IMPROVED COOKING TECHNOLOGY PORGRAM (RECHO PAW)

National CDM and GOLD Standard Baseline Report

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HAITI IMPROVED COOKING TECHNOLOGY PROGRAM

NATIONAL CDM AND GOLD STANDARD BASELINE REPORT

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The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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INTRODUCTION

According to the CDM rulebook "the baseline (or 'baseline scenario') for a CDM project activity is defined in 3/CMP.1, Annex, paragraph 44 as follows: *the baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity*." This report will review current research and literature made available to the writer by Chemonics related to establishing a National CDM and Gold Standard baseline in Haiti.

The purpose of this report is to facilitate the establishment of fundamentals for a sustainable market for clean, efficient and affordable energy sources for cooking in Haiti that are able to harness carbon offset opportunities while decreasing pressure on deforestation and enabling afforestation efforts. Due to its scant upslope forest cover to protect down slope communities and productive agricultural areas on its mountains, Haiti is at the harsh frontline of climate change vulnerability/fragility. Moreover, this Caribbean Island is subject to hurricanes of increasing intensity and frequency. Over the last five years, many Haitians have been killed and others displaced due to flash flooding, hurricane force winds and/or devastating landslides. "In 2008 alone, four hurricanes – Ike, Fay, Hanna and Gustav – struck the country within a space of 30 days, destroying more than 60% of agricultural crops and killing more than 1,000 people[1]". The impact on the hurricane-vulnerable Haitian agriculture-based economy has been equally devastating. "The 2008 hurricane damage amounted to over 5% of the country's $17 billion GDP[2]". With the present land use and land use change and forestry (LULUCF) baseline, the extreme levels of vulnerability and fragility will continue to worsen in spite of considerable efforts by local and international stakeholders. With effective technical assistance, untapped resources could be meaningfully harnessed by Haiti to implement ambitious action against climate change that decreases baseline Green House Gas (GHG) emissions through LULUCF mitigations and/or clean renewable energy initiatives. This would also allow vulnerable/fragile populations to become much more resilient to extreme climate events while also improving local livelihoods. The replacement of inefficient traditional charcoal stoves in Haiti with efficient stoves to reduce the surplus carbon dioxide (CO_2) that would be emitted through the inefficient burning of charcoal by traditional stoves is an important foundation for building local climate resilience and promoting more efficient energy usage while being a practical and effective means to alleviate the depletion of forest wood resources and associated local environmental impacts.

"Approximately 90% of Haitian households meet their energy needs through the use of firewood and charcoal while more than 30% of middle class family income is spent on charcoal for cooking in Port-au-Prince" (Chemonics sources 2013). This not only has devastating effects on Haiti's fragile ecosystem and reforestation efforts but is a health hazard for the women and children cooking indoors. This health hazard is "now the second largest cause of child mortality under the age of five in Haiti" (Chemonics sources 2013). This represents a massive potential market for clean cooking solutions, including Liquefied Petroleum Gas (LPG), solar and improved biomass Cookstoves. This is the impetus behind the three-year USAID-funded Haiti Improved Cooking Technology Program (ICTP) that Chemonics is currently implementing. This program is in line with the integrated energy strategy that the Haitian government, with USAID support, is introducing to address deforestation through ICTP and other

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[1]Madeleine Rubenstein (2012). Climate Change in Haiti. http://blogs.ei.columbia.edu/2012/02/01/climate-change-in-haiti/ accessed October 2013.
[2]Jeffrey Masters (2012). Hurricanes and Haiti: A Tragic History http://www.wunderground.com/resources/education/haiti.asp accessed October 2013.

energy sources such as the introduction of Liquid Petroleum Gas (LPG) in schools, households and for use by street vendors.

Acknowledgement
Chemonics International hired Papyrus Consulting to establish a National CDM and Gold Standard baseline report under USAID contract number AID-521-C-12-00003. This report follows a field trip conducted by Dr. Eliane Ubalijoro, a Papyrus consultant, from September 9 to 16, 2013. Dr. Ubalijoro also reviewed surveys conducted by Papyrus under this subcontract and conducted desk-based research. Dr. Ubalijoro also reviewed multiple reports submitted to her by Chemonics. Papyrus is grateful for the full support provided by the ICTP team to conduct this research.

Objectives
Papyrus was asked to:

- Produce a National Baseline Report that meets CDM and Gold Standard requirements and that includes:
  - Suggested monitoring procedure to evaluate different monitoring methodologies and identify the most effective ones for National CDM monitoring
  - Implementation protocol and methodology used to conduct surveys/data collection
  - Adherence to CDM baseline reporting requirements and review of all data to ensure compliance to CDM baseline reporting
- Critically examine Program of Activities (PoA) Design Documents submitted to the CDM and ensure that the baseline report meets both CDM and Gold Standard requirements.

