the Coordinating Entity and the CPA implementer or by contracts such as lease agreement or purchase agreements signed by the CPA implementer to start operations. The PoA-DD was first published on February 24, 2011. No CPA will have a start date prior that date.
(e)	Methodology	Comply with the applicability criteria of the Methodology AMS II G: - deploy appliances involving the efficiency improvements in the thermal applications of non-renewable biomass and -demonstrate that non-renewable biomass has been used since 31 December 1989,	Each CPA will promote improved biomass cook stoves which are efficiency improvement appliances in thermal application. Indeed improved cookstoves are used as example of applicable technology in the

		using survey methods or referring to published literature, official reports or statistics.	methodology. This will be evidenced in the CPA-DD and in the reports of any feasibility study or baseline study conducted for the CPA Non-renewable biomass use in the host country since 31 December 1989 will be researched in published literature and official reports or statistics. This will be reported on in baseline study reports
(f)	Additionality	Have project stoves that save no more than 5% of the small-scale CDM thresholds: CPA-DD section B.1 shows that the energy saved by the project stoves is less than (180GWh$_{th}$/year * 0.05 =) 9GWh$_{th}$/year.	Efficiency test reports and baseline consumption reports will be used to calculate the energy savings of each stove and to demonstrate that it does not reach 9 GWh/year each.
(g 1)	Stakeholder meeting	hold a local stakeholder consultation that meets these minimum requirements: -be a physical meeting -invite parties that will be impacted by the projects or who are involved in the cook stove sector (end-users, NGO, government agencies) -provide an overview of the project -collect comments from participants -take account of the comments A single stakeholder consultation can be held for multiple CPA located in the same host country provided that the type of cook stove promoted by each CPA is well presented and all the CPA are included within 5 years of the date the meeting was held.	Stakeholder consultation report and reporting in the CPA-DD of comments and how they were taken into account.
(g 2)	Environmental Impact Analysis	Conduct an Environmental Impact Analysis if required by the host country. One EIA can be applicable for several CPA if located in the same host country provided that local laws on EIA do not differ.	Environmental Impact Analysis report or local regulation or statement from relevant government authority confirming that an EIA is not required by the host country
(g 3)	Monitoring	have procedures in place to track distribution of stoves. The tracking system will involve the recording of stove type, stove size, date of sale, contact	Electronic sales database and paper records of sales will serve as evidence.

		information of purchaser and any other information that is deemed useful to locate the stove.	
(g 4)	Approval of CPA by CME	have a project implementer that is either the Coordinating Entity or another entity that has signed a contractual agreement with the Coordinating Entity	Contractual agreements between project implementers and Coordinating Entity
(g 5)	Inclusion of CPA	be reviewed by a DOE	Contractual agreement between DOE and CME
(h 1)	Funding from Annex I countries	State clearly in the CPA-DD the source of public funding, if any	Contractual agreement between funder and recipient.
(h 2)	No diversion of ODA	state clearly in the CPA-DD that there is no diversion of ODA	If there is no funding, statement from the Coordinating Entity that there is no diversion of Official Development Assistance. If there is funding, statement from the funder that funds are not a diversion of ODA
(i)	Target Group and Distribution Mechanism	serve households, commercial entities and institutions in the host countries either in urban, peri-urban or rural areas. Distribute the stoves through direct or indirect sale	The type of stove promoted will define the target group. Each CPA-DD will state very clearly the target group and the distribution mechanism used
(j)	Sampling	Provide a sampling method (e.g. in the monitoring plan and baseline studies) that follows the "Standard For Sampling And Surveys for CDM Projects and Programmes of Activities (Version 2.0) The sampling plan contains information relating to: (a) sampling design; (b) data to be collected; and (c) implementation plan. The CPA complies with the following confidence interval and error requirement: - When biennial inspection is chosen a 95% confidence interval and a 10% margin of error requirement for the sampling parameter. - When annual inspection is used, a 90% confidence interval and a 10% margin of error requirement is achieved for the sampled parameters. - In cases where survey results indicate that 90/10 precision or 95/10 precision (above) is not achieved, the lower bound	The sampling plan presented in baseline study reports and in the monitoring plan of the CPA-DD will serve as evidence

		of a 90% or 95% confidence interval of the parameter value is chosen as an alternative to repeating the survey efforts to achieve the 90/10 or 95/10 precision. If leakage related to the non-renewable woody biomass saved by the project activity is found to be true, an adjustment factor of 0.95 will be applied to B_{old} as an alternative to conducting surveys. Sampling across CPA is possible if the CPA are located in the same country and are disseminating the same type of cook stove	
(k)	SSC Limit for CPA	show annual energy savings data that demonstrate that the CPA does not exceed the small threshold of 180 GWh/year, for each year of the crediting period.	Efficiency test reports and baseline consumption reports will determine the maximum number of stoves that can be disseminated within the CPA and their energy savings. The number of stoves disseminated per the sale database will serve as evidence that the threshold is not being exceeded.
(l)	De-bundling	demonstrate that the stoves do not realize more than 1.8 GWh of energy savings annually each as a proof that a de-bundling check is not required.	Efficiency test report and baseline consumption reports will serve to calculate the energy savings of each stove.

A SSC-CPA is additional if it meets the eligibility criteria number 6 above related to additionality. Specifically a CPA must demonstrate that its stoves do not save an energy equivalent of more than 9 GWh/year each.

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

Equations to be used for calculation of emission reductions per stove type and size

Equation # 1

$$\mathbf{ER_y = (B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}) - E_{additional}}$$

Where:

ER_y	Emission reductions during the year y in tCO_2e
$B_{y,savings}$	Quantity of woody biomass that is saved in tonnes
$f_{NRB,y}$	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website
$NCV_{biomass}$	Net calorific value of the non-renewable biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable biomass by similar consumers. The substitution fuel likely to be used by similar consumers is assumed to be LPG or Kerosene
$E_{additional}$	Additional emissions resulting from the switch from wood to charcoal

The methodology provides three options for determining $B_{y, savings}$ –the quantity of woody biomass saved by the project activity. These options are described in Equation 2 below. Each CPA will use the option that is more suitable for the appliance that is disseminated in that CPA

Equation # 2 –For Option 1 of $B_{y, savings}$

$$\mathbf{B_{y,savings} = (B_{old} * B_{old\text{-}adjustment\ factor}) - B_{y,new}}$$

Where:

B_{old}	Quantity of woody biomass used in the absence of the project activity in tonnes.
$B_{old\text{-}adjustment\ factor}$	Adjustment factor for leakage emissions (if found to exist, a value of .95 will be used)
$B_{y,new}$	Annual quantity of woody biomass used during the project activity in tonnes, measured as per the Kitchen Performance Test (KPT) protocol.

Equation #2 –For Option 2 of $B_{y,savings}$

$$\mathbf{B_{y,savings} = (B_{old} * B_{old\text{-}adjustment\ factor}) \cdot (1-\eta_{old}/\eta_{new})}$$

Where:

B_{old}	Quantity of woody biomass used in the absence of the project activity in year *y* in tonnes.
$B_{old\text{-}adjustment\ factor}$	Adjustment factor for leakage emissions (if found to exist, a value of .95 will be used)
η_{old}	Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction)
η_{new}	Efficiency of the system being deployed as part of the project activity (fraction)

Equation # 2 – For Option 3 of $B_{y,savings}$

$$\mathbf{B_{y,savings} = (B_{old} * B_{old\text{-}adjustment\ factor}) \cdot (1-SC_{new}/SC_{old})}$$

Where:

B_{old}	Quantity of woody biomass used in the absence of the project activity in year *y* in tonnes
$B_{old\text{-}adjustment\ factor}$	Adjustment factor for leakage emissions (if found to exist, a value of .95 will be used)
SC_{old}	Specific fuel consumption or fuel consumption rate of the baseline system/s i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively. Use weighted average values if more than one type of system is being replaced
SC_{new}	Specific fuel consumption or the fuel consumption rate of the system/s deployed as part of the project i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively. Use weighted average values if more than one type of system is being introduced by the project activity

Equation #3 – Determination of B_{old}

B_{old} will be established by estimates of average annual consumption of woody biomass per appliance (tonnes/year). CPAs may target either wood or charcoal. When wood is the fuel, B_{old} is set equal to $B_{old\text{-}wood}$. When charcoal is used as the fuel, B_{old} is set equal to $B_{old\text{-}charcoal}$ multiplied by the wood to charcoal conversion factor (CF).

Equation # 4 – Emissions resulting from the replacement of a wood stove with a charcoal project stove (if applicable)

$$E_{additional} = (B_{y,charcoal} * CF - B_{old\text{-}wood}) * F_{NRB,y} * NCV_{biomass} * EF_{projected\text{-}fossilfuel}$$

Where

$E_{additional}$	Additional emissions resulting from the switch from wood to charcoal
$B_{y,charcoal}$	annual quantity of charcoal used by households during the project activity
CF	Conversion factor from charcoal to wood
$B_{old\text{-}wood}$	quantity of wood used in the absence of the project activity in the area where the replacement has occurred
$f_{NRB,y}$	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website
$NCV_{biomass}$	Net calorific value of the non-renewable biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable biomass by similar consumers. The substitution fuel likely to be used by similar consumers is assumed to be LPG or Kerosene

Equation # 5 – Determination of $B_{y,charcoal}$ (if applicable)

$$B_{y,charcoal} = B_{old,charcoal} - B_{y,savings\text{-}charcoal}$$

Where

$B_{y,charcoal}$ annual quantity of charcoal used during the project activity
$B_{old,charcoal}$ quantity of charcoal used in the absence of the project activity in the area where the replacement has occurred
$B_{y,savings-charcoal}$ quantity of charcoal saved by the project stove

Equation #6

$f_{NRB,Y}$= NRB/NRB+DRB

Where
$f_{NRB, Y}$ Fraction of non-renewable biomass in year y
NRB Non-renewable biomass
DRB Demonstrably renewable biomass

The following steps are followed to determine the value of the each part of the equations

Step 1: Determination of average annual woody biomass consumption (B_{old}) per household, commercial entity or institution
This step can be determined from historical data, surveys or through a KPT if the CPA uses option 1 for determining $B_{y,savings.}$ Each CPA will describe this step in details before inclusion.

Step 2: Determination of charcoal to wood conversion factor for CPA where B_{old} is charcoal:
This step will be determined from literature review or by using a default factor of 6 per version 5 of AMS.II. G.

Step 3: Determination of leakage
Leakage will be assessed from literature review and research and will be considered if the non-renewable woody biomass saved by the project is being used by non-project users to replace renewable energy sources and if it is used to justify the baseline of other CDM project activities. Leakage will also be considered if baseline stoves continue to be used by project stove users. If assessment shows that leakage exist, an adjustment factor of 0.95 will be applied B_{old} as an alternative to conducting a survey.

Step 4a: Determination of the annual quantity of woody biomass used during the project activity in tonnes ($B_{y,new)}$ for CPA using option 1 to calculate $B_{y,savings}$
This step will be determined through a KPT, the details of which will be stated in the CPA DD prior to inclusion

Step 4b: Determination of the thermal efficiency of baseline stoves (η_{old}) and project stoves (η_{new}) for CPA using option 2 to calculate $B_{y,savings}$
This step will be determined through a WBT which will be described in details in the CPA-DD prior to inclusion

Step 4c: Determination of the specific consumption of baseline stoves (SC_{old}) and project stoves (SC_{new})

This step will be determined through a CCT which will be described in details in the CPA-DD prior to inclusion.

Step 5: Determination of the charcoal consumption of households that have replaced their wood stove with a charcoal project stove ($B_{y,charcoal}$)

This step will be determined by deducting charcoal savings ($B_{y,savings-charcoal}$) from the baseline charcoal consumption ($B_{old-charcoal}$). $B_{old-charcoal}$ is determined during baseline studies.

Step 6: Determination of the wood consumption of households that have replaced their wood stove with a charcoal stove

$B_{old-wood}$ is determined during baseline studies

Step 7: Determination of fraction of non-renewable biomass

When possible, the CDM SSC-WG default values for NRB will be used. Otherwise the CPA will conduct an NRB study.

Step 8: Determination of Net Calorific Value of Wood Fuel

The IPCC default value for wood fuel which is provided by the methodology as:
NCV = 0.015 TJ/Tonne

Step 9: Determination of Projected Fossil Fuel

A default value is provided by the methodology as:
$EF_{projected\ fossil\ fuel} = 81.6\ tCo_2/TJ$

Step 10: Estimation of the number of stoves in operation

The number of stoves in operation is dictated by the energy savings threshold of 180 GWh/year. Each CPA will have its own estimation prior to inclusion.

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

Data / Parameter:	η_{old}
Unit	Fraction
Description	Efficiency of appliance being replaced in the first CPA
Source of data	Historical data or Water-Boiling Test Source of data for first CPA: Water-Boiling Test for CPA 1 reported in the following documents "Projet de Renforcement des Capacités des Fabricants de Foyers Améliorés-Rapport Technique – Université de Lomé » « Rapport des Tests de Foyers pour E+Carbon – Université de Lomé »
Value (s) applied	CPAs in Togo that replace Malgache stove and clay stoves shall use the following values:

Stove type	**Efficiency**	**Method**
Malgache	0.18	Measured
Bucket clay stove	0.23	Measured
Bowl clay stove	0.22	Measured
Weighted Average	**0.21**	Calculated

	Other CPAs shall assess this value prior to inclusion in the PoA.
Choice of data or Measurement methods and procedures	The baseline stoves in the first CPA are the Malgache stoves and clay stoves. One Malgache stove was tested by the University of Lomé under a previous project while two clay stoves were tested at the request of E+Carbon. The weighted average calculation is derived from field surveys showing that 27.4% and 61.3 % of households use the Malgache stove and clay stove respectively. Considering that only 1 malgache stove and 2 clay stoves were tested, it is assumed that the 90/10 confidence/precision was not achieved however the value of 0.21 is more conservative than the default value of .20 proposed by the methodology. Other CPAs shall demonstrate the parameter value using historical data, 3rd-party literature, or based on a water boiling test performed by an independent 3rd-party.
Purpose of data	Calculation of project emissions
Additional comment	This parameter is only applicable to CPA applying option 2 for the calculation of $B_{y,savings}$ These parameter values are applicable for CPAs in Togo that replace Malgache stove and clay stoves. It will re-assessed for other CPA and other countries. For all CPAs that determine Nold using a weighted average shall monitor the relative proportions of each baseline stove, and will update the weighted average accordingly (see parameter $P_{baseline\text{-}replaced}$).

