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

Replacement of traditional charcoal stoves with efficient EcoRecho stoves in Haiti
Version 5.0
16/07/2013

A.2. Purpose and general description of the PoA

Description and goal of the PoA

D&E Green Enterprises (D&E) is the proponent and the Coordinating Managing Entity (CME) for the Programme of activities (PoA), entitled "Replacement of traditional charcoal stoves with efficient EcoRecho stoves in Haiti" under the Clean Development Mechanism (CDM). The goal of the PoA, as envisaged by D&E, is the replacement of inefficient traditional charcoal stoves in the Republic of Haiti (Haiti) with efficient EcoRecho stoves to reduce the surplus carbon dioxide (CO_2) that would be emitted by inefficient burning of charcoal by traditional stoves. The terms "Republic of Haiti" or "Haiti" will be used interchangeably throughout this document when referring to the host country where this PoA will be implemented.

Haiti is the poorest country in the western hemisphere with limited access to modern energy services. Charcoal and wood, being the predominant fuels, account for 70% of Haitian household energy use for day-to-day purposes[1]. As a result, Haiti has undergone a dramatic reduction in forest resources and is facing a rapidly depreciating forest cover, which presently stands at less than 2 percent (%) of the total land cover[2]. Beyond its environmental impact, the massive use of wood for fuel rests on important economic foundations, as this resource constitutes a source of activity that provides non-negligible income in an impoverished farming environment, generating on average 16 %[3] of the rural income, and employs a substantial workforce in areas where chronic underemployment is the norm. This has led to large population migration from rural areas to slums in urban centres, adding to the pressure of forest lands around them. It has also resulted in people shifting to ecologically sensitive areas, thus aggravating environmental degradation.[4] Therefore, it is imperative to implement sustainable solutions to address the growing needs of the Haitian population and avoid an impending environmental catastrophe.

The charcoal produced in the countryside is gathered by wholesalers and distributed through the retail chain in Port-au-Prince. It is estimated that most Haitian household spends 25-30 % of their income on charcoal[5]. The 2010 United States Agency for International Development (USAID) Report[6] on fuel use indicates an increase in charcoal and wood prices after the 2010 earthquake in Haiti, caused by wood utilization in rebuilding. Charcoal production is an important source of rural income and the charcoal

[1] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Fuelwood Resources), ESMAP, 2007, Executive Summary, Pg xv.
[2] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Fuelwood Resources, ESMAP, 2007, Pg 33.
[3] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Fuelwood Resources, ESMAP, 2007, Executive Summary, Pg xv.
[4] Environmental Scarcities and Conflict in Haiti, 1998, Philip Howard Pg. 8
[5] Assessment of Haiti Alternate Cooking Technologies Program, USAID, 2010, Pg 36.
[6] Assessment of Haiti Alternate Cooking Technologies Program, USAID, 2010, Pg 2.

supply chain is an unregulated industry that is highly competitive and hostile to external involvement fraught with corruption. An improved charcoal stove or alternative fuel supply chain would be perceived as a major threat to the industry and its beneficiaries, creating real challenges in convincing current beneficiaries to pursue employment in a new supply chain. The USAID's 2010 report highlights that one of the largest barriers to adopting improved stoves and alternative fuels is lack of awareness and education to both encourage the adoption of new technology and to properly implement and sustain positive behavioural change[7]. This situation necessitates effective capacity building of the country to enable newer technologies to enter and mature in the Haitian market. Till then, practices that promote efficient ways of cooking in traditional households provide both a practical and effective interim approach to alleviating the depletion of forest wood resources and associated environmental impacts faced by Haiti.

Other efforts are also under-way in Haiti as seen in the February 2012 announcement of USAID's award to Chemonics International to implement the three-year Improved Cooking Technology Project[8], which is aimed at a public-private partnership to develop a local market – on both the supply and demand sides – and a sustainable industry for clean cooking solutions using Liquefied Petroleum Gas (LPG) and more efficient biomass cookstoves, but this effort is focused primarily on large commercial cookstoves.

Efforts to initiate country-wide actions that can reduce charcoal consumption through application of improved technology are needed in Haiti, but its implementation should occur without significant disruption or deleterious effects on the local livelihood of the Haitian population. Further, if attempts to improve charcoal burning cookstove efficiency are limited to a particular area or region of the country, the impact on preventing loss of forest cover in Haiti may not be significant. Thus, a PoA under the CDM will be the approach that will be initiated to enable D&E to extend its current pilot-scale operations to an industrial-scale manufacturing operation to disseminate efficient EcoRecho stoves starting in Port-au-Prince, followed by the surrounding communes, and then to other regions of Haiti.

Through this PoA, D&E seeks to expand the reach and use of EcoRecho stoves in Haiti in order to reduce charcoal consumption, and in turn the depletion of forest cover in the country. Although the government of Haiti has a stated policy to support more efficient use of charcoal and fuel wood, there are no specific requirements governing the use of improved cookstoves (ICS)[9]. In the absence of any national or local regulation mandating the use of efficient stoves, this proposed PoA is completely voluntary.

Being a first-of-its-kind CDM project in Haiti, D&E expects the implementation of the CDM Component Project Activities (CPAs) under this PoA to encourage similar interest from users in other parts of the country and to kick-start sustainable cooking practices that can improve the environmental, economic and social conditions of Haiti. The expected benefits from implementing the proposed PoA are summarized below:

Environmental Benefits:

- Improve local environment by reducing deforestation so as to allow natural recovery of forests in and around the project area.
- Improve quality of life by reducing indoor pollution.
- Reduce global warming by reducing the CO_2 emission levels.

Socio-Economic Benefits:

- Improve the overall health of the family by reducing indoor pollution.
- Decrease cooking time so as enable the women to engage in other occupations.

[7] Assessment of Haiti Alternate Cooking Technologies Program, USAID, 2010, Pg 38

[8] USAID Press Release – USAID supports new Haiti project for clean cooking solutions http://transition.usaid.gov/press/releases/2012/pr120221.html

[9] Haiti Energy Sector Development Plan 2007 – 2017

- Decrease the family spending on charcoal by improved cooking efficiency.
- Generate employment in the local communities through manufacturing and CDM activity.

Technological Benefits:

- Introduction of new improved stoves in the community.
- Generate further interest in research and development (R&D) to further improve the efficiency of EcoRecho stoves.

Framework for the implementation of the proposed PoA

D&E will manufacture the EcoRecho stoves locally to the extent allowed by the resources available in Haiti. The current versions of the medium and large EcoRecho stoves are being produced indigenously at the artisanal level. D&E plans to scale-up the production using industrial manufacturing equipment prior to implementation of the first CPA. D&E also plans on developing improved, high-efficiency EcoRecho models in the future. However, if the newer cookstove models have to be partially or fully manufactured outside Haiti due to resource constraints, or are based on imported ICS technology; the CME will acquire the imported ICS technology or licences to sell the stoves under the EcoRecho brand name. The dissemination of the EcoRecho stoves will take place through D&E's direct sales team and network of distributors and Non-Governmental Organisations (NGOs) in strict compliance with the PoA guidelines. Enel Trade SpA (Enel) will purchase the Certified Emission Reduction (CER) credits from the implemented CPAs under the PoA, and will provide D&E up-front financing to install stove manufacturing machinery needed to scale up the project from the current pilot phase. Based on the described responsibilities, D&E will serve as the CME for this proposed PoA and, together with Enel, will serve as the joint focal point. Enel will communicate with the Executive Board (EB), Designated Operational Entity (DOE), and Designated National Authority (DNA) and address all PoA related issues. Currently, there is no other CDM PoA or CDM component project activity (CPA) of any scale or type that is registered or operating in Haiti. However, in the future, D&E will ensure that all new CPAs under this proposed PoA are clearly identified and not registered either as an individual CPA or included as part of another registered PoA.

This PoA is designed for dissemination of energy efficient stoves within the national boundaries of Haiti by implementing CPAs through application of an approved Small Scale CDM (SSC) baseline and monitoring methodology[10] (AMS II.G., Version 04). Given the absence of any national policy/regulation that mandates the use of efficient stoves, usage of traditional stoves is the prevalent baseline scenario. Under the prevailing socio-economic conditions in the country, it has also been observed that reception of any new technology and/or alternate fuel is highly dependent on specific traditions, learned behaviour and ingrained habits in relation to the types of foods cooked and preparation styles[11]. Therefore it is highly improbable that the target group of stove users will be adopting environmentally friendly measures on their own. This PoA is completely voluntary and there is no financial incentive from the Republic of Haiti for implementing the PoA.

A.3. CMEs and participants of PoA

As stated in Section A.2, the two project participants at the PoA level are:

- D&E, who will act as the CME for the PoA; and
- Enel, who will purchase the CERs from this PoA and provide the up-front funding for implementing the PoA.

[10] Approved Methodology for Small-scale CDM project Activities, Type II – Energy Efficiency Improvement Projects, "Energy Efficiency Measures in Thermal Applications of Non-renewable Biomass," AMS II.G., Version 04, EB 68, Annex 23, August 03, 2012.

[11] Assessment of Haiti Alternate Cooking Technologies Program, USAID, 2010, Pg 34.

Therefore, D&E and Enel will act as the joint focal point for this PoA and for communications with the EB.

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)
Republic of Haiti (Host Country)	D&E Green Enterprises (Private Entity)	No
Italy	Enel Trade SpA (Private Entity)	No

A.5. Physical/ Geographical boundary of the PoA

The PoA will be implemented within the geographical boundary of the Caribbean nation of Haiti. **Figure 1** shows the geographical location of Haiti along with the major Departments (i.e., provinces) and major urban centres and cities. The EcoRecho stoves will initially be disseminated in the communes of the urban centres in Haiti starting with the communes within the Port-au-Prince region. All CPAs will be implemented considering all applicable national / sectoral policies and regulations of Haiti.

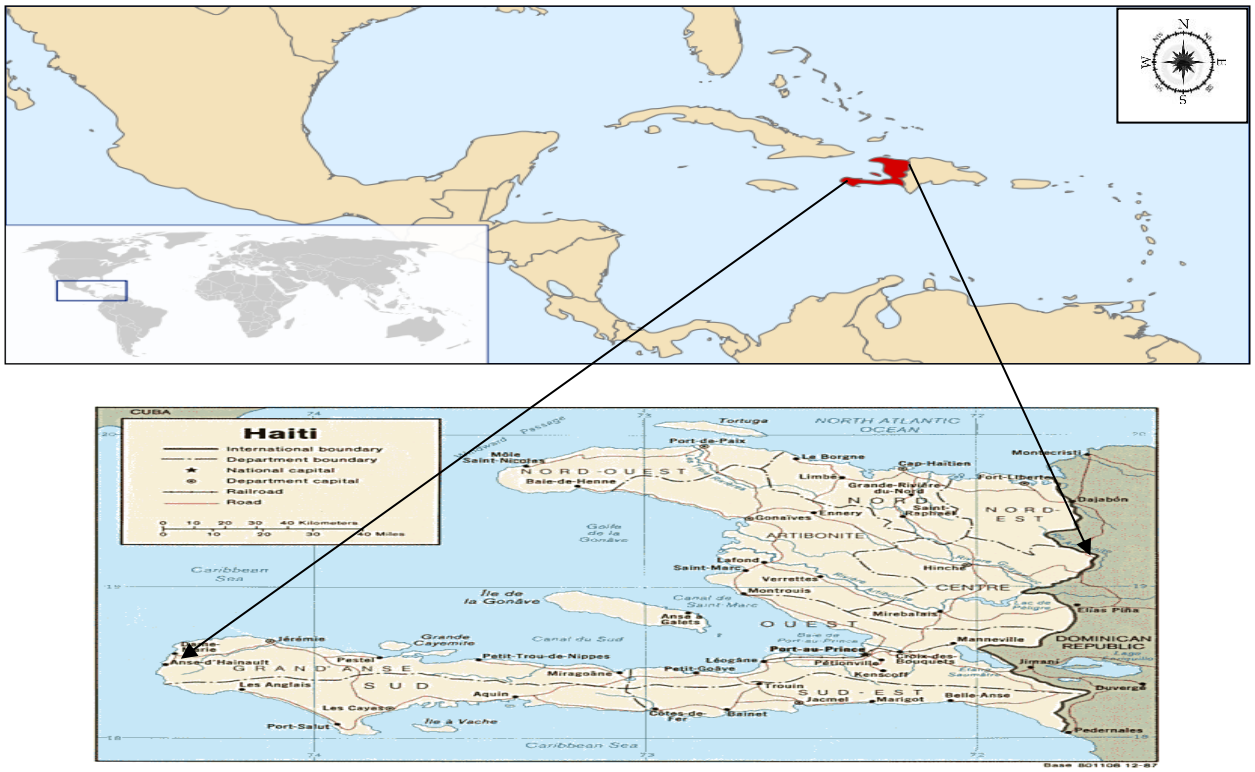


Figure 1: Map showing the location of Haiti and Urban Centres

A.6. Technologies/measures

D&E manufactures the EcoRecho stove brand and is largely produced with manual labour. The PoA involves industrial scaling-up to quickly produce more, quality-controlled stoves, which involves deploying machinery to streamline the manufacturing process. Currently, the PoA plans on dissemination of two models of the EcoRecho brand, namely the medium and large, single-pot efficient charcoal stoves, which are described below. As the PoA progress, D&E plans on improving the design, efficiency and functionality of the current models as well as manufacturing other ICS for dissemination under the PoA.

Details of the type of stoves that will be disseminated will be provided in each CPA of the PoA and will be in compliance with the CDM methodology AMS II.G version 4 requirements for technology measures that are allowed to be included, which states in part:

> "*This category comprises appliances involving the efficiency improvements in the thermal applications of non-renewable biomass. Examples of these technologies and measures include the introduction of high efficiency*[12] *biomass fired cook stoves*[13] *or ovens or dryers and/or improvement of energy efficiency of existing biomass fired cook stoves or ovens or dryers.*"

The current model of the EcoRecho stove is a portable, improved charcoal-burning unit consisting of an hourglass shaped metal structure with a perforated, interior ceramic liner that permits ash to fall to the collection box at the base. The ash can then be collected and disposed of safely. The ceramic liner is designed to increase efficiency – it insulates, captures, and preserves the heat that would otherwise escape if the charcoal is directly exposed to the metal frame. A thin layer of cement between the cladding and the liner keeps it in place. The head of the stove has metal rings that hold a pot in place for cooking. The base of the stove is provided with a hinged door to control the flow of air to the stove. **Figure 2** shows a schematic and photographs of the traditional and EcoRecho stoves side-by-side. The EcoRecho stove shown in **Figure 2** is a medium size charcoal stove.

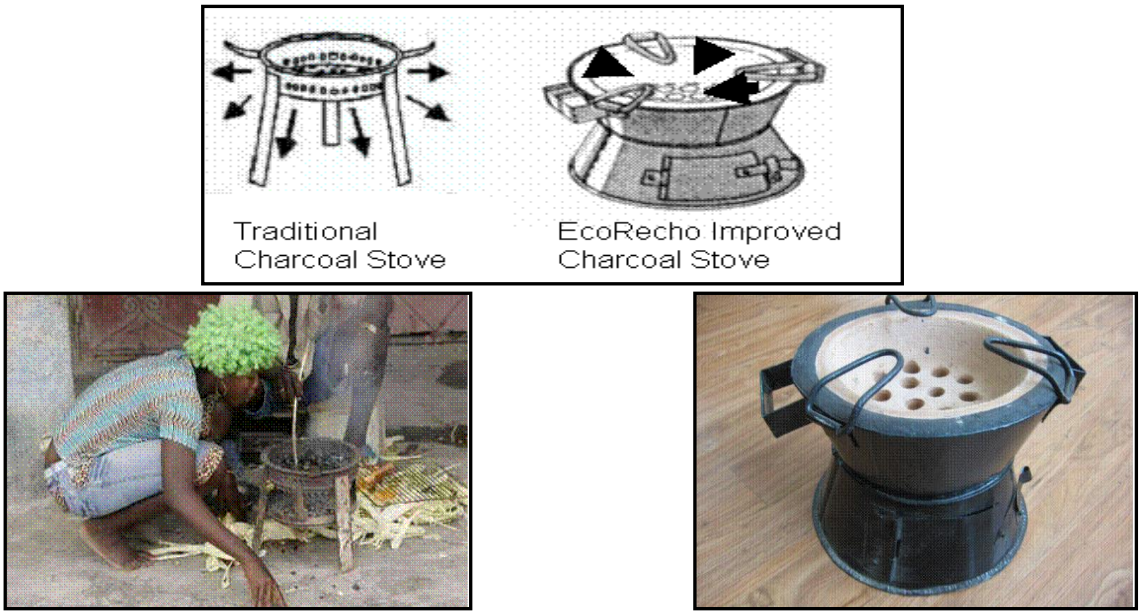


Figure 2: Schematic diagram and pictures of a traditional stove (left) & first EcoRecho stove model (right)

Most traditional metal stoves are made of used scrap metal and have a typical life span of six months to one year.[14]. In contrast, using new iron sheets in the manufacturing of the EcoRecho stove increases the average life span of the stove to two to three years. Because of the ceramic liner insertion, increased heat is transferred to the pot and cooks food faster; it is also cleaner due to ash retention in the base of the stove. D&E's initial user surveys and other independent surveys of EcoRecho stoves indicate a reduction of charcoal consumption in households by an average of 50%. **Table 1** below presents a comparison between traditional stoves and EcoRecho stoves.

[12] The efficiency of the project systems as certified by a national standards body or an appropriate certifying agent recognized by it. Alternatively, manufacturer's specifications may be used.
[13] Single-pot or multi-pot portable or in-situ cook stoves with specified efficiency of at least 20%.
[14] Performance of Charcoal Cookstoves for Haiti, Part 1: Result from the Water Boiling Test; Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, 2011.

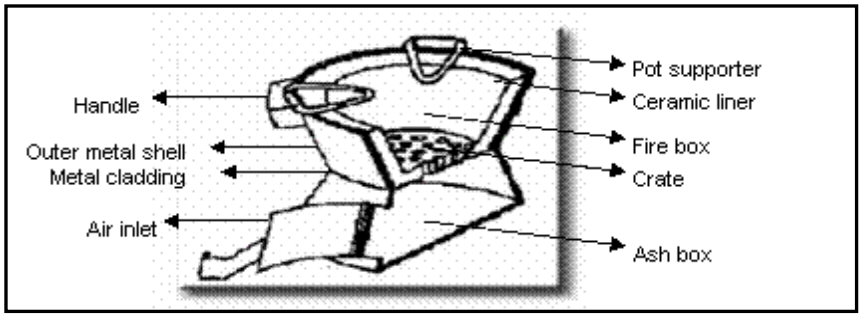


Figure 3: Cross Sectional diagram of the EcoRecho stove

Table 1. Technical Comparison of traditional stove and efficient EcoRecho stove

Parameter	Traditional stove	D&E's EcoRecho Stove
Average Life Span	6 months – 1 year[15]	2 -3 Years
Construction Material	Used scrap metal	New iron sheets fitted with ceramic liner to improve fuel efficiency
Economic Implications – Price	US$2.50[15]	Ranging from US$ 8.67 for medium stoves to US$ 11.25 for large stoves
Health Implications	Releases indoor air pollutants such as carbon monoxide, methane and other carcinogens at levels that could be dangerous to health	Lowers smoke related illnesses through reduced exposure to airborne pollutants
Environmental Implications	Exacerbates deforestation while reducing biodiversity and increasing greenhouse gas emissions	Reduces charcoal use, thus lowering rate of deforestation and greenhouse gas emissions; retains ash in stove base

A.7. Public funding of PoA

There is currently no public funding, nor is any public funding being sought for the PoA.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

Additionality of the PoA is determined based on the requirements of the CDM project standard CDM-EB65-A05-STAN, version 3.0, Section 11 – Specific design requirements for programme of activities. Paragraphs 154 and 155 of the CDM project standard, CDM-EB65-A05-STAN, Section 11.4.2. - Demonstration of additionality states the following:

> *The coordinating/managing entity shall demonstrate that the proposed CDM PoA is additional in accordance with the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities".*
>
> *The coordinating/managing entity shall consider that a full additionality assessment is not required in the context of CPA. Instead, the confirmation of additionality for CPAs should be conducted by means of the eligibility criteria.*

[15] USAID, Assessment of Haiti Alternative Cooking Technologies Program, 2010, Annex D

The CDM Standard: Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities, CDM-EB65-A03-STAN, version 2.1, Section 3 – Requirements, paragraphs 7 and 8 states the following:

> *Additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur.*
>
> *PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the "Guideline for demonstrating additionality of small-scale project activities".*

Additionality of the PoA as a Whole

With the rapid depletion of forest cover in Haiti, it is imperative to initiate activities to reduce charcoal consumption on a wide scale throughout Haiti. The SSC-CPAs that are implemented under this PoA will reduce anthropogenic emissions of greenhouse gases (GHG) by lowering charcoal consumption through improved stove efficiency. There is no mandatory policy or regulation at the national or local level that requires improvements in stove efficiency. Without such regulations, the traditional stoves will continue to be used in the absence of this PoA. Therefore, the proposed PoA is deemed a voluntary measure that is not mandated by any national or local regulations.