In addition, the report writer was asked to assess the current state of fuel consumption in Haiti, including but not limited to:

- The current value to the Haitian cook stove market
- How current funding can best be spent or allocated within the program or as a program developed carbon asset

The objectives were treated in the following order:

1. Assess the potential of the PoA for Gold Standard and CDM markets in Haiti
2. Assess the current value to the Haitian cook stove market
3. Assess how current funding can best be spent or allocated within the program or as a program developed carbon asset
4. Suggest a monitoring procedure to evaluate different monitoring methodologies and identify the most effective one for National CDM monitoring
5. Evaluate the implementation protocol and methodology used to conduct surveys/data collection
6. Evaluate and review adherence to CDM baseline reporting requirements of all data to ensure compliance with CDM baseline reporting

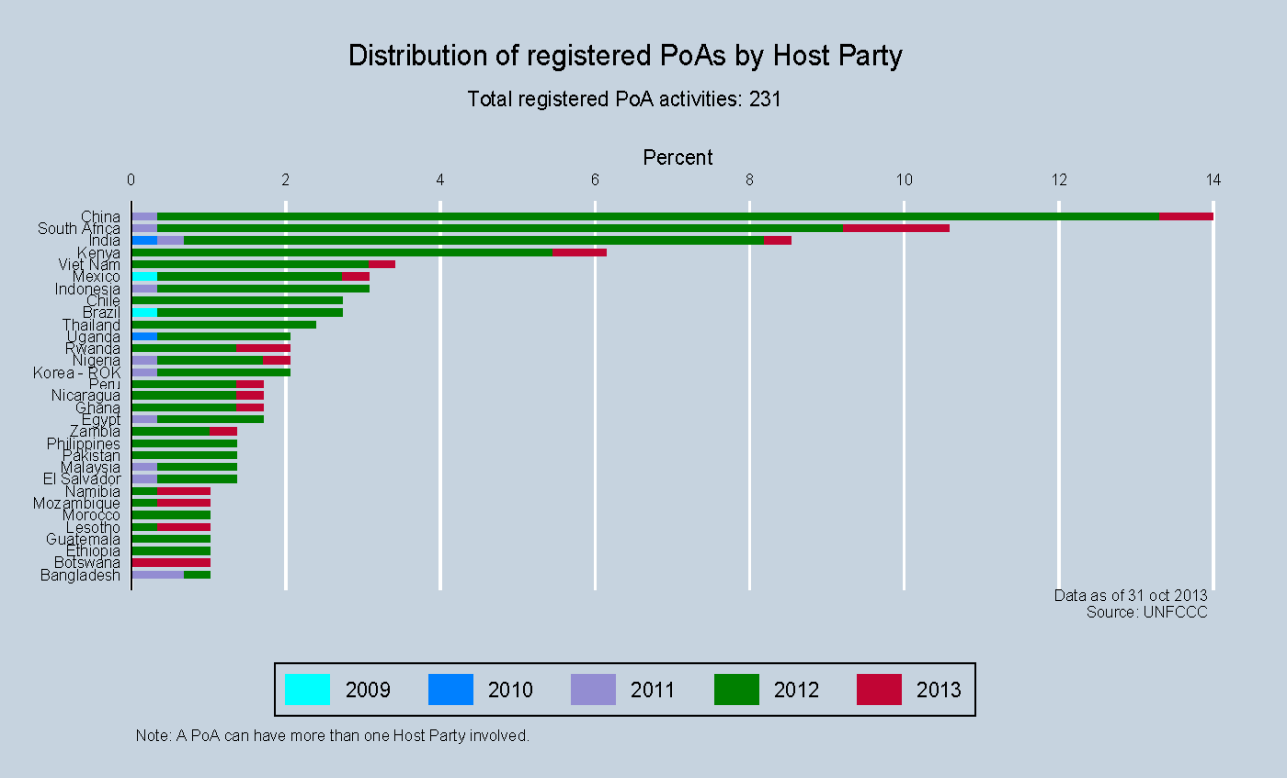
ASSESSMENT, SUGGESTIONS AND REVIEW

Potential of PoA for Gold Standard and CDM markets in Haiti
Currently in Haiti, there is only one PoA Design Document that has been submitted to the CDM related to improved cookstoves, based on meetings and knowledge made available to the writer while she was in Haiti. Additional private sector stakeholders (cook stove manufactures wanting to join or

write their own PoA) will require a baseline report that meets the CDM requirements and takes into account the current state of fuel consumption in Haiti. All of the stoves currently part of the ICTP program perform well in laboratory tests and those that are locally manufactured, locally assembled or imported. They are all designed to burn charcoal. The baseline comparisons are the "three-stone fire" or "open fire". All the improved Cookstoves being evaluated in Haiti either have metal combustion chambers in which the fire is contained or have a ceramic liner. In order to optimize the mix of combustible elements (e.g. the air to fuel ratio), airflow evaluation was an intrinsic part of all the cook stove designs. This has led to improved efficiency and cleanliness of the burning process becoming available in Haiti.

Critical examination of PoA Design Documents submitted to the CDM by D&E Green, the related CDM Component Project Activities (CPAs) as well as Gold Standard guidelines were used to guide the writing of this report. The D&E Green PoA was the only PoA submitted to the CDM from Haiti. So far 231 PoA have been registered through the CDM process in the world for 2013.

Figure 1 Distribution of Registered PoAs by Host Party for 2013 as of October 31[3]



Current CDM projects sell below Gold standard prices. Aiming for Gold Standard guidelines ensures CDM guidelines are met and that additional social and environmental benefits can be planned and certified so that whenever possible a higher price for projects can be attracted above or at the CDM going rate.

According to the *State of the Voluntary Carbon Markets 2013* report "*voluntary actors contracted 101 million tons of carbon offsets (MtCO2e) for immediate or future delivery in 2012 – 4% more than in 2011. While the overall market value of these transactions decreased 11% to $523 million due to falling prices for several*

[3] Total potential supply of CERs from program of activities as consulted on November 16, 2013 http://cdm.unfccc.int/Statistics/Public/index.html/

popular project types, voluntary actors paid a volume-weighted average price of $5.9/tCO2e, slightly down from $6.2/tCO2e in 2011 but significantly higher than under the United Nations' regulatory Clean Development Mechanism scheme.[4]"

The 2013 Voluntary Carbon Markets report also mentions the following critical facts:

Private sector leaders and Corporate Social Responsibility have accounted for 90% of offset market purchases in 2012.