Data / Parameter:	η_{new}
Unit	Fraction
Description	Efficiency of appliance in project activity in the first CPA
Source of data	Historical data or Water-Boiling Test Source of data for first CPA: Water Boiling Test (WBT) for the first CPA documented in the report "Rapport des Tests de Foyers pour E+Carbon – Université de Lomé »
Value (s) applied	CPAs in Togo that promote the Toyola Asuto-type stove shall use the following values: **Stove size** / **Efficiency** / **Method** HS / 0.278 / Measured HM / 0.256 / Measured HL / 0.281 / Measured CS / 0.286 / Measured CL / 0.280 / Measured Other CPAs shall assess this value prior to inclusion in the PoA.
Choice of data or Measurement methods and procedures	Water boiling test was conducted on all 5 sizes for project stoves in the first CPA Other CPAs shall demonstrate the parameter value using historical data, reference literature, or based on a water boiling test performed by an independent 3rd-party.
Purpose of data	Calculation of project emissions

Additional comment	This parameter is fixed for all the CPAs in Togo that promote the Toyola Asuto-type stove. Other CPAs shall demonstrate the parameter value prior to inclusion in the PoA.

Data / Parameter:	$B_{y,new}$
Unit	Tonnes/year
Description	Quantity of woody biomass used during the project activity
Source of data	Kitchen Performance Test (KPT)
Value (s) applied	Varies according to stove type and size
Choice of data or Measurement methods and procedures	Suggested in methodology. KPT conducted according to national standards or international standards and guidelines. The sampling plan detailed in Appendix 6 will be followed. $B_{y,new}$ and B_{old} will be determined in the same KPT
Purpose of data	Calculation of project emissions
Additional comments	This parameter is only applicable to CPA applying option 1 for the calculation of $B_{y,savings}$. It is determined once before inclusion of the CPA but $B_{y,new/age}$ is monitored annually

Data / Parameter:	$B_{old\ -charcoal}$
Unit	Tonnes/year
Description	Quantity of charcoal used in the absence of the project activity (per stove)
Source of data	Survey, historical data or Kitchen Performance Test (KPT) Source of data for first CPA Togo Baseline Report – HED Consulting
Value (s) applied	CPAs in Togo that target household and commercial end-users: Household stoves : 0.866 tonnes Commercial stoves: 1.23 tonnes Other CPAs shall assess this value prior to inclusion in the PoA.

Choice of data or Measurement methods and procedures	According to the methodology, B_{old} can be determined from historical data or surveys of local use. For CPAs in Togo, household consumption is determined from a 2007 study on household energy consumption by the Togolese Ministry of Energy[5]. Further field surveys by HED Consulting showed that the average urban household uses 1.1 stoves. Other CPAs shall demonstrate the parameter value prior to inclusion in the PoA. Data will be derived from annual average biomass consumption of households businesses and institutions in the host countries. Historical data will be used if available otherwise, project proponents will conduct a survey. The survey will apply sampling plan detailed in Appendix 6. If the CPA applies option 1 of the methodology for calculating $B_{y,savings}$, $B_{old-charcoal}$ will be determined through a KPT conducted by an independent 3rd party.
Purpose of data	Calculation of emissions resulting from the replacement of wood stove with charcoal project stoves
Additional comment	This parameter is fixed for CPAs in urban areas in Togo that replace Malgache stoves and clay stoves. It will be re-assessed for other CPAs and other countries. If a survey is required, $B_{old-charcoal}$ will be determined by sampling. A sampling plan for future baseline studies is provided in Appendix 6. This parameter is only applicable to CPAs that promote improved charcoal stoves

Data / Parameter:	$B_{old-wood}$
Unit	Tonnes/year
Description	Quantity of firewood used in the absence of the project activity (per stove)
Source of data	Survey, historical data or Kitchen Performance Test (KPT) Source of data for CPAs in urban areas of Togo Togo Baseline Report – HED Consulting
Value (s) applied	1.25 tonnes for CPAs in urban areas of Togo Other CPAs shall assess this value prior to inclusion in the PoA.

[5] *Enquête Consommation des Energies Domestique au Togo, aout 2007*

Choice of data or Measurement methods and procedures	According to the methodology, B_{old} can be determined from historical data or surveys of local use. For CPAs in Togo, household consumption is determined from a 2007 study on household energy consumption by the Togolese Ministry of Energy[6]. Other CPAs shall demonstrate the parameter value prior to inclusion in the PoA. Data will be derived from annual average biomass consumption of households businesses and institutions in the host countries. Historical data will be used if available otherwise, project proponents will conduct a survey. The survey will apply sampling plan detailed in Appendix 6. If the CPA applies option 1 of the methodology for calculating $B_{y,savings}$, $B_{old\text{-}wood}$ will be determined through a KPT conducted by an independent 3rd party.
Purpose of data	Calculation of emissions resulting from the replacement of wood stove with charcoal project stoves
Additional comment	This parameter is fixed for CPAs in urban areas in Togo that replace Malgache stoves and clay stoves. It will be re-assessed for other CPAs and other countries. If a survey is required, $B_{old\text{-}wood}$ will be determined by sampling. A sampling plan for future baseline studies is provided in Appendix 6.

Data / Parameter:	CF
Unit	Kg/kg
Description	Wood to charcoal conversion factor
Source of data	Field study or literature review or default conversion factor of 6kg if historical data doesn't exist Source of data for first CPA Togo Baseline Report – HED Consulting
Value (s) applied	CPAs in Togo 7 CPAs in other countries shall assess this value prior to inclusion in the PoA.
Choice of data or Measurement methods and procedures	According to the methodology AMS II G, version 5, the wood to charcoal conversion factor can be derived from credible literature review. Several sources consulted during the baseline study in Togo pointed to a conversion factor of 7kg of wood for 1 kg of charcoal. Other CPAs shall demonstrate the parameter value prior to inclusion in the PoA. Data will be derived from literature review otherwise a default factor of 6kg of wood for 1 kg of charcoal will be used
Purpose of data	Calculation of baseline emissions, project emissions and emissions resulting from the replacement of 3-stove fire by charcoal project stoves.
Additional comment	This parameter is fixed for CPAs in Togo that promote charcoal stoves. It will be re-assessed for other CPAs and other countries.

[6] *Enquête Consommation des Energies Domestique au Togo, aout 2007*

Data / Parameter:	$f_{NRB,y}$
Unit	Fraction
Description	Fraction of woody biomass saved by the project activity in year y that can be established as non renewable biomass, in Togo (host country for the first CPA)
Source of data	CDM SS-WG Default NRB list
Value (s) applied:	For CPAs in Togo: 0.97 Other CPAs will establish values prior to inclusion
Choice of data or Measurement methods and procedures	When available, the default NRB value from the CDM Small-scale Working Group can be chosen. Alternatively, fNRB shall be established by an independent 3rd party during baseline assessment
Purpose of data	Calculation of baseline emissions and project emissions
Additional comment	-

Data / Parameter:	SC_{old}
Unit	g/kg (gram of fuel/kg of cooked food)
Description	Specific fuel consumption of the baseline system
Source of data	3rd party literature or Controlled Cooking Test (CCT)
Value (s) applied	Varies according to stove type and size
Choice of data or Measurement methods and procedures	Historical data based on reference literature will be used in some cases. In other cases, stove will be submitted to a CCT performed by an independent 3rd party
Purpose of data	Calculation of project emissions
Additional comment:	This parameter is only applicable to CPA applying option 3 for the calculation of $B_{y,savings}$

Data / Parameter:	SC_{new}
Unit	g/kg
Description	Specific fuel consumption of project stoves
Source of data	Controlled Cooking Test (CCT)
Value (s) applied	Varies according to stove type and size
Choice of data or Measurement methods and procedures	CCT tests will be conducted for each type of stove, by an independent 3rd party.
Purpose of data	Calculation of project emissions
Additional comment:	This parameter is only applicable to CPA applying option 3 for the calculation of $B_{y,savings}$. It is determined once before the inclusion of the CPA but SC_{new}/age is monitored biennially

Data / Parameter:	$B_{y\ savings/\ stove}$
Unit	Tonnes/year
Description	Biomass saved per stove in project activity
Source of data	Calculated based Survey,historical data, KPT or CCT
Value (s) applied	For first CPA

	1.51 Other CPA will establish value prior to inclusion
Choice of data or Measurement methods and procedures	Baseline woody biomass consumption as well as results from stove testing are used to calculate $B_{y\ savings}$ according to one of the equations provided by the methodology: $B_{y,savings} = B_{old}-B_{y,new}$ $B_{y\ savings} = B_{old} * (1-\eta_{old}/\eta_{new})$ $B_{y,savings} = B_{old}*(1-SC_{new}/SC_{old})$
Purpose of data	Calculation of project emissions
Additional comment	-

Data / Parameter:	$B_{y\ savings-charcoal}$
Unit	Tonnes/year
Description	Charcoal saved per stove in project activity
Source of data	Calculated based on Survey,historical data, KPT or CCT
Value (s) applied	For CPAs in Togo promoting charcoal stoves 0.216 Other CPA will establish value prior to inclusion
Choice of data or Measurement methods and procedures	Baseline charcoal consumption as well as results from stove testing are used to calculate $B_{y\ savings-charcoal}$ according to one of the equations below: $B_{y,savings-charcoal} = B_{old-charcoal}-B_{y,new-charcoal}$ $B_{y\ savings-charcoal} = B_{old-charcoal} * (1-\eta_{old}/\eta_{new})$ $B_{y,savings-charcoal} = B_{old-charcoal}*(1-SC_{new}/SC_{old})$
Purpose of data	Calculation of emissions resulting from the replacement of wood stoves by charcoal project stoves
Additional comment	This parameter is only applicable to CPA that promote improved charcoal stoves

B.6.3. Ex-ante calculations of emission reductions

The following calculations are based on data available from the first CPA. Data for other CPAs will be available prior to their inclusion in the PoA.

$$\mathbf{ER_y = (B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}) - E_{additional}}$$

Where:

ER_y	Emission reductions during the year y in tCO_2e
$B_{y,savings}$	Quantity of woody biomass that is saved in tonnes
$f_{NRB,y}$	Fraction of biomass saved by the project activity in year *y* that can be established as non renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website
$NCV_{biomass}$	Net calorific value of the non-renewable biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/ton)

$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO_2/TJ
$E_{additional}$	Additional emissions resulting from the switch from wood to charcoal

Equation # 1: By,savings	Calculation	Result	Source of data
Baseline Charcoal used/year/hh (metric tonnes)	79.4kg of charcoal consumed per hh/month*12 months/1000	0.953 tonnes per hh/year	Baseline Study- Consolidation of CRISTO Data.xls (Rouse 2011)
Charcoal to Wood Conversion Factor	7*1 (It takes 7kg of wood to make 1kg of charcoal)	7	E+Carbon West Africa Stove PoA - Togo Baseline Report, page 22, section 4.1
Baseline Fuelwood Equivalent (metric tonnes)	0.953*7	6.67 tonnes per hh/year	
Number of stoves per hh	1.10	1.10 stoves	E+Carbon West Africa Stove PoA - Togo National Follow-up Survey, page 9, table 4
Baseline Fuelwood consumption per stove	6.67/1.10	6.06 tonnes per stove/year	
Leakage emission	1	1.00	Leakage will be adjusted to 0.95 if found to exist after ex-post assessment
By,savings per year/stove (metric tonnes)	**(6.06-0)*(1-0.211/0.281)**	**1.51 tonnes per stove/year**	Formula given by AMS II G Version 4
Stove Efficiency			
Efficiency Toyola Household Large stove	0.281	0.281	Rapport des Tests de Foyers Toyola pour E+Carbon , page 16
Weighted Average Efficiency Malgache/Clay Household stove	0.211	0.211	Rapport des Tests de Foyers Argile pour E+Carbon, page 12
Net Calorific Value of Fuelwood (TJ/tonnes)	0.015	0.015	AMS II G Version 4
Emission Factor for the substitution fuel (CO2/TJ)	81.6	81.6	AMS II G Version 4
Non-Renewable Biomass Fraction	0.97	0.97	E+Carbon West Africa Stove PoA - Togo Baseline Report, page 22
Equation # 2: Emissions Reduction in tCO2e			

Baseline Emissions per stove per year (tonnes)	6.06*0.97*0.015*81.6	7.20 tCO2e	Formula from AMS II G version 4
Project Emissions per stove per year (tonnes)	(6.06-1.51)*0.97*0.015*81.6	5.41 tCO2e	
Emission Reductions per stove per year (tonnes)	**1.51*0.97*0.015*81.6**	**1.79 tCO2e**	

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter:	$B_{y\ savings}$/ stove
Unit	Tonnes/year
Description	Biomass saved per stove in project activity
Source of data	KPT
Value (s) applied	Varies per CPA
Measurement methods and procedures	Baseline woody biomass consumption as well as results from KPT are used to calculate $B_{y\ savings}$ according to the equation provided by the methodology: $B_{y,savings} = B_{old}-B_{y,new}$
Monitoring Frequency	Before inclusion of CPA and annually thereafter
QA/QC Procedure	NA
Purpose of data	Calculation of project emissions
Additional comment	By,savings for CPAs using a KPT will determined annually in conjunction with annual KPT. By,savings for CPAs using a WBT or CCT is fixed and already included in section B.6.2 above.