Haiti is one of the poorest countries in the world. Approximately 80% of Haitians live on US$ 2 per day or less and 54% are officially under the international poverty line of less than US$ 1 per day. Post-earthquake workers in Cash for Work program earn US$4 - US$5 out of which US$1.42 – US$2.13 is spent on buying 2 – 3 marmites (1 marmite is equivalent to 2.5 kg) of charcoal per day; which constitutes nearly 40% of the average post-earthquake daily income.[16]. People living under such harsh economic conditions cannot be expected to readily accept new technologies that are more expensive than existing ones. In addition, the reception of any new technology and/or alternate fuel is highly dependent on specific traditions, learned behaviour and ingrained habits in relation to food types and preparation styles[17]. The USAID report[17] also established that traditional cooking practices and cultural norms are the most influential drivers of behaviour with regards to adoption and use of efficient cooking technologies and/or alternate fuel. Taste, consistency and smell of the food produced are paramount in determining the success of any new technology. Consequently, any new technology that changes cooking times, heat distribution to pots, fuel load requirement and other aspects ingrained in the daily cooking habits will require a campaign to educate users, aggressive marketing and promoting the benefits of using a more efficient cook stove in order to make the technology more acceptable to the local population.

Based on the socio-economic status of the Haitian people in the project area and nationally, and review of the financial and prevailing practice (cultural) barriers to adoption of new technology, GHG ERs would be unlikely in the absence of CPA implemented under this CDM PoA. The continuation of inefficient stove usage is a plausible alternate scenario to the project activity since the status quo faces little or no barriers. The status quo allows the beneficiaries of the current charcoal market to make no changes and the users do not have the financial resources to invest in a more expensive new technology, particularly if there is any perception that the new stoves will not perform as expected to serve traditional cooking methods.

However, this PoA involves implementation of CPAs that cover small-scale units that have automatic additionality provided they meet certain criteria, which are discussed below in accordance with EB 68,

[16] Cooking Fuel Needs in Haiti: A Rapid Assessment. Women's Refugee Commission & World Food Program March2010, Pg 11.

[17] USAID, Assessment of Haiti Alternative Cooking Technologies Program, 2010, Annex B, Pg 8 of 21.

Annex 27 – Guidelines on the Demonstration of Additionality of Small-Scale Project Activities, Version 9.0[18].

Automatic Additionality of CPAs implemented under the PoA

Paragraph 2 of the "Guideline on the demonstration of additionality of small-scale project activities" states that the documentation of barriers is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g., installed capacity up to 15 MW). Option (c) of the positive list includes project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size[19] of each unit is no larger than 5% of the small-scale CDM thresholds. These criteria will be applied to demonstrate automatic additionality for each CPA implemented under the proposed PoA.

To ensure that the EcoRecho stoves disseminated for use is in compliance with the above criteria, each CPA will make these criteria a part of the eligibility criteria for inclusion of CPAs in the PoA. Therefore, no documentation of barriers is required and automatic additionality can be conferred on each CPA under this PoA.

Prior Consideration of CDM Revenues

Prior consideration of CDM revenues as a source of funding was discussed during the early development of the project activity, but the submission of the application was not made at the time due to the absence of a functional Designated National Authority (DNA) in Haiti and lack of knowledge regarding the CDM process[20]. The USAID report, dated 10 November 2009, on private financing for watershed stewardship in Haiti highlighted that Haiti did not have an operational DNA; therefore the carbon readiness at the government level was not established. Due to this circumstance, the awareness within the private stakeholder community, and reading the specific nuances of the CDM project development process was not established as well. However, the CME conducted a meeting inviting the stakeholders on December 18, 2009 under the Gold Standard (GS) guidelines, which establishes that the CME considered carbon offset revenues prior to implementing the pilot phase of the project. On February 4, 2011, the prior consideration of CDM form was filed with the newly established DNA in Haiti based on guidance from the CDM consultant. **Table 2** shows key project-related events in chronological order associated with establishing prior consideration of CDM.

Table 2. Important dates to establish prior consideration of CDM

Event	Date
Stakeholders Consultation	18 December 2009
Start of pilot phase	01 June 2010
Submitted "Prior Consideration of CDM Form" to UNFCCC	04 February 2011
No Objection Letter from DNA	17 December 2011
Global stakeholder consultation through posting of the PoA on the UNFCCC website; also the start date of the PoA	13 July 2012

In addition, paragraph 26 of the CDM Project Standard states the following:

[18] Previously known as Attachment A of Appendix B to simplified modalities and procedures of small scale CDM project activities

[19] That is the size of each unit under 750 kW installed capacity or under 3000 MWh of energy savings per year or 3000 tonnes of emission reductions per year.

[20] USAID Private Financing for Watershed Stewardship in Haiti, 2009, Section 3, Pg 23 of 66.

If the start date of a proposed CDM project activity, as determined in paragraph 57 below, is prior to the date of publication of the PDD for the global stakeholder consultation, project participants shall demonstrate that the CDM benefits were considered necessary in the decision to undertake the project as a proposed CDM project activity.

In accordance with paragraph 159 of the CDM Project Standard, applicable to PoAs. the CME has determined the start date of the proposed PoA as the date of publication of the PoA-DD for global stakeholder consultation. Since the start date is not prior to the date of publication of the PoA-DD for the global stakeholder consultation, no demonstration of prior consideration of CDM benefits is considered necessary in the decision to undertake the PoA in accordance with paragraph 26 of the CDM Project Standard.

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

The PoA involves introduction of EcoRecho stoves in the Haitian market with the goal of replacing inefficient traditional charcoal stoves. Through this proposed PoA, D&E plans to extend the reach of the EcoRecho stoves throughout Haiti. This will be achieved through contractual agreements with different distributors and NGOs who will be selling the EcoRecho stoves in different regions of the country. The following eligibility criteria[21] have been developed for inclusion of a CPA in the PoA:

1. **Technological Requirement:** The CPA must include distribution of EcoRecho brand biomass fueled stoves with improved thermal efficiency compared to the baseline (i.e., traditional charcoal burning stove) in accordance with the approved small-scale methodology (AMS.II.G, ver. 04). In particular, the thermal efficiency of the EcoRecho stove replacing the traditional stove must be greater than 20%.

2. **Boundary and location:** CPA must be located within the geographical boundary of Haiti.

3. **Avoiding double counting:** CPA must implement procedures to ensure that double counting of emission reductions does not take place. Specifically, each stove that is manufactured is labeled or engraved with a unique identification (ID) number and assigned to a specific CPA. A database program will be set up to check and verify that stove identification numbers assigned to each stove remains unique. These measures will prevent double counting of CERs.

4. **Certified Emission Reduction (CER) Ownership:** End users receiving the EcoRecho stove under the specific CPA will be required to cede their rights to claim and own emission reductions (ERs) as a condition for purchasing an EcoRecho stove that is part of a CPA by signing a statement included on the Purchase Receipt acknowledging the transfer of CER ownership to D&E.

5. **SSC limit for CPA:** Each CPA under the proposed PoA will remain under the SSC threshold of 180 GWh per annum thermal energy savings throughout the crediting period of the CPA.

6. **CPA Start Date:** In accordance with CDM project standard, CDM-EB65-A05-STAN, version 3.0, the CME shall determine the CPA start date as the earliest date at which either the

[21] CDM Standard: "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities," version 2.1, CDM-EB65-A03-STAN, dated 3 December 2012.

implementation or construction or real action of the CPA begins. In addition, the CME shall confirm that the start date of any proposed CDM CPA is on or after the start date of the PoA.

7. **Applicability of methodology:** The proposed PoA involves replacement of traditional stoves with EcoRecho stoves. The CDM-approved methodology AMS.II.G version 04 is appropriate for this PoA and must be used for estimating ERs from each CPA of the PoA and for formulating monitoring procedures applicable to each CPA of the PoA. Each CPA must demonstrate that non-renewable biomass has been used within the project boundary (i.e., Haiti) since December 31, 1989 using surveys or through reference to appropriate published literature, official reports or statistics.

8. **Additionality:** The CME must demonstrate that each CPA of the PoA meets the additionality requirements by demonstrating that for each CPA: (i) procedures are included to ensure that the thermal savings from each CPA of the PoA is limited to 180 GWh per annum and; (ii) the thermal energy savings from each EcoRecho stove disseminated under a CPA of the PoA is not greater than 5% of the SSC threshold of 180 GWh per annum.

9. PoA Specific Requirements: Each CPA of the PoA must comply with any PoA-specific requirements stipulated by the CME, including any conditions related to undertaking stakeholder consultations and environmental impacts.

10. **Official Development Assistance (ODA) funding:** Each CPA of the PoA must provide an affirmation stating that public funding from Annex I parties, if any, does not result in a diversion of official development assistance.

11. **Project Target Group:** The PoA intends to disseminate efficient EcoRecho stoves to low-income households in the Republic of Haiti. Initial CPAs are intended to replace the traditional stoves in the urban communes of Port-au-Prince, where the average consumption of charcoal has been determined through a Household Biomass Survey in 2011. If other CPAs are implemented in non-urban or rural areas within the project boundary, where charcoal consumption may vary, CME must take appropriate steps to obtain representative estimates of average charcoal consumption and other parameters involved in the estimation of ERs. In addition, each CPA must include procedures to ensure that only traditional inefficient cook stoves are targeted for replacement by the improved efficient EcoRecho cook stove applicable under the CPA.

12. **Sampling Method:** Sampling to be undertaken as part of the CPA must be performed in accordance with the requirements of the applied methodology AMS II G V4.0, and the latest applicable guidelines/standards for sampling and surveys.

13. **De-bundling Check:** The CPA under the PoA must include a demonstration to establish that the CPA is not a de-bundled component of any other large scale CDM project activity.

14. **Updating CPA eligibility criteria:** CME should include provisions to update the eligibility criteria in case of held or withdrawn methodologies, in accordance with CDM Standard: Demonstration of additionality, development of eligibility criteria and application of multiple

methodologies for programmes of activities, CDM-EB65-A03-STAN, version 2.1., paragraph 23 and 24.

B.3. Application of methodologies

The PoA involves industrial scaling-up to quickly produce a larger number of quality-controlled EcoRecho stoves, which involves deploying machinery to streamline the manufacturing process. The CME plans on dissemination of the EcoRecho brand improved cookstoves, as described in section A.6., for use in Haitian households in place of the traditional charcoal stove.

The activities under the PoA falls into the category of a Type II project "Energy Efficiency Improvement Projects." Therefore, the small scale baseline and monitoring methodology, AMS II.G., version 4, "Energy Efficiency Measures in Thermal Applications of Non-renewable Biomass" is applicable to the PoA.

Sampling

The establishment of ER resulting from the dissemination of EcoRecho stoves included as part of the CPAs requires the collection of important monitoring parameters. In accordance with the CDM methodology applicable to the PoA, statistically valid sampling methods will be used to determine parameter values that are used for ER calculations. The sampling plan provided in **Appendix 6**, provides the specific sampling procedures that will apply to each of the CPAs under the PoA.

SECTION C. Management system

D&E, as the entity responsible for managing the PoA, will serve as the CME. Enel, the entity providing up-front financing for the PoA, and D&E will serve together as the joint focal point with responsibility for communicating with the Executive Board (EB) on matters relating to the distribution of CERs, along with the implementation of the project activity.

Figure 4 provides a graphical illustration of the Management System along with identified activities. For each identified activity, which has been assigned a number, the entities responsible for the activity and a detailed description of the role of the responsible entities in carrying out each activity is shown in **Table 3**. The Management System has been developed in accordance with the requirements of CDM Standard: Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities, CDM-EB65-A03-STAN, version 2.1, paragraph 19. In addition to the summary level information provided below, the CME will develop a CME management handbook which describes in detail the structure for the Operation and Management of the PoA, from an operational perspective.

Figure 4: Management System Flow Diagram

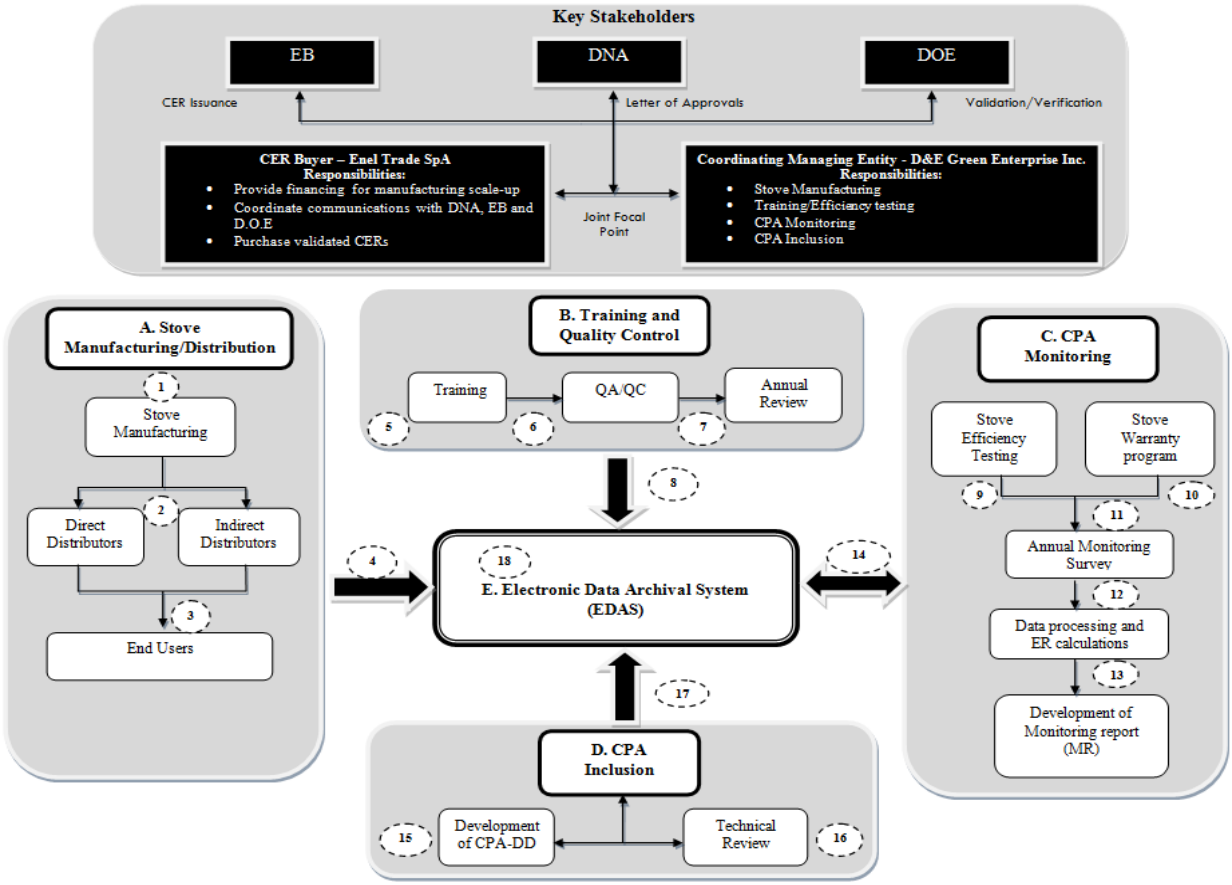


Table 3. Activity, Roles and Responsibilities

A. Stove manufacturing/Distribution		
1	**Activity**	**Stove Manufacturing**
	Responsibility	**CME**
	Description of Role	D&E, also referred to as the CME, will manufacture the EcoRecho stoves locally to the extent possible or, if imported technology or manufacturing outside Haiti is required, acquire the rights to the technology and license to sell such high efficiency stoves under the EcoRecho brand name. D&E, with financing from Enel, will purchase and install stove manufacturing machinery needed to scale up the project from the current pilot phase. D&E will continue to manage and operate an on-going stove manufacturing facility to meet demand and produce quality-controlled cook stoves. D&E will also be responsible for research and development to manufacture newer model EcoRecho stoves with higher efficiency.
2	**Activity**	**Stove Marketing and Distribution**
	Responsibility	**CME and Distributors**
	Description of Role	CME intends to utilize both direct and indirect distribution channels to maximize the market penetration of EcoRecho stoves. The direct distribution strategy will consist of building an internal sales team, who will be responsible for promoting and selling directly to end users (customers) at festivals, religious events, business expos and other venues. A strong focus of the stove dissemination will be on the indirect distribution strategy, which will consist of distribution organizations, which purchase the stoves from the CME and sell it to the end users. The distribution organizations will comprise of entities such as, community leaders, local NGOs, small grocery vendors, charcoal sellers, small business owners and independent sales associates involved in product distribution where the stove can complement their existing business endeavours. The selection of distribution organizations will involve a deliberate process of finding interested individuals who have owned and operated a small business or to have been in sales positions with proven results for at least one year. In addition to distributors, community leaders and NGOs, selected to be part of the indirect distribution network, will be expected to possess well developed networks and be respected in their communities. Upon identification of a potential distributor they will be put through a rigorous interview process that will vet them to ensure that they are reliable and trustworthy and capable of promoting the EcoRecho stove and maintaining the projected sales volume. Upon completion of the vetting process, each distributor will be required to sign a contract, which will involve specific provisions and declarations that their activity (dissemination of EcoRecho stoves to end-users) is being subscribed under the PoA, require attendance at the mandatory training programme that will be developed by the CME and be assigned a distributor ID.
3	**Activity**	**Stove Dissemination/Sales to End Users**
	Responsibility	**CME Distributors/Sales Team**
	Description of Role	Each distribution organization along with the CME's direct sales team will be responsible for selling the stoves to end users and will be required to collect information from the customers during the sale of each stove. The information collected will be recorded on a standardized Purchase Receipt (PR) provided by the CME. As part of the sale, the customer is provided instructions and guidance on using and maintaining the stove and explaining the terms of the warranty. The information on the PR will be recorded in triplicate, with one copy each going to the customer, distribution organization and CME. The PR will contain the

		following information: • Name of Buyer • Address, if known, and Area where buyer lives and plans to use the stove • Telephone number of buyer • Stove identification number • Date of purchase • Name/ID of Seller/Distributor • Telephone number of seller/distributor • Type of traditional stove(s) used by the customer (i.e., buyer) prior to the purchase of an EcoRecho stove and identification of the traditional stove(s) that the customer intends to replace. • Attestation/Signing of an Agreement by the customer that the traditional stove being replaced by the EcoRecho purchase will no longer be used • Carbon credit waiver transferring the stove's ER to the CME. • Manufacturer's warranty and return policies
4	**Activity**	**EDAS Recordkeeping and Management**
	Responsibility	**CME and EDAS Contractor**
	Description of Role	As part of the monitoring plan, a record keeping system will be used to keep track of the stoves sold under each CPA of the PoA. Each EcoRecho stove manufactured by the CME will be uniquely imprinted with a physically readable identification (ID) number. Movement of stoves out of the manufacturing facility using direct distribution channel (to customer) and indirectly via a DO is reported (i.e., entered) into the database of the Electronic Data Archival System (EDAS) with the associated unique IDs. The retail sale of each stove to a customer is captured in a PR, and the distribution organization will be responsible for transmitting the stove sale information in each PR to the CME using Short Message Service (SMS) or other equivalent method for data capture needed to populate the EDAS. The CME will assign each PR record with the corresponding CPA number to eliminate the potential for erroneous double counting, and facilitate the monitoring plan. In addition, the CME will be responsible for collecting the PR records (paper copies) and will archive the data manually, if necessary. On implementation of the project activity, the CME will have a fully-functioning EDAS with an associated relational database that can be used to track the movement of stoves produced and disseminated to end user accurately and produce reports on all the sales-related information by stove ID and CPA number. Further discussion on the system for preventing double counting and means of identification is provided in Part II, Section A.1.

B. Training/Quality Control		
5	**Activity**	**Training**
	Responsibility	**CME**
	Description of Role	The CME will be responsible for developing the training programme with the goal of ensuring that each potential distribution organization leaves the training with product usage, maintenance and warranty information, marketing strategies, the profit margin available to them and other benefits of being successful stove distributor, as well as a comprehensive understanding of the CDM rules and data management requirements for cookstoves sold under the umbrella of a CPA. The training programme will be carried out with the assistance of local training institutes.
6	**Activity**	**QA/QC (Quality Assurance/Quality Control)**
	Responsibility	**CME**
	Description of Role	The CME will be responsible for developing and implementing QA/QC procedures, which involve the following: • Insuring accurate transfer of data from PR to EDAS by cross checking with paper records of the PR. • Conducting thermal efficiency testing, discussed in more detail in Item C.9. • Obtaining customer feed on EcoRecho stove operations, design, etc. • Continue with further research and development on improved cookstoves, with the goal of improving thermal efficiency of EcoRecho stoves.
7	**Activity**	**Annual Review**
	Responsibility	**CME with assistance from the CDM consultant**
	Description of Role	The CME responsible for coordination of the annual management review, preparation of information for consideration during the review, and documentation and implementation of the decisions reached by the review. The goal of the annual review is to improve the effectiveness and efficiency of management and operations. In addition, the CDM consultant will review the EDAS, data collection procedures, annual monitoring survey design and provide recommendation to the CME to facilitate improvements to the Management System.
8	**Activity**	**EDAS Recordkeeping and Management**
	Responsibility	**CME and EDAS Contractor**
	Description of Role	All records of training, contracts and changes to the EDAS Database for quality control purposes will be recorded in the EDAS Database by the EDAS Contractor and maintained by CME with an audit trail available to DOE during verification.