> "• *A sizeable portion of market value (64% of value associated with a contract type or $170 million) was paid to offset sellers at the point of transaction rather than offset delivery – primarily via spot contracts (35.6 MtCO2e, up 25% from 2011) and pre-payment for future delivery (8.7 MtCO2e, down 1% from 2011).*
> • *Demand surged for carbon offsets from forestry projects certified to the Verified Carbon Standard and the Climate, Community and Biodiversity Standards.* ***Voluntary buyers also funneled $80 million to Gold Standard-certified offsets from projects that distribute clean Cookstoves and water filtration devices.***
> • *Suppliers predict market value could reach $1.6 - $2.3 billion in 2020 – if market actors can effectively communicate the relevance of offsetting and carbon market infrastructure to private sector actors, the international donor community, and governments seeking tools to incentivize, verify, and finance climate action.*[5]"

These findings are critical to the present and future ability to identify buyers for projects that can scale up clean Cookstoves in Haiti by identifying up-front financing as well as the potential to pair forestry projects with Cookstoves in Haiti to bring maximum carbon revenues locally, while significantly contributing to climate resilience in the most climate vulnerable nation in the western hemisphere.

The Gold Standard (GS) Certification Process is cited below, as it appears on Validating Carbon Reductions and Community Development, http://www.cdmgoldstandard.org/project-certification/ what-is-the-process as of November 16, 2013. Monitoring of GS project will be further discussed in later parts of the present document.

1. Identify suitable renewable energy/energy efficient projects
2. Open registry account
3. Undertake local stakeholder consultation
4. Produce final project design documentation
5. Obtain stakeholder feedback and project implementation
6. Identify independent auditor (Designated Operating Entity: DOE) to review & validate project
7. GS Reviews audit before project registration
8. GS External (DOE) verification
9. GS reviews verification before issuance of credits

[4] 2013 Voluntary Carbon Markets Report as consulted on November 16, 2013 http://www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9789
[5] 2013 Voluntary Carbon Markets Report as consulted on November 16, 2013 http://www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9789

Figure 2 Gold Standard Certification Process

What is its current value to the Haitian cook stove market?
The ICTP program strategy involves identifying the most effective carbon finance mechanism to reduce (buy-down) the market price of improved charcoal stoves in Haiti.

As stated in the Mid-Term Evaluation of State of Carbon Finance for the Improved Cookstoves (ICS) Program in Haiti (September 2013), "*hundreds of Cookstoves programs all over the world have assessed the use of carbon finance to reach the same objective. Many programs have been successful and have generated millions of dollars from carbon credits, such as the GERES ICS program in Cambodia, which have produced over two million ICS. This helped to create a functioning market and provide affordable ICS. However many projects have failed for very different reasons such as*:

- Poor design of the program
- The stoves were not suitable for the local populations
- The program did not generate enough carbon credits to cover the certification costs, therefore no money was available to subsidize the stoves
- Political instability made it too difficult to develop the program
- Not enough cash flow to cover the first 3-5 years before enough carbon revenues are generated

The ICTP design has relied on continued consultation with local stakeholders to understand their needs and identify the gaps between the current operating reality and the necessities related to establishing a successful cook stove program. This includes consultations with manufacturers, retailers, consumers,

consultants, policymakers and microfinance institutions. Some of the entities involved have been: Entrepreneurs du Monde, D&E Green, Ticadaie, International Lifeline Fund, Prakti, Haiti Metal, and Safico/Micama Soley, and microfinance institutions such as Fonkoze, Mercy Corps, Ananda Marga Universal Relief Team (AMURT), International Monetary Fund, BME and Papyrus, as well as self-help consumer groups.

This has also included consultation and engagement with C-Quest Capital (CQC) to initiate dialogue with local manufacturers bringing expertise in the design and administration of programs of activities in the form of carbon management services to the compliance and voluntary markets, covering all aspects of project and program design and administration.

The self-help groups meetings with ICTP staff and AMURT facilitators have ensured that stoves under consideration were improved to meet the local population's needs while being more energy efficient than traditional Cookstoves. Each improved cook stove designer was given input on their specific cook stove to modify the design to better meet the needs of the Haitian kitchen. A longitudinal study currently underway is evaluating locally manufactured Cookstoves versus imported ones. The stoves being evaluated are:

1. EcoRecho (locally produced)
2. Envirofit
3. PlopPlop (locally produced)
4. Prakti Wouj (locally assembled)
5. Men Recho d'Haiti Metal (locally produced)
6. Charbel du Burn
7. Éclair de GIZ
8. Ecozoom

This longitudinal study will help further understand local consumer preferences as well as the performance of the selected improved Cookstoves over time in Haiti.

In order for the program to generate enough carbon credits to cover the certification costs, design, approval and registration, a PoA is needed. Project scaling and identification of carbon buyer are also needed. Capacity to monitor the program over the lifetime of Offset is critical to ensure continued project compliance. All these steps are essential to subsidize stoves for long-term viability.

Current political will to improve governance while making the environment a pillar of economic growth will mitigate what can be seen as a country in transition with a past of political instability and will add to the willingness of partners to support program development.

The current ICTP program elements that facilitate manufacturers' access to grants for increased production, dialogue with microfinance institutions and learn more about carbon finance partnerships are all critical steps towards enabling the potential to generate enough cash flow to cover the first 3-5 years before sufficient carbon revenues are generated.

In order to estimate the current value of the cook stove market, data from the surveys is presented here to estimate household, street vendor and school average charcoal yearly consumption.