Data / Parameter:	N_{sold}
Unit	Number
Description	Number of stoves sold
Source of data	Sales tracking system
Value (s) applied	Varies per CPA
Measurement methods and procedures	Local project participant records every stove sold or installed in a database
Monitoring Frequency	Quarterly
QA/QC procedures	The database is sent to the coordinating entity periodically for accuracy check, consistency check and archiving. Each stove will have unique identifier that can be traced back to the manufacturer
Purpose of data	Calculation of project emissions
Additional comments	-

Data / Parameter:	$N_{installed}$
Unit	Number
Description	Number of stoves installed
Source of data	installation tracking system
Value (s) applied	Varies per CPA
Measurement methods and procedures	Local project participant records every stove installed in a database
Monitoring Frequency	Quarterly
QA/QC procedures	The database is sent to the coordinating entity periodically for accuracy check,

	consistency check and archiving.
Purpose of data	Calculation of project emissions
Additional comments	This parameter is applicable to CPA that promote stationary stoves

Data / Parameter:	$B_{y,new}$/age
Unit	Tonnes/year
Description	Quantity of woody biomass used by project stoves, by age group
Source of data	Annual Kitchen Performance test on a representative sample
Value (s) applied	Varies per stove type and size
Measurement methods and procedures	Each SSC-CPA will test stoves among a statistically significant subset of end users using KPT. If stoves are found to use woody biomass below $B_{y, new}$ they will be replaced with new projects stoves or with other stoves of similar performance. The sampling plan detailed in section B.7.2 will be followed.
Monitoring Frequency	Annually
QA/QC procedures	Tests will be performed by third parties, which will build in an additional layer of checks and QA/QC.
Purpose of data	Calculation of project emissions
Additional comment	This parameter is applicable to CPA applying option 1 for the calculation of $B_{y,savings}$

Data / Parameter:	η_{new}/age
Unit	Fraction
Description	Efficiency of stove being deployed as part of the project activity , by age group
Source of data	Biennial Water-Boiling test on a representative sample
Value (s) applied	Varies per stove type and size
Measurement methods and procedures	Each SSC-CPA will test stove efficiency among a statistically significant subset of end users using a water-boiling test or other approved tests If stoves are found to perform below $\eta_{new,}$ they will be replaced with new projects stoves or with other stoves of similar performance. The sampling plan detailed in section B.7.2 will be followed
Monitoring Frequency	Every two years
QA/QC procedures	Tests will be performed by third parties, which will build in an additional layer of checks and QA/QC.
Purpose of data	Calculation of project emissions
Additional comments	This parameter is applicable to CPA applying option 2 for the calculation of $B_{y,savings}$

Data / Parameter:	SC_{new}/age
Unit	g/kg
Description	Specific fuel consumption of project stoves , by age group
Source of data	Biennial Controlled Cooking Tests on a representative sample of stoves
Value (s) applied	Varies per stove type and size
Measurement methods and procedures	Each SSC-CPA will test stoves among a statistically significant subset of end users using a CCT. If stoves are found to perform below SC_{new} they will be replaced with new projects stoves or with other stoves of similar performance.

	The sampling plan detailed in section B.7.2 will be followed
Monitoring Frequency	Every two years
QA/QC procedures	Tests will be performed by third parties, which will build in an additional layer of checks and QA/QC.
Purpose of data	Calculation of project emissions
Additional comments	This parameter is applicable to CPA applying option 3 for the calculation of $B_{y,savings}$

Data / Parameter:	Usage rate
Unit	Fraction
Description	Percentage of stoves of age x still in use in year y
Source of data	Survey
Value (s) applied	Varies per CPA
Measurement methods and procedures	Surveys will be conducted on a representative sample of end-users taken from the CPA sales database. The sampling plan detailed in section B.7.2 will be followed
Monitoring Frequency	Every two years
QA/QC procedures	Surveys will be conducted by independent third parties
Purpose of data	Calculation of project emissions
Additional comments	-

Data / Parameter:	F_{old}
Unit	Fraction
Description	Percentage of project stove users still using baseline stoves
Source of data	Survey
Value (s) applied	Varies per CPA
Measurement methods and procedures	Surveys will be conducted on a representative sample of end-users taken from the CPA sales database. The sampling plan detailed in section B.7.2 will be followed
Monitoring Frequency	Every two years
QA/QC procedures	Surveys will be conducted by independent third parties
Purpose of data	Calculation of project emissions
Additional comments	-

Data / Parameter:	Q_{old}
Unit	Kg
Description	The amount of fuelwood that continues to be used in replaced baseline stoves
Source of data	Survey
Value (s) applied	Varies per CPA
Measurement methods and procedures	Surveys will be conducted on a representative sample of end-users taken from the CPA sales database. The sampling plan detailed in section B.7.2 will be followed
Monitoring Frequency	Every two years
QA/QC procedures	Surveys will be conducted by independent third parties
Purpose of data	Calculation of project emissions
Additional comments	-

Data / Parameter:	$B_{old\text{-}adjustment\ factor}$
Unit	Fraction
Description	Percentage by which B_{old} is adjusted to account for leakage, if leakage is found to exist
Source of data	Methodology & existing literature and research
Value (s) applied	0.95 if leakage assessment finds leakage is a concern. 1.0 otherwise
Measurement methods and procedures	Leakage will be assessed from review of existing literature and research. If this assessment confirms that leakage is a concern, the default leakage value of .95 shall be applied.
Monitoring Frequency	Every two years
QA/QC procedures	Assessment surveys will be conducted by a third party
Purpose of data	Calculation of leakage
Additional comments	The adjustment factor will be applied if assessment shows that renewable energy is a significant source of cooking fuel in the host country; if other CDM project activities use the non-renewable biomass saved by the project activity to justify their baseline and if the project increases the use of non-renewable biomass outside the project boundary.

Data / Parameter:	N_{wood}
Unit	Number
Description	Number of charcoal project stoves replacing wood stoves
Source of data	Surveys
Value (s) applied	0
Measurement methods and procedures	A survey will be conducted every two years on a representative sample of project stove users to determine whether their purchase of a Toyola stove led to complete replacement of a wood stove rather than replacement of an inefficient charcoal stove. Emission for these stoves will be calculated based on the quantity of charcoal they currently use and the baseline wood consumption in the area (urban or rural) where they are being used. If the replacement leads to increased emissions from the baseline, this increase will be deducted from the project's emissions reductions.
Monitoring frequency	Every two years
QA/QC procedures	Surveys will be conducted by a third party
Purpose of data	Calculation of emissions resulting from the replacement of wood stove by charcoal project stove
Additional comment	The Parameter is only applicable to CPAs that promote improved charcoal stoves.

Data / Parameter:	$P_{baseline\text{-}replaced}$
Unit	fraction
Description	Proportion of different baseline stoves replaced
Source of data	Surveys
Value (s) applied	For first CPA 30.8% Malgache 69.1% Clay

	Other CPA will determine this value prior to inclusion
Measurement methods and procedures	A survey will be conducted every two years on a representative sample of project stove users to determine what type of baseline stove they have replaced to ensure that the proportions are aligned with the ex-ante estimations.
Monitoring frequency	Every two years
QA/QC procedures	Surveys will be conducted by a third party
Purpose of data	Calculation of project emissions
Additional comment	This parameter is applicable to CPA that identify more than one baseline stove and where the default efficiency value provided by the methodology is not used. The results will be used to update the weighted average.

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

Monitored Parameters

1. Stove sales

The CPA implementer is responsible for recording every sale in an electronic database from data collected by stove distributors at the time of sale . The database will have information on the stove type, stove size, stove unique identifier, date of sale and if available, the name and address of the purchaser. The database is sent to the Coordinating Entity periodically, who ensures that the reported sales are accurate by comparing them to the number of stoves manufactured (in the case of locally-manufactured stoves) or received (in the case of imported stoves) and to the number of stoves in stock. Stove sales are recorded on an ongoing basis. Because sales to restaurants in the first CPA are done directly and because a switch from wood use to charcoal use can result in significant emissions, the CPA will restrict commercial stoves to charcoal users only. The sales database will capture the type of stove replaced.

2. Stove installation

For stoves that require installation, in addition to sales data, the day of installation as well as the name of the installer will be recorded.

3. Stove Performance Check

Each CPA (or a group of CPA) will conduct testing on a representative sample of stoves to determine if their performance has changed. A sample of stoves sold in year 1 will be tested first. If their performance is found to be still at B_{new}, η_{new}, or SC_{new} (according to option applied for calculating $B_{y,savings}$) it would be safe to assume that younger stoves also have the same performance. Otherwise, stoves sold in year 2 will be tested, and so on. If stoves are found to perform below B_{new}, η_{new} or SC_{new} they will be replaced with new project stoves or with other stoves of similar performance. Performance check for the first CPA will occur two years after the PoA is registered and every two years thereafter. Performance check for other CPA will occur two years after their inclusion or sooner if the CME decides to combine them with other CPA.

4. Stove Usage rate

Since each CPA is limited by a threshold of 180GWh of annual energy savings and ER are calculated based on the number of stoves in operation, these stoves must be carefully monitored. Once the number of stoves sold reaches the threshold, surveys will be conducted among end-users in the sales database to determine the fraction of stoves that are no longer in use. These surveys will be conducted

by independent third parties. The first survey for the first CPA will occur two year after the PoA is registered and every other year thereafter. The first survey for other CPA will occur two years after their inclusion or sooner if the CME decides to combine them with other CPA. The verification for CPAs that have performed a Stove Usage rate survey yet will be based on the number of stoves sold.

5. Continuous Use of Replaced Low Efficiency Appliances (F_{old} and $B_{baseline\ stoves}$)

In conjunction with the biennial stove performance check, a survey will be conducted among households and institutions within the sample population to determine if they are still using their inefficient stoves. If so, the reason for that usage will be investigated. B_{old} will not be adjusted if it can be reasonably proven that the use of low efficient stoves does not change the baseline consumption of woody biomass. These cases include: 1) the use of low efficient stoves on special occasion only; 2) an increase in household size that justifies the use of a second charcoal stove 3) the replacement of one low efficient stove among several similar stoves in a business setting. If the reason for usage does not fit any of the above reasons, users will be given the option to purchase another project stove at a discount in exchange for surrendering their old stove. Otherwise the wood fuel used by these old stoves will be assessed and excluded from B_{old}. The assessment will include interview with the user to determine the frequency of use of the baseline stove. Survey for the first CPA will occur two years after the PoA is registered and every two years thereafter. Survey for other CPA will occur two years after their inclusion or sooner if the CME decides to combine them with other CPA.

6. Leakage Assessment ($B_{old\text{-}adjustment\ factor}$)

A leakage study will be conducted either by the Coordinating Entity or by a third party hired by the Coordinating entity. The assessment will be performed through a review of existing literature. For instance, the Energy Ministries in the host countries usually publish reports on the country energy use. If these reports reveal that renewable energy is not a significant source for cooking in the country this type of leakage will be quantified at zero.

The leakage assessment will also investigate whether the non-renewable woody biomass saved by the CPA is being used to justify the baseline of other CDM project activities or whether it increases the use of non-renewable woody biomass outside the project boundary. If the assessment show that these three types of leakage exist, then , B_{old} will be multiplied by an adjustment factor of 0.95 instead of conducting a survey. Leakage study for the first CPA will occur two years after the PoA is registered and every two years thereafter. Leakage study for other CPA will occur two years after their inclusion or sooner if the CME decides to combine them with other CPA.

7. Replacement of wood stove by improved charcoal stoves (only applicable to CPAs that promote improved charcoal stoves)

Improved charcoal stoves promoted by the PoA are intended to replace less efficient charcoal burning stoves. Charcoal usage will be dominant in the project area where improved stoves are promoted, however, some households use both charcoal and wood and in a limited number of cases, may purchase a charcoal project stove to replace their wood stove. To account for this type of replacement, a survey will be conducted every two years on a representative sample of project stove users to determine whether their purchase of a charcoal project stove led to a replacement of a wood stove rather than a replacement of an inefficient charcoal stove. Emission for these stoves will be calculated by 1) deducting the savings realized by the project stove ($B_{y,\ savings\text{-}charcoal}$) form the baseline charcoal consumption ($B_{old\text{-}charcoal}$) 2) converting the result into wood by using a wood to charcoal conversion factor (CF), 3) deducting the baseline wood consumption ($B_{old\text{-}wood}$) from this result and 4) multiplying that number by $F_{NRB,y}$,$NCV_{biomass}$ and $EF_{projected\text{-}fossilfuel.}$

Below is an illustration of the calculation. The calculation assumes that by abandoning wood use, these new charcoal users would be using the same quantity of charcoal as project stove users.

	Calculation	Result	Unit
Baseline charcoal use ($B_{old\text{-}charcoal}$)			
baseline charcoal consumption for baseline stove users	79.4kg of charcoal consumed per hh/month*12 months/1000	0.953	tonnes per year
number of stoves per household	1.1	1.1	
consumption per stove		**0.87**	tonnes per year
Charcoal savings by project stoves ($B_{y,savings\text{-}charcoal}$)			
Efficiency of baseline stove	0.211	0.211	
Efficiency of project stove	0.281	0.281	
Charcoal savings	0.87*(1-0.211/0.281)	**0.216**	tonnes per year
Charcoal consumption of project stoves ($B_{y\text{-}charcoal}$)	0.87-0.216	**0.651**	tonnes per year
Wood to charcoal conversation factor		**7**	kg/kg
Wood equivalent		**4.55**	tonnes per year
Baseline wood consumption of wood stove users ($_{Bold\text{-}wood}$)	(104.1*12 months)/1000= 1.25	**1.25**	tonnes per year
Difference in wood consumption between wood stove and project stove	4.55-1.25=3.3	**3.30**	tonnes per year
Emission Calculation			
Net Calorific Value of Fuelwood (TJ/tonnes) (6)	0.015	0.015	
Emission Factor for the substitution fuel CO2/TJ (8)	81.6	81.6	
Non-renewable biomass fraction	0.97	0.97	
Additional emissions per stove per year	3.3*0.015*81.6*0.97= **3.92**	**3.92**	tonnes of CO2e per stove/year

8. Type of baseline stoves being replaced

When more than one baseline stove is identified in a CPA and a weighted average is used, a survey will be conducted every two years to determine the proportion of each baseline stove replaced to ensure that they are aligned with ex-ante estimations

Sampling Plan for Monitored Parameters that require sampling

The sampling plan follows the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" (Version 02.0). It can be applied to individual CPA or to a group of CPAs if they are located in the same host country and are promoting the same type of cook stove. The sampling plan below is based on an individual CPA. If multiple CPA are used the confidence interval and precision level for $By_{new/age}$ will be 95/10

a. Sampling Design

i. Objectives and Reliability Requirements.