C. CPA Monitoring		
9	**Activity**	**Stove Efficiency Testing**
	Responsibility	**CME and Third Party Stove Testing Agency**
	Description of Role	The CME will be responsible for developing procedures to test a representative sample of stoves, randomly selected from stoves in operation to be measured for thermal efficiency using the latest version of the Water Boiling Test (WBT) or equivalent protocol. Testing will be conducted at a reputable laboratory or trained in-house representatives with specific knowledge and testing equipment needed to conduct the WBT to ensure reliability of test results. The sampling plan for stove testing will be in conformance with the requirements of AMS II.G ver. 4 and meet the reliability criteria specified in "Standards for sampling and surveys for CDM project activities and programme of activities." Further details regarding sampling are provided in section B.3, and the Sampling Plan in **Appendix 6**.
10	**Activity**	**Stove Warranty program**

	Responsibility	**CME**
	Description of Role	The EcoRecho stoves sold to end users under each CPA will be covered under the terms and conditions of the warranty for a period of one year from the sale of the stove. Malfunctioning units will be replaced through collection centres, operated by the CME. These centres will be located in different areas where trained personnel will check the malfunctioning stove and determine whether the warranty terms are applicable or not. The specific manner in which the terms of the warranty apply will be provided and described to the buyer during the purchase of the stove, including a listing of the different conditions that the warranty will not cover. If the malfunctioning unit is determined to satisfy the warranty clause, the customer will be given a new EcoRecho stove with a new PR. The defective stove will be sent to the manufacturing centre where it will be refurbished and sold as a new stove with a new unique ID number or discarded if it cannot be refurbished. The collection centre will record the problem with the malfunctioning unit and any other associated data on the PR of the malfunctioning stove and send a copy to the CME for archiving. Defective units that are refurbished will meet the same performance standard as a new unit; the refurbished EcoRecho stoves will be sold with new Unique ID number. These replacement stove transactions will be tracked with both the replacement stove ID and defective stove ID along with the effective date of replacement (i.e., replacement date).
11	**Activity**	**Annual Monitoring Survey**
	Responsibility	**CME and Local Surveying Entities with assistance from CDM Consultant**
	Description of Role	The CME will be responsible for conducting the annual monitoring survey to collect specific parameters and data to facilitate Emission Reduction calculations. The survey and sampling plan will be developed in accordance with AMS II.G ver. 4 and meeting the data reliability requirements in the "Standards for sampling and surveys for CDM project activities and programme of activities". Further details are provided in the monitoring plan. During survey activities, the CME will seek assistance from local entities with the knowledge and experience to conduct surveys in Haiti and from the CDM consultant.
12	**Activity**	**Data processing and ER calculations**
	Responsibility	**CDM Consultant**
	Description of Role	All information collected by the EDAS Database relating to Emission Reduction calculation will be processed by the CDM consultant and will be used in the development of the Monitoring Report. In addition, the CDM consultant will review the EDAS Database, data collection procedures, annual monitoring survey design and provide recommendation to the CME to facilitate improvements to the Management System.
13	**Activity**	**Development of Monitoring report (MR)**
	Responsibility	**CDM Consultant**
	Description of Role	The CDM consultant will be responsible for developing and providing the Monitoring Report (MR) to the CME, which will be submitted to the DOE for verification, and EB for issuance of CERs.
14	**Activity**	**EDAS Recordkeeping and Management**
	Responsibility	**CME and EDAS Contractor**
	Description of Role	All data collected from the stove efficiency testing, stove replacements and annual monitoring survey will be archived in the EDAS Database by the CME. During verification all records relating to CDM requirements will be provided to the DOE. Further details are provided in the monitoring plan.

D. CPA Inclusion		
15	**Activity**	**Development of CPA-DD**
	Responsibility	**CDM Consultant**
	Description of Role	The CDM consultant with specific knowledge relating to CDM standards and requirements will be responsible for developing the CPA-DD for inclusion under the PoA. The development will involve the following: • Development, updating and application of CPA eligibility criteria • Completing SSC-CPA-DD for submission to DOE for inclusion under the PoA
16	**Activity**	**Technical Review**
	Responsibility	**CME with assistance from the CDM consultant**
	Description of Role	Prior to submission of a CPA to DOE for inclusion under the PoA, CME and the CDM consultant will conduct a technical review of the CPA. The technical review will involve crosschecking the information in the CPA-DD against the PoA documentation requirements and if consistency/integrity is confirmed, which involves as assessment of the following: • Criteria for CPA additionality and associated evidence • Criteria for CPA inclusion and associated evidence • Operation and management arrangements • Avoidance of double counting • Monitoring procedures
17	**Activity**	**CPA Inclusion**
	Responsibility	**CME and EDAS Contractor**
	Description of Role	Prior to submission of CPA to DOE for inclusion under the PoA, the CME will ensure that the EDAS Database is updated to facilitate the inclusion of a new CPA.

E. Electronic Data Archival System (EDAS)		
	Activity	**EDAS Recordkeeping and Management**
	Responsibility	**CME and EDAS Contractor to provide maintenance and support**
	Description of Role	The data management system referred to as EDAS will be a developed as a Relational Data-Base Management System (RDBMS). The EDAS will be leveraged for the following functions with a focus on meeting the CDM requirements: • Data management pertaining to entire life cycle of stove, through manufacturing, to sales to customer and final retirement of stove. • Statistical analysis and sampling for quality assurance. • Data processing for training requirements • Generate reports to facilitate verification including on-demand reports. Further details on the EDAS system is provided in **Appendix 5**.

SECTION D. Duration of PoA

D.1. Start date of PoA

13/07/2012. This date represents the date of commencement of global stakeholder consultation conducted by the DOE (AENOR).

D.2. Length of the PoA

28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

The objective of the SSC-PoA and the CPAs under the PoA is to replace traditional charcoal stoves with efficient EcoRecho stoves. The improved thermal efficiency of charcoal burning stoves is expected to result in reduction in the amount of charcoal used, but there will not be a significant reduction in environmental degradation from charcoal production and charcoal burning activities from any single stove. The full environmental impact of the PoA can best be acknowledged when measured in totality to account for the cumulative effects of each individual stove. The implementation of the CPAs under the proposed PoA will result in a decrease in the GHG emissions generated from household charcoal burning. In addition, the project activity does not fall under the purview of the Haitian environmental law (Des Lois Haitiennes de l'environnement – October 1995[22]), nor does it require an Environmental Impact Assessment to be completed. The project activity is not expected to affect the environment adversely. On the contrary, it will have a positive impact on the local environment by reducing indoor air pollution, reducing carbon dioxide emissions, reducing the quantity of wood resources diverted to charcoal production, all of which can indirectly increase the regeneration capacity of forest resources in Haiti. Based on these considerations, the environmental impact of the project will be assessed at the PoA level.

E.2. Analysis of the environmental impacts

Environmental Impacts and PoA Benefits:

- The increasing demand for charcoal in Haiti is primarily due to the absence of any other alternate affordable source of energy such as natural gas, liquid petroleum gas (LPG), kerosene etc. Given the economic status of the country, charcoal and/or dry biomass is the most affordable fuel. This has resulted in massive depletion of forest cover in Haiti which now stands at 2 %. The PoA will improve the local environment by reducing deforestation so as to allow natural recovery of forests in and around the project area.
- Beyond the negative economic and environmental impacts of charcoal consumption, cooking with firewood and charcoal exposes women and children to smoke or 'indoor pollution' and associated health problems, especially respiratory diseases, which is the second largest killer of children under the age of five in Haiti.[23] The PoA will hopefully improve the quality of life by reducing indoor air pollution:
- Reduced deforestation rate as a result of the PoA may open up opportunities to replenish depleted forest cover through reforestation, thus creating a carbon sink. In the immediate future, the PoA will lower GHG emissions from a reduction in the quantity of charcoal burned in Haitian households where traditional stoves are to be replaced. This in turn will reduce global warming by reducing the overall carbon dioxide emission levels released to the atmosphere.

[22] http://www.foprobim.org/Documents/EnvironmentaLawsofHaiti%20pdf.pdf
[23] USAID, Assessment of Haiti Alternative Cooking Technologies Program, 2010, Pg 2.

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

Each CPA will take place inside Haiti's international borders and the boundary of each CPA includes the entire country. Therefore, stakeholder consultation process is conducted at the PoA level. The stakeholder consultation process does not fall under the purview of the Haitian environmental laws (Des Lois Haitiennes de l'environnement – October 1995). The World Wildlife Fund's Gold Standard (GS) guidelines were used to guide the stakeholder consultation process that was conducted on December 18, 2009.

The stakeholder's meeting was conducted in an urban setting in Port-au-Prince on December 18, 2009, at the Hotel le Plaza, Port-au-Prince, Haiti. The choice of urban setting was necessary so as to attract representation from different groups of stakeholders. A total of 75 persons, including the project proponents, attended the meeting, which was conducted according to GS guidelines. Using the guidelines provided in the GS toolkit, the invitation process for the local stakeholder conference was successfully executed. Efforts were made to include a broad range of relevant stakeholders. Men and women from diverse backgrounds and age groups were invited. One hundred and ninety five invitations (67 from A, 9 from B, 117 from D, 1 from C and 1 from F) were made to local people impacted by the project, local NGOs and international NGO's that focus on the environment, business development, health and gender issues. Members of the church, policy makers, the national DNA and GS expert and supporters were invited for the Stakeholders Meeting.

The stakeholders were contacted through formal invitation letters, emails, phone calls and/or verbal invitations. NGOs, government agencies and other institutions were invited through formal invitation letters. The stakeholder conference was not advertised in newspapers because the groups that were being targeted did not read the local newspaper regularly. The locals who are most likely to be impacted by the project are not likely to read the paper. As result, to the use of a direct outreach method was deemed to be very effective.

The meeting lasted for three hours (05.00 pm – 08.00pm), where the stakeholders were enlightened about the project activity with reference to its rationale, the technology and its socio-economic impact on the community. Following the break after the project introduction, the stakeholders joined the Question and Answer session that lasted for about 30 minutes. EcoRecho stoves were displayed during the meeting for the stakeholders. The stakeholders were also provided with questionnaires for their remarks.

Figure 5: Stakeholder Consultation Pictures

F.2. Summary of comments received

Many stakeholders voiced their interests in participating in the programme. Being the first-of-its-kind project, some stakeholders were understandably apprehensive about the effect of the project on the community. **Table 4** summarizes the issues that were raised by the stakeholders and D&E's responses:

Table 4. Comments Received

Questions	Responses
Why did you choose to do this project versus an LPG project?	High price of LPG and limited income of population, limited and sporadic distribution, political and economic risks related to importing are the main reasons to opt for EcoRecho stoves above LPG.
This project may negatively impact the livelihood of charcoal makers.	Charcoal makers represent a very small subset of the population while the impact of burning is felt by everyone. While it is understood that the negative economic implications that may have on the charcoal makers, we believe the project will greatly benefit the population and environment. In addition, there are ways to make charcoal in a sustainable way and we are ready to assist in that regard. Also charcoal makers can supplement their income by becoming stoves distributors.
What about other industries such as dry cleaning or carpentry that also use wood? Are you going to address this problem?	We have to be methodical and pragmatic in how we approach the problem. This particular project tackles one key contributor to the rapid deforestation in Haiti which is usage of wood for cooking purposes. We do not believe that this project by itself will stop deforestation in Haiti but will rather help to slow down the phenomenon. Our project is a step in the right direction that will certainly contribute to the solution. It will take a host of different of solutions and approaches to solve the problem. Wood is used in many products and services that are necessary for our survival and it impossible for any country not use wood. Using wood is only a problem when it is done in an unsustainable way. The real challenge for us in Haiti is to figure out how to harvest wood in a sustainable way.
What is price for the stoves?	Prices of stoves are yet to be determined.
I would like to try using your stove, where can we find stoves?	We have not officially started selling the stove but we can make one available to you if you want to try it. Please see me or any other staff member after the conference.

Questions	Responses
I am sceptical about the effectiveness of the stove.	It is ok to be sceptical; however this kind technology is well known throughout the world and has been shown to reduce charcoal consumption. In addition, we have conducted many tests in Haiti that show an average charcoal savings of over 50%. We have many users in the room with us tonight; they can perhaps share with you their experience with the stove. Also we can make one available to you to try. We would greatly appreciate your feedback on stove in general and particularly on the charcoal savings.
You mentioned during the presentation that women age 14 and up are the target market for the stoves, why is that?	Traditionally, Haitian women have been responsible for most household chores including cooking, cleaning and childcare, and it makes sense to primarily target the cooks, however anyone that uses charcoal to cook is considered our target market.
How will you distribute the stoves?	The stove will be distributed through a large network of distributors.

It was evident from the questions raised by stakeholders, that there was no strong opposition against the project activity.

F.3. Report on consideration of comments received
Refer to Section F.2 above.

SECTION G. Approval and authorization

The DNAs of Italy and the Republic of Haiti have provided Letters of approval (LoAs), dated June 25, 2013 and April 2, 2013, respectively, constituting the required approvals and authorization from the parties involved in the PoA. The LoAs have been made available to the DOE for their review and subsequent request for registration of the PoA with the CDM Executive Board.

The LoA from the Republic of Haiti's authorized DNA (Ministère de L'Environment) confirms that Haiti has ratified the Kyoto Protocol on October 4, 2005, participates voluntarily in the CDM, and approves the CDM-PoA, including authorizing the participation of D&E as a project participant and CME in the PoA. The LoA from Italy's authorized DNA (Ministry for the Environment Land and Sea, Department for Sustainable Development Climate Change and Energy) declares that Italy ratified the Kyoto Protocol on May 31, 2002, participates voluntarily in the CDM and provides written approval for voluntary participation by Italy in the CDM PoA in order to register this PoA with the CDM Executive Board. The Italian LoA also acknowledges that Enel's confirmation of its intent to be added as a project participant in the proposed PoA may be taken as constituting authorization of Enel as a participant in the CDM PoA.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The CPA of the proposed PoA will involve replacement of traditional charcoal stoves with more efficient EcoRecho stoves. The improved heat transfer efficiency of the EcoRecho stoves will result in reduced charcoal or wood fuel consumption for cooking, thus reducing the amount of GHGs emitted into the atmosphere. ERs occurring through implementation of the CPAs will be calculated using approved methodology AMS.II.G version 04 and will be limited to a maximum thermal energy savings equal to the SSC threshold of 180 GigaWatt-hour per year (GWh/yr).

D&E will serve as the CME to the PoA and will be the focal point jointly with Enel, who will communicate with the EB and the DOE and address all CPA related issues.

Stove Dissemination Plan

The stove dissemination plan initiated by the CME will extend D&E's current pilot-scale operations to an industrial-scale manufacturing operation under the CPA and will focus initially on stove sales within the urban area of Port-au-Prince, followed by the surrounding urban communes and then to other urban and rural regions of Haiti. The CME will manufacture the EcoRecho stoves locally to the extent allowed by the resources available in Haiti. However, the current versions of the medium and large EcoRecho stoves are being indigenously manufactured and will be scaled up with new machinery prior to implementation of CPA01. In the event that the EcoRecho models sold under this CPA01 are partially or fully manufactured outside Haiti due to resource constraints or require imported ICS technology, the CME will acquire the imported ICS technology or licence to sell the stoves under the EcoRecho brand name.

The CME intends to utilize both direct and indirect distribution channels to maximize the market penetration of EcoRecho stoves. The direct distribution strategy will consist of building an internal sales team, who will be responsible for promoting and selling directly to end users (customers) at festivals, religious events, business expos and other venues. A strong focus of the stove dissemination will be on the indirect distribution strategy, which will consist of distribution organizations, which purchase the stoves from the CME and sell it to the end users. The distribution organizations will comprise of entities such as, community leaders, local NGOs, small grocery vendors, charcoal sellers, small business owners and independent sales associates involved in product distribution where the stove can complement their existing business endeavours.

The selection of distributors will involve a deliberate process of finding interested individuals who have owned and operated a small business or to have been in sales positions with proven results for at least one year. In addition to distributors, community leaders and NGOs, selected to be part of the indirect distribution network, will be expected to possess well developed networks and be respected in their communities. Upon identification of a potential distributor they will be put through a rigorous interview process that will vet them to ensure that they are reliable and trustworthy and capable of promoting the EcoRecho stove and maintaining the projected sales volume. Upon completion of the vetting process, each distributor will be required to sign a contract, which will involve acceptance of specific provisions and declarations that their activity (dissemination of EcoRecho stoves) is being subscribed under a CPA of the PoA, and that it will require their attendance at the mandatory training programme that will be developed by the CME.

The goal of the training program is to make sure that each potential distributor leaves the training with product usage, maintenance and warranty information, marketing strategies, the profit margin available to them and other benefits of being a successful stove distributor, as well as a comprehensive understanding of the CDM rules and data management requirements for improved cookstoves (ICS) sold under the umbrella of a CPA.

System for stove identification to prevent double counting

During the manufacturing process, each stove will be imprinted with a unique identification (ID) number, which will serve as the serial number to identify each stove by the PoA, stove model and manufacturing count (i.e., serial number) of each EcoRecho stove. **Table 5** provides a generic example of the stove ID number that will be used to capture each of the stoves and models of stoves to be included within the CPA.

Table 5. Generic Stove ID Number

Generic Stove Serial Number	⟨*D&E*|*MODEL ID*|*COUNT ID*⟩
Parameter	**Description**
MANUFCTURER ID	Represents identification number of the PoA proponent/stove manufacturer and unique serial numbers for each stove in a CPA included under the PoA, which will begin with D&E.
MODEL ID	Represents numerical identification of the stove type and size, e.g., EcoRecho Medium = 01, EcoRecho Large = 02.
COUNT ID	Represents the numerical identification of the manufacturing tally for each model, e.g., first stove manufactured for each model = 00001.

Each stove ID will be recorded and stored within the EDAS in order to register and track each stove, manufactured and provided to each distributor for dissemination to end users. The EDAS system will assign a unique CPA number (e.g., CPA01, CPA02, CPA03, etc.) to each stove sold to keep track of the stoves sold under each CPA. Thus there will be no two EcoRecho stoves with the same ID and CPA number combination, which will eliminate the chance of erroneous double counting of emission reductions. The EDAS database will also have the functionality to track any damaged/non-working stove that is returned for replacement with a like-for-like stove, by assigning a unique ID and CPA number combination for the replacement stove along with a record of the date that the damaged/non-working stove is taken out of service and the date that the replacement stove is put into service. Data integrity and data security in the system will be controlled by allowing only authorized access to the EDAS with audit trails, which will be available for review during verification.

SECTION B. Application of a baseline and monitoring methodology

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

The CPAs under the PoA falls under the Type II project: "Energy Efficiency Improvement Projects." The methodology selected for application to the CPAs is the small scale baseline and monitoring methodology, "Energy Efficiency Measures in Thermal Applications of Non-renewable Biomass," AMS II.G., version 4[24]. The selected methodology is approved by the EB for application to CPAs under the PoA.

B.2. Application of methodology(ies)

The CDM project standard, CDM-EB65-A05-STAN, version 3.0, Section 8 – Specific design requirements for small-scale project activities and the specific requirements of the selected methodology have been used to provide justification to show or demonstrate how the SSC-CPAs under the PoA meets each of the applicability conditions of the selected methodology.

1) **Project Type:** Type II Energy Efficiency Improvement Projects include energy efficiency improvement from project activities, which reduce energy consumption on the supply and/or demand side. For small-scale project activities, the energy savings is limited to a maximum of 60 GWh_e/yr of electrical energy (or an appropriate equivalent)[25] in any year of the crediting period.

    - Each CPA's emission reduction will be limited to a maximum thermal energy savings of 180 GWh_{th}/yr or 180 million Kilowatt hour/year (10^6 KWh/yr), which is equivalent to the small scale threshold electrical energy savings of 60 GWh_e/yr. Ex-ante calculation of the maximum

[24] http://cdm.unfccc.int/methodologies/DB/REQC2MYZJJ6I7BC9SKCS32T2K87AOW
[25] A total saving of 60 GWh_e per year is equivalent to a maximal saving of 180 GWh_{th} per year

number of stoves that can be sold under each CPA without exceeding the small-scale threshold is provided in **Appendix 3**.

2) **Selected Small-Scale Methodology:** AMS II.G version 4. Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass is in a category that comprises appliances involving efficiency improvements in the thermal application of non-renewable biomass. Examples of these technologies and measures include the introduction of higher efficiency[26] biomass-fired cook stoves[27], ovens or dryers and/or improvement of energy efficiency of existing biomass fired cook stoves, ovens or dryers.

   - The CPAs involve replacing inefficient traditional charcoal stoves with efficient EcoRecho stoves with a thermal efficiency of 20% or greater. In the baseline, inefficient traditional cooking stoves are used.

3) **Non-renewable Biomass Usage:** Project participants must show that non-renewable biomass has been used since December 31, 1989, using surveys or by referring to published literature, official reports or statistics to document non-renewable biomass usage within the boundary of each CPA of the PoA.

   - Haiti's 2006 profile[28] provides a description of Haiti's environmental conditions, which states that *"In 1923, forests covered nearly 60 percent of the country; today they cover less than 2 percent."* Further, the 1989 report of the study conducted by Stevenson on the production, distribution, and consumption of fuelwood in Haiti attributes the deforestation problem to both agricultural clearing and the use of wood for fuel, and states that, *"Today deforestation has advanced to the point where trees are felled at the extremities of the country (up to 300 kilometers away) to supply charcoal to Port-au-Prince*[29]. It was observed in the 2007 ESMAP study[30] that the trend in charcoal consumption was still dominant with about 33 percent of the total 4 million tons of woody biomass collected, being redirected to charcoal production. According to the 2007 ESMAP study[31], the presence of 37 million cubic meters of living wood and a 2% annual growth rate means that 474,000 tons of wood or 71,000 tons of charcoal could be produced sustainably from existing wood stocks in Haiti. The consumption rate of charcoal in Port-au-Prince alone is estimated to be approximately 413,000 tons/year, based on a population of 3.5 million with an average household size of 4.9 and a 70% charcoal usage rate. Clearly, the depleted Haitian forest resource base is clearly not sufficient to meet current demand[32]. The current wood fuel crisis, which is clearly exacerbating the deforestation problem in Haiti, with no end in sight, needs to be addressed. The proposed CDM PoA is a step in that direction. The CDM methodology requirement is met by the discussion and references cited in this section, which provides sufficient evidence that non-renewable biomass has been used since December 31, 1989.