For households (Fwaye) and for street food (Manje kwit), annual charcoal consumption was calculated based on charcoal expenses, using an estimated price per kg of 17.37 gourdes (from the "machann chabon" survey).

Table 1 Yearly Charcoal Consumption from CQC Surveys

Survey	Yearly consumption	Margin of error at 95% confidence	Lower limit	Upper limit
FWAYE	988 kg	81 kg	907 kg	1 069 kg
LEKOL	10 282 kg	2 036 kg	8 246 kg	12 318 kg
MANJE KWIT	5 526 kg	607 kg	4 919 kg	6 133 kg

Lower limit is yearly consumption – margin of error
Upper limit is yearly consumption + margin of error

Remark: Statistical margin of error is a theoretical measure that takes into account assumptions that are beyond the control of analysis and representative sampling and standard measuring units. The sampling method adopted by CQC was treated post survey so no on-hand study is available to evaluate error due to variation in measuring units; however the margins take into account sample size. Because sample size from Papyrus data was larger, its margin of error is lower.

Table 2 Showing Yearly Charcoal Consumption from Papyrus Data

Survey	Yearly consumption	Margin of error at 95% confidence	Lower limit	Upper limit
FWAYE	789 kg	22 kg	767 kg	811 kg
MANJE KWIT	4 508 kg	389 kg	4 119 kg	4 897 kg

Estimating the Number of Schools, Households and Street Vendors in Haiti

In 2007, it was estimated that there were 15,200 primary schools in Haiti[6]. According to the World Innovation Summit on Education, there were 2,190 secondary schools in Haiti in 2011. It is estimated that charcoal consumption in 2007 had reached 30,000 metric tons and that most of this production was of local origin (data shared with writer from Chemonics files: Relevant Data and Trends for Haiti and the DR_UN and FAO Data Sources.pdf). A 2013 census of street food vendors in metropolitan Port-au-Prince registered 6,417 merchants. Because Port-au-Prince represents about 30% of Haiti's population, we could speculate that the total number of street vendors in the country is anywhere between double and 3.5 times that number, if we assume a constant ratio of street food vendors to total local population. We will use this information to project the potential size of the cook stove street vendor market and the potential savings, with a 30% reduction in yearly charcoal purchases and the adoption of improved cooking stove technologies.

According to the *Institut Haïtien de Statistiques et d'Informatique* http://www.ihsi.ht/produit_demo_soc.htm, Haiti's population has surpassed the ten million mark. In the National Baseline Study for Fuel Consumption final report by Papyrus (September 2013), the average household size was 5.5 people for the target population of potential improved stove purchases (CQC data also is very close showing 5.9 people per household surveyed on average). According to Haiti's Bureau of Mines and Energy in 2006, close to 80% of Haiti's population depended on fuel wood and charcoal for cooking while less than 30% of the households were connected (including illegal connections) to the electricity grid and only 12.5% were regularly connected to meters (taken from the Haiti Energy Sector Development Plan 2007 – 2017). Both of these factors make the current value of the Haitian cook stove market very attractive.

The significant use of charcoal in Port-au-Prince by large users and households represents an opportunity for Haiti to establish longer term sustainable energy efficient cooking solutions that build a local green economy to replace the losses in charcoal sales while encouraging local reforestation efforts.

[6] http://web.archive.org/web/20080515051806/http://www.usaid.gov/ht/education.htm as viewed on November 15th 2013.

With expansion of the market for improved biomass Cookstoves and cleaner fuels such as LPG and waste-based charcoal briquettes, clean energy businesses can engage in supplying the market with cleaner fuels and improved biomass Cookstoves. This, combined with consumer education, can pull market demand of sustainable products to heretofore unseen levels in Haiti.

However, it is critical that all Cookstoves go through a market distribution mechanism. If alternative stoves are dumped on the market, this could create a destabilizing effect on local producers' entrepreneurial drive to participate while also creating unfair competition to their efforts that non-carbon financing could undo. This can also create issues with consumers' willingness to access financing when others are getting stoves for free. This in turn would affect lending institutions' capacity to attract enough customers to maintain improved cooking stove financing programs.

How should current funding best be spent or allocated within the program or as a program developed carbon asset?

Ensuring that retailers are trained to document improved Cookstoves sales and track serial numbers uniquely to a CDM Component Project Activities (CPA) will be critical to building trust and growing partnerships with carbon asset institutions. During Dr. Ubalijoro's field visit to Haiti in September 2013, only International Life Line Fund (ILF) had established a system of indelible serial numbers for its PlopPlop stove. D&E green's PoA and CPA state that their EcoRecho stoves will be uniquely imprinted with a physically readable identification (ID) number. Paolo Lopes in his *Mid-term evaluation of the state of carbon finance for the ICS Program in Haiti - for Chemonics International* recommended that a CQC PoA required serial numbers for all stoves but that this unique code did not have to start "with CQC-H" … "to allow more flexibility for the CPAs and future changes" over the 28 years of its intended life span. Availability of a certified cook stove eco-label and marketing this label to ensure customers recognize it will facilitate branding of improved Cookstoves.

Making affordable financing available to manufacturers and consumers will be a critical element to ensuring program scaling and sufficient volume to attract sound carbon asset partnerships. Giving Haitians in the diaspora access to mechanisms to gift purchases of improved Cookstoves and possibly even waste-derived charcoal briquettes could represent significant leverage to growing the market. With an estimated two billion dollar annual remittance envelope, this is definitely an option that needs to be fully harnessed[7]. Funding a regulatory body to oversee the certification process and also monitor standards established by certification is needed. Assuring the long term sustainability of a regulatory body and the training of technicians to use Portable Emissions Monitoring Systems or alternative means of monitoring are also required.