The objective is to obtain a reliable estimate of the following key variables over the course of the crediting period and meeting the indicated confidence/precision levels.

Parameter	Description	Objective	Frequency	Comments
$B_{y,new}$/age	Quantity of woody biomass used by project stoves, by age group (tonnes/year)	Determine the mean annual value with a 90/10 precision	annually	This parameter is applicable to CPA using Option 1 of the methodology to calculate $B_{y,savings}$
η_{new}/age	Efficiency of stove being deployed as part of the project activity , by age group (%)	Determine the mean thermal efficiency with a 95/10 precision	Biennially	This parameter is applicable to CPA using Option 2 of the methodology to calculate $B_{y,savings}$
SC_{new}/age	Specific fuel consumption of project stoves , by age group (g/kg)	Determine the mean specific fuel consumption with a 95/10 precision	Biennially	This parameter is applicable to CPA using Option 3 of the methodology to calculate $B_{y,savings}$
Usage rate	Percentage of stoves of age x still in use in year y (%)	Determine the proportion of project stoves that are in use during a year y compared to the number of project stoves deployed in previous years, with a 95/10 precision	Biennially	
F_{old}	Percentage of project stove users still using baseline stoves (%)	Determine the proportion of baseline stoves being used in parallel with project stoves with a 95/10 precision	Biennially	
Q_{old}	The quantity of fuelwood that continues to be used in replaced baseline stoves (tonnes/year)	Determine the mean annual value of fuelwood that continues to be used in replaced baseline stoves with a 95/10 precision	Biennially	

N_{wood}	Number of charcoal project stoves replacing wood stoves	Determine the number of stoves that are replacing wood stoves instead of charcoal stoves with a 95/10 precision	Biennially	This parameter is applicable to CPA promoting improved charcoal stoves
$P_{baseline-replaced}$	Proportion of Malgache and Clay stoves being replaced	Determine the weight of each baseline stove (Malgache and Clay) in the efficiency of baseline stoves with a 95/10 precision	Biennially	This parameter is for CPA that have more than one baseline stove and that do use a default baseline efficiency

ii. Target Population

The overall PoA has 4 target populations determined by the type of improved cook stove disseminated in the CPA (or in a group of CPA)
-Urban Households: households that use primarily charcoal for their cooking needs and are currently using inefficient cooking methods. Improved charcoal stoves will be promoted among this group
-Rural Households: households that use primarily firewood for their cooking needs and are currently using the 3-stone fire method or other inefficient cooking appliances. Improved wood stoves will be promoted among this group.
-Charcoal-using commercial entities or institutions: these are entities or institutions such as restaurants, school cafeteria, hospitals, prisons, etc. that consume large quantities of charcoal using inefficient cooking appliances. Improved institutional charcoal stoves will be promoted among this group
-Firewood-using commercial entities or institutions: these are entities or institutions such as restaurants, traditional breweries, school cafeteria, hospitals, prisons, etc. that consume large quantities of firewood using the 3-stone fire method or other inefficient cooking appliances. Improved firewood stoves will be promoted among this group.

For monitoring, the target population will the project stoves or baseline stoves used by these different groups.

Parameter	Target Population
$B_{y,new}$/age	• Charcoal project stoves being used in urban households • Firewood project stoves being used in rural households • Charcoal project stoves being used in commercial entities and institutions • Firewood project stoves being used in commercial entities and institutions
η_{new}/age	Same as above
SC_{new}/age	Same as above
Usage rate	• Urban households having acquired a charcoal project stove • Rural households having acquired a firewood project stove • Commercial entities and institutions having acquired a charcoal project stove • Commercial entities and institutions having acquired a firewood project stove

F_{old}	Same as above
Q_{old}	• charcoal baseline stoves being used by urban households that have charcoal project stoves • firewood baseline stoves being used by rural households that have firewood project stoves • charcoal baseline stoves being used by commercial entities and institutions that have charcoal project stoves • firewood baseline stoves being used by commercial entities and institutions that have firewood project stoves.
N_{wood}	• improved charcoal stoves replacing wood stoves
$P_{baseline\text{-}replaced}$	• Toyola stoves purchased by households and restaurants in the urban areas of Togo

iii. Sampling method

A stratified random sampling method will be used for parameters $B_{y,new}$/age, η_{new}/age and SC_{new}/age because the tests may have to be performed on different age groups (if the performance of the oldest age group tests below $B_{y,new,}$ η_{new} or SC_{new}). The sample is drawn from the project sales database. If the project stoves come in one size only, the project database will be divided into one stratum: stove age. If the project stoves come in different sizes, two strata will be considered: stove age and stove size. The performance of the stoves is not likely to differ from one geographical location to another given the standardization in their manufacturing process. Therefore a geographical stratification is not necessary. For this same reason, the CME may elect to select samples from areas where 80% of the project stoves have been distributed.

Step 1: the project database is divided into stove sizes (if applicable)
Step 2: the "stove size" sub-databases are in turn divided into age group
Step 3: a simple random sample is drawn from each age group.

For parameter Usage Rate, F_{old} and Q_{old} simple random sampling will be used in the areas where at least 80% of the distribution has occurred if the stove comes in one size. If the stove comes in different sizes used by different target groups, stratified random sampling will be used with the stratum being the target group. This is the case for the first CPA whose cook stoves come in 5 different sizes; 3 sizes used by households and 2 sizes used by restaurants.

iv. Sample Size

Parameters: $B_{y,new}$, η_{new} and SC_{new}

The sample size calculation below for stove performance check ($B_{y,new}$, η_{new} and SC_{new}) are based on η_{new} using known data from the first CPA. CPA using $B_{y,new}$ and SC_{new} for the calculation of $B_{y,savings}$ will present a sample size calculation in the monitoring plan of their PDD prior to their inclusion in the PoA.

Sample size for Stratified Random Sampling using one stratum: stove age

The total number of stoves in the project database is 28,601 which correspond to small-scale limit for the first CPA. We assume that the sample size is for the first monitoring period (2 years after CPA inclusion), that only one size stove is distributed in the CPA and that stoves are distributed by age as follow

Stove age	Number of project stoves	Mean[7]	Standard Deviation[8]
0-1	18,601	0.281	0.023
1-2	10,000	0.281	0.023

[7] University of Lomé "Rapport des Tests de Foyers pour E+Carbon »
[8] University of Lomé "Rapport des Tests de Foyers pour E+Carbon »

Total sample size across all stove sizes

$n \geq 1.96^2 \times NV/(N-1) \times 0.10^2 + 1.96^2V$

Where

$V = (SD/Mean)^2$

n	sample size
N	Total number of stoves
SD	Is the overall Standard Deviation
Mean	Is the overall mean
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$$SD = \frac{(18{,}601 * 0.023) + (10{,}000 * 0.023))}{28{,}601}$$

SD= 0.023

$$Mean = \frac{(18{,}601 * 0.281) + (10{,}000 * 0.281)}{28{,}601}$$

Mean = 0.281

$V = (SD/Mean)^2 = (0.023/0.281)^2$

V= 0.006

$n \geq 1.96^2 \times 28{,}601 \times 0.006/(28{,}601-1) \times 0.10^2 + 1.96^2 \times 0.006$

$n \geq 659.24/286.02 = 2.3$ rounded up to 3

If we expect a response rate of 80%, then the sample size should be increased to 3/0.8= 3.75 rounded up to 4

The sample size is divided proportionally among different age groups

$n_{0\text{-}1}$=(18,601/28,601) x 4 = 2.6 rounded up to 3
$n_{1\text{-}2}$= (10,000/28,601) x 4 =1.39 rounded up to 2

3 stoves in the age group 0-1 will be sampled and 2 stoves in the age group 1-2 will be sampled.

Sample size for Stratified Random Sampling using two strata: stove age and stove size

The total number of stoves in the project database is 28,601 which correspond to small-scale limit for the first CPA. We assume that the sample size is for the first monitoring period (2 years after CPA inclusion), that the project stove comes in 5 sizes and that the stoves are distributed in the CPA as follow:

Stove size	Number of project stoves	Mean[9]	Standard Deviation[10]
HS – age 0-1	2,500	0.278	0.016
HS – age 1-2	2,500	0.278	0.016
HM – age 0-1	2,500	0.256	0.026
HM – age 1-2	2,526	0.256	0.026
HL – age 0-1	9,500	0.281	0.023
HL- age 1-2	9,000	0.281	0.023
CS – age 0-1	15	0.286	0.006
CS – age 1-2	15	0.286	0.006
CL – age 0-1	10	0.280	0.01
CL – age 1-2	10	0.280	0.01

Total sample size across all stove sizes

$n \geq 1.96^2 \times NV/(N-1) \times 0.10^2 + 1.96^2V$

Where

$V = (SD/Mean)^2$

n	sample size
N	Total number of stoves
SD	Is the overall Standard Deviation
Mean	Is the overall mean
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$$SD = \frac{(5{,}000 * 0.16) + (5{,}051 * 0.026) + (18{,}500 * 0.023) + (30 * 0.006) + (20 * 0.01)}{28{,}601}$$

SD= 0.022

$$Mean = \frac{(5{,}000 * 0.278) + (5{,}051 * 0.256) + (18{,}500 * 0.281) + (30 * 0.286) + (20 * 0.280)}{28{,}601}$$

Mean = 0.276

$V = (SD/Mean)^2 = (0.022/0.276)^2$

V= 0.006

$n \geq 1.96^2 \times 28{,}601 \times 0.006/(28{,}601-1) \times 0.10^2 + 1.96^2 \times 0.006$

$n \geq 659.24/286.02 = 2.30$ rounded up to 3

If we expect a response rate of 80%, then the sample size should be increased to 3/0.8= 3.75 rounded up to 4

The sample size is divided proportionally among different sizes

[9] University of Lomé "Rapport des Tests de Foyers pour E+Carbon »
[10] University of Lomé "Rapport des Tests de Foyers pour E+Carbon »

$n_{hs\text{-}0\text{-}1}$=(2,500/28,601) x 4 = 0.34 rounded up to 1
$n_{hs\text{-}1\text{-}2}$=(2,500/28,601) x 4 = 0.34 rounded up to 1
$n_{hm\text{-}0\text{-}1}$= (2,500/28,601) x 4= 0.34 rounded up to 1
$n_{hm\text{-}1\text{-}2}$= (2,526/28,601) x 4 = 0.35 rounded up to 1
$n_{hl\ 0\text{-}1}$= (9,500/28,601) x 4 = 1.32 rounded up to 2
$n_{hl\text{-}1\text{-}2}$= (9,000/28,601) x 4 = 1.25 rounded up to 2
$n_{cs\ 0\text{-}1}$= (15/28,601) x 4 = 0.002 rounded up to 1
$n_{cs\ 1\text{-}2}$= (15/28,601) x 4 = 0.002 rounded up to 1
$n_{cl\text{-}0\text{-}1}$= (10/28,601) x 4 = 0.001 rounded up to 1
$n_{cl\text{-}1\text{-}2}$= (10/28,601) x 4 = 0.001 rounded up to 1

Even though the calculations show that less than 1 CS and CL should be tested, the CME elects to sample one of each size and age group.

Parameter: Usage Rate

The calculation below is for the first monitoring period which is 2 years after the PoA is registered. We try to determine the percentage of cook stove still in operation 2 years after they have been distributed. The total number of cook stoves distributed is 28,601 and we expect 90% of them to be still in operation.

Sample size for Simple Random Sampling

$n \geq 1.96^2\ NV/(N-1) \times 0.10^2 + 1.96^2V$

Where
$V=P\ (1-P)/P^2$

n	sample size
N	Total number of stoves (28,601)
P	Is the expected Proportion (0.90)
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$V= 0.9 \times (1-0.9)/0.9^2$
$V= 0.09/0.81 = 0.11$

$n \geq 1.96^2 \times 28{,}601 \times 0.11/(28{,}601-1) \times 0.10^2 + 1.96^2 \times 0.11$

$n \geq 12{,}086.1/286.42 = 42.19$

If we assume a response rate of 80%, the sample size should be increased to 42/0.8= 52.5 stoves; rounded up to 53.

Sample size for Stratified Random Sampling with one stratum: target group

We assume that 90% of household stoves are still operating and 80% of commercial stoves because the latter are used more intensely and are therefore more prone breakage.

Stove type	Number of stoves	Proportion in operation
Household stoves	28,551	90%
Commercial stoves	50	80%

Total sample size for all stoves

$n \geq 1.96^2 NV/(N-1) \times 0.10^2 + 1.96^2V$

Where
$V=SD^2/p^2$

n	sample size
N	Total number of stoves (28,601)
SD^2	Overall variance
P	Overall proportion
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$SD^2 = 28,551 \times 0.9 (1-0.9) + 50 \times 0.8 (1-0.8)/ 28,601$
$= (28,551 \times 0.9 \times 0.1) + (50 \times 0.8 \times 0.2)/28,601$
$= 2,577.59 / 28, 601$
$SD^2 = 0.09$

$P= (28,551 \times 0.9) + (50 \times 0.8)/28,601$
$= 25,735.9/28,601$
$P= 0.89$

Therefore
$V= SD^2/p^2 = 0.09 / 0.89^2$
$V= 0.11$

$n \geq 1.96^2 NV/(N-1) \times 0.05^2 + 1.96^2V$
$n= 1.96^2 \times 28,601 \times 0.11/ (28,601-1) \times 0.10^2 + 1.96^2 \times 0.11$
$n= 12,086.1/286.42$
$n= 42.19$

The total sample size is 42. If we assume a response rate of 80%, the sample size should be increased to 42/0.8= 52.5 stoves; rounded up to 53. We then divide the sample size proportionally between groups

Households: (28,551/28,601) * 53 = 52.9 rounded up to 53
Commercial: (50/28,601) *53 = 0.09 rounded up to 1

Parameter: F_{old}
The calculation below is for the first monitoring period which is 2 years after the PoA is registered. We try to determine the fraction of project stove users that are still using their baseline stoves. The total number of cook stoves distributed is 28,601 and we assume 1.1 stove per user[11] = 26,001 users. We expect 5% to be still using their baseline stove.