[26] The efficiency of the project appliance as certified by a national standards body or an appropriate certifying agent recognized by it. Alternatively, manufacturer's specifications may be used.
[27] Single pot or multi pot portable or in-situ cook stoves with specified efficiency of at least 20%.
[28] Library of Congress – Federal Research Division – Country Profile: Haiti May 2006
[29] Stevenson, G.G., "The production, distribution and consumption of fuelwood in Haiti," Journal of Developing Areas 24 (October 1989). Pg 59 – 76.
[30] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Fuelwood Resources, ESMAP, 2007. Pg 15
[31] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Fuelwood Resources, ESMAP, 2007. Pg 18
[32] Assessment of Haiti Alternate Cooking Technologies Program, USAID, 2010, Pg 13.

4) **Debundling:** Project participants must demonstrate that the proposed small-scale CDM project activity is not a debundled component of a large-scale project activity. Project participants shall follow the applicable provisions in the. "Guidelines on assessment of debundling for SSC project activities".

- The "Guidelines on assessment of de-bundling for SSC project activities," v03 (EB 54, Annex 13, par. 10) for determining the occurrence of de-bundling under a PoA states that if each of the independent subsystem/measures included in the CPA of a PoA is no larger than 1% of the small scale threshold defined by the methodology applied, than that CPA of a PoA is exempted from performing a de-bundling check, i.e. the CPA is considered as not being a de-bundled component of a large scale activity.

- The small scale threshold defined by AMS.II.G limits the maximum thermal energy savings under each CPA to 180 GWh/yr. The ex-ante calculations provided in **Appendix 3** demonstrates that the energy savings is 0.002 % and 0.001 % of the SSC threshold for Medium and large EcoRecho stoves, respectively. Thus none of the EcoRecho stove exceeds 1% of the SSC threshold. Therefore, the CPAs under this PoA are exempt from performing the de-bundling check.

B.3. Sources and GHGs

The boundary for the PoA in terms of a geographical area is defined as the political boundary of the Republic of Haiti.

In accordance with the methodology AMS II.G version 4, the GHGs included for emissions estimation within the PoA boundary includes carbon dioxide in the baseline as well as in the project activity. **Table 6** identifies the GHG emission sources for the baseline and project scenarios and the justification for their inclusion.

Table 6. Sources and GHGs

Sources	Emission Source	GHG	Applicability	Justification / Explanation
Baseline	Combustion of non-renewable biomass for cooking	Carbon dioxide (CO_2)	Yes	Major source of emissions.
		Methane (CH_4)	No	Minor source of emissions and limited data available.
		Nitrous oxide (N_2O)	No	Minor source of emissions and limited data available. Exclusion is conservative assumption.
Project Activity	Combustion of non – renewable biomass for cooking	Carbon dioxide (CO_2)	Yes	Major source of emissions.
		Methane (CH_4)	No	Minor source of emissions and limited data available.
		Nitrous oxide (N_2O)	No	Minor source of emissions and limited data available.

B.4. Description of baseline scenario

Households in Haiti rely primarily on inefficient traditional stoves fuelled by charcoal for cooking food. Use of charcoal in such stoves is costly, deleterious to health and safety, and devastating to the environment. The rapid decline in forested areas aided by its dependence on charcoal, Haiti has become one of the world's most deforested countries, with forest cover at just 1-2% of total land area. The

increased use of efficient charcoal cookstoves is a "quick win" for reducing charcoal consumption in Port-au-Prince, which is home to nearly one-third of Haiti's population and accounts for approximately 80% of national charcoal consumption[33].

Baseline Scenario:

Absent the proposed project activity and government regulation that mandates replacement of inefficient traditional stoves with efficient ones, the intended beneficiaries of the project activity would continue using inefficient traditional stoves for day-to-day cooking purposes. According to the methodology, AMS II.G version 4, the baseline scenario can be assumed to be as follows:

> *"It is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs."*

B.5. Demonstration of eligibility for a generic CPA

Table 7: Generic CPA Eligibility Criteria

Sl. No.	Eligibility Criteria		Items/Parameters to be checked for proof of eligibility for inclusion of a CPA under the PoA
	Category	Description	
1	Technological Requirement	The CPA must include distribution of EcoRecho brand biomass-fueled stoves with improved thermal efficiency compared to the baseline (i.e., traditional charcoal-burning stove) in accordance with the approved AMS.II.G, ver. 04. In particular, the thermal efficiency of the EcoRecho stove replacing the traditional stove must be greater than 20%.	WBT results will be provided, which includes data on thermal efficiency of EcoRecho stove(s) to be disseminated and included in a specific CPA.
2	Boundary and location	CPA must be located within the geographical boundary of Haiti	A signed contract between the CME and distribution organization will be provided, which will include a provision to limit the dissemination of EcoRecho stoves included in each CPA only to end users within the geographical boundary of Haiti. When a contract between the CME and the distributor has not yet been signed, the CME's self-declaration will be provided attesting that the EcoRecho stoves disseminated under each CPA will be located within the boundaries of Haiti to meet the eligibility criterion for CPA boundaries and location.
3	Avoiding double counting	CPA must implement procedures to ensure that double counting of emission reductions does not take	CME Handbook will be provided, which include specific procedures consistent with the PoA-DD

[33] Haiti: Strategy to alleviate the pressure of Fuel Demand on National Woodfuel Resources; ESMAP, 2007, Pg 21

Sl. No.	Eligibility Criteria		Items/Parameters to be checked for proof of eligibility for inclusion of a CPA under the PoA
	Category	Description	
		place.	requirements, to ensure each stove manufactured and disseminated under a CPA is assigned a unique identification number, along with a CPA number and recorded for tracking by an electronic recordkeeping system. Specifically, each stove that is manufactured is labeled or engraved with a unique identification (ID) number and assigned to a specific CPA. A database program will be set up to check and verify that stove identification numbers assigned to each stove remains unique. These measures will prevent double counting of CERs.
4.	Certified Emission Reduction (CER) Ownership	End users receiving the EcoRecho stove under the specific CPA will contractually cede their rights to claim and own emission reductions (ERs).	Purchase Receipt associated with sale of an EcoRecho stove included in a specific CPA will include a waiver signed by the customer ceding the rights to the ERs achieved through the use of the EcoRecho stove to the CME. The purchase receipt will only be available after stoves are disseminated. Alternatively, prior to the date of purchase of an EcoRecho stove included in a specific CPA, the CME's self-declaration will be provided attesting that the eligibility criterion for CER ownership will be met.
5	SSC limit for CPA	Each CPA under the proposed PoA will remain under the small-scale threshold of 180 GWh per annum thermal energy savings throughout the crediting period of the CPA.	Excel spreadsheet will be provided, which includes ex-ante calculations that determine the maximum number of EcoRecho stoves that can be disseminated without exceeding the upper limit of the small-scale CDM threshold.
6	Start Date	In accordance with CDM project standard, CDM-EB65-A05-STAN, version 3.0, the CME shall determine the start date as the earliest date at which either the implementation/ or construction or real action of the CPA begins. In addition, the CME shall confirm that the start date of any	The first Purchase Receipt signed by the customer for an EcoRecho stove that is included as part of the specific CPA will be provided, which constitutes implementation and/or start of the real action of the CPA. In situations where the CPA start date

Sl. No.	Eligibility Criteria		Items/Parameters to be checked for proof of eligibility for inclusion of a CPA under the PoA
	Category	Description	
		proposed CDM CPA is on or after the start date of the PoA.	is estimated to be a future date after either the validation stage or the request for inclusion of the CPA, the CPA start date will still be the actual date of the first signed purchase receipt for an EcoRecho stove that is included as part of a specific CPA. The first signed purchase receipt that establishes the start date of a specific CPA will be available only after the CME receives funding to implement the PoA and the sale of the first EcoRecho stove under that CPA takes place. Alternatively, prior to the date of purchase of the first EcoRecho stove, the CME's self-declaration will be provided attesting that the eligibility criteria for the CPA start date will be met.
7	Applicability of methodology	Each CPA must demonstrate that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics. As described in Part II, Section B.2.of the PoA, the use of non-renewable biomass has been conducted at the country level. Therefore, given that the project boundary for the PoA is the Republic of Haiti, the analysis conducted at the PoA level is applicable to all CPAs so long as each CPA is implemented within the Republic of Haiti.	Example contract between the CME and distribution organization will be provided. Contract will include a provision to limit the dissemination of EcoRecho stoves included in each CPA only to end users within the geographical boundary of Haiti.
8	Additonality	The CME must demonstrate that each CPA of the PoA meets the additionality requirements by demonstrating that; (i) each CPA includes procedures to ensure that the thermal savings from each CPA is limited to 180GWh per annum and; (ii) the thermal energy savings from each EcoRecho stove disseminated under the respective CPA is not greater than 5% of the small-scale CDM threshold of 180 GWh per annum.	Excel spreadsheet, with all supporting evidence will be provided, which includes ex-ante calculations that determine the maximum number of EcoRecho stoves that can be disseminated without exceeding the small-scale threshold of 180 GWh savings per annum. In addition, the spreadsheet will also include calculations of thermal savings from each EchoRecho stove included as part of the specific CPA, to demonstrate savings from each stove

Sl. No.	Eligibility Criteria		Items/Parameters to be checked for proof of eligibility for inclusion of a CPA under the PoA
	Category	Description	
			is not greater than 5% of the small-scale CDM threshold. Alternatively, the CME's self-declaration will be provided attesting that the eligibility criteria for additionality will be met.
9	PoA Specific Requirements	Each CPA of the PoA must comply with any PoA-specific requirements stipulated by the CME including any conditions related to undertaking stakeholder consultations and environmental impacts. The project boundary for the PoA is the Republic of Haiti, therefore, as described in Part I, Section E and F of the PoA, environmental impacts and stakeholder consultation is conducted at the PoA level. Each CPA will meet this requirement provided that the project boundary for each CPA is within the Republic of Haiti.	An example of the contract between the CME and distribution organization will be provided. Contract will include a provision to limit the dissemination of EcoRecho stoves included in each CPA only to end users within the geographical boundary of Haiti. Therefore, stakeholder consultation and environmental impacts are not required at the CPA level.
10	Official Development Assistance (ODA) funding	To be included in the PoA, the CPA must provide an affirmation stating that public funding from Annex I parties, if any, does not result in a diversion of official development assistance (ODA) .	No ODA funding is sought for the CPAs, but if ODA finding is sought and obtained for any specific CPA, affirmation obtained from parties providing such funding, in accordance with applicable provisions related to official development assistance in the Project standard will be provided.
11	Project Target Group	The PoA intends to disseminate efficient EcoRecho stoves to the low-income population in the Republic of Haiti. Initial CPA is intended to replace the traditional stoves in the urban communes of Port-au-Prince, where the average consumption of charcoal has been determined through a Household Biomass Survey (HHBS) in 2010. In case, other CPAs are implemented in rural areas within the project boundary, where charcoal consumption may vary, CME must ensure that proper steps are taken to estimate the parameters involved in the estimation of Emission Reduction. In addition, each CPA must include	Additional Household Biomass Survey(s) will be conducted and provided if required, to account for the difference in baseline biomass consumption between urban and rural households. The result of any new HHBS will be presented in the CPA-DD before inclusion in the PoA. In addition, sample Purchase Receipt to be used by the specific CPA will be provided, which will include procedures to collect information on the type of stove customer is replacing. Only EcoRecho stoves that are sold to customer that are replacing traditional inefficient cook stoves will be included by the

Sl. No.	Eligibility Criteria		Items/Parameters to be checked for proof of eligibility for inclusion of a CPA under the PoA
	Category	Description	
		procedures to ensure only traditional inefficient cook stoves are targeted for replacement by the improved efficient EcoRecho cook stove applicable under the CPA.	specific CPA for emission reduction.
12	Sampling Method	Sampling to be undertaken as part of the CPA must be done in accordance with the requirements of the applied methodology AMS II G V4.0, and the latest applicable guidelines/standards for sampling and surveys.	CPA-specific excel spreadsheet will be provided, which will include important assumptions and calculations of the sample size for each parameter sampled.
13	De-bundling Check	CPA must establish that they are not a de-bundled component[34] of any other large scale CDM project activity.	Excel spreadsheet will be provided, which includes ex-ante calculation of energy savings from specific EcoRecho stove models planned for dissemination and included as part of the specific CPA. Ex-ante calculation will demonstrate that the thermal energy savings from each stove model included in a specific CPA is not greater than 1% of the small-scale threshold, which provides an exemption from conducting a de-bundling check.
14	Updating the CPA eligibility criteria	CME should include provisions to update the eligibility criteria in case of held or withdrawn methodologies, in accordance with CDM standard: Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities, CDM-EB65-A03-STAN, version 2.1., paragraph 23 and 24. If the version of methodologies applied by the CPA is revised or replaced, subsequent to being placed on hold, the CME shall update the eligibility criteria to the requirements of the revised or new methodologies with immediate effect. A new version of the PoA DD and generic CPA-DD	Methodology updates and status can be reviewed on the UNFCCC website. In situations where the methodology has been revised or replaced subsequent to being placed on hold or withdrawn, CME will incorporate the latest version of the PoA-DD and generic CPA-DD, including updates to the eligibility criteria and submit it for EB review. No action is required if the version of methodologies applied by the CPA-DD is revised without being placed on hold or is withdrawn for the purpose of inclusion in a consolidation of methodologies, unless otherwise indicated in a report of the meeting of the Board that has

[34] According to the "Guidelines on assessment of de-bundling for SSC project activities, v03 (EB 54, Annex 13, par. 10) for determining the occurrence of de-bundling under a Programme of Activities (PoA)", if each of the independent subsystem/measures included in the CPA of a PoA is not larger than 1% of the small scale threshold defined by the methodology applied, then that CPA of the PoA is exempted from performing de-bundling check, i.e. considered as being not a de-bundled component of a large scale activity.

Sl. No.	Eligibility Criteria		Items/Parameters to be checked for proof of eligibility for inclusion of a CPA under the PoA
	Category	Description	
		containing updated eligibility criteria validated by a DOE shall be submitted to the Board for approval.	approved the new methodologies.

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

In accordance with the methodology AMS.II.G version 4, Paragraph 5, the specific equations for calculation of Baseline emissions, Project emissions or Leakage are not provided; instead the equations for ERs are specified as follows:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\ fossil\ fuel} \quad (1)$$

Where:

ER_y = Emission reduction during the year y in tonnes of carbon dioxide equivalent (tCO_2e)

$B_{y,savings}$ = Quantity of woody biomass that is saved by the project activity 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

$NCV_{biomass}$ = Net Calorific value of the non-renewable woody biomass that is substituted (IPCC default value for wood fuel, 0.015 TJ/tonne)

$EF_{projected\ fossil\ fuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use the default value of 81.6 tCO_2/TJ specified in AMS.II.G ver. 04 methodology.

$B_{y,savings}$ will be determined using Option 2 provided by the AMS.II.G methodology, which is expressed as follows:

$$B_{y,savings} = B_{old} \cdot (1 - \frac{\eta_{old}}{\eta_{new}}) \quad (2)$$

where:

B_{old} = Quantity of woody biomass used in the absence of the project activity in tonne/yr

η_{old} = 1. Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of system is being replaced; or

2. A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney; for other types of systems a default value of 0.2 may be optionally used

η_{new} = Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. Use weighted average values if more than one type of system is being introduced by the project activity

Therefore the following parameters will need to be determined in order to calculate emission reductions.

1) Quantity of woody biomass used per year in the absence of the project activity (B_{old})
2) Efficiency of the system being replaced (η_{old})
3) Efficiency of the system being deployed (η_{new})
4) Fraction of woody biomass that can be established as non-renewable biomass ($f_{NRB,y}$)

Determination of B_{old}:

According to the methodology AMS II.G version 4, B_{old} is determined by using one of the two following options:

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

b) Calculated from the thermal energy generated in the project activity as:

$$B_{old} = \frac{HG_{p,y}}{NCV_{biomass} * \eta_{old}} \quad (3)$$

Where:

$HG_{p,y}$ = *Amount of thermal energy generated by the project technology in year y (TJ)*

For this proposed PoA, Option (a) will be used to determine B_{old}, The determination of B_{old} will be determined based on the number of stoves sold and the average annual charcoal consumption per stove, but which includes adjustments to account for the fraction of stoves sold that remain in use during the monitoring period, fraction of replaced traditional stoves that have been disposed and are no longer in use, the period that the stove is in operation and for leakage. The formula used for the calculation will be as follows:

$$B_{old} = NS_{CP} * f_{trad\text{-}unused} * SOF * Q_{biomass} * SOP * LAF \quad (3a)$$

where,

NS_{CP} =Total number of systems (i.e., stoves) in operation during the monitoring period (number).

$f_{trad\text{-}unsed}$ = Fraction of replaced traditional stoves either disposed or not in use during the monitoring period, estimated from annual monitoring survey.

$Q_{biomass}$ = Average annual biomass consumption per traditional stove (tonne/stove-year).

SOF = Stove operational fraction, which is estimated from annual monitoring at the level of the CPA of a sample of households that have purchased EcoRecho stoves to determine the fraction of the stoves sold under the umbrella of the CPAs that continue to be used.

SOP = Calculated average stove operating period during the monitoring period in years.

LAF = Leakage Adjustment Factor. The Net to gross Adjustment factor of 0.95 is applied in accordance with paragraph 13 and 23 of the AMS.II.G version 4 methodology.

The term SOP is expressed as follows:

$$SOP = \frac{\sum_{i=1}^{NS_{CP}} SOP_i}{NS_{CP}} \quad (3b)$$

where,

SOP = Average operating period considering all the systems in operation during the monitoring period (i.e., average operating period of the NS_{CP} stoves)

i = Number of stoves from 1 to NS_{CP}

SOP_i = The time period that the i^{th} stove in the group has been operational during the monitoring period (i.e., from the purchase date or beginning of the monitoring period to the end of the monitoring period or end of the stove life time). This parameter is determined for each of the NS_{CP} stoves based on the number of days that the stove was operating during the monitoring period divided by 365.

Determination of $Q_{biomass}$:

EarthSpark, on behalf of D&E, completed a HHBS in August 2011 by surveying 300 households in the three major sections of the Commune of Port-au-Prince (163 households in 1ere Section Turgeau; 47 households in 2eme Section Morne Hopital; and 89 households in 3eme Section Martissant). The commune of Port-au-Prince is estimated to have a total population of 875,978, with an average population density of 34,637 persons per square kilometre.

Based on the results of the survey, the household charcoal consumption was 180 pounds per month. In order to obtain charcoal consumption per stove, the average number of stoves in a household, which was found to be 2 stoves per household, was used, by dividing household charcoal consumption by number of stoves in a household. The weighted average charcoal consumption per stove was estimated to be 91 pounds per month per stove. B_{old} can then be determined using this charcoal consumption value, which was considered representative of Haiti's urban areas.

The question that was of interest and considered was whether the charcoal consumption as determined during the HHBS and used to determine B_{old} can be applied to all other areas of Haiti. Based on an analysis of the HHBS, it was found that a household with 2 stoves had a per-stove consumption that is approximately 1/2 that of a household with one stove; and a household with 3 stoves has a per-stove consumption that is approximately 1/3 that of a household with one stove. However, the monthly charcoal consumption per household was roughly the same across all households. The explanation for this was gleaned from the survey results, which found that it is more common for households with one stove to use a stove that has 2 or 3 burners than households with more than 2 stoves. In order to obtain a representative, yet conservative estimated for charcoal consumption per stove, the mean charcoal consumption per stove for 1-stove households and for 2 or more-stove households were both used to calculate an average charcoal consumption weighted by the number of stoves in each type of household. The weighted-average charcoal consumption in Port-au-Prince was estimated to be 91 pounds per month (lbs/month) per stove. This value was comparable to a similar study done independently for another commune (Les Anglais) where the average charcoal consumption per stove was found to be 90 lbs/month. This observed consistency in per-stove consumption across the two locations was taken to be positive evidence supporting the validity of the results. This is indicative that the average annual charcoal consumption per stove found in Port-au-Prince may be applicable to other areas of Haiti and that it is a conservative estimate of the charcoal consumption per stove.

For purposes of this PoA, the plan is to use the average charcoal consumption, $Q_{biomass}$ of 3.31 tonne/yr-stove (i.e., 91 lb/month/[lb/2.2 kg]*[12 months/yr]/ [tonne/1000 kg]*6.67[35] = 3.31 tonne per year) for determining B_{old} and for calculating emission reductions applicable to stoves sold within the metropolitan Port-au-Prince area. In the future, as dissemination of stoves extend beyond the Port-au-Prince urban areas, it is contemplated that additional HHBS will be conducted, as needed at the CPA level, if it is determined that a more accurate estimate of B_{old} is needed. Further details on the HHBS are provided in **Appendix 4**.

Determination of $f_{trad-unused}$:

An annual monitoring survey will be conducted to determine the value of $f_{trad-unused}$, which is an estimate of the fraction of replaced traditional stoves either disposed of or not in use during the monitoring period of the respective CPA.. The monitoring plan involves checking a representative sample of households that have purchased the EcoRecho stoves. A monitoring survey flowchart with detailed criteria and follow-up questions for identifying usage of traditional stoves, as specified in **Appendix 5** of the PoA, will be used to determine if any traditional stoves that should have been retired are still being used, which would require the charcoal consumption of those stoves to be excluded from B_{old}. The ratio of the number of replaced traditional stoves that are disposed or not being used to the total number of stoves in the sample of households sampled during the monitoring period is used to obtain $f_{trad-unused}$, which will be applied in accordance with **Equation 3a** to correct the NS_{CP} that is used to calculate B_{old}.