The reality that many of the charcoal and stove wholesalers are men and the micro-retailers are women requires specific gender-sensitive support to ensure that assistance to the improved cook stove program is not seen as a threat to earnings from charcoal sales but as a diversification of income and also a contributing element to valuing Haiti's five E's of Education, Environment, Energy, Employment and rule of law-based Economy and state (*Etat de droit*) for both men and women.
Awareness of the continuously evolving state of carbon funds is critical to Haiti's capacity to tap into these funds as well as identify partners able to facilitate this process. The table below shows a list of carbon funds as identified by the writer as being of potential interest to Haiti.

[7] Tatiana Wah (2013). Engaging the Haitian Diaspora in Cairo Review of Global Affairs as consulted on November 7, 2013: http://www.aucegypt.edu/gapp/cairoreview/pages/articleDetails.aspx?aid=333#.

Table 3 Carbon Funds of Potential Relevance to Haiti

Sampling of Carbon funds and their monetary value (2012)	
Adaptation Fund (AF)	$120,660,000
Amazon Fund	$32,440,000
Australia's International Forest Carbon Initiative	$216,270,000
Clean Technology Fund (CTF)	$2,855,000,000
Forest Carbon Partnership Facility - Carbon Fund (FCPF-CF)	$121,000,000
Forest Carbon Partnership Facility - Readiness Fund (FCPF-RF)	$179,500,000
Forest Investment Program (FIP)	$206,000,000
GEF Trust Fund (GEF 4)	$753,740,000
GEF Trust Fund (GEF 5)	$1,141,000,000
Germany's International Climate Initiative	$851,280,000
Global Climate Change Alliance (GCCA)	$385,360,000
Global Energy Efficiency and Renewable Energy Fund (GEEREF)	$169,500,000
Green Climate Fund (GCF)	$799,000
Indonesia Climate Change Trust Fund (ICCTF)	$21,010,000
Japan's Fast Start Finance	$15,000,000,000
Least Developed Countries Fund (LDCF)	$470,539,999
MDG Achievement Fund	$89,500,000
Norway's International Climate and Forest Initiative	$1,607,820,000
Pilot Program for Climate Resilience (PPCR)	$514,000,000
Scaling Up Renewable Energy Program (SREP)	$229,000,000
Special Climate Change Fund (SCCF)	$241,610,000
UK's International Climate Fund	$4,640,000,000
UN-REDD	$24,029,999
Total Availability	**$29,870,058,998**

Suggested monitoring methodology included in the baseline report to evaluate different monitoring methodologies and identify the most effective one for National CDM monitoring

This section will integrate simplified sections of CDM methodology with illustrations from the ICTP program data, related surveys and commentary from the writer. No quotation marks will be used in reference to CDM methodology: reference to the methodology is implicit. The type of project under consideration belongs to the CDM category AMS-II.G Small-scale Methodology: Energy efficiency measures in thermal applications of non-renewable biomass Version 05.0 (most recent version available as of November 17, 2013 as described at http://cdm.unfccc.int/methodologies/DB/REQC2MYZJJ6I7BC9SKCS32T2K87AOW.

If a CDM+Gold Standard methodology is chosen, monitoring will also include certified co-benefits covering social, economic and environmental aspects that are clearly articulated in addition to being CDM compliant.

Table 4 CDM Methodology Key Elements

Typical project(s)	Introduction of highly-efficient thermal energy generation units utilizing non-renewable biomass or retrofitting existing units (e.g. complete replacement of existing biomass fired Cookstoves or ovens or dryers with more-efficient appliances) reduces use of non-renewable biomass for combustion
Type of greenhouse gas (GHG) emissions, mitigation action	(a) Energy efficiency. Displacement or energy efficiency enhancement of existing heat generation units results in saving of non-renewable biomass and reduction of GHG emissions

Comparative of methodology based on different carbon standards as described by Paolo Lopes in *Mid-term evaluation of the state of carbon finance for the ICS Program in Haiti - for Chemonics International (September 2013)* is shown in the table below:

Table 5 Comparative Methodology of Carbon Standards

CDM	CDM + GS	VGS
The methodology uses several default values which lower the need to complete studies, thus it becomes cheaper; however it generates fewer credits	On top of the CDM methodology, the GS requires more monitoring and studies to assess the co-benefits. This increases the costs of running the program	Voluntary Gold Standard (VGS) methodology is more suitable for local conditions and provides a more accurate picture of the reality on the ground. As the co-benefits are also certified, the monitoring costs increase

(Complete table with description of other critical elements beyond methodology is available in the annex, "Understanding the Carbon Market")

Initial interest of the ICTP program to choose a path to develop a CDM project makes sense in terms of D&E Green Enterprise having initiated the PoA registration process under CDM, obtained the letter of approval from DNA and having Enel (Italy's largest power company and the second largest utility listed in Europe by installed capacity) as an offset buyer lined up at a $7/Certified Emission Reduction (CER) carbon credit. The pricing of the CER is a very advantageous one in current market conditions for a CDM project where CERs are trading at $0.30/CER and averaging $3. According to Paulo Lopes, improved cook stove projects can be sold at a higher price, but there is no estimate at the moment. Publication of PoA 9698: Replacement of traditional charcoal stoves with efficient EcoRecho stoves in Haiti at http://cdm.unfccc.int/ProgrammeOfActivities/poa_db/45N2WHPB9DJYUFTELKR8ZIC7OQSAM6/view provides a baseline for other local manufacturers to work with. What is also critical is that the independent validation report associated with this PoA provides useful information for new projects in the pipeline which are considering joining this PoA – a current consideration for International Life Line Fund (ILF) or others wanting to establish their own PoA within the CDM framework or interested in a CDM+GS project that also certifies social, economic and environmental co-benefits. The advantage is that CERs+GS are trading at a higher price than stand-alone CERs. CERs+GS are trading at an average price of $13 (min $2, max $35). Going the VGS path at this point is also a possibility as Voluntary Emissions Reduction carbon credits (VERs) have an average price of $9 and trade between $5 and $35. As discussed with ICTP staff, a CERs+GS path with the right partnerships in place would be of great benefit to Haiti. This report includes information from the mid-term evaluation of carbon finance for an ICS Program that supports this route and that remains up-to-date at the time this report was written.