Sample size for Simple Random Sampling

$n \geq 1.96^2 NV/(N-1) \times 0.10^2 + 1.96^2V$

Where
$V=P (1-P)/P^2$

[11] E+Carbon West Africa Improved Cookstove Project: Togo National Follow-up Survey

n	sample size
N	Total number of users (26,001)
P	Is the expected Proportion (0.05)
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$V= 0.05 \times (1-0.05)/0.05^2$
$V= 0.0475/0.0025 = 19$

$n\geq 1.96^2 \times 26{,}001 \times 19/(26{,}001-1) \times 0.10^2 + 1.96^2 \times 19$
$n= 1{,}897{,}823.39/332.99 = 5{,}699$ stoves

The calculation yields a sample size that cannot be achieved by the project. However, the fraction of end users continuing to use their baseline stoves is related to the fraction of end users not continuing to use their baseline stoves. Therefore the sample size can be calculated by assuming that 95% of project stove users are not using their baseline stove:

$V= 0.95 \times (1-0.95)/0.95^2 = 0.052$
$n\geq 1.96^2 \times 26{,}001 \times 0.052/ (26{,}001-1) \times 0.10^2 + 1.96^2 \times 0.052$
$n\geq 5{,}194.04/260.19 = 19.96$

A sample size of 20 will be sufficient to achieve the confidence/precision requirement. The surveys will be conducted on the sample as Usage Rate until the desired confidence/precision is achieved.

Sample size for Stratified Random Sample with one stratum: target group
We expect 5% of users to be still using their baseline stoves both in the household group and the commercial group therefore the sample size calculation will be the same as in simple random sample. We assume 1.1 stoves for households and 3.09 per commercial entity[12], therefore the total number of user is (28,551/1.1) + (50/3.09) = 25,955 + 16 = 25,971.

$n\geq 1.96^2\ NV/(N-1) \times 0.10^2 + 1.96^2V$

Where
$V=P\ (1-P)/P^2$

n	sample size
N	Total number of users (25,971)
P	Is the expected Proportion (0.95)
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$V= 0.95 \times (1-0.95)/0.95^2 = 0.052$
$n\geq 1.96^2 \times 25{,}971 \times 0.052/ (25{,}971-1) \times 0.10^2 + 1.96^2 \times 0.052$
$n\geq 5{,}188.05/259.89 = 19.96$

A sample size of 20 will be sufficient to achieve the confidence/precision requirement.
If we divide the sample size between the two groups we get:

Households: (25,955/25,971) * 20 = 19.98

[12] Togo Restaurant Survey Data 161231 V14 Final.xls

Commercial: (16/25,971) * 20 = 0.00003 (at least one commercial entity will be surveyed)

The surveys will be conducted on the sample as Usage Rate until the desired confidence/precision is achieved.

Parameter Q_{old}
The sample size for this parameter should be drawn from the number of users that are found to still use their baseline stoves but since this size is expected to be less than the sample size required for the parameter F_{old}, Q_{old} will be assessed on all the users found to still use their baseline stove. In this case sample size = sampling frame.

Parameter N_{wood}

Sample size for Stratified Random Sample with one stratum: target group
We expect that 98% of project stove to have replaced charcoal stoves

Stove type	Number of stoves	Proportion
Household stoves	28,551	98%
Commercial stoves	50	98%

Since the expected proportion is the same for both groups, the overall sample size calculation is the same as in a simple random sample.

$n \geq 1.96^2 NV/(N-1) \times 0.10^2 + 1.96^2 V$

Where
$V=P(1-P)/P^2$

n	sample size
N	Total number of users (28,601)
P	Is the expected Proportion (0.98)
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$V= 0.98 \times (1-0.98)/0.98^2$
$V= 0.019/0.96=0.019$

$n \geq 1.96^2 \times 28,601 \times 0.019/(28,601-1) \times 0.10^2 + 1.96^2 \times 0.019$
$n= 2,087.60/286.07 = 7.29$ stoves

A sample size of 8 stoves is sufficient to meet the expected confidence/precision. If we expect a 80% response rate, the sample size will be increased to 8/0.8= 10. The surveys will be conducting on the sample as Usage rate until the desired confidence/precision is reached.

Parameter $P_{baseline\text{-}replaced}$

Simple random sampling among project stoves that have been sold to households
The total number of stoves sold to households is 28,551. We expect that 27.4% have replaced Malgache stoves and 61.3% have replaced Clay stoves. We first calculate the sample size for Malgache stoves then Clay stoves. The larger sample size will be used to conduct the survey

Malgache stoves

$n \geq 1.96^2\ NV/(N-1) \times 0.10^2 + 1.96^2 V$

Where
$V=P\ (1-P)/P^2$

n	sample size
N	Total number of users (28,551)
P	Is the expected Proportion (0.31)
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$V= 0.31 \times (1-0.31)/0.31^2$
$V= 0.21/0.073=2.87$

$n \geq 1.96^2 \times 28,551 \times 2.87/(28,551-1) \times 0.10^2 + 1.96^2 \times 2.87$
$n= 244,130/294 = 830$ stoves

The calculation yields a sample size that cannot be achieved by the project. However, the fraction of end users replacing a malgache stove is related to the fraction of end users not replacing a malgache stove. Therefore the sample size can be calculated by assuming that 69.1% of project stove users are not replacing a malgache stove which is the same as the proportion replacing a clay stove:

Clay stoves

$n \geq 1.96^2\ NV/(N-1) \times 0.10^2 + 1.96^2 V$

Where
$V=P\ (1-P)/P^2$

n	sample size
N	Total number of users (28,551)
P	Is the expected Proportion (0.69)
1.96	represents the 95% Confidence Interval
0.10	represents the 10% relative precision

$V= 0.69 \times (1-0.69)/0.69^2$
$V= 0.21/0.47=0.44$

$n \geq 1.96^2 \times 28,551 \times 0.44/(28,551-1) \times 0.10^2 + 1.96^2 \times 0.44$
$n= 49,277/287 = 172$ stoves
A sample size of 172 stoves is sufficient to meet the expected confidence/precision. If we expect

a 80% response rate, the sample size will be increased to 172/0.8= 215.

v. Sampling Frame

Parameter	Sampling Frame
$B_{y,new}$/age	• All household charcoal stoves distributed under a CPA or a group of CPA • All household firewood stoves distributed under a CPA or a group of CPA • All institutional charcoal stoves distributed under a CPA or a group of CPA • All institutional firewood stoves distributed under a CPA or a group of CPA
η_{new}/age	Same as above
SC_{new}/age	Same as above
Usage rate	Same as above
F_{old}	• All households using charcoal stoves distributed under a CPA or a group of CPA • All households using firewood stoves distributed under a CPA or a group of CPA • All commercial entity/institution using charcoal stoves distributed under a CPA or a group of CPA • All commercial entity/institution using firewood stoves distributed under a CPA or a group of CPA
Q_{old}	• All households using their baseline stove in parallel with charcoal stoves distributed under a CPA or a group of CPA • All households their baseline stove in parallel with firewood stoves distributed under a CPA or a group of CPA • All commercial entity/institution using their baseline stove in parallel with charcoal stoves distributed under a CPA or a group of CPA • All commercial entity/institution using their baseline stove in parallel with firewood stoves distributed under a CPA or a group of CPA
N_{wood} and $P_{baseline-replaced}$	• All improved charcoal stoves sold under a CPA

b. Data

i. Field Measurements

Parameter	Timing	Frequency	Measurement method	Sensitivity to seasonal fluctuation
$B_{y,new}$/age	First monitoring will occur 1 year after the CPA is included or sooner if combined with other CPA. Can occur at any time during the year	Annually	Kitchen Performance Test and interview	Likely, Interview questions will address seasonal variation and $B_{y,new}$ will be adjusted accordingly

η_{new}/age	First monitoring will occur 2 years after the CPA is included or sooner if combined with other CPA. Can occur at any time during the year	Biennially	Water Boiling Test	Unlikely
SC_{new}/age	First monitoring will occur 2 years after the CPA is included or sooner if combined with other CPA. Can occur at any time during the year	Biennially	Control Cooking Test	Unlikely
Usage rate	First monitoring will occur 2 years after the CPA is included or sooner if combined with other CPA. Can occur at any time during the year	Biennially	Interview with end user and physical inspection of stoves	Unlikely
F_{old}	First monitoring will occur 2 years after the CPA is included or sooner if combined with other CPA. Can occur at any time during the year	Biennially	Interview with end user and physical inspection of stoves	Likely, Interview questions will ask if use of baseline stove is due to seasonal variations.
Q_{old}	First monitoring will occur 2 years after the CPA is included or sooner if combined with other CPA. Can occur at any time during the year	Biennially	Interview with end user to determine frequency of use of the baseline stove and estimate quantity of biomass used in these stoves	Likely, Interview questions will ask if use of baseline stove is due to seasonal variations
N_{wood} and $P_{baseline-replaced}$	First monitoring will occur 2 years after the PoA is registered. Can occur at any time during the year.	Biennially	Interview with end users to determine if they have replaced a wood stove with a charcoal project stove and what type of baseline stove they have replaced	Unlikely

ii. Quality Assurance/Quality Control

Measurements and interviews will be conducted by third parties such as research institutes, universities, consulting firms or NGO that are experienced in conducting these type of studies. Together with the CME, they will develop a plan that responds to the proposed Sampling Plan.

Monitoring agents engaged by the 3rd party will undergo training on the objectives of the study and on how to treat non-responses. The potential for non-responses, refusals and outliers will be addressed by oversampling. In all cases, each of these occurrences will be documented clearly. The decision to exclude or include an outlier will be made during data analysis. Surveys results will be reviewed daily by a field supervisor so that errors can be corrected promptly while agents are still in the field. In order to ensure the quality of the sampling results, the study will draw on the provisions for reliability calculations as provided by the Draft Best Practices Examples: Focusing on Sample Size and Reliability Calculation (Agenda of EB 66).

The CME will be responsible for maintaining and storing a database of distributed stoves and for archiving study results in a secure server.

vi. Analysis

Data obtained from the field measurements will be used to estimate the value of the parameters described above. The values will then be factored in the emissions reduction calculation.

Parameters $B_{y,new}$/age, η_{new}/age and SC_{new}/age

- If option 1 is used to calculate $B_{y,savings}$, then the value for $B_{y,new}$/age will be taken into account as follows for each size (if applicable) :

$B_{y,savings} = B_{old} - (B_{ynew}/age)$

Where

$B_{ynew}/age = (B_{ynew\text{-}age\ 0\text{-}1} * number\ of\ stoves_{age\ 0\text{-}1}) + (B_{ynew\text{-}age\ 1\text{-}2} * number\ of\ stove_{age\ 1\text{-}2}) + \ldots + (B_{ynew\text{-}age\ n} * number\ of\ stove_{age\ n}) /$ total number of stoves

- If option 2 is used to calculate $B_{y,savings}$, the value of η_{new}/age, will be taken into account as follows for each size (if applicable)

$B_{y,savings} = B_{old} * (1 - \eta_{old}/\eta_{new/age})$

Where

$\eta_{new}/age = (\eta_{new\ age\ 0\text{-}1} * number\ of\ stoves_{age\ 0\text{-}1}) + (\eta_{new\ age\ 1\text{-}2} * number\ of\ stove_{age\ 1\text{-}2}) + \ldots + (\eta_{new\ age\ n} * number\ of\ stoves_{age\ n}) /$ Total number of stoves

- If option 3 is used to calculate $B_{ysavings}$, the value of $SC_{new/age}$ will be taken into account as follows for each size (if applicable)

$B_{y,savings} = B_{old} * (1 - SC_{new/age}/SC_{old})$

Where

SC_{new}/age = ($SC_{new\ age\ 0\text{-}1}$ * number of stoves $_{age\ 0\text{-}1}$) + ($SC_{new\ age\ 1\text{-}2}$ * number of stoves $_{age\ 1\text{-}2}$)+ …+ ($SC_{new\ age\ n}$ * number of stoves $_{age\ n}$) / total number of stoves

Further, since the methodology requires that appliances that perform below $B_{y,new}$, η_{new} and SC_{new} be replaced, this data will be used to determine which age group of stove should be replaced.

Parameter Usage Rate
Data on Usage Rate will be used to adjust the number of project stoves that can be credited during a monitoring period from the number of stoves distributed during that period. Emissions reductions are calculated per stove using the formula in the methodology:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

To determine ER for all the project stoves in operation the following equation will be used:

$$ER_y = (B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}) * (Numberofstovesdistributed * UsageRate)$$

This data will also be used to determine the additional number of project stoves that can be deployed without exceeding the small-scale threshold.