Determination of SOF:

The annual monitoring survey will also be used to determine the value of SOF, which is the fraction of efficient EcoRecho stoves sold under the umbrella of a CPA that continues to be used during the monitoring period. From the sample of households chosen for the annual survey, the ratio of the number of EcoRecho stoves sold that continue to be in operation, as intended under to the CPA, to the total number of stoves sold in the sample of households monitored during the crediting period is used to obtain SOF, which will be applied in accordance with **Equation 3a** to correct the NS_{CP} that is used to calculate B_{old}. The monitoring survey flowchart provided in **Appendix 5** provides further details regarding the process that will be used for determining the SOF value.

Determination of η_{old}:

The project activity involves the replacement of traditional charcoal cookstoves used in the Haitian market. All traditional stoves, however, are not the same. Traditional stoves, as shown in **Figure 6**, include the Recho Tol (made of tin or aluminum) and the Recho Fer (made of iron or steel). A modification of the Recho Tol, called the Recho Mirak, is also in use in Port-au-Prince but is much less common. The Recho Mirak, which translates to "miracle stove," is a type of efficient stove. However, the Recho Mirak is all artisan-made in small batches, and the quality (i.e., efficiency) tends to be highly variable from stove to stove.

[35] The conversion factor from charcoal to wood of 6.67 is taken from ESMAP Technical Paper 112/07 April 2007; Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources; Page 21

Figure 6: Recho Tol (Left) & Recho Fer (Right)

The project activity will only be replacing the Recho Tol and Recho Fer charcoal stoves not the Recho Mirak, which can be considered as an efficient stove.

Furthermore a study conducted by ESMAP[36], found that the Recho Mirak stove almost disappeared from the market after successfully selling 20,000 units during the promotional phase. The reasons for this model no longer being manufactured or sold are: (i) it was more expensive than traditional stoves, because of the small production scale; (ii) the advertisement and promotion campaigns ended after less than two years; and (iii) quality problems caused by pirated versions manufactured by unqualified artisans. Those facts further underline the additionality arguments.

According to AMS.II.G version 4, η_{old} is determined based on the following:

1. Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of system is being replaced;
2. A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney; for other types of systems a default value of 0.2 may be optionally used

Recho Tol and Recho Fer can be considered conventional systems, with no improved combustion air supply or flue gas ventilation system; therefore the default value of 0.10 will be used for the efficiency of such conventional systems, as allowed by the methodology. As the PoA progress, additional testing for thermal efficiency of the traditional charcoal stoves may be conducted if traditional stoves targeted for replacement under the CPA of the PoA has changed, e.g., traditional wood burning stoves for rural market, traditional commercial stoves, etc. Adjustment of η_{old} value will be reported at the CPA level.

Determination of η_{new}:

In accordance with the AMS.II.G version 4 methodology, η_{new} is determined as follows:

"Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. Use weighted average values if more than one type of system is being introduced by the project activity"

A study was conducted by Lawrence Berkeley National Laboratory[37] (LBNL) in April 2010. The D&E EcoRecho stove was one (1) of the five (5) charcoal stoves tested at the LBNL stove testing facility using

[36] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources; Page 51
[37] Performance of Charcoal Cookstoves for Haiti, Part 1: Results from the Water Boiling Test – June 2011

a modified form of version 3 of the Shell Foundation Household Energy Project WBT. The stove was tested for time to boil, thermal efficiency, specific fuel consumption, and emission of CO, CO_2, and the ratio of CO/CO_2. **Table 8** summarizes the results of the LNBL study.

Table 8. Results of WBT of EcoRecho Stove

Stove Type	Thermal Efficiency (Entire WBT)	Time to boil from Cold Start (Minutes)	Time to Boil from Hot start (Minutes)	Temperature adjusted specific Fuel consumption (g)	Total CO_2 emissions in all phases (g)
EcoRecho stove	31.6%	55.2	32.1	324	1376

Currently, the project activity involves dissemination of two models of the EcoRecho stoves, large and medium sized stoves, which may differ in their efficiencies. The study conducted by LBNL did not identify in their final report which type of stove was tested. Therefore, in January 2012, additional testing was conducted by Colorado State University (CSU) on both the large and medium sized stoves using replicate samples and a modified form of version 3 of the Shell Foundation Household Energy Project WBT, identified as the Stove Manufacturers Emission & Performance Test Protocol (EPTP). The test results for thermal efficiency are provided below in **Table 9**.

Table 9. EPTP Results of Efficiency of EcoRecho Stoves

Parameter	Large sized EcoRecho stoves	Medium sized EcoRecho stove
High power thermal efficiency	24.4 ± 1.2	29.2 ± 1.8

The project activity subscribed by the PoA will involve implementation of new machinery upon commencement of the PoA. The new machinery will be needed to scale up the project and to streamline the stove manufacturing process, which currently is all artisan-made. The current manufacturing process tends to lead to high variability in the efficiency values and it is planned that the new machinery and streamlined manufacturing process will lead to a reduced variability in the efficiency values. Therefore additional testing will be conducted upon commissioning of the new stove manufacturing process, and the results will be reported at the CPA level. For ex-ante emission reduction estimation a weighted average thermal efficiency will be determined based on the CSU test results and fraction of each type of stove disseminated, as presented in **Table 10**.

Table 10. Weighted Average Efficiency Calculations

Parameter	Large sized EcoRecho stoves	Medium sized EcoRecho stove
High power thermal efficiency	24.4 %	29.2%
Estimated percent of each type of stove disseminated.	P_L % (assume 20% for example calculation	P_M % = 100-P_L (assume 80% for example calculation
η_{new} (weighted average value)	**{(0.244 * P_L/100)+(0.292 * P_M/100)}/{(P_L+P_M)/100} Example Calculation: {(0.244*0.2)+(0.292*0.8)}/1 = 0.2824**	

Determination of $f_{NRB,y}$:

The current status of forest in Haiti remains at 1-2%. Studies have found that under certain circumstances, scarcities of renewable resources, such as cropland, forests and water produce civil conflict and

instability. These environmental resource scarcities result in degradation and depletion of renewable resources, the increased consumption of these resources and their inequitable distribution[38]. Most of the forest lands have been converted to agricultural and livestock use, or simply deforested for charcoal production, without replanting, leading to extensive erosion[39]. In addition, USAID reports state that restrictions on harvesting from National Parks (created in 1968 under joint administration by the Ministry of Agriculture and the Office National du Tourisme) are not strictly enforced[40]. In this situation, it can be surmised that the majority of the woody biomass sourced for charcoal production is non-renewable. In order to quantify the non-renewable biomass fraction, values ascribed to Haiti on a national basis will be applied as provided in the 2010 FAO Global Forest Resource assessment and EB 67, Annex 22 – Default values of fraction of non-renewable biomass for least developed countries and small island developing States. Justification for using national values is provided later in this section. As specified by EB 67, Annex 22, the following formulae will be applied:

$$f_{NRB,y} = NRB/(NRB+DRB) \quad (4)$$

Where,
NRB = Non-Renewable Biomass
DRB = Demonstrably Renewable Biomass

Determination of Demonstrably Renewable Biomass (DRB)

According to the AMS II.G methodology, "*Project participants shall determine the shares of renewable and non-renewable woody biomass in B_{old} (the quantity of woody biomass used in the absence of the project activity) the total biomass consumption using nationally approved methods (e.g. surveys or government data if available) and then determine $f_{NRB,y}$, as described below. The following principles shall be taken into account:"*

"In establishing woody biomass as renewable, one of the following conditions are to be satisfied:

I. The woody biomass is originating from land area that are forests where:

a. The land area remains a forest; and

b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decreases over time (Carbon stocks may temporarily decrease due to harvesting); and

c. Any national or regional forestry and nature conservation regulations are complied with.

II. The biomass is woody biomass and originates from non-forest areas (cropland, grasslands) where:

a. The land area as non-forest or is reverted to forest; and

b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decreases over time (Carbon stocks may temporarily decrease due to harvesting); and

[38] Environmental Scarcities and Conflict in Haiti Ecology and Grievances in Haiti's troubled past and Uncertain Future, Philip Howard, June 1998, Pg 13.
[39] Disaster Management Programs for Priority Countries, Latin America & Caribbean.
[40] USAID, Haiti Country Analysis of Tropical Forestry and Biodiversity 2006, Pg. 16

c. *Any national or regional forestry and nature conservation regulations are complied with."*

DRB will be determined in accordance with EB 67, Annex 22, by applying 2010 FAO Forest Resource Assessment value on "Protected Area Extent of Forest" and 2006 IPCC Guidelines for National Greenhouse Gas Inventories value on "Annual Growth Rate of Biomass".–The following formula will be applied:

$$DRB = PA * GR \quad (5)$$

Where:

PA = Protected Area Extent of Forest (ha)
GR = Annual Growth Rate of Biomass (t/ha-yr)

Determination of Non-renewable Biomass (NRB):

The methodology describes this parameter as follows:

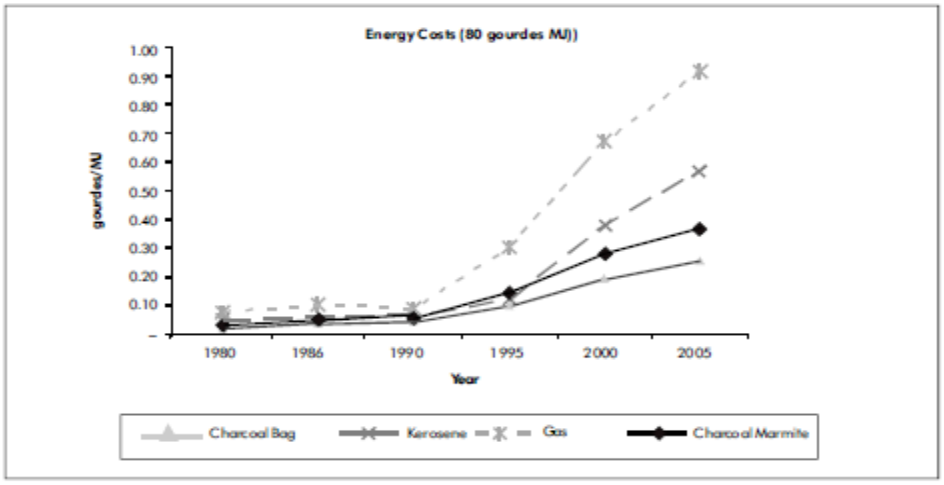
"Non-renewable woody biomass (NRB) is the quantity of woody biomass used in the absence of the project activity (B_{old}) minus the demonstrably renewable biomass (DRB) component. The definition can be used to calculate NRB as long as at least two of the following supporting indicators are shown to exist:

- *A trend showing an increase in time spent or distance travelled for gathering fuelwood, by users (or fuel-wood suppliers) or alternatively, a trend showing an increase in the distance the fuel-wood is transported to the project area;*
- *Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area;*
- *Increasing trend in fuel wood price indicating scarcity of fuel-wood;*
- *Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass."*

As mentioned earlier, USAID and ESMAP studies have reported that carbon stocks in the form of forest cover has been depleted at a rapid pace and have recognized that Haiti is facing an environmental catastrophe.

In Haiti charcoal is distributed by a network of producers, local and regional transporters, wholesalers and retailers, all of whom add to the cost of charcoal to the consumer. However, the market price of charcoal is still a good indicator of resource scarcity, and the World Bank has charted the increasing scarcities of fuelwood resources by following charcoal price trends. Up to the late 1960s, fuelwood was relatively abundant and real prices remained steady. Between 1968 and 1986 prices increased by about 5 % each year, a period of "relative scarcity" according to the World Bank[41]. With the decreases in forest land, fuelwood demand has increased many-fold. In addition, charcoal prices have increased rapidly, as have other fuels, since 1990 as shown in **Figure 7**.

[41] Environmental Scarcities and Conflict in Haiti Ecology and Grievances in Haiti's troubled past and Uncertain Future, Philip Howard, June 1998, Pg 19.



Sources: ESMAP and BME.

Figure 7: Trends in Charcoal prices

In light of the above discussion as well as EB 67 Report, Annex 22', NRB is determined using 2010 FAO Forest Resource Assessment values on "Extent of Forests and "Annual change in living forest biomass". The following formula is applied:

$$NRB = R - DRB \quad (6)$$

Where:

R = Total annual biomass removals (t/yr)

Further, for the determination of R, the following formula was used:

$$R = MAI + \Delta F \quad (7)$$

Where:

MAI = Mean Annual Increment of biomass growth (t/yr).
This parameter is determined as the product of Extent of Forest (F), in hectares and Annual Growth Rate of biomass growth (GR), in t/yr.

ΔF = Annual change in living forest biomass (t/yr)

Further guidance is provided by the methodology, which states:

> *In cases of charcoal produced from woody biomass, the demonstration of renewability shall be done for the areas where the woody biomass is sourced."*

Charcoal is distributed by network of producers, local and regional transporters, wholesalers and retailers; the source of its production is not limited to a particular area.[42] A survey conducted by ESMAP[43] revealed that charcoal is produced all over Haiti and includes Grande-Anse, Belle-Anse, Aquin, the south coast, the Plateau central and the north-west region. A different study conducted by Stevenson in 1989 provided a similar account of sources of charcoal for the Port-au-Prince market as shown in **Figure 8**. It can be

[42] Stevenson, G.G., "The production, distribution and consumption of fuelwood in Haiti," Journal of Developing Areas 24 (October 1989), Pg 59 – 76.
[43] Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Fuelwood Resources, ESMAP, 2007,; Pg 19

inferred that the woody biomass sourced for charcoal production is sourced from all over Haiti, even as far back as 1989. The continuing increase in shortage of wood resources, which can be attributed to the decline of forest cover to a mere 1.44 % of the nation's territory, and the practice of procurement of woody biomass for charcoal production from all over Haiti is still practiced today. Hence it is not possible to precisely identify the source of the charcoal saved under the project activity.

Figure 8: Sources of charcoal and transportation routes for the Port-au-Prince charcoal market

Considering the above discussion on charcoal production and the specific activity subscribed by the PoA, which involves dissemination of improved cook stoves (ICS) throughout Haiti, national-level renewability data will be used. EB 67, Annex 22 – Default values of fraction of non-renewable biomass for least developed countries and small island developing States was used to obtain the Haiti-specific default value of **96%** for $f_{NRB,y}$ and will be applied to each CPA included under the PoA. **Appendix 4** contains additional details regarding the calculations and source of data.

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

Data / Parameter	**$Q_{biomass}$**
Unit	tonne/(stove-yr)
Description	Annual average biomass consumption per stove
Source of data	Household Biomass Survey (HHBS) conducted by EarthSpark for urban areas of Port-au-Prince, in accordance with the 'General guidelines for sampling and surveys for small-scale CDM project activities'. Sample size was selected so as to ensure a 90/10 precision along with the 5 % margin of error. A total of 300 households were surveyed during the HHBS.
Value(s) applied	3.31
Choice of data or Measurement methods and procedures	The value is obtained based on historical data and survey results within the project boundary, as required by the methodology.
Purpose of data	Calculation of baseline emissions
Additional comment	Used for calculation of B_{old}. Additional HHBS surveys may be conducted and reported at the CPA level to account for difference in $Q_{biomass}$ value between rural and urban household.

Data / Parameter	$f_{Wood\ to\ Charcoal}$
Unit	kg/kg
Description	Ratio of mass (kg) of wood used to the mass (kg) of charcoal produced
Source of data	2007 ESMAP report, "Haiti Strategy to Alleviate the Pressure of Fuel Demand".
Value(s) applied	6.67
Choice of data or Measurement methods and procedures	2007 ESMAP report, on page 14, states that that "Most charcoal producers use traditional grindstones, which only produce 10-15 kg of charcoal per 100 kg of (dry) wood. This represents a loss of resources: households using firewood for cooking use fewer trees than those using charcoal. If he used an improved grindstone, a coalman could almost double his production, and, therefore, his income." To be conservative, the lower wood-to-charcoal ratio based on 100 kg of wood input to generate 15 kg of charcoal was used to obtain the value of 6.67
Purpose of data	Calculation of baseline emissions
Additional comment	Fixed Parameter

Data / Parameter	η_{old}
Unit	Fraction or percent
Description	Efficiency of the baseline systems being replaced, measured using representative sampling methods or based on referenced literature (fraction), use weighted average values if more than one type of systems are encountered.
Source of data	AMS II.G Version 4
Value(s) applied	0.10 or 10%
Choice of data or Measurement methods and procedures	According to the methodology, a default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney; for other types of systems a default value of 0.2 may be optionally used. Recho Tol and Recho Fer can be considered as examples of conventional systems, with no improved combustion air supply or flue gas ventilation; therefore the default value of 0.10 is deemed appropriate.
Purpose of data	Calculation of project emissions.
Additional comment	Over time, as the PoA progresses, additional testing for thermal efficiency of the traditional charcoal stoves may be conducted if traditional stoves targeted for replacement using the PoA changed, e.g., use of wood burning stoves or stoves that may be different for the rural market, use of commercial stoves, etc. Revisions to η_{old} will be reported at the CPA level.

Data / Parameter	$NCV_{biomass}$
Unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	AMS II.G Version 4
Value(s) applied	0.015
Choice of data or Measurement methods and procedures	Adopted IPCC 2006 default value
Purpose of data	Calculation of baseline emissions
Additional comment	Fixed Parameter

Data / Parameter	$EF_{projected\_fosilfuel}$
Unit	tCO_2/TJ
Description	Emission factor for the substitution of non-renewable woody biomass by similar consumers.
Source of data	AMS II.G Version 4
Value(s) applied	81.6
Choice of data or Measurement methods and procedures	The methodology used suggests that the emission factor of the substitution fuels likely to be used by similar users, be obtained as a weighted average of the fuels used. It is assumed that the mix of present and future fuels used would consist 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).
Purpose of data	Calculation of baseline emissions
Additional comment	Fixed Parameter

Data / Parameter	$f_{NRB,y}$
Unit	Fraction or percent
Description	Fraction of woody biomass saved by the project activity in the year y that can be established as non-renewable biomass
Source of data	EB 67, Annex 22 – Default values of fraction of non-renewable biomass for least developed countries and small island developing States
Value(s) applied	0.96 or 96%
Choice of data or Measurement methods and procedures	Detailed calculation performed in accordance with the 'Default values of fraction of non-renewable biomass for least developed countries and Small Island developing States". **Appendix 4** contains detailed calculations.
Purpose of data	Calculation of baseline emissions
Additional comment	Fixed Parameter

Data / Parameter	Leakage Adjustment Factor (LAF)
Unit	Fraction
Description	Diversion of non-renewable biomass saved under the project activity by non-project households
Source of data	AMS II.G Version 4
Value(s) applied	0.95
Choice of data or Measurement methods and procedures	The use/diversion of non-renewable woody biomass saved under the project activity by non-project users that previously used renewable energy sources, is impossible to identify. Charcoal consumed is sourced from various locations in Haiti. Hence, the default leakage value of 0.95 suggested in the methodology has been adopted in the calculation of ER.
Purpose of data	Calculation of leakage.
Additional comment	Fixed Parameter

B.6.3. Ex-ante calculations of emission reductions

Formulas used for calculation of emission reductions are provided in section B.6.1, Part II. The tables below provide a summary of the values of each of the parameters available before validation, as stated above in section B.6.2, Part II; and the estimated values of parameters that will be determined based on the results of the monitoring plan, as stated below in section B.7.1.

Determination of B_{old}:

B_{old} refers to the quantity of woody biomass used in the absence of the project activity in period y and will be calculated as per **Equation 3(a)** in Section B.6.1.

Parameter ID	Description	Unit	Value used	Source of data
$Q_{charcoal}$	Average annual consumption of charcoal per stove	t/(y-stove)	0.50	Household Biomass Survey for urban areas of Port-au-Prince.
$f_{Wood\ to\ Charcoal}$	Ratio of mass (kg) of wood used to the mass (kg) of charcoal produced	kg/kg	6.67	2007 ESMAP report, "Haiti Strategy to Alleviate the Pressure of Fuel Demand"
$Q_{biomass}$	Average annual consumption of woody biomass per stove	t/yr	3.31	$Q_{charcoal} * f_{Wood\ to\ Charcoal}$
NS_{CP}	Maximum number of stoves that can be included in a CPA such that the energy savings do not exceed the small-scale threshold limit	Number	20,200	Ex-ante calculation of maximum number of stoves corresponding to the small-scale threshold (see **Appendix 3**).
$f_{trad-unused}$	Fraction of replaced traditional stoves disposed or not in use	Fraction	0.95	Ex-ante Estimation

Parameter ID	Description	Unit	Value used	Source of data
SOF	Stove Operational Fraction representing the fraction of stoves in operation	Fraction	0.90	Ex-ante Estimation
SOP	Stove Operating Period representing the average length of time that stoves included in a CPA operate during the monitoring period	yr	1	Ex-ante Estimation
LAF	Leakage Adjustment Factor or Net-to-gross adjustment factor for NRB Leakage	Fraction	0.95	AMS.II.G ver. 04
B_{old}	**Quantity of woody biomass used in the absence of the project activity in period y**	**t/yr**	**54,321**	**$NS_{CP} * f_{trad-unused} * SOF * Q_{biomass} * SOP * LAF$**

Determination of $B_{y\ savings}$:

$B_{y\ savings}$ refers to the quantity of woody biomass that is saved in period y and will be calculated as per **Equation 2** in Section B.6.1.