Another element to take into consideration is the co-benefits clearly stated in D&E Green's CDM PoA:

- 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.

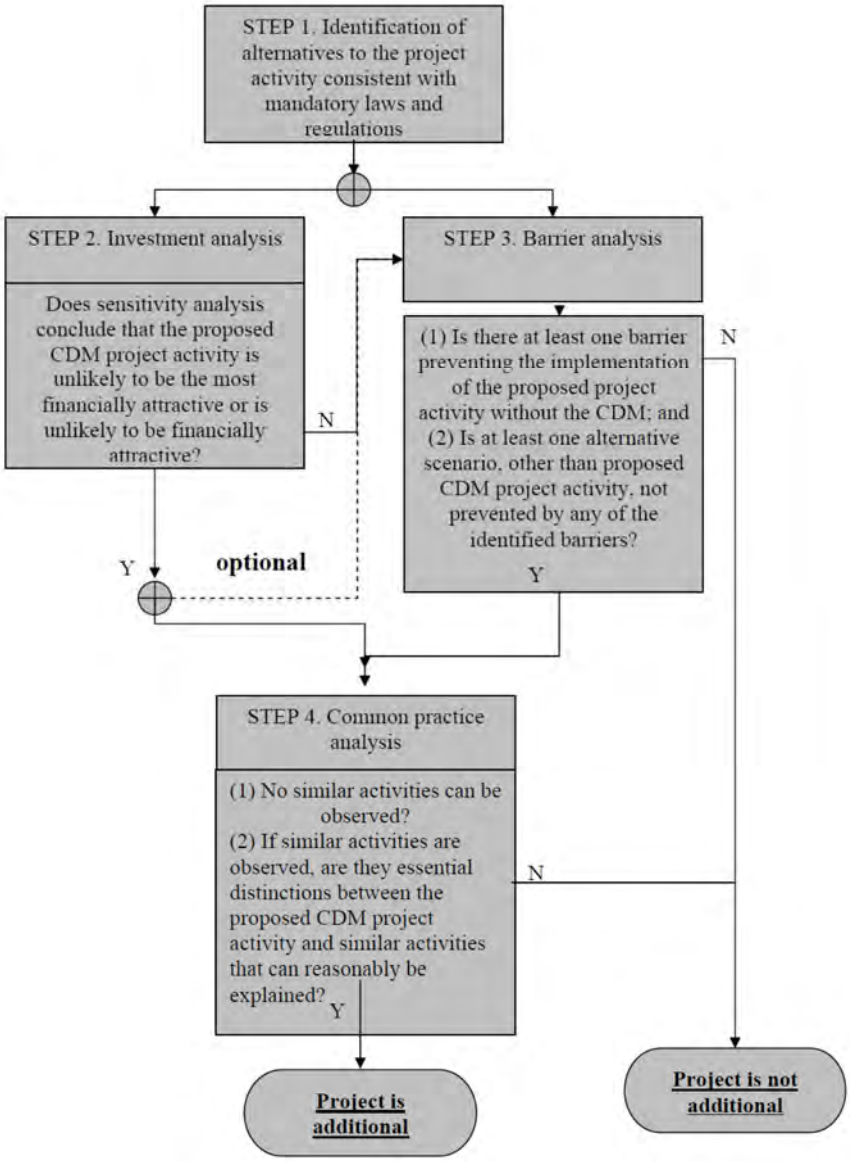
- Socio-Economic Benefits:
    - Improve the overall health of the family by reducing indoor pollution. Decrease cooking time so as enable the women to engage in other occupations. Decrease the family spending on charcoal by improved cooking efficiency.
    - Generate employment in the local communities 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.

Showing Additionality

The capacity to show additionality in relation to project activity is the foundation of any successful monitoring. Project participants can use either investment analysis or barrier analysis step from the EB 65 Report Annex 21 on Methodological tool: Tool for the demonstration and assessment of additionality" (Version 06.0.0). They may, if they so wish, use both investment and barrier analysis step.

The table below demonstrates the steps required to ensure that additionality is present using this CDM methodology.

Figure 3 Step by Step Methodological Additionality Tool Examination[8]:



Baseline methodology should include:

- Project boundary: The physical, geographical site of the efficient devices that burn biomass.
- Baseline emissions: This should show the scenario in the absence of the project activity
- Emission reductions calculations
- The emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis.
- Specific yearly fuel consumption or fuel consumption rate of the baseline devices using weighted average values if more than one type of device is being replaced
- Specific yearly fuel consumption or the fuel consumption rate of the devices deployed as part of the project

[8] Methodological tool "Tool for the demonstration and assessment of additionality" from CDM Executive Board (EB) 65 report http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf as captured on November 8, 2013.

- Testing protocol that is the same for both the device being replaced and the device being deployed.