Parameters F_{old} and Q_{old}

These two parameters together are used to adjust the value of B_{old} if baseline stoves are being used in parallel with project stoves. The following equation will be used to calculate the new value of B_{old}

$B_{old\text{-}adjusted}$ = B_{old} – (total number of stoves*F_{old}*Q_{old}/total number of stoves)

Parameter N_{wood}

Data from N_{wood} will be used to calculate emissions resulting from the replacement of a wood stove with a charcoal project stove. Emissions with calculated as follows:

$E_{additional}$ = [($B_{y,charcoal}$*CF-$B_{old\text{-}wood}$) * $F_{NRB,y}$ * $NCV_{biomass}$ *$EF_{projected\text{-}fossilfuel}$] * N_{wood}

Parameter $P_{baseline\text{-}replaced}$

Data from Pbaseline-replaced will be use the adjust the weight of malgache stove and clay stoves in the efficiency of the baseline stoves

c. Implementation

(i) Implementation Plan

Collection of data on stove distribution will occur continuously during the implementation of the CPA. The CME will implement the Sampling Plan during the 12 months preceding the actual field surveys and measurements, including contracting with third parties. These third parties must have the following profile:

-Experience conducting door-to-door surveys
-Experience using measuring instruments
-Knowledge of the local language and of French or English
-Cultural awareness
-Data entry skills
-Data analysis skills
-Report writing skills

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

Organization	E+Carbon
Street/P.O. Box	5 Hanover Square
Building	Suite 401
City	New York
State/Region	New York
Postcode	10004
Country	United States of America
Telephone	+1 212 913 9385
Fax	
E-mail	cathy.diam@persistentenergypartners.com
Website	
Contact person	Catherine Diam-Valla
Title	Project Manager
Salutation	Mrs
Last name	Diam-Valla
Middle name	
First name	Catherine
Department	Carbon finance
Mobile	+1 (301) 325-5370
Direct fax	
Direct tel.	+1 212 913 9385
Personal e-mail	cathy.diam@persistentenergypartners.com

Appendix 2: Affirmation regarding public funding

There is no public funding to implement the PoA

Appendix 3: Application of methodology(ies)

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

I. TESTING OF TOYOLA STOVES

A series of Water-Boiling Tests (WBT) and Controlled Cooking Tests (CCT) were conducted by the Laboratoire sur l'Energie Solaire of the University of Lomé, Togo on all 5 sizes of Toyola Asuto stoves during the period of August 15 through September 5, 2010. The goal of the WBT was to determine the efficiency of the Toyola stoves for the purpose of calculating emission reductions while the CCT was to assess the performance of the stoves for cooking of actual Togolese dishes. Only the results of the WBT are reported here.

5 sizes of Toyola stoves

Stove	Burning Rate (g/mn)	Thermal Efficiency (%)	Specific Consumption (g/l)	Fire Power (Watts)
Toyola 1	6,23	27,88%	214,83	2925,50
Toyola 2	9,33	25,63%	235,50	4377,40
Toyola 3	12,47	28,17%	165,37	5857,10
Toyola 4	17,67	28,60%	190,77	8296,87
Toyola 5	26,20	28,09%	260,8	12312,70

Summary of Water Boiling Test Results

II. TESTING OF CLAY STOVES

A series of Water-Boiling Tests (WBT) were conducted by the Laboratoire sur l'Energie Solaire of the University of Lomé, Togo on 2 types clay stoves that are commonly used by Togolese households. These stoves, along with the Malgache stove, constitute the baseline stoves. The result of the WBT is summarized below.

Param.	Units	Clay bucket	Clay bowl
		Mean.	Mean.
BR	(g/mn)	8.77	9.37
TE	(%)	23%	22%
SFC	(g/l)	109.83	114.33
FP	Watts	4120.07	4396.47

The efficiency of the Malgache stove is derived from historical data[13]. Further, a survey conducted on 212 households by HED Consulting, an independent third party, concluded that 27.4% (58 households) and

[13] « Projet de Renforcement des Capacités des Fabricants de Foyers Améliorés-Rapport Technique – Université de Lomé »

61.3 % (130 households) use the Malgache stove and clay stove respectively. The remaining 24 households were using other the type of improved stoves. Most of them developed by the University of Lomé and distributed on a pilot basis. The baseline efficiency is therefore calculated as follows:

Malgache stove households	58
Clay stove households	130
Total baseline stove households	188
Malgache stove Efficiency (%)	18
Average Clay stove Efficiency (%)	22.5
Weighted Average Efficiency (%)	**(58*0.18)+(130*0.225)/188 = 21.11**

The sample size used to determine the efficiency of the baseline stoves did not meet the 90/10 confidence/precision reliability criteria however the value of 0.21 is more conservative than the default value of .20 proposed by the methodology.
Considering the 188 households comprise 100% of baseline stoves, Malgache stoves represent 30.8% and Clay stoves represent 69.1%

III. DOMESTIC BIOMASS CONSUMPTION

This section provides a high-level summary of baseline domestic wood and charcoal consumption across Togo. This is not based on primary data, but a credible detailed and extensive study[14] undertaken by Centre de Recherche et d'Ingénierie Sociales du Togo (CRISTO) in Togo in 2007 for the Togo Ministry of Energy.

The CRISTO study has been carried out by two complementary approaches: (i) a field survey of different target groups and (ii) a literature search. The field survey was conducted twice, both in the dry and rainy season to assess the seasonal effect on the consumption of biomass by households. It covered 3039 households (around 0.38% of the total population in Togo) selected from across the five administrative regions of the country (Savannah, Kara, Central, Plateau and Maritime). Within each region, urban and rural populations were consulted and analyzed separately. Efforts were also made to ensure different socio-economic groups are included in the sample. The number of households selected in each area roughly reflects the percentage of the national population found in respective areas.
The majority of surveys in this study were administered during the first phase in the dry season of 2007, which is likely to make results inherently conservative as wood is often dryer during dry seasons (thus less is required, as weight for weight it has a higher calorific value). The follow-up was conducted in June 2007, during the wet season.

Baseline calculation

[14] Enquetes Consommation des Energies Domestiques au Togo – Août 2007

The CRISTO report provides the number of households surveyed in each season, the total number of people in the survey as well as their wood, charcoal and agricultural waste consumption on a daily basis. This daily fuel consumption data is the average over two days. By dividing the total consumption of households by the number of households, we have the average consumption per household per day. This result is in turn multiplied by 365 days then divided by 12 months to get the consumption per household per month. The same steps are repeated for the wet season. To obtain a weighted average for both season, the following formula is applied:[(number households dry season*average consumption dry season) + (number of households wet season*average consumption wet season)] / (number of households dry season+number of households wet season). It is felt kilograms per household per month is a more useful basis for comparing and analyzing the data. The result is summarized in the table below

	Rural Kg/ HH/ month	Urban Kg/ HH/ month	Countrywide Kg/ HH/ month
Wood	206.9	104.1	155.5
Charcoal	16.2	79.4	47.8

High-resolution data is to be found in the spreadsheet "Consolidation of CRISTO Data Round 2-final.xls", which presents data in 10 discrete areas – namely rural and urban in each of the five geographical zones of Togo.

Many domestic fuel consumption studies have been undertaken in biomass-dependent populations. The variability of data, and therefore the required sample size, is well understood from such studies. Two recent carbon-finance projects in West Africa[15] which followed the AMS-II.G. methodology used sample sizes of 251 and 392 respectively and met the precision requirements of the methodology (90% confidence with a 10% margin of error). The total sample of 3039 households consulted in the CRISTO study exceeds the numbers required to collect data meeting the precision criteria of the methodology for large areas of Nigeria by a factor of 10. Even if the sample for the CRISTO study was to be treated as 10 discrete samples, the individual sample sizes would still likely be sufficient to meet 90/10 requirements. Therefore, in view of many precedents, we are confident that the CRISTO data meet the precision requirements of the AM-II G methodology.

Proportion of biomass use in urban and rural areas by region

Charcoal is predominantly used in urban areas and wood in rural areas. CPA1 is being implemented in Lome, the Capital City of Togo which is part of the Maritime region. 91% of urban households in this region use charcoal. Since the CPA promotes charcoal efficient stoves it is expected that the project stoves will go in households that already use charcoal. Therefore, only charcoal is considered in the baseline fuel. The baseline consumption is 79.4 kg/HH/month.

Percentage of households according to the type of biomass used, per region

REGION	Household type	Wood		Charcoal		Vegetal waste	
		Number of	%	Number of	%	Number of	%

15 http://cdm.unfccc.int/ProgrammeOfActivities/Validation/DB/7N1V6GU9NH6QDKUCKT07T03X74EVA9/view.html and http://cdm.unfccc.int/Projects/Validation/DB/23HQ9GTETWW0K8C0A6R4Q0BSMJJBFP/view.html

		households		households		households	
MARITIME	Total	409	38,47	840	79,20	125	1,75
	Urban	65	10,20	586	91,70	21	3,30
	Rural	344	81,0	254	59,80	104	24,5
PLATEAUX	Total	578	77,79	379	51,00	83	11,17
	Urban	64	47,70	113	84,07	05	3,60
	Rural	514	84,40	266	43,06	78	12,80
CENTRALE	Total	192	82,40	146	62,66	12	5,15
	Urban	42	57,40	59	81,90	00	00
	Rural	150	93,40	87	53,70	12	7,40
KARA	Total	214	83,59	169	66,01	84	32,81
	Urban	66	62,20	103	96,70	15	14,40
	Rural	148	99,20	66	44,40	69	46,00
SAVANES	Total	253	94,75	164	61,42	95	35,58
	Urban	42	81,40	47	93,00	13	25,60
	Rural	211	97,80	117	54,40	82	84,10
TOGO	Total	1646	64,24	1698	66,27	399	15,57
	Urban	279	27,81	908	90,52	54	05,38
	Rural	1367	87,68	790	50,67	345	22,12

Source : « Enquête Consommation des Energies Domestiques – Aout 2007 » page 38

Number of stoves used per household

A field study was conducted in June 2011 to determine the number of stoves used per household

A total of 214 households were interviewed; 94 from Lomé; and 40 each from Atakpamé, Sokodé and Dapaong. 2 households were removed due to lack of key data leaving a total of 212 study households.

The proportion of households reporting simultaneous stove use varied considerably between cities: from 22.5% in Atakpamé to 77.5% in Sokodé. Despite this, the mean number of stoves used simultaneously in each of the four cities investigated were very similar, within the small range of 1.08 to 1.16. The mean value, without accounting for the proportions of national population each city represented, was equal to 1.10.

A statistical analysis indicated there was no statistically significant difference between the cities. However, in order to further establish that the site variation in mean number of stoves used would not affect the national mean if relative population was accounted for, weighted means were calculated, and these too resulted in an overall national mean of 1.10.

Therefore, the clear conclusion from this study is that the mean number of stoves used simultaneously in households across Togo, throughout the seasons, is 1.10. This translates into an adjustment factor of [1/1.10 = 0.91] to the baseline charcoal consumption.

The anticipated reduction in secondary stove use reported by households, and described in Section 4.8 of the report, would indicate that this adjustment would be conservative.

Details are available in the full report "Togo National Follow-up Survey-August 2011"

Fuel mixing in households

The study conducted in June 2011 to determine the number of stoves used per households surveyed 212 households in 4 urban areas: Lomé, Sokode, Atakapame and Dapaong.

The inclusion criteria for the study ensured that the households within the sample used charcoal as their main fuel. However it was noted that a number of households also had wood burning stoves in their kitchens. The highest number was seen in Atakpamé where 30% of HH (n=12) were observed to have wood burning stoves. This was reported in much lower numbers in the other areas (Lome n=2; Sokode n=3; Dapaong n=0). Overall 17 households or 8% of the sample size were found to use wood in addition to charcoal.

IV. Baseline charcoal consumption by restaurants

Methodology and sampling plan

The surveys were administered by experienced surveyors from CRISTO under the supervision of HED Consulting. Questionnaire was designed by HED Consulting, translated in French and refined after feedback from the field team.
Lomé was roughly divided in three major areas that have been assigned to each of the survey team members. In order to obtain a representative sample of food vendors, the various food hubs of the town were listed and related to the corresponding districts. Finally a random choice of 4/5 interviews were expected to take place in each district.

Identified areas of town with higher density of restaurants:

a. Transport hub, station
b. Markets areas, several
c. University area
d. Hot spot (lively central area, most expensive and European style)
e. Banks and Gov district

Types of restaurants:

a. Gargotte: small street restaurant. The construction is often made of wood and includes one or two tables covered and benches where customers eat traditional African food.
b. Maquis: The Maquis are well equipped, well fenced, smaller than regular restaurants and can host dance nights (with light games). They serve meals and pizzas
c. Cafeteria: Cafeterias are serving mainly coffee and pastries, some salad and very few drinks.
d. Restaurant: An ordinary restaurant is fairly spacious but dedicated exclusively to consumptions of meals. The restaurants serve a variety of meals and more often customers can order the drinks they want.
e. Bonne femme: lady sitting on the road side selling food to people passing by.

In total, 84 surveys were administered in Lomé, and a further 20 in Sokode and 20 in Kpalime.

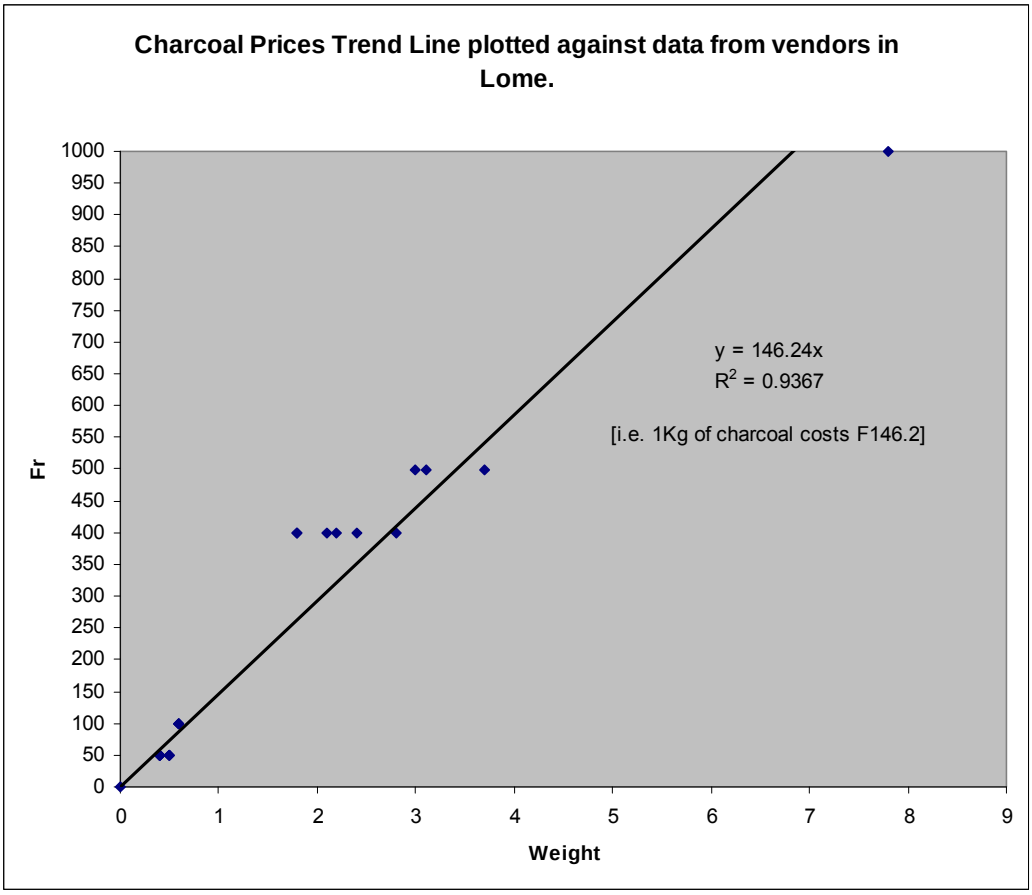
Data cleaning & analysis

Much of the data is 'skewed', so medians are presented for many parameters as these are more representative when data is skewed.