Parameter ID	Description	Unit	Value used	Source of data
η_{old}	Thermal efficiency of the baseline system being replaced	Fraction	0.10	AMG.II.G ver. 04
η_{new}	Thermal efficiency of the new system being deployed as part of the project activity	Percent	28.24	Ex-ante calculation based on weighted average see table10
B_{old}	Quantity of woody biomass used in the absence of the project activity in period y	t/yr	54,321	Calculated (see table associated with determination of B_{old} above)
$B_{y,savings}$	**Quantity of woody biomass that is saved**	**t/yr**	**35,085**	**$B_{old} * (1- \eta_{old} / \eta_{new})$**

Determination of Emission Reduction:

In accordance with the methodology, which does not provide a formula for calculating baseline emissions and project emissions separately, **Equation 1** in Section B.6.1 was used to estimate the ERs.

Parameter ID	Description	Unit	Value used	Source of data
$B_{y,saving}$	Quantity of woody biomass that is saved through the CPA in period y	t/yr	35,085	Calculated in Table above
$f_{NRB,\ y}$	Fraction of woody	Fraction	0.96	EB 67, Annex

Parameter ID	Description	Unit	Value used	Source of data
	biomass saved by the project activity in period y that can be established as non-renewable biomass			22
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted	TJ/tonne	0.015	AMS II.G ver. 4 Default value
$EF_{projected\_fossilfuel}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers	tCO_2/TJ	81.60	AMS II.G ver. 4 Default value
ER_y	**Emission reductions from project activity during period y**	**tCO_2e/yr**	**41,227**	$B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$

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	NS_{CP}
Unit	Number
Description	The total number of EcoRecho stoves in operation under a CPA during a monitoring period
Source of data	Purchase Receipts and Electronic Data archival System (EDAS). Sales projections have been used to estimate value for ex-ante emission reduction calculation.
Value(s) applied	Medium EcoRecho stove model: 16,160 Large EcoRecho stoves model: 4,040
Measurement methods and procedures	The purchase receipt signed between the buyer and the seller will record details of the purchaser and will be archived in triplicate. The Purchase Contract will require the buyer to cooperate in the project monitoring procedures. Monitoring team will launch an easy SMS programme for distributors to transmit information on each sale in real time to the EDAS.
Monitoring frequency	Annual
QA/QC procedures	All purchase receipt will be backed up with paper copies
Purpose of data	Calculation of baseline emissions.
Additional comments	Data Collection procedures will be reviewed annually by the CME to assure compliance to prescribed guideline and take corrective measures in cases of deviations. The number of medium to large stove models assumes an 80%:20% distribution of stoves sold.

Data / Parameter	η_{new}
Unit	Fraction or percent
Description	Efficiency of the EcoRecho stoves sold
Source of data	Water boiling test (WBT) on operational stoves.
Value(s) applied	0.2824 or 28.24%
Measurement methods and procedures	WBT will be performed on a representative number of samples of the EcoRecho stove to be used in the specific CPA. The representative number of stoves to be sampled will be determined based on the CPA sampling plan, which will involve selecting randomized operational stoves for testing. WBT will be performed by a qualified third party testing agency or trained personnel within the CME. The number of stoves tested will meet the reliability criteria of 90/10 confidence/precision for annual monitoring.
Monitoring frequency	Annual.
QA/QC procedures	Testing procedures will be reviewed annually by the CME to assure compliance to prescribed guideline and take corrective measures in cases of deviations.
Purpose of data	Calculation of baseline emissions.
Additional comments	Value estimated for ex-ante emission reduction calculations is based on a weighting of 80% medium to 20% large stoves sold. Weighted average based on ex-post annual thermal efficiency testing will be used for ex-post emission reduction calculation.

Data / Parameter	**SOF**
Unit	Fraction or percent
Description	Stove Operational Fraction (fraction of EcoRecho stoves operating or replaced by equivalent in-service appliance)
Source of data	Annual survey and customer feedback. Estimated value has been used for ex-ante emission reduction calculation.
Value(s) applied	0.90 or 90%
Measurement methods and procedures	SOF is the statistically reliable estimate of the fraction of stoves still in operation from among the total number of stoves operating in a given monitoring period. The SOF will be determined based on annual sampling of households and customer surveys to meet the reliability criteria of 90/10 confidence/precision.
Monitoring frequency	Annually
QA/QC procedures	Annual surveys will be conducted along with periodic customer follow-up surveys conducted by the monitoring team. Quality assurance team will review and solve any discrepancies found during the annual surveys.
Purpose of data	Calculation of baseline emissions.
Additional comments	Refer to monitoring survey flow chart for specific procedures to be followed by the monitoring team. The monitoring survey flow chart may be revised to improve the efficiency of data collection procedures based on site specific field conditions not contemplated during the design phase of the PoA. Any changes will be reported at the CPA level.

Data / Parameter	$f_{trad\text{-}unused}$
Unit	Fraction or percent
Description	Fraction of replaced traditional stoves disposed or not in use.
Source of data	Annual survey and customer feedback. Estimated value will be used for ex-ante emission reduction calculation.
Value(s) applied	0.95 or 95%
Measurement methods and procedures	$f_{trad\text{-}unused}$ is the statistically reliable estimate of the fraction of replaced traditional stoves that have been disposed or not in use (i.e., replaced by EcoRecho stoves) in a given monitoring period. The $f_{trad\text{-}unused}$ will be determined as the ratio of replaced/disposed/not-in-use traditional stoves to the total number of EcoRecho stoves sold during the monitoring period and will be based on annual sampling of households and customer surveys to meet the reliability criteria of 90/10 confidence/precision for this parameter.
Monitoring frequency	Annually
QA/QC procedures	Annual surveys will be conducted along with periodic customer follow-up surveys conducted by the monitoring team. Quality assurance team will review and solve any discrepancies found during the annual surveys.
Purpose of data	Calculation of baseline emissions
Additional comments	Refer to monitoring survey flow chart for specific procedures the monitoring team will follow. The monitoring survey flow chart may be revised to improve the efficiency of data collection procedures based on site specific field conditions not contemplated during the design phase of the PoA. Any changes will be reported at the CPA level.

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

The AMS.II.G version 4 methodology requires a monitoring plan to be developed, which provides a method for:

- *Checking the efficiency of all appliances or a representative sample thereof, at least once every two years (biennial) to ensure that they are still operating at the specified efficiency (η_{new}) or replaced by an equivalent in service appliance. Where replacements are made, monitoring shall also ensure that the efficiency of the new appliances is similar to or higher than the appliances being replaced.*

- *Checking of all appliances or a representative sample thereof, at least once every two years (biennial) to determine if they are still operating or are replaced by an equivalent in service appliance.*

In addition, monitoring shall ensure that:

a) Either the replaced low efficiency appliances are disposed of and not used within the boundary or within the region; or

b) If baseline stoves continue to be used, monitoring shall ensure that the fuel-wood consumption of those stoves is excluded from B_{old}.

Following the commencement of the PoA, the CME will initiate a comprehensive monitoring plan to collect data and ensure accurate estimation of parameters used for ER calculations. The following parameters will be monitored:

Table 11. Monitoring Parameters

Parameter	Description
NS_{CP}	Total number of EcoRecho stoves in operation during the monitoring period.
η_{new}	Thermal efficiency of EcoRecho stoves manufactured using new machinery and manufacturing process, which is determined from stove testing (WBT or equivalent) results.
SOF	Stove Operational Fraction (fraction of stoves operating or replaced by an equivalent in-service appliance) estimated from annual monitoring survey.
$f_{trad\text{-}unused}$	Fraction of replaced traditional stoves disposed or not in use, estimated from annual monitoring survey.

Monitoring of NS_{CP}:

D&E will introduce permanent engraving of a unique identification number on the stoves (and/or attaching a RFID tag, if appropriate) since labels stand the risk of being torn or becoming unreadable over time. D&E will collect data needed for accurately estimating the monitoring parameters used for ER calculations, and the information will be recorded using the EDAS database. The EcoRecho stoves are transferred to a storage facility after manufacturing from where they are distributed to the network of distributors on contract with D&E. These distributors then sell the stoves within metropolitan Port-au-Prince and other areas of Haiti. However stoves sold under each CPA of the PoA will be uniquely identified and tagged and carbon credits will only be claimed for those stoves used within the PoA boundaries (i.e., within Haiti) identified for each CPA.

The following data will be collected for each sale and maintained in the EDAS:

- Name of Buyer
- Address, if known, and Area where buyer lives and plans to use the stove
- Telephone number of buyer
- Stove identification number (s)
- Date of purchase
- Name/ID of Seller/Distributor
- Telephone number of seller/distributor
- Type of traditional stove(s) used by the customer (i.e., buyer) prior to the purchase of an EcoRecho stove and identification of the traditional stove(s) that the customer intends to replace.
- Attestation/Signing of an Agreement by the customer that the traditional stove being replaced by the EcoRecho purchase will no longer be used.
- Carbon credit waiver transferring the stove's ER to the CME (i.e., D&E).
- Manufacturer's warranty and return policies

Further details on the EDAS system is provided in **Appendix 5**.

Determination of η_{new}:

Annual stove testing for thermal efficiency using the WBT or equivalent protocol, in conformance with the methodology, will be conducted on a representative number of operational EcoRecho stoves. **Appendix 6** provides further details regarding sampling procedures.

Determination of Stove Operational Fraction (SOF):

SOF is the statistically estimated fraction of EcoRecho stoves still in operation from among the total number of stoves sold in a given monitoring period. The SOF will be determined based on annual

sampling of households. Details of the annual on-site household survey are provided in **Appendix 5**. Further details regarding sampling procedures are provided in **Appendix 6**.

Determination of $f_{trad\text{-}unused}$:

The parameter, $f_{trad\text{-}unused}$, is an important factor that represents the fraction of low efficiency appliances (i.e., traditional stoves) that were slated for replacement with higher efficiency EcoRecho stoves and which have been disposed and are not in use. This fraction is used to adjust the value of NS_{CP}. Based on the HHBS survey conducted by D&E in 2011, it was found that it is very common to find more than one stove per household and it is likely that the consumer will not replace all stoves at once. As a result, tracking the usage of the replaced stove can be difficult. To find a practical solution, customer attestation that the replaced traditional stove will not be used will be obtained as a pre-condition to the sale of the EcoRecho stove. In addition, a clearly defined decision flow chart (see **Figure 9** in **Appendix 5**) has been developed and will be used during the annual monitoring survey, which will include a representative number of households with EcoRecho stoves from among the total stoves sold. Information gathered from the monitoring survey will be used to determine the fraction of replaced traditional stoves disposed, or not in use ($f_{trad\text{-}unused}$), which will be applied to obtain the total number of valid systems (i.e., stoves) in operation during the monitoring period.

Sampling

In accordance with the Sampling Plan provided in **Appendix 6**, each CPA is required to provide specific values and assumptions used in determining statistically valid number of samples required to conduct the annual household survey and annual thermal efficiency testing. A summary of the key parameters and assumptions used as part of each CPA will be reported at the CPA level and must be in accordance with the PoA Sampling Plan.

The scenarios likely to be observed during the monitoring survey of households are as summarized below in **Table 12**:

Table 12. Household Scenarios – Number and Type of Stoves Encountered

Number of Traditional Stoves	Number of EcoRecho Stoves		
	0	**1**	**>1**
0	A	C	C
1	B	D	F
>1	B	E	G

- Scenario A: No stoves in household are either traditional or EcoRecho (some other type of stove present). This represents a household that does not have a stove that is part of this PoA, or has transferred the stove to another user.
- Scenario B: All stoves in household are traditional stove(s), no EcoRecho stove is found. This represents a household that has no stove that is part of this PoA, or has transferred the stove to another user.
- Scenario C: All stoves in household are EcoRecho stove(s); no traditional stove is found. This represents a household in which no adjustment to NS_{CF} is required, since $f_{trad\text{-}unused}$ is 1.0.
- Scenario D: One traditional stove and one EcoRecho stove in household. This scenario needs additional queries to confirm the nature of the usage of the traditional stove and whether the EcoRecho has replaced a previously owned traditional stove to decide if $f_{trad\text{-}unused}$ needs to revised.

- Scenario E: More than one traditional stove and one EcoRecho stove in household. This scenario needs additional queries regarding the size of the household and how the traditional stoves are used, how many stoves they had prior to the EcoRecho purchase and whether the EcoRecho replaced a previously owned traditional stove. The answers to these questions and the additional criteria described below will be used to determine if $f_{\text{trad-unused}}$ needs to be revised.
- Scenario F: More than one EcoRecho stove and one traditional stove in household. This scenario represents a household where the EcoRecho is being used and it is reasonable to assume that the EcoRecho stove(s) properly replaced a previously used traditional stove. Some additional queries may be necessary to determine how the traditional stove is being used and whether it serves only as an emergency stove.
- Scenario G: More than one traditional stove and more than one EcoRecho stove in household. This scenario may indicate a household with a large number of people. Additional queries regarding the size of the household and how the traditional stoves are used, how many stoves they had prior to the EcoRecho purchase and whether the EcoRecho stove(s) replaced previously owned traditional stoves. The answers to these questions and the additional criteria described below will be used to determine if $f_{\text{trad-unused}}$ needs to be revised.

The flowchart and annual survey design in **Appendix 5** provides the step-wise decision process to be used during the monitoring survey to help determine: (i) if the replaced (traditional) stove has been disposed and/or is not in use; and (ii) if the EcoRecho stoves that are part of a CPA continues to be used during the monitoring period. Where traditional stoves are present along with the EcoRecho stoves, the determination of whether EcoRecho stoves in use properly replaced a traditional stove will be based on an analysis of the following:

1. Customer attestation;
2. Household characteristics gathered from previous surveys results, and
3. Survey questionnaire responses.

1. Customer Attestation

Each time an EcoRecho stove is sold, the distributor will obtain information from the customer regarding the traditional stove that the customer intends to replace. The distributor will also ask the customer for a commitment (attestation) that the current stove in use (traditional stove) will be disposed/destroyed and not used or given as a gift to a family member or friend. The information will be recorded in the PR and the PR will be provided to D&E for entry into the EDAS. The attestation will not be a prerequisite for the distributor to sell a EcoRecho stove to the customer; however, only new and returning EcoRecho stove customers that attest to prior use of a traditional stove and agree that the replaced traditional stove will be discontinued and discarded will have their EcoRecho stoves listed and counted (NS_{CP}) under this PoA, and be subject to the annual monitoring survey.

2. Household characteristics from previous survey results

Based on the HHBS, a household uses on average 2 stoves. In addition, the HHBS along with other studies found the average household has 5 people[44]. This translates to an average of 2.5 persons per stove. Based on this data on characteristics of Haitian households, the following criteria will be applied in the decision process:

[44] HHBS result indicates an average of 4.1 people per household. USAID, Assessment of Haiti Alternative Cooking Technologies Program, 2010, Pg. 13, shows an average of 4.9 people per household. An average of 5 people per household will be applied.

- Given the average household uses two stoves, if Scenarios D or F is observed (i.e., one traditional stove and one or more EcoRecho stoves), it can be reasonably assumed that prior to the purchase of the EcoRecho stove, the household was likely using two traditional stoves, and one of which has been replaced with an EcoRecho stove currently is use.

- If Scenarios E or G is observed, the number of people in the surveyed household will be considered. If the household size is large, i.e. 6 or more people and the number of traditional stoves observed is 2 along with an EcoRecho stove (i.e., Scenario E with a total 3 stoves observed), then it can be reasonably assumed that the EcoRecho stove very likely replacing a traditional stove and that the traditional stoves in use are required to satisfy the cooking needs of the larger household

If the above criteria (Conditions D, E, F or G) are observed, then the household will be subject to further follow-up questions as described below to provide additional information to determine the fraction of replaced traditional stoves disposed and not in use ($f_{trad\text{-}unused}$).

3. Survey Questionnaire Responses

The Monitoring Survey questions will be designed to gather information on number of persons in the household, stove usage, previous stoves used, recent stoves purchased etc. The following are some examples of questions that will be asked during the survey:

- Has the EcoRecho stove you purchased replaced any traditional stove that you were previously using?
- Is the EcoRecho stove used as the primary stove for cooking?
- Have you recently purchased any new stoves after the purchase of the EcoRecho stove? If so what type of stove.
- How many persons reside in the household?
- If a traditional stove is used along with the EcoRecho, is it used only for rare occasions such as festivals, family events, etc.? If so, how many times in a quarter or year is the traditional stove used?
- Any other questions, as appropriate, to decide if the replaced stove is still in use.

Stove life time:

Stove life time will be reported at the CPA level, specific to EcoRecho stove models disseminated within the specific CPA. Until new information becomes available, the stove life time will be assumed to be no more than 2 years of operation for both the medium and large EcoRecho stove models included in this PoA. Stoves that are still in operation after the pre-determined life time of 2 years will not be counted for purposes of emission reduction calculations.

Leakage Adjustment Factor:

B_{old} is multiplied by a net gross adjustment factor of 0.95 to account for leakages according to the methodology, in which case ex-post surveys are not required to estimate the LAF. This parameter accounts for the leakage due to an increase in the use of non-renewable woody biomass by non-project households/users that is attributable to the project activity.

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

1. Contact information for the CME

Organization:	D&E Green Enterprises
Street/P.O. Box:	29 W 138th Street, Suite 5E
Building:	
City:	New York
State/Region:	New York
Postfix/ZIP:	10037
Country:	United States of America
Telephone:	+1-646-645-0780 (USA number); +509-4848-5118 (Haiti number)
FAX:	+39 06 83059349
E-Mail:	dfednard@gmail.com
URL:	http://www.dandegreen.com/
Represented by:	Duquesne Fednard
Title:	Founder / CEO
Salutation:	Mr.
Last Name:	Fednard
Middle Name:	
First Name:	Duquesne
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

2. Contact information for project participants at the PoA level

Organization:	Enel Trade SpA
Street/P.O. Box:	Viale Regina Margherita 125
Building:	
City:	Rome
State/Region:	
Postfix/ZIP:	00198
Country:	Italy
Telephone:	+39 06 83059553
FAX:	+39 06 83059349
E-Mail:	viviana.vitto@enel.com
URL:	
Represented by:	Viviana Vitto
Title:	
Salutation:	Ms.
Last Name:	Vitto
Middle Name:	
First Name:	Viviana
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Appendix 2: Affirmation regarding public funding

No ODA funding procured for the implementation of the PoA.

Appendix 3: Application of methodology (ies)

Table 13. Ex-ante calculation of SSC threshold in terms of number of stoves sold per year

Parameters	Unit	Value	Source of data
$Q_{biomass}$	tonne/yr	3.31	Household Biomass Survey for urban areas of Port-au-Prince
$NCV_{biomass\ TJ}$	TJ/tonne	0.015	AMS II.G ver. 4 default value
$NCV_{biomass\ KWh}$	KWh/tonne	4,167	Unit conversion from TJ per tonne to KWh per tonne $NCV_{biomass\ TJ}$ in TJ/tonne * 10^{12} J/TJ * 10^{-3} KW-s/J) / (60 * 60) s/hr
Annual Energy Generation (Baseline) per appliance (EG_B)	KWh/(yr-stove)	13,794.77	$Q_{biomass}$* $NCV_{biomass\ KWh}$
η_{old}	Fraction	0.10	AMS II.G ver. 4 default value
η_{new}	Fraction	0.2824	Ex-ante calculation based on weighted average see **Table 10**
Efficiency Gain (η_{gain})	Fraction	0.6459	$(1-\eta_{old}/\eta_{new})$
Annual Energy Generation (New Stove) per appliance (EG_{NS})	KWh/(yr-stove)	4,884.83	EG_B *$(1- \eta_{gain})$
Annual energy savings per appliance (stove) (ES)	KWh/(yr-stove)	8,909.94	EG_B-EG_{NS}
Small scale threshold limit ($SSC_{threshold}$)	KWh/yr	180,000,000	AMS II.G ver. 4
Maximum number of stoves allowed under a SSC-CPA	**Number of new appliances (i.e., stoves)**	**20,202 rounded down to 20,200**	**$SSC_{threshold}$/ES**

Table 14. Ex-ante calculation of single stove's energy savings as a % of the small scale threshold

Parameter	Unit	Medium Stove	Large Stove
$Q_{biomass}$	tonne/yr	3.31	3.31
$NCV_{biomass\ TJ}$	TJ/tonne	0.015	0.015
$NCV_{biomass\ KWh}$	KWh/tonne	4,167	4,167
Annual Energy Generation (Baseline) per appliance (EG_B)	KWh/(yr-stove)	13,794.77	13,794.77
η_{old}	Fraction	0.10	0.10
η_{new}	Fraction	0.292	0.244
Efficiency Gain (η_{gain})	Fraction	0.6575	0.5902
Annual Energy Generation (New Stove) per appliance (EG_{NS})	KWh/(yr-stove)	4,724.62	5,654.05
Annual energy savings per appliance (stove) (ES)	KWh/(yr-stove)	9,071.26	8,141.83
Upper limit of annual energy savings under small scale CDM threshold ($SSC_{threshold}$)	KWh/yr	180,000,000	180,000,000
Energy savings from a more efficient stove as a percentage of the small-scale CDM threshold	**%**	**0.005040**	**0.004523**

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

Household Biomass Survey Methodology and Quality Assurance

The HHBS was designed by D&E, EarthSpark and BalanceCO2 Inc. to obtain baseline information and estimates of key parameters with a high degree of confidence. The HHBS is a requirement for evaluating baseline conditions within the project boundary related to cookstoves usage, charcoal consumption rates and estimation of the non-renewable biomass fraction, which are used for quantifying certified emission reductions from the project. The HHBS was completed in accordance with CDM methodology and criteria.