Table 6 Traditional Stove Specific Fuel Consumption Results Based on ICTP Testing

	ICTP CCT results	ICTP CCT results	ICTP CCT	Nexant CCT results
Ingredients tested	1.75kg rice, 0.65kg beans	1.75kg rice, 0.65kg beans	1.75kg rice, 0.65kg beans	1kg rice, 0.5kg beans
Stove model tested	Traditional round	Traditional rebar (single burner stove)	Traditional square	Traditional round
Value	**Result**			
Stove costs	75-100 HTG ($1.90-$2.50)	200-500 HTG ($5-$12.50)	100-200 HTG ($2.50-$5)	
Charcoal fuel savings % (compared to traditional round)	0%	3%	-1%	0%
Charcoal fuel savings % (compared to traditional rebar)	-3%	0%	-4%	N/A
Charcoal fuel savings % (compared to traditional square)	1%	4%	0%	N/A
Average fuel savings % (compared to all 3 traditional stoves)	-0.9%	2.3%	-1.6%	N/A
Average amount of food cooked (g)	3278	3624.5	3246.3	3583 Trad Round
Average cooking time (min)	153	135	145	N/A
Average fuel consumed (g)	1196.1	1158.4	1204.21	954 Trad Round
Fuel cost savings per family meal (compared to average of traditional stoves) $	($0.01)*	$0.02	($0.02)*	0
Average annual charcoal savings (kg/HH) from cooking 1 meal on a fuel efficient stove (fes) per day	-3	8	-6	N/A
Annual savings $ from constant fes use compared to average traditional stoves (USD)**	($3.02)*	$8.22	($5.51)*	N/A

*Dollar amounts in parentheses are negative numbers and demonstrated the added cost to the household each time the cook stove is used. It is clear that within one year, it is more costly for a household to continue to use the same traditional round cook stove or traditional square cook stove then to purchase a new cook stove.

** Does not include the price of the cook stove

List of values calculated for each improved cook stove to establish viability as a source of energy efficiency improvement:

- Charcoal fuel savings % (compared to traditional round)
- Charcoal fuel savings % (compared to traditional rebar)
- Charcoal fuel savings % (compared to traditional square)
- Average fuel savings % (compared to all 3 traditional stoves)
- Average amount of food cooked (g)
- Average cooking time (min)
- Average fuel consumed (g)
- Fuel cost savings per family meal (compared to average of traditional stoves) $
- Average annual charcoal savings (kg/HH) from cooking 1 meal on improved cook stove per day

Simplified description with commentary from sections 4.2 to 5.1 of energy efficiency measures in thermal applications of non-renewable biomass CDM baseline and monitoring methodology

4.2.1 Differentiation between non-renewable and renewable woody biomass

Project participants shall determine the shares of renewable and non-renewable woody biomass (the quantity of woody biomass used in the absence of the project activity) and the total biomass consumption using nationally approved methods (e.g. surveys or government data, if available). The following principles shall be taken into account:

4.2.2 Demonstrably renewable woody biomass (DRB)

Woody biomass is "renewable" if one of the following two conditions is satisfied:

(a) The woody biomass originates from land areas that are forests in which:
  - (i) The land area remains a forest; in the case of charcoal produced from woody biomass, the demonstration of renewability shall be done for the areas where the woody biomass is sourced.
  - (ii) 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 decrease over time (carbon stocks may temporarily decrease due to harvesting); and
  - (iii) Any national or regional forestry and nature conservation regulations are complied with;

(b) The biomass is woody biomass and originates from non-forest areas (e.g. croplands, grasslands) in which:
  - (i) The land area remains as non-forest or is reverted to forest;
  - (ii) Sustainable management practices are undertaken on these land areas to ensure that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
  - (iii) Any national or regional forestry, agriculture and nature conservation regulations are complied with.

4.2.3 Non-renewable biomass (NRB)

NRB is the quantity of woody biomass used in the absence of the project activity minus the *DRB* component, as long as at least two of the following supporting indicators are shown to exist:

(a) A trend showing an increase in time spent or distance travelled for gathering fuel wood, 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;

(b) 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;

(c) Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;

(d) Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass. Thus the fraction of woody biomass saved by the project activity in year *y* that can be established as non-renewable can be calculated.

Project participants shall also provide evidence that the identified trends are not occurring due to the enforcement of local/national regulations. This is a very important criterion to keep in mind and go over with policymakers, as environmental regulation related to enforcement could annul additionality.

4.3 Leakage

Leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced. The potential source of leakage due to the use/diversion of non-renewable woody biomass saved under the

project activity by non-project households/users that previously used renewable energy sources shall be considered. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass by the non-project households/users that is attributable to the project activity, then calculations are adjusted to account for the quantified leakage. If devices currently being utilized outside the project boundary are transferred to the project activity, then leakage is to be considered. In this instance, for example, monitoring a sudden increase in the use of traditional energy inefficient stoves within project boundaries (in this case national borders) in an area where woody biomass has had no time to be renewed – thus effectively considered non-renewable – would require calculation adjustments. This can be relevant in disaster situations.

5. Monitoring methodology

Monitoring shall consist of checking all devices or a representative sample thereof at least once every two years (biennially) to determine if they are still operating; those devices that have been replaced by an equivalent in-service device can be counted as operating.