Internal checking of data

The most important parameter in this study, namely baseline charcoal consumption in restaurants, was investigated in two independent ways: by asking about daily expenditure on charcoal; and by weighing the quantity of charcoal used per day.

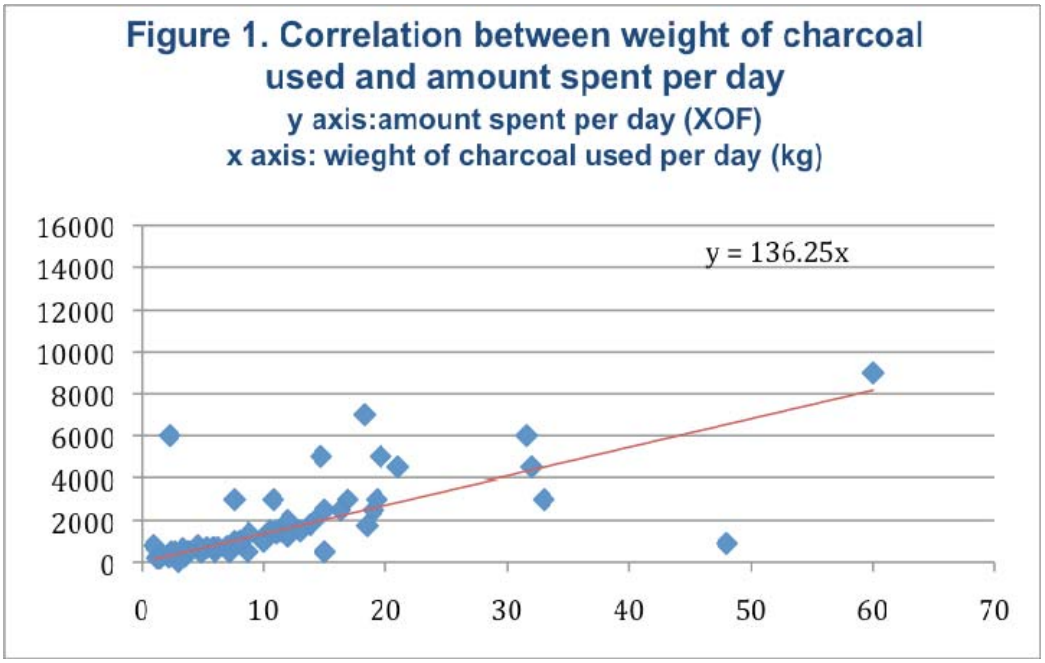
The first set of data based on expenditure can be interpreted and translated into kilograms of charcoal used per day by knowing the cost of charcoal. A series of visits were made to charcoal vendors in Lomé, where the weight and price of a range of quantities of charcoal (ranging from small cans up to 8 kg buckets) were measured and noted. These are presented in the following graph.



(Bellanca 2010a)

From this, we can conclude that there appears to be some, but relatively little, benefit in bulk-buying of charcoal, and that because of this we can use a linear relationship to determine the cost per kilogram: CFA146.2/kilogram.

Further analysis included investigating the relationship between stated charcoal expenditure and stated charcoal consumption (weighed by surveyors). These data showed a strong positive relationship, which suggests that the survey and implementation has been effective, and that the data is valid. The trendline (presented in the graph below) indicates an average cost of CFA136/kilogram of charcoal. This is less than 10% different from that calculated independently at vendors, which underlines the validity of the approach.



(Jagoe and Rouse 2010)

As both methods of calculating cost / kg of charcoal are valid in themselves, we may take the average:

$$= \text{CFA}\frac{(146.2 + 136.25)}{2} = \text{CFA}141.23$$

Average cost of purchasing charcoal in Lomé: CFA 141.2/ Kg
This figure is used to convert the daily expenditure data (CFA) into charcoal daily consumption data (kg).

Precision

Restaurants encompass many sizes and types of establishment, and data on charcoal consumption is accordingly, unavoidably variable. The baseline charcoal consumption data, both that collected through the expenditure questions and by weighing, do not meet the precision requirements of the methodology. Therefore, the lower bound of the 90% confidence interval for the means are presented, which satisfy the requirements of the methodology. These also largely, match the medians of the data, and so do not result in gross compromises in baselines.
The document *'Detailed analysis of data from Lomé'* (Jagoe and Rouse 2010) describes the process of analyzing and interpreting these data in more detail.

Restaurant charcoal consumption baseline

Weekly consumption of charcoal per restaurant was calculated as either:
= [[Daily expenditure on charcoal/ price per Kg charcoal] * No days open each week].
Or
= [Daily consumption weighed in Kg * No days open each week].
The following table presents the end-point of the detailed analysis of the restaurant survey data. Note - some data cleaning took place (noted in the accompanying spreadsheet) including the removal of one outlier (Survey ref TG10-LM-NY-RA-025). n (total data points for each value) are less than the sample surveyed due to removal of some data points with uncertainty (for example ambiguous descriptions).
Table 2.3 Baseline weekly charcoal consumption per restaurant in Togo

Measure	n	Lower bound of 90% confidence interval for the mean	Mean	SD	Median
		Kg/ week/ restaurant			Kg/ week/ restaurant
Weekly charcoal consumption per restaurant based on expenditure					
Lomé only	76	76.6	104.4	145.8	49.6
* 'Other cities'	33	32.4	41.5	31.4	35.4
Combined	**109**	**65.3**	**85.4**	**126.1**	**44.6**
Weekly charcoal consumption per restaurant based on weight					
Lomé only	48	54.5	104.4	145.8	52.9
'Other cities'	22	37.1	41.5	31.4	37.2
Combined	**70**	**53.7**	**66.5**	**64.7**	**46.9**

n = the number of data points which make up the dataset.
* The data point on expenditure in 'other cities' may be discounted from calculations, because the price for charcoal in Lomé was applied for other cities, while in reality it is understood to be considerably cheaper, although no quantitative data was collected in this study. This is confirmed by the CRISTO report (CRISTO 2007, 104) which presents data on cost of charcoal for each of the 5 zones in Togo, reproduced below for reference.

Average price (CFA/Kg) of wood fuel in February 2007

	Fuel wood	Charcoal	Agricultural residues
Région des Savanes			
Milieu rural	11	31	0
Milieu urbain	18	51	13
Région de la Kara			
Milieu rural	23	34	0
Milieu urbain	57	80	10
Région Centrale			
Milieu rural	12	36	0
Milieu urbain	18	50	3
Région de Plateaux			
Milieu rural	22	45	0
Milieu urbain	46	87	5
Région Maritime			
Milieu rural	55	67	0
Milieu urbain	84	119	25

We may use the above data to conclude that although the actual price of charcoal has changed in absolute terms since 2007, it is likely that its price relative to other areas of Togo remains the same. The ratio between Lome and other cities may be calculated by comparing CFA119/ kg charcoal in urban Maritime (in which Lomé lies) to an average price of CFA 67/ kg charcoal elsewhere (using a simple average of values in other states). Therefore, at today's prices of CFA141.2 / kg in Lome, we can calculate the likely price of charcoal elsewhere as:

Price of charcoal in Other Cities 141.2 * (67/119) = CFA 79.5/ kg charcoal.
Applying this price for other cities, we see the total quantity of charcoal used per restaurant in Other Cities increase from 32.4 kg / week to 57.6 kg / week.

Conclusion

The final **baseline daily charcoal consumption for restaurants is taken to be 53.7kg**. This is the more conservative estimate, and is based on actual weighing of fuel, rather than recall of expenditure.

Baseline charcoal consumption per stoves in restaurants in Togo

Overall, there are 3.1 stoves/ restaurant within the sample. However, there are slightly more stoves/ restaurant in Lomé (mean 3.28; n=71) than in Other cities (mean 2.7; n = 35).
Therefore, translating data on charcoal consumption per restaurant into charcoal consumption per individual stove, requires analysis which accounts for this variation. This is undertaken in the spreadsheet 'Consolidation of CRISTO Data Final.xls' (Rouse 2011), and final figures are presented in the following table 2.4.

Table 2.4 Baseline weekly charcoal consumption per-stove in restaurants

Measure	n	Lower bound of 90% confidence interval for the mean	Mean	SD	Median
		Kg/ week/ restaurant			Kg/ week/ restaurant
Weekly charcoal consumption per stove based on expenditure					
Lomé only	66	26.9	36.2	45.8	24.8
* 'Other cities'	28	22.8	33.0	32.6	22.0
Combined	**94**	**28.0**	**35.3**	**42.2**	**22.2**
Weekly charcoal consumption per stove based on weight					
Lomé only	40	21.7	29.9	31.2	21.8
'Other cities'	19	17.2	36.2	49.8	22.5
Combined	**59**	**23.7**	**31.9**	**37.9**	**22.0**

* using the cost of charcoal of CFA79.5 calculated in Section 2.3.

Estimates are based on the lower bound of the 90% confidence interval (CI) for the mean. Estimates for Lomé and Other cities agree closely, so it is legitimate to consider a baseline for the country as a whole. Combining data for Lomé and Other cities and then taking the lower-bound of the 90% CI results in a higher combined value than either of the values for Lomé and Other cities individually.
It may be concluded that the baseline charcoal consumption per week per stove in restaurants sampled across Togo = **23.7Kg per stove per week.**

Seasonal variation

Only 14 (16.7%) of restaurants in Lomé; and 20% in other cities reported that there was some seasonal variation in charcoal use.
Of those that described the nature of the seasonal variation, no clear pattern can be discerned as some reported decreases in charcoal consumption during the rainy season while others reported increases. In view of the fact that any quantified impact would only apply with a weighting of around 0.2 (to reflect the proportion of the population affected) and that reported variations are relatively minor, it is felt that seasonal variation in charcoal consumption may be discounted for restaurants.

Fuel use pattern among restaurants

The table below summarizes the different fuels used by restaurants and their pattern of use.

Fuel use pattern	Lomé N=82	Other Cities N=40
	N (%)	N (%)
Charcoal only	34 (41.4)	10 (25)
Fuel wood only	1 (1.2)	-
Charcoal primary fuel with fuel wood secondary	18 (22.0)	14 (35)
Charcoal as primary fuel and LPG as secondary	11 (13.4)	1 (2.5)
Fuel wood primary fuel with charcoal secondary	7 (8.5)	12 (30)
LPG primary fuel with wood or charcoal as secondary	11 (13.4)	3 (7.5)

Conclusions

Despite considerable variability in the data, consistencies within the data indicate validity, and it is possible to present lower-bound values for the mean charcoal consumption which closely match the median values.
The close match between charcoal consumption measured in Lomé and other cities in Togo, indicates that it is reasonable to combine data into a single baseline value.
Therefore, the baseline charcoal consumption per week per restaurant in Togo = **23.7Kg per stove per week.**
This is equivalent to **1232.4 Kg per annum per stove.**

V. Evidence of NRB in use in since 1989

1989 evidence: 3. Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.

- Table (Ia) below presents FAO data on decreasing forested area stretching back to 1990.

- Table (Ia): Forested area recorded in Togo between 1990 and 2010 (FAO, 2010).

	Forest area (1 000 ha)				Annual change rate					
					1990-2000		2000-2005		2005-2010	
Country/area	1990	2000	2005	2010	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Togo	685	486	386	287	-20	-3.37	-20	-4.50	-20	-5.75

- The FOSA table reproduced below also presents evidence of reducing forest resources from 1979 (Koffi 2001).

Past and projected trends in deforestation in Togo

Trend Indicator (Production)	**Unit of measurement**	**Past trends ; Reference year 1979**		**Current 1995**	**Future trends for 2020**	**Likely decline in 25 years**
Total area	km²	25,550	-3.5	14,432	59225	-58%
Dense forests (semi-deciduous)	km²	2 931	- 1,5	2 265	1 552,3	-9,50%
Mountain forest	km²	863	- 3	525	245	-53,3%
Dry forest	km²	637	- 4,8	315	186	-41%
Forest regrowth	km²	1 159	- 3,8	.615	233	-62%
Savanna and other	km²	12 922	- 4,6	6 048	1 863,5	-69%
Shrublands and herbaceous	km²	5 138	- 3,8	2 720	1 052	-61%
Areas of crops and other	km²	1 840	0,3	1 944	2 095	7%

(Koffi 2001, 12)

These were the earliest references to decreasing forest resources found.

VI. Other information

Charcoal production efficiency

A range of sources mention the efficiency of charcoal production in Togo, as follows:

- 15-20% (Kouami, Yaovi, and Honan 2009) = average 17.5%

- 7-15% (CRISTO 2007, 14, para 12) = average 11%

- As low as 13% (JVE interview in Bellanca 2010b)

IPCC guidelines state that 'Values for estimating the amount of carbon released through charcoal production and consumption, the wood-to-charcoal factor, are stated to be between 4 and 8. If no local information is available, 6 kg of wood input per kg of charcoal may be used as default' (IPCC 1996, 1.41). 6kg of wood per kg of charcoal is equivalent to an efficiency of 16.7%
The average value for Togo for the sources above is 13.8%. This is in line with IPCC guidelines. It is equivalent to a charcoal yield factor of 7.2, which is conservatively rounded down to 7.0.