In addition to the baseline survey, secondary sources of information consisting of recent reports on the state of Haiti's forests and the charcoal production value chain were also used, as were the results of similar surveys fielded by EarthSpark. In 2008 and 2010, EarthSpark fielded two related surveys in the town of Les Anglais comprised of 194 and 119 households, respectively, out of a population of approximately 5,000 households. The town of Les Anglais is located some 200 km west of Port-au-Prince commune. Although the data from these surveys are not expected to contribute to estimating the key parameters, the data will be useful as points of comparison to supplement the analysis and judge the validity of data.

In order to comply with quality assurance standards, the Les Anglais data were also used as a benchmark for cookstoves usage in the project area. The approach was to compare the usage of traditional stoves and demographics between the two areas while considering the relevant socioeconomic and geographic contexts of Les Anglais and Port-au-Prince. Similarities prevailed in almost all cases and there were no differences found between the datasets that could not be easily explained.

Target Population:
The primary population being targeted for the dissemination of stoves is low-income households. The population of interest changes with the question(s) being asked in the survey. .

Survey Design:
The HHBS was conducted in Port-au-Prince, Haiti for determining the baseline usage of charcoal per stove over a period of time, Number of stoves used per household and fraction of woody biomass that can be established as non-renewable biomass ($f_{NRB,y}$). The most important aspect of survey design involved the calculation of the sample size, which required evaluation and consideration of the survey scope and estimation of the most appropriate sample size. A sample is a subset of the population that is being surveyed. For the project activity, the primary population being targeted for the dissemination of stoves is low income households. The population of interest changes with the question(s) being asked in the survey. However, for purposes of estimation of the baseline and certified emissions reduction (CERs), the population of interest would come from households with traditional, inefficient, stoves that would benefit from having them replaced with the more efficient EcoRecho stoves, independent of the economic status of the household, as long as the stove replacement takes place within the Project boundary. Unlike charcoal consumption rate and cookstove usage, which were obtained using sampling methods, $f_{NRB,y}$ was determined using macro-level data for Haiti. This was done primarily due to the fact that charcoal consumed in Port-au-Price is not produced locally and is sourced from various rural areas throughout the country and hence no local value for Port-au-Prince could be determined.

Sampling Method:
Stratified random sampling method was employed for achieving the objectives of the HHBS. Stratification was based on household income levels (very low, low, medium, etc.) and was used for data collection during the survey that provided useful information on price points, stove and fuel preferences.

Two general types of equations were used to calculate the sample size. One is used when estimating proportions or percentages; and the other is used when estimating averages.

The Commune of Port-au-Prince consists of three sections: Turgeau, Morne l'Hopital and Martissant. According to the Institut Haitien de Statistique et D'Informatique, the Commune of Port-au-Prince has a total population of 875,978, with an average population density of 34,637 persons per square kilometre (persons/km^2). The population of the commune of Port-au-Prince and the populations for each section are shown in **Table 15**.

Table 15. Total Population and Population Density of Project Area

Section of Port-au-Prince	Total Population	Population Density (persons/km^2)
1ere Section Turgeau	474,702	27,631
2e Section Morne l'Hopital	138,745	55,721
3e Section Martissant	262,530	46,714
Commune de Port-au-Prince	**875,977**	**34,637**

The number of households surveyed in each of these sections was directly proportional to the population size of that section. **Table 16** shows the number of households surveyed in each section of the commune of Port-au-Prince.

Table 16. Total household surveyed in each section of the commune of Port-au-Prince

Section of PAP	Total Population	Total Population %	Household surveyed
1.ere Sect. Turgeau	474,702	54	163
2.eme Sect. Morne Hopital	138 ,745	16	90
3.eme Sect. Martissant	262,530	30	47
Total	875,977	100	300

In order to determine the baseline emissions, it is important to determine the number of stoves used per household so as to obtain a high confidence in charcoal consumption estimates. USAID and ESMAP studies suggested that charcoal consumption per household maintains an average value but it is important to realize that the charcoal consumption per stove directly depend on the number of stoves owned by a household.

Sample Size:

Two general types of equations were used to calculate the sample size. One for estimating proportions or percentages; and the other for estimating averages. **Table 17** provides detailed explanation of the formula used for determining sample size:

Table 17. Sample Size determination

Formula	Description
$n \geq \frac{Np(1-p)}{(N-1)D + p(1-p)}$ Where, N = population size p= priori assumption of the population parameter	A total population of approximately 900,000 in the project area was translated to approximately 200,000 households based on assuming 4.5 persons per household. Knowing that the proportion of households with traditional stoves is high, an a priori assumption was made that the proportion would be at least 0.8. Assuming a margin of error of ±10% and that the estimate of the proportion from the survey requires a confidence level of 90%, the minimum sample size required was found to be

Formula	Description
& $D = \frac{\alpha^2}{z^2_{\frac{\alpha}{2}}}$ Where α is the margin of error and z is the number of standard deviations relative to the mean of the standard normal distribution corresponding to the desired level of confidence.	43 (i.e., $n \geq 43$).
$n \geq \frac{z^2_{\frac{\alpha}{2}} N V_x^2}{z^2_{\frac{\alpha}{2}} V_x^2 + (N-1)\varepsilon^2}$ Where: N = Population size & $V_x^2 = \frac{\hat{\sigma}_x^2}{\bar{\hat{x}}^2} = \frac{\frac{(N-1)}{N} s_x^2}{\bar{x}^2}$ σ = Variance x = population mean	Consider again the total population (i.e., number of households) within the project boundary to be approximately 200,000. The determination of minimum sample size requires an estimate of the mean and variance in the variable of interest (i.e., household charcoal consumption) and the required level of confidence and acceptable margin of error. Based on previous research in Haiti conducted by EarthSpark, Nexant and ESMAP, households in Haiti consume between 25 and 1,875 pounds of charcoal per month (lb/mo). The mid-point of the range of charcoal consumption is 950 lb/mo, which was taken to be the sample mean. The sample standard deviation was obtained by dividing the range of values by 4, since 4 standard deviations represent 95% of most population distributions. This produces a standard deviation of 462 lb/mo. Using these values, the ratio of the population variance to the population mean squared was calculated to be 0.2365. Then the minimum sample size needed to achieve a confidence level of 90% was found to be 64 (i.e., $n \geq 64$).

To ensure a high confidence/precision level for the sampling, 300 households were sampled during the HHBS. **Table 18** shows the number of households sampled in each area.

Table 18. Number of households surveyed in different areas

PAP Section	Area/Street Name	# of Surveys	Total
1.ere Sect. Turgeau	Aveni milè	15	**163**
	Avni Poupla	40	
	Ba pe de choz	6	
	Boudon	6	
	dekayèt	50	
	Kris wa	11	
	Lali	8	
	Ri Maslen	15	
	Ri romilis	5	

PAP Section	Area/Street Name	# of Surveys	Total
	Ri sen aleksand	7	
2. eme Sect. Morne Hopital	4eme avni	1	**90**
	5eme avni	11	
	Fontamara 27	8	
	Fontamara 29	4	
	Fontamara 36	2	
	Fontamara 36 A	1	
	Fontamara 41	3	
	Matisan 1	8	
	matisan 17	6	
	Matisan 2 A	8	
	Matisan 23	1	
	Matisan 24	1	
	Matisan 7	12	
	Pòs machan	14	
	Ri chavann	10	
3.eme Sect. Martissant	Ri Kamo	7	**47**
	Ri maglwa anbwaz	10	
	Ri mgrs giyou	21	
	Salomon	9	

Survey Method:

The field enumerator team consisting of 4 enumerators and 2 expert statisticians, collected quantitative and qualitative data through oral questioning orally and questionnaires. The orally obtained answers were recorded. In order to corroborate some of the answers, the surveyors observed the purchases and charcoal usage habits for approximately 12% of participant households.

The survey was carried out over a period of 14 days by the team. **Table 19** shows a breakdown of the number of days spent to complete each of the major survey tasks.

Table 19. Distribution of Time Spent on Survey Tasks

Task Description	Survey Preparation	Field Work	Data Analysis

No. of days required	2	10	2

Once the field work was completed, the survey results were entered on a spreadsheet under the supervision of the field enumerator team leader. Where there was confusion or contradiction in the data, clarification was sought from the field enumerator who collected the information. The data in question was thrown out if the clarification was deemed insufficient by the team leader. After completion of all data entry, statistical analysis was performed.

Summary of Survey Results

The average consumption per stove in Port-au-Prince depends on the number of stoves in the household as well as the number of burners per stove. That is, as we add more stoves to a household, total charcoal consumption does not rise. Instead, per-stove consumption decreases. The average consumption per stove for one-stove households is much greater than for 2-stove and 3-stove households. To cope with this issue, the estimated mean charcoal consumption per stove for one-stove households and for 2 or more-stoves households were combined to calculate an average charcoal consumption weighted by the number of stoves in each type of household, which was found to be 91 lb/month per stove. Remarkably, if we take the average household charcoal consumption in Les Anglais (data from a survey fielded in 2008) and divide this by the average number of stoves per household in Les Anglais (using data from a survey fielded with a different sample in 2010), we find the average per-stove consumption to be 90 lbs/month. We take this consistency in per-stove consumption across the two locations to be positive evidence supporting the validity of our results.

299 of the 300 respondents answered in the affirmative when asked if they believed they were currently spending more on charcoal than five years ago. Of those who answered in the affirmative, 197 respondents provided an estimate of the difference, while the remaining 102 respondents were not sure how much their monthly charcoal expenditures increased. The average reported expenditure increase was US$4.68, which is about 10% of the current monthly expenditure in Port-au-Prince, US$45. While we cannot ascertain a quantitative measure of NRB from these data, increasing trends in charcoal expenditures indicates scarcity. This scarcity supports the preponderance of non-renewable biomass for the production of charcoal in Haiti.

Table 20. Calculation of Fraction of Non-Renewable Biomass

Parameter	Description	Value used	Units	Source of data
F	Extent of Forest	1,01,000	hectare (ha)	FAO Forest Resource Assessment (FRA) 2010 Global Table, Table 2
GR	Annual Growth rate of biomass	7.88	tonne per hectare per year (tonne/ha-yr)	Distribution of total forest area by ecological zone (FAO Global Forest Resources Assessment, 2000, Table 14; <http://www.fao.org/DOCR EP/004/ Y1997E/y1997e21.htm#bm73)> Above-ground biomass growth rates (t/ha-yr) for different ecological zones (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4, Table 4.9)
MAI	Mean Annual Increment of Biomass Growth	796,234	tonne per year (tonne/yr)	F * GR
ΔF	Annual change in living forest biomass	-		Annual change in carbon stock in living forest biomass 2005-2010 (FAO Forest Resource Assessment 2010 Global Tables, Table 11)
R	Total annual biomass removal	796,234	tonne/yr	MAI + ΔF
PA	Protected Area Extent of Forest	4,000	ha	FAO Forest Resource Assessment (FRA) 2010 Global Table, Table 6
DRB	Demonstrable Renewable Biomass	31,520	t/yr	PA * GR
NRB	Non-Renewable Biomass	764,714	t/yr	R – DRB
$f_{NRB,y}$	Fraction of non-renewable biomass	96.04	%	{NRB/(DRB+NRB)}
$f_{NRB,y}$	**Value provided by EB 67, Annex 22 - Default values of fraction of non-renewable biomass for least developed countries and small island developing States**	**96**	**%**	**EB67, Annex 22**

Appendix 5: Further background information on the monitoring plan

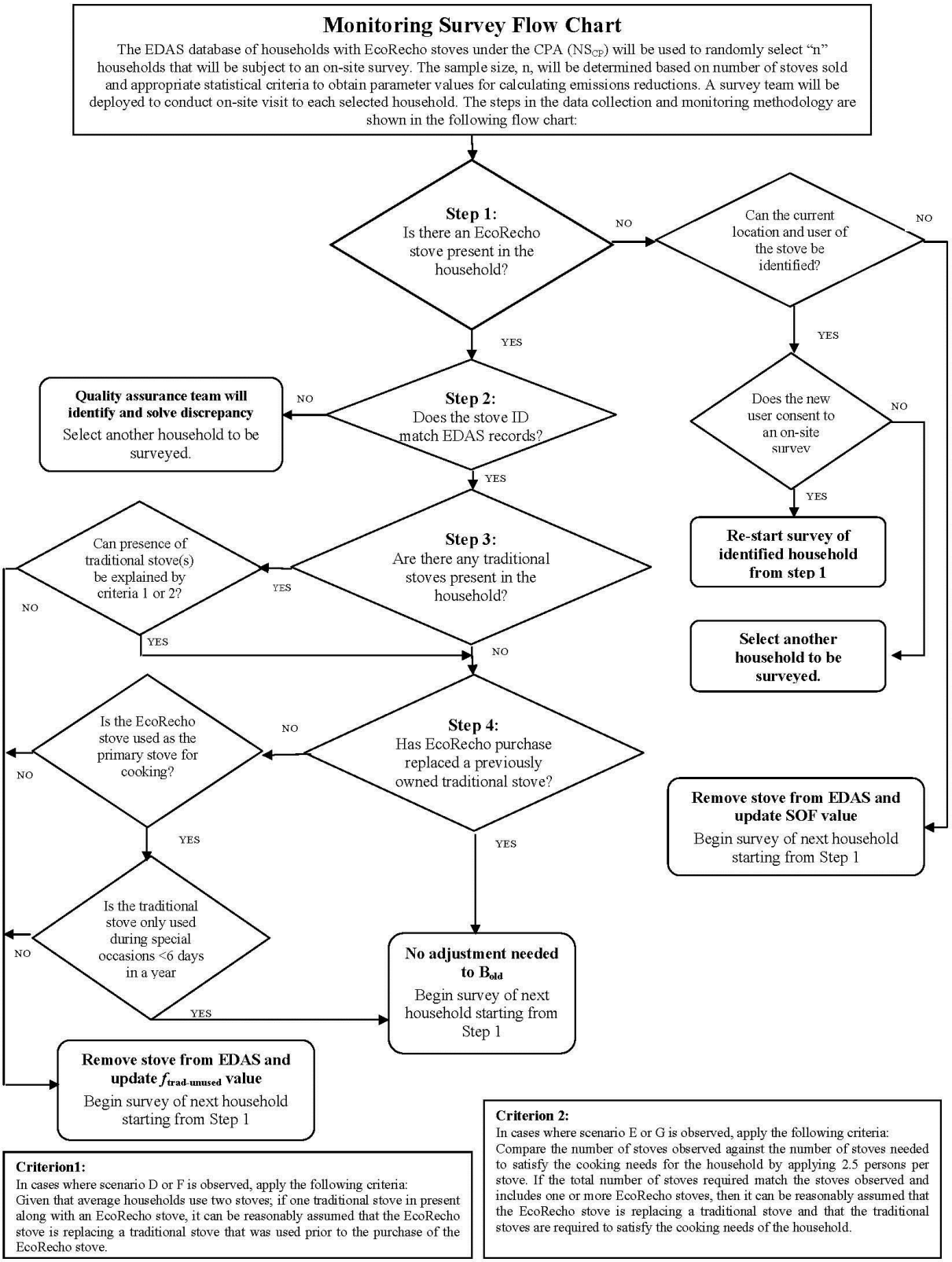
Annual On-Site Survey Design

During the annual monitoring, a survey team will visit the requisite number of households in the sample population, based on the number of samples required to achieve 90/10 reliability, the EDAS will be used to randomly select customers/households to be surveyed. Approximately 20% more customers/households may be chosen and kept in reserve for later use if the some of the selected households cannot be reached or do not provide adequate responses to the questionnaires during the survey or the data cannot be validated.

The monitoring team will follow the survey flow chart, which will provide specific procedures to follow in order to determine the fraction of EcoRecho stoves still in operation (SOF) and the fraction of replaced traditional stoves that meet the criterion of non-usage during the monitoring period ($f_{\text{trad-unused}}$). In addition, the condition of the EcoRecho stove will be inspected and usage patterns will be determined. A questionnaire in creole will also be prepared for recording answers and obtaining any affirmations with signatures from the customer. In scenarios where the survey cannot be completed for the selected household, additional households will be selected until the required reliability criteria are achieved. The monitoring survey flow chart is provided below. The specific procedures that the monitoring team uses for the survey could be revised to improve efficiency and accuracy in data collection, as site specific conditions are identified that were not contemplated during the development of the PoA. Any revisions to the monitoring procedure will be provided in the CPAs.

If, during the twelve-month monitoring period, the monitoring survey of a household does not demonstrate or provide evidence of any usage of the EcoRecho stove replacing the traditional stove, or the EcoRecho stove is not operational, the stove(s) in that household that is in question will not be counted for purposes of determining the ER. The CME will also facilitate a training programme for monitoring team members prior to completion of annual surveys. The training programme will impart technical knowledge of the working principles of EcoRecho stoves, manufacturer's warranty and replacement policy, monitoring procedures and data collection/management techniques. As a result, D&E employees and distributors will be able to give live demonstrations to customers, explain the terms and conditions of the manufacturer's guarantee and identify malfunctioning units and their causes. This will not only guarantee smooth execution of the monitoring plan but also facilitate the customer's continued use of the EcoRecho stove. The CME has already organized awareness programmes for local people to make them aware of the benefits of EcoRecho stoves and its long term positive impact on the socio-economic and environmental conditions in Haiti.

Figure 9: Monitoring Survey Flow Chart



Electronic Data Archival System (EDAS) and QA/QC procedures:

The data collected through monitoring will be further used for ex-post calculation of the actual GHG ER resulting from the implementation of the proposed project activity.

The CME, supported by consultants will collectively develop the monitoring plan necessary for its effective implementation and smooth functioning during the Project activity (CPAs). The success of the project activity lies in the sales of EcoRecho stoves to the low income population in Port-au-Prince and other areas of Haiti through a developed network of distributors in the area. Therefore, in order to monitor the required parameters, the cooperative effort of all stakeholder institutions involved in the Project is required. The CME will appoint a CDM Project Team comprised of a CDM Project Manager and representatives of all involved organisations, who will be entrusted with the responsibilities of Monitoring Project activity. A team management structure that involves all parties to the project will be developed with specific monitoring procedures and guidelines to allow monitoring to be conducted in strict compliance with AMS II.G Version 04 and other guidelines prescribed by United Nations Framework Convention on Climate Change (UNFCCC). The overall responsibility of the CDM Project Team will include: -

- Providing assistance on the proper operation and use of EcoRecho stoves and providing clear and unequivocal guidance on the requirement to discontinue use of traditional stoves in households where EcoRecho stoves have been disseminated for emission reductions to be counted.
- Training of households using EcoRecho stoves on the appropriate use of the technology to avoid unanticipated accidents and ensure safe, efficient and prolonged functioning of the stoves.
- Conducting periodic monitoring as well as spot checks for collecting information on required parameters.

The functionality of EDAS will be a developed as a Relational Database Management System (RDBMS) to meet the core requirements of the monitoring plan inclusive of the business process requirements of the CME to manufacture, sell and distribute the EcoRecho stoves. In essence, EDAS will hold all records of stove transactions following the business process rules laid out by the CME, reflecting the lifecycle of the stove from stove manufacturing at the production facility, through sales and distribution to the end user, and till its retirement. With the goal of specifically meeting the requirements of the monitoring plan, the EDAS will serve as an information repository for storing profiles of each stove manufactured, relevant data on all customers and distributors, sales transaction data and monitoring records pertaining to each stove sold under the CDM project. Procedures will be developed within EDAS to ensure that data monitored and required for verification and CER issuance is maintained and archived electronically for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later. The database structure will allow efficient data retrieval using the stove ID as the primary key to allow tracking of its lifecycle from manufacturing to final retiring of the stove. All CPA stove sale transactions across the nation, including internal movement of stove, replacement of defective stove, or any other transaction data will be captured in the EDAS. The back-end functionality of the RDBMS will make the EDAS a very powerful tool for monitoring tracking and retrieving data needed to fully support the tracking, monitoring and verification requirements of the CPAs under this PoA as summarized below:

- The back-end RDBMS will contain the following categories of information in the form of Master Tables, sale transaction and financial data:
    - Stove Master (data pertaining to manufactured stoves)
    - Distributor Master (Basic data of each distributors)
    - Customer Master (Basic data of each customers)
    - Stove Sale transaction data (direct, indirect and replacement sale)
    - All relevant financial data collaborating sale transactions

- The back-end RDBMS can be used for statistical analysis, determining sampling requirements, Auditing and Quality Assurance, Periodic Training of Distributors and other Ad-hoc Reports. The reports that can be generated include, but are not limited to, the following:
    - Stoves sold by period
    - Generation of sampling size for conducting on-site survey for quality assurance and confirmation of stoves in operation and discontinuation of traditional stove.
    - Generation of statistical sampling data needed to conduct Stove efficiency testing for Quality Assurance.
    - Generate audit reports for annual verification by DOE.
    - Generation of periodic random samples that can be used by the Monitoring Team to compare physical paper copies of a stove's PR against corresponding records of Stove sale transactions in the database

Appendix 6: Sampling Plan

The Clean Development Mechanism (CDM) Programme of Activities (PoA) entitled, *Replacement of traditional charcoal stoves with efficient EcoRecho stoves in Haiti* involves the active dissemination of EcoRecho improved cook stoves (ICS) that are more efficient than traditional cookstoves within the Republic of Haiti (Project boundary) and will be referred to as the "Haiti EcoRecho ICS PoA," "the Haiti PoA" or simply as "PoA" in this section.