Appendix 5: Further background information on the monitoring plan

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Appendix 6: Sampling Plan for Future Baseline Studies

The following parameters are determined through sampling during baseline studies

B_{old} and $B_{y,new}$	Quantity of woody biomass used in the absence of the project activity; Quantity of woody biomass used during the project activity. By specifying what type of biomass is measured (wood or charcoal) we obtain $B_{old\text{-}wood}$ and $B_{old\text{-}charcoal}$ which are used to calculated emissions from the replacement of wood stove by improved charcoal stoves.
$Stove_{number}$	Number of baseline stoves used per household or commercial entity/institution
$Stove_{baseline}$	Type of stove that will be replaced by project stove

These parameters can be derived from historical data or using survey method. In case a survey is needed, the following sampling plan will be used.

a. Sampling Design

(i) Objectives and Reliability Requirements:

The objective is to identify the different types of $Stove_{baseline}$, to obtain the mean annual value of B_{old} and $B_{y,new}$ and the mean value of $Stove_{number}$ for the target group described below (depending on the stove being promoted) and meeting the 90/10 confidence/precision levels.

(ii) Target Population:
The target population will be determined by the type of improved cook stove disseminated in the CPA (or in a group of CPA). The PoA includes several types of improved cook stoves targeted at four main population groups:
-Urban Households: households that use primarily charcoal for their cooking needs and are currently using inefficient cooking methods. Improved charcoal stoves will be promoted among this group
-Rural Households: household that use primarily firewood for their cooking needs and are currently using the 3-stone fire method or other inefficient cooking appliances. Improved wood stoves will be promoted among this group.
-Charcoal-using commercial entities or institutions: these are entities or institutions such as restaurants, school cafeteria, hospitals, prisons, etc. that consume large quantities of charcoal using inefficient cooking appliances. Improved institutional charcoal stoves will be promoted among this group
-Firewood-using commercial entities or institutions: these are entities or institutions such as restaurants, traditional breweries, school cafeteria, hospitals, prisons, etc. that consume large quantities of firewood using the 3-stone fire method or other inefficient cooking appliances. Improved firewood stoves will be promoted among this group.

To determine B_{old}, $B_{y,new}$, $Stove_{baseline}$ and $Stove_{number}$ for a specific type of cook stove, a sample will be drawn from the general population that meets the characteristics for this cookstove. For instance, if a charcoal improved stove is being promoted, the sample will come from households in urban areas that use charcoal.

(iii) Sampling Method
The sampling method will be Simple Random sampling among the target population if the CPA has a limited geographical spread e.g. within one town or one village. If the CPA extends over a large

geographical area or CPA are grouped, the sampling method will be a Stratified Random sampling with the strata being the towns, villages or localities. Similarly, if an institutional cook stove is promoted among user of different profile e.g a cook stove is distributed to restaurants, schools and hospitals, the sampling method will be Stratified Random Sampling with strata being the user type i.e restaurants, schools and hospitals.

(iv) Sample Size

The sample sizes below assume a Simple Random Sampling method because of lack of detailed data. If a CPA or a group of CPA uses a Stratified Random Sampling the sample size will be calculated based on that method.

Determining the sample size requires the knowledge of the

a) The expected mean
b) The standard deviation and
c) The level of precision and confidence in that precision

The level of precision and confidence interval is provided by the methodology as being 90/10. For the expected mean and standard deviation we can use our "best guess" (as recommended by "Draft Best Practices Examples Focusing on Sample Size and Reliability Calculations") based on data from the baseline study in Togo for the first CPA and on other studies in the West African region. However, prior to the inclusion of any future CPA, the baseline study report for that CPA (or the group of CPA) will present a more accurate sample size based on data collected in the specific host country for the specific target group.

Urban Households

B_{old} and $B_{y,new}$	Expected mean: 79.4 kg/month-hh Standard deviation: 45 kg/month[16]. Level of precision: 90/10 Urban population[17]: 2,140,600/5.4 (average household size)[18] = 396,407 households $n \geq 1.645^2 NV/(N-1) \times 0.1^2 + 1.645^2 V$ Where $V=(SD/mean)^2$

[16] Carbon Monitoring Report on the Sewa Improved Charcoal Stoves of Katene Kadji, Mali – August 2008, table 3 (1.5 kg/day-hh*30days= 45 kg/month-hh)
[17] Enquete Biomasse, page 34, table 6
[18] Consolidation of CRISTO data.xls

	n sample size N Total number of households mean expected mean SD expected Standard Deviation 1.645 represents the 90% Confidence Interval 0.1 represents the 10% relative precision $V=(45/79.4)^2 = 0.321$ $n= (1.645^2 \times 396,407 \times 0.321)/ (396,407-1) \times 0.1^2 + 1.645^2 \times 0.321$ n= 344,332.60/3,964.92 n=86.84 The sample size should be a minimum of 87 households. We can expect a response rate of about 70%, therefore the sample size will be 87/0.7=124 households.
$Stove_{number}$	Expected mean: 1.10 stoves[19] Standard deviation: 0.20 Level of precision: 90/10 Urban population[20]: 2,140,600/5.4 (average household size)[21] = 396,407 households $n \geq 1.645^2NV/(N-1) \times 0.1^2 + 1.645^2V$

[19] E+Carbon West Africa Improved Cookstove PoA Togo Baseline Report-Togo National Follow-Up Survey, table 4

[20] Enquete Biomasse, page 34, table 6

[21] Consolidation of CRISTO data.xls

	Where $V=(SD/mean)^2$ n sample size N Total number of households mean expected mean SD expected Standard Deviation 1.645 represents the 90% Confidence Interval 0.1 represents the 10% relative precision $V=(0.20/1.10)^2 = 0.033$ $n= (1.645^2 \times 396,407 \times 0.033)/ (396,407-1) \times 0.1^2 + 1.645^2 \times 0.033$ n= 35,398.35/3,964.14 n=8.92 The sample size should be a minimum of 9 households. Although our calculation shows that only a small number of households have to be surveyed to achieve the 90/10 precision, this survey will be conducted in conjunction with field measurement for B_{old}, therefore the same sample size of 124 will apply.
$Stove_{baseline}$	This parameter is assessed by cataloguing the type of baseline stoves identified during the measurement of B_{old} so that the predominant ones can tested to determine η_{old}. The sample size will be same as the sample size for $B_{old.}$

Rural households

B_{old} and $B_{y,new}$	Expected mean: 206.9 kg/month-hh

	Standard Deviation: 72 kg/month-hh[22] Level of Precision: 90/10 Rural population: 3,196,400/6.9 (average household size)[23] = 463,246 $n \geq 1.645^2 NV/(N-1) \times 0.1^2 + 1.645^2 V$ Where $V=(SD/mean)^2$ n sample size N Total number of households mean expected mean SD expected Standard Deviation 1.645 represents the 90% Confidence Interval 0.1 represents the 10% relative precision $V=(72/206.9)^2 = 0.121$ $n= (1.645^2 \times 463,246 \times 0.121)/ (463,246-1) \times 0.1^2 + 1.645^2 \times 0.121$ n= 151,680.2/4,632.77 = 32.74 The sample size will be a minimum of 33 households. We can expect a response rate of about 70%, therefore the sample size will be 33/0.7= 47 households.

[22] Carbon Monitoring Report on the Sewa Improved Charcoal Stoves of Katene Kadji, Mali – August 2008, table 6 (2.4 kg/day-hh*30 days= 72 kg/month-hh)

[23] Consolidation of CRISTO data.xls

$Stove_{number}$	Expected mean: 1.10 stove Standard Deviation: 0.20 Level of Precision: 90/10 Rural population: 3,196,400/6.9 (average household size)[24] = 463,246 $n \geq 1.645^2 NV/(N-1) \times 0.1^2 + 1.645^2 V$ Where $V=(SD/mean)^2$ n sample size N Total number of households mean expected mean SD expected Standard Deviation 1.645 represents the 90% Confidence Interval 0.1 represents the 10% relative precision $V=(0.20/1.10)^2 = 0.033$ $n= (1.645^2 \times 463,246 \times 0.033)/ (463,246-1) \times 0.1^2 + 1.645^2 \times 0.033$ n= 41,367.32/4,632.53 = 8.92 The sample size will be a minimum of 9 households. Although our calculation shows that only a small number of households have to be surveyed to achieve the 90/10 precision, this survey will be conducted in conjunction with field measurement for B_{old}, therefore the same sample size of 47 will apply.
$Stove_{baseline}$	This parameter is assessed by cataloguing the type of baseline stoves identified during the measurement of B_{old} so that the predominant ones can tested to determine η_{old}. The sample size will be same as the sample size for B_{old}.

[24] Consolidation of CRISTO data.xls

Charcoal-using commercial entities or institutions

B_{old} and $B_{y,new}$	Expected mean: 66.5 kg/week[25] Standard Deviation: 64.7 kg/week Level of Precision: 90/10 The total population size is unknown however it is expected to be larger than 5000[26] therefore the approximate equation is being used. $n=1.645^2V/0.1^2$ Where $V= (SD/mean)^2$ n sample size N Total number of households mean expected mean SD expected Standard Deviation 1.645 represents the 90% Confidence Interval 0.1 represents the 10% relative precision $V= (64.7/66.5)^2 = 0.946$ $n= 1.645^2 \times 0.946/0.1^2$ n= 2.559/0.01 n= 255.98 The sample size is very large because of the high variation of charcoal consumption among users. If the sample size cannot be reached, the lower bound of the 90% confidence interval will be used as per the methodology.
$Stove_{number}$	Expected mean: 3.09 stoves[27]

[25] E+Carbon West Africa Improved Cookstove PoA Togo Baseline Report – table 2.3
[26] Draft Best Practices Examples Focusing on Sample Size and Reliability Calculations
[27] Togo Restaurant Survey Data 161231 V14 Final.xls

	Standard Deviation: 2.31 Level of Precision: 90/10 The total population size is unknown however it is expected to be larger than 5000[28] therefore the approximate equation is being used. $n=1.645^2V/0.1^2$ Where $V= (SD/mean)^2$ n sample size N Total number of households mean expected mean SD expected Standard Deviation 1.645 represents the 90% Confidence Interval 0.1 represents the 10% relative precision $V= (2.31/3.09)^2 = 0.558$ $n= 1.645^2 \times 0.558/0.1^2$ n= 1.509/0.01 n= 150.9 A minimum of 151 commercial entities/institutions must be sampled.

[28] Draft Best Practices Examples Focusing on Sample Size and Reliability Calculations

$Stove_{baseline}$	This parameter is assessed by cataloguing the type of baseline stoves identified during the measurement of B_{old} so that the predominant ones can tested to determine η_{old}. The sample size will be same as the sample size for B_{old}.

Firewood-using commercial entities or institutions

B_{old} and $B_{y,new}$	Data for this target group is not available however; we can expect a high variability in consumption among users similar to entities using charcoal and as result, a large sample size will be needed to meet the precision requirements.
$Stove_{number}$	The same sample size as B_{old} and $B_{y,new}$ will be applied
$Stove_{baseline}$	The same sample size as B_{old} and $B_{y,new}$ will be applied

(v) Sampling Frame

All parameters will use the same sampling frame.

For CPA promoting household charcoal stoves: all households in urban areas that are using charcoal as their primary cooking fuel

For CPA promoting household firewood stoves: all households in rural areas that are using firewood as their primary cooking fuel

For CPA promoting commercial charcoal stoves: all commercial entities and institutions using charcoal as their primary cooking fuel

For CPA promoting commercial firewood stoves: all commercial entities and institutions using firewood as their primary cooking fuel

b. Data

(i) Field Measurements

Parameter	Frequency	Measurement method	Sensitivity to Seasonal variations

B_{old} and $B_{y,new}$	One time, before start of project activity	Interview and weighing of biomass used per day (over several days) then extrapolation to the entire year	Likely Interview questions will address seasonal variations and B_{old} will be adjusted accordingly.
$Stove_{number}$	One time, before start of project activity	Interview and visual inspection	Unlikely
$Stove_{baseline}$	One time, before start of project activity	Interview and visual inspection	Unlikely

(ii) Quality Assurance/Quality Control

Measurements and interviews will be conducted by third parties such as research institutes, universities, consulting firms or NGO that are experienced in conducting these type of studies. Together with the CME, they will develop a plan that responds to the proposed Sampling Plan.

Monitoring agents engaged by the 3rd party will undergo training on the objectives of the study and on how to treat non-responses. The potential for non-responses, refusals and outliers will be addressed by oversampling. In all cases, each of these occurrences will be documented clearly. The decision to exclude or include an outlier will be made during data analysis. Surveys results will be reviewed daily by a field supervisor so that errors can be corrected promptly while agents are still in the field. In order to ensure the quality of the sampling results, the study will draw on the provisions for reliability calculations as provided by the Draft Best Practices Examples: Focusing on Sample Size and Reliability Calculation (Agenda of EB 66).

The CME will be responsible for storing the data results in a secure server.

(iii) Analysis

- Data obtained from the field measurements will be used to estimate the value of B_{old} which is used in the following equations to calculate $B_{y,savings}$

Option 1:

$$B_{y,savings} = B_{old} - B_{y,new}$$

Option 2:

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

Option 3:

$$B_{y,savings} = B_{old} * (1 - \frac{SC_{new}}{SC_{old}})$$

- B_{old} is generally assessed at the household or commercial entity/institution level then the value is divided by the number of stoves in use to get B_{old} per stove. The parameter $Stove_{number}$ is used in that calculation:

$B_{old/stove} = B_{old}/Stove_{number}$

- $Stove_{baseline}$ is used to identify the most commonly used baseline stoves on which η_{old} and SC_{old} are based.

c. Implementation

(i) Implementation plan

Surveys and field measurements will take place as part of baseline study prior to the inclusion of the CPA or the group of CPA. The 3rd party engaged by the CME must have the following profile:

-Experience conducting door-to-door surveys
-Experience using measuring instruments
-Knowledge of the local language and of French or English
-Cultural awareness
-Data entry skills
-Data analysis skills
-Report writing skills

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