Sampling Design

Objective

The determination of greenhouse gas emission reductions (ERs) resulting from the dissemination of ICS under each of the Component Project Activities (CPAs) of the Haiti PoA requires the collection of data from households surveyed and testing of operational stoves sampled during the annual survey. The PoA Sampling Plan has been developed to provide the specific sampling and survey procedures that will be used by the PoA's coordinating managing entity (CME), namely D&E Green Enterprises , to determine the values of the parameters used in ER calculations. This Sampling Plan specifies appropriate, statistically valid sampling and survey procedures for parameter estimation that are in accordance with the CDM methodology, standards and guidelines applicable to the PoA, and have been developed based on the following CDM documents:

- AMS II.G. version 4.0, Energy Efficiency Measures in Thermal Applications of Non-renewable Biomass (AMS II.G.)
- Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities version 3.0 (Standard for Sampling and Surveys)
- Guidelines for Sampling and Surveys for CDM project Activities and Programme of Activities version 2.0 (Guidelines for Sampling and Surveys)

Sampling and Reliability Requirements

The CDM methodology, AMS II.G. is applicable to the Haiti EcoRecho PoA. AMS II.G., Section 5.2, Representative sampling methods, Paragraph 22 states as follows:

> *A statistically valid sample of the locations where the systems are deployed, with consideration, in the sampling design, of occupancy and demographics differences can be used to determine parameter values used to determine emission reductions, as per the relevant requirements for sampling in the "Standard for sampling and surveys for CDM project activities and programmes of activities". When biennial inspection is chosen a 95% confidence interval and a 10% margin of error requirement shall be achieved for the sampling parameter. On the other hand when the project proponent chooses to inspect annually, a 90% confidence interval and a 10% margin of error requirement shall be achieved for the sampled parameters. In cases where survey results indicate that 90/10 precision or 95/10 precision are not achieved, the lower bound of a 90% or 95% confidence interval of the parameter value may be chosen as an alternative to repeating the survey efforts to achieve the 90/10 or 95/10 precision.*

The Standard for Sampling and Surveys has been used in developing this sampling plan. Paragraph 7 of this Standard states the following:

> *CDM PDDs or CDM Programme of Activities Design Documents (CDM-PoA-DDs, CDM-CPA-DDs) utilizing sampling for the determination of parameter values for calculating emission*

reductions shall include a sampling plan[45] with a description of the sampling approach, important assumptions, and justification for the selection of the chosen approach.

In addition, paragraph 12 of the Standard for Sampling and Surveys states the following:

When developing a sampling plan, project proponents shall calculate the sample size required to achieve a required level of reliability. The sample size should be determined manually or using appropriate statistical software. The calculation is dependent on all of the following as well as the target level of confidence and the precision (e.g. 90/10 or 95/10):

(a) The type of parameter of interest, i.e. mean value or proportion value;

(b) The target value, i.e. the expected value of the parameter, which should be determined using the project planner's knowledge and experience;

(c) Expected variance (or standard deviation) for that measure in the sample, based on results from similar studies including other similar CDM projects or previous monitoring periods, pilot studies, or from the project planner's own knowledge of the data.

If the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 shall be chosen.

Based on the Standard for Sampling and Surveys, this minimum sample size of 30 will be used to meet the reliability criteria for both proportional and mean value parameters.

Specific requirements for PoA sampling is also provided in paragraph 20, which states the following:

Parameter values shall be estimated by sampling in accordance with the requirements in the applied methodology separately and independently for each of the CPAs included in a PoA except when a single sampling plan covering a group of CPAs[46] is undertaken applying 95/10 confidence/precision for the sample size calculation.

Sampling Method

An on-site annual monitoring survey will be conducted in accordance with this sampling plan and will include appropriate protocols for thermal efficiency testing of an adequate number of operational EcoRecho stoves in order to obtain unbiased and reliable estimates of the parameters that will be used for calculating ERs associated with each CPA of the PoA. The Electronic Data Archrival System (EDAS) to be developed and implemented under the PoA will support the annual monitoring survey and will be used to randomly select stoves and households without bias for testing, and to record data associated with the sampling parameters.

The sampling requirements for each CPA will be conducted independently from other CPAs. In addition, the required sample size for each parameter will be determined independently from each other based on meeting the reliability criteria, namely, 95/10 confidence/precision when biennial monitoring is chosen,

[45] Revision to sampling plan included in registered PDD documents (for example, a shift to a single sampling plan across CPAs of a PoA from separate sampling plans in each CPA) may be proposed following the CDM Project Cycle Procedure for changes to registered CDM project activity or PoAs.

[46] That is, the populations of all CPAs in the group are combined together, the sample size is determined and a single survey is undertaken to collect data. For example, if the parameter of interest is the daily usage hours of light bulbs, it may be feasible to undertake a single sampling and survey effort spread across geographic regions of several CPAs when either homogeneity of included CPAs relative to the light usage hours can be demonstrated or the differences among the included CPAs is taken into account in the sample size calculation. Currently PoAs applying large scale CDM methodologies are not allowed to apply a single sampling plan covering a group of CPAs, pending further analysis.

or 90/10 confidence/precision when annual monitoring is chosen. These levels of reliability shall be achieved for each of the monitoring parameters of interest. When multiple parameters values can be obtained from the same population, the largest sample size calculated will be used for data collection.

In particular, the proportion value parameters: stove operational fraction (SOF) and fraction of replaced traditional stoves that are properly disposed or not in use ($f_{trad\text{-}unused}$), will be determined based on annual sampling from the population of households that have purchased EcoRecho stoves under the PoA, with the sample size being the larger of the sample sizes calculated for each parameter.

The parameter, η_{new} representing the mean thermal efficiency will be determined for each type of EcoRecho model (e.g., medium and large) disseminated under the PoA and the value of this key parameter will be determined for each stove model from sampling annually (with a 90/10 reliability).

The sampling method for all parameters will be based on a simple random sampling approach, considering that simple random sampling is most useful when the target population is relatively homogeneous. As stated earlier, each CPA will be subjected to separate sampling. Further, the target population for each CPA will be similar i.e., similar socioeconomic status and stove category (household stoves or commercial stoves). In addition, for each stove model, representing a homogeneous target population, a representative number of operating stoves will be randomly sampled and tested for thermal efficiency.

Data to be collected

A summary of the monitoring parameters to be measured in the field or estimated from the annual monitoring survey, and the proposed sampling method including the assumptions are shown in **Table 21.**

The target values presented in **Table 21** for each parameter are the values used in CPA01 and represent the ex-ante calculation of the best estimated value for each parameter. Each CPA planned for inclusion under the PoA must develop separate sample size calculation spreadsheets with specific assumptions regarding target parameter values and standard deviations that are updated based on subsequent survey results. A sample size calculation spreadsheet has been developed based on the sampling method and the appropriate equations described herein, and are to be used as an accompaniment to this Sampling Plan.

Table 21. Field Measurements and Assumptions

Parameter	Description	Reliability Confidence/ Precision (%)	Sampling Method	Parameter Type		Target Value	Standard Deviation
NS_{CP}	Total number of EcoRecho stoves in operation during the monitoring period.	100/0	Continuous monitoring of Purchase Receipts	Actual number of stoves disseminated in each CPA (not a sampling parameter)	Medium EcoRecho Stoves	16,160[47]	NA
					Large EcoRecho Stoves	4,040[46]	
					Total	20,200	

[47] Estimated target value of the maximum number of stoves planned for dissemination under CPA01. Ex-post values will be used in sample size calculations.

Parameter	Description	Reliability Confidence/ Precision (%)	Sampling Method	Parameter Type		Target Value	Standard Deviation
η_{new}	Thermal efficiency of EcoRecho stoves manufactured using new machinery and manufacturing process, which is determined from stove testing (WBT or equivalent) results.	90/10	Annually based on simple random sampling of stoves and testing for efficiency. Each type of stove is sampled and tested separately	Mean Value (sampling parameter)	Medium EcoRecho Stoves	29.2%[48]	Estimated range[49] between 1.8% and 4.0%
					Large EcoRecho Stoves	24.4%[47]	Estimated range[48] between 1.2% and 4.0%
SOF	Stove Operational Fraction (fraction of EcoRecho stoves operating or replaced by an equivalent in-service appliance) estimated from annual monitoring survey.	90/10	Annually based on Simple Random Sampling	Proportion Value (sampling parameter)		Estimated range[50] between 70% to 90%	NA
$f_{trad\text{-}unused}$	Fraction of traditional stoves not in use and that have been replaced by purchasing the EcoRecho stove.	90/10	Annually based on Simple Random Sampling	Proportion Value (sampling parameter)		Estimated range[49] between 75% to 95%	NA

Sampling Frame and Procedures

The parameters identified in **Table 21** must be determined from the annual or biennial monitoring survey. Details of the sampling procedure used for each of the parameters listed are as described below:

NS_{CP} represents the total number of EcoRecho stoves in operation during the monitoring period (i.e., total number of stoves during the time frame between verifications) under each CPA, with each stove in operation representing one (1) household. In situations where a household operates more than one EcoRecho stove and multiple EcoRecho stoves from that single household has been randomly selected as part of the survey, each EcoRecho stove from that household will be considered as a representative of a separate household for purposes of the survey. This parameter is not determined by sampling, but rather is established for each CPA of the PoA through continuous ongoing monitoring of customer purchase receipts and records maintained by the EDAS. The EDAS will include specific procedures to uniquely identify each stove and the CPA to which it belongs. NS_{CP} is an important parameter representing the actual population of EcoRecho stoves disseminated to customers in each CPA of the PoA and will be the population from which sample sizes will be determined and drawn for estimating the values of the other monitoring parameters, namely, η_{new}, SOF and $f_{trad\text{-}unused}$. The value of the NS_{CP} parameter shown in **Table 21** represents the target ex-ante estimates of the number of medium and large of EcoRecho stoves that are

[48] Based on Colorado State University EcoRecho Stove Evaluation report – February 18, 2012. Will be updated during each monitoring period to reflect results from previous test results and the addition of new EcoREcho models.

[49] Lower bound of range is based on Colorado State University EcoRecho Stove Evaluation report – February 18, 2012. Upper bound of range is a conservative estimate. Standard deviation will be updated during each monitoring period to reflect previous test results and the addition of new EcoRecho models.

[50] Assumed to be conservative. Will be updated during each monitoring period to reflect results from previous test results.

planned to be in operation for the first monitoring period as part of CPA01. Ex-post values will be used when determining the actual sample size.

η_{new} is the parameter used to measure the value of the mean thermal efficiency obtained from laboratory testing of an adequate number of EcoRecho stoves using the Water Boiling Test (WBT) or equivalent protocol. The required number of stove samples will be determined for each type of EcoRecho stove separately (i.e., medium, large and any other type included in the CPA) and the operational stoves will be randomly selected by use of a random number generator and the selected stove will be collected from the end users. The sample size will be determined to meet the parameter's reliability criteria of 90/10 for the annual sampling survey. The specific operational stoves to be tested will be collected from the users, who will be provided with a replacement stove for each stove collected for testing. The stoves selected for testing will be identified by ID number and records will be maintained in the EDAS to keep track of the stoves using strict chain-of-custody protocols as it is shipped to a laboratory for WBT or equivalent thermal efficiency testing. In addition, stoves tested during manufacturing will be used for quality control of the EcoRecho stoves manufacturing operation, and may be used to specify the target thermal efficiency used for estimating the sample size. For the first monitoring period, the samples will be collected at the end of the monitoring period by randomly selecting the required number of samples to meet the 90/10 confidence/precision criteria. In subsequent monitoring periods, the CME may collect stoves from samples chosen randomly throughout the monitoring period at a frequency determined on the basis of the required sample size. For example, if the minimum sample size of 30 is required, three (3) operational stoves might be collected each month randomly (which provides 36 samples per year from among the stoves in operation under the CPA) with the objective of selecting stoves that have been in operation for at least 3 months in order to make sure that the stove tested is representative of an operational stove. Approximately 1-2 additional operational stoves will be sent to the laboratory for testing to account for stoves that may be damaged during transportation or to account for any difficulties encountered during testing.

The **SOF** parameter measures the fraction of EcoRecho stoves disseminated that are operational during the monitoring period of the CPA and still in use. **The $f_{trad\text{-}unused}$** represents the fraction of replaced traditional stoves that are disposed or not in use. These two parameters have to be determined on an annual basis to properly estimate the number of stoves to be included during each monitoring period for purposes of ER calculations. The sample size determination will be based on simple random sampling for the SOF and $f_{trad\text{-}unused}$ parameters, separately. However, since the NS_{CP} parameter represents the population from which sampling for both parameters will be conducted, the larger of the sample sizes obtained for each parameter based on the 90/10 reliability criteria will actually be used for the survey. The EDAS will be used to assist in the identification of the sampling frame (households associated with the NS_{CP} parameter) used for sampling size calculations, which changes with the monitoring period. The selection of households to be surveyed will be determined by using a random number generator. An additional 20% more households will be selected and kept in reserve for later use if some of the selected households are non-responsive, cannot be reached or do not provide adequate responses to the questionnaires during the annual survey. This precaution will ensure that the 90/10 reliability criterion is met and prevent survey from being repeated.

Sample Size Calculation

η_{new}

A simple random sampling approach will be applied to select samples used to determine the η_{new} parameter for each EcoRecho stove model disseminated under the CPA. The stoves manufactured and planned for dissemination under each CPA will consist of several models of EcoRecho stoves; e.g., CPA01 will consist of medium and large EcoRecho stoves, each with different target values and standard deviation for the η_{new} parameter. The objective of sampling is to collect the requisite number of representative stoves of each model and conduct WBT or equivalent stove thermal efficiency testing to

obtain the mean value of stove thermal efficiency for each stove model with a 90% confidence limit and 10% margin of error.

Formula for simple random sampling of a mean value parameter of interest

$$n \geq \frac{z_{\alpha/2}^2 \times N \times V}{(N-1) \times \varepsilon^2 + z_{\alpha/2}^2 \times V} \qquad \textbf{(Eq. 1)}$$

Where;

n = Sample size

$z_{\alpha/2}$ = z-statistic defined at the required confidence level of (1-α) (the z-statistic is 1.96 at the 95% confidence level; and 1.645 at the 90% confidence level)

N = Total number of households with stoves disseminated under a CPA

ε = Relative precision required (typicaly10% or 5%)

Formula for determination of variance

$$V = \left(\frac{SD}{mean}\right)^2 \qquad \textbf{(Eq. 2)}$$

Where;

SD = Expected standard deviation

Mean = Expected weighted mean

The mean value of stove efficiency for each stove model is determined from the WBT results of stoves of that model. The overall weighted average efficiency for all stove models will be determined by weighting the actual number of stoves in operation for each model and will be used for ER calculation. During the inclusion of CPAs, the CME must include specific η_{new} target values and standard deviation values for each stove model, which are included in the CPA's sample size calculation (excel spreadsheet). The following is an example of the application of equations 1 and 2, using the values in **Table 21** and the required 90% confidence level and 10% margin of error, to calculate the required sample size of stoves within each stove model that will be need to be tested for efficiency. In the absence of previous sampling results, a conservative standard deviation value of 4.0% for all stove models will be applied in the first monitoring period, shown as the estimated upper bound in **Table 21**. The expected mean and standard deviation will be revised in subsequent monitoring periods and justification provided within the monitoring report during verification. The calculations performed using the accompanying excel spreadsheet will have greater precision and the final sample size, *n*, will always be rounded up to the next integer value. The examples below are only for illustrative purposes.

Sample size calculation for Medium EcoRecho model

Sample size is calculated by using **Eq. 1** as follows:

$$n \geq \frac{1.645^2 \times 16160 \times 0.018765}{(16160-1) \times 0.01^2 + 1.645^2 \times 0.018765} = 5.0757$$

Variance is calculated using **Eq. 2** as follows:

$$V = \left(\frac{0.0400}{0.2920}\right)^2 = 0.018765$$

Sample size calculation for Large EcoRecho model

Sample size is calculated by using **Eq. 1** as follows:

$$n \geq \frac{1.645^2 \times 4040 \times 0.026874}{(4040-1) \times 0.01^2 + 1.645^2 \times 0.026874} = 7.2597$$

Variance is calculated using Eq. 2 as follows:

$$V = \left(\frac{0.0400}{0.2440}\right)^2 = 0.026874$$

The final values are always rounded up. Therefore n≥ 6 samples for n_{Medium}, and n≥8 samples for n_{Large}. However, a minimum sample size of 30 is used if the calculated sample size is less than 30.

SOF and $f_{trad\text{-}unused}$

A simple random sampling approach will be applied to determine the SOF and $f_{trad\text{-}unused}$ parameters. The objective of sampling for these two parameters is to conduct annual household surveys on a representative sample of households where EcoRecho stove are disseminated under a CPA to obtain the proportion value parameters with a 90% confidence level with a 10% margin of error, which in turn will be applied to the total number of stoves (NS_{CP}) included in the monitoring period. The determination of the representative sample of households to be surveyed (sample size) will be determined for each parameter (SOF and $f_{trad\text{-}unused}$) and the largest of the sample sizes estimated will be used for conducting the surveys.

Formula for simple random sampling of a proportional value parameter of interest

$$n \geq \frac{z_{\alpha/2}^2 \times N \times p(1-p)}{(N-1) \times \varepsilon^2 \times p^2 + z_{\alpha/2}^2 \times p(1-p)} \qquad \textbf{(Eq. 3)}$$

Where;

n = Sample size

$z_{\alpha/2}$ = z-statistic defined at the required confidence level of (1-α) (the z-statistic is 1.645 at the 90% confidence level)

N = Total number of households with stoves disseminated under a CPA

p = Proportion of the parameter of interest

ε = Relative precision required (10%)

To account for non-responses of household to be surveyed, *n* must be adjusted to account for the expected response rate. In accordance with CDM standard for sampling and surveys, a minimum of 30 households must be sampled during each survey. Each CPA sample size calculator (excel spreadsheet) includes specific *n*, p and response rate values. As an example of the application of **Eq. 3**, the sample size of households to be surveyed, in order to determine the values of the SOF and $f_{trad\text{-}unused}$ parameters, is

estimated using the target values shown in **Table 21**, which represent conservative values for the proportion of interest, namely, 70% for SOF and 75% for $f_{\text{trad-unused}}$; and an expected survey response rate of 80%. The target values will be revised for each subsequent monitoring period based on previous survey results and included in the monitoring report prepared during verification.

Sample size calculation for SOF parameter:

Sample size is calculated using **Eq. 3** as follows:

$$n \geq \frac{1.645^2 \times 20200 \times 0.7(1-0.7)}{(20200-1) \times 0.1^2 \times 0.7^2 + 1.645^2 \times 0.7(1-0.7)} = 115.2958$$

Sample size calculation for $f_{\text{trad-unused}}$ parameter:

Sample size is calculated using **Eq. 3** as follows:

$$n \geq \frac{1.645^2 \times 20200 \times 0.75(1-0.75)}{(20200-1) \times 0.1^2 \times 0.75^2 + 1.645^2 \times 0.75(1-0.75)} = 89.7884$$

The value calculated will be rounded up, therefore n≥ the greater of the two calculated sample sizes and adjusted for an expected response rate of 80%. Therefore, n≥ 145 (116 / 0.8 = 145.0). However, a minimum sample size of 30 is used if the calculated sample size is less than 30.

Implementation

Quality Assurance/Quality Control and Implementation Plan

The CME will be responsible for appointing trained and reliable personnel and acquiring the required testing equipment in order to conduct thermal efficiency testing in accordance with the latest Water Boiling Test protocol. In the absence of trained personnel and/or testing equipment, CME will appoint an independent third party trained in performing the WBT or equivalent protocol to ensure that the test methodology is followed accurately and consistently and that the results are documented and retained for the duration of the PoA. The stoves selected for testing will be operational stoves collected from users that will be transported under strict chain-of-custody to the testing location. The stoves tested will be recorded by stove ID and CPA number and the results will be recorded in the EDAS for tracking and documented for use in ER calculations. As part of the quality assurance/quality control (QA/QC) program used by the stove manufacturing operation, the CME will be testing stoves for thermal efficiency as a check on the quality of newly manufactured stoves as well as to provide a comparison with the efficiencies of operational stoves tested during the annual monitoring.

In addition the CME will be responsible for appointing trained and reliable personnel or an independent third party with the experience to perform the annual household survey. The sampling plan will provide the approach and statistical basis for the sampling and the EDAS will be used to select the households to be surveyed. The survey will be designed for each CPA in consultation with the CDM consultant and will include the preparation of a questionnaire (in both creole and English) that can be used during the survey. The party conducing the survey will be trained and be familiar with the goals of the sampling (i.e., obtaining operational stoves for testing, and collecting data on stove usage to determine the proportion value parameters), so that appropriate questions can be posed and the time required for the survey minimized. The survey must be conducted in a manner that documents the responses accurately and relied upon for determining the values of the parameters, which are subsequently used in ER calculations. The results of the survey will be transferred to the EDAS as a permanent record of the annual survey.

Data Analysis

The EDAS will serve as the repository for all the data associated with the CPAs under the PoA. This system will be used to automate the process of calculating the sample sizes required for each monitoring period. The survey results and the results of stove testing that is conducted on the operational stoves sampled will be recorded within the EDAS system. During CDM Verification of the CPAs and development of the monitoring report, data collected will be analyzed by the CDM consultant to make sure that the required reliability is achieved for each of the monitored parameters, in accordance with Appendix B of Guidelines for Sampling and Surveys, and that the appropriate value for each sampled parameter is used for ER calculations. In situations where the required reliability is not met, the methodology and/or Guideline for Sampling and Surveys will be used to determine alternate statistical approaches and the level of confidence in the data, and if required, additional testing or surveys will be conducted in order to meet the required reliability.

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
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