Monitoring shall also consist of checking the efficiency of all devices or a representative sample thereof annually as below:

(a) For project activities using the Kitchen Performance Test Protocol to determine the quantity of fuel saved, monitoring shall determine the fuel consumption per operating device of all operating devices or a representative sample thereof, annually;
(b) For project activities using the Water Boiling Test protocol, monitoring shall consist of determining the efficiency of all operating devices or a representative sample thereof, annually.
(c) For project activities using the Controlled Cooking Test protocol, monitoring shall consist of determining the specific fuel consumption of all operating devices or a representative sample thereof, annually. Biennial monitoring (i.e. monitoring once every two years) may be chosen, if the project proponents are able to demonstrate that the efficiency of the cook stove does not drop significantly, compared to the initial efficiency of the new device, over a time period of two years of typical usage. In Haiti, harsh weather conditions with frequent hurricanes combined with heavy amounts of salt in the air affect the longevity of Cookstoves. According to ICTP staff with experience in landlocked regions, stoves that have a 1-2 year life span in Haiti, can keep their energy efficiency over 3-5 years. The replacement rate and initial cost of Cookstoves need to be embedded in the project life span for technical and cost monitoring to ensure cash flow and carbon revenues are well lined up.

In order to assess the leakage described above, monitoring shall include data on the amount of woody biomass saved under the project activity that is used by non-project households/users (who previously used renewable energy sources). Other data on non-renewable woody biomass use required for leakage assessment shall also be collected.

Monitoring shall ensure that either:

(a) The replaced low efficiency devices 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 calculations.

Relevant parameters shall be monitored and recorded during the crediting period as indicated in section 5.1 below. The applicable requirements specified in the "General guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be followed by the project participants.

5.1 Data and parameters monitored

Table 7 Data/Parameter table sample

Data/Parameter	
Data unit:	-
Description:	Number of project devices that are operating in year *y*
Source of data:	-
Measurement procedures (if any):	As per paragraph 11 and 22
Monitoring frequency:	At least once every two years (biennial)
QA/QC procedures:	-
Any comment:	-

Tables for the following seven parameters can be monitored:

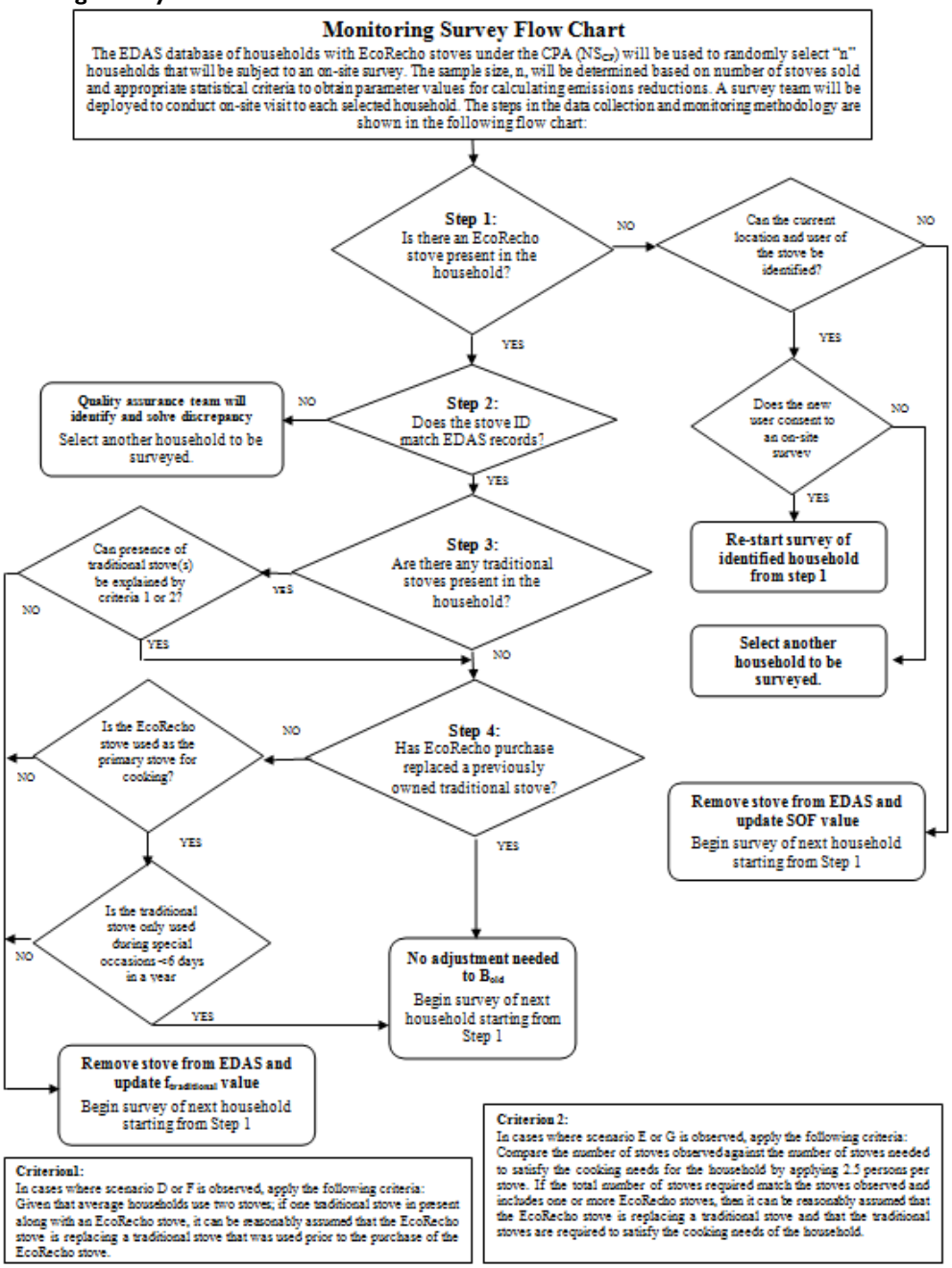
1. Ny = Number of project devices of type *i* operating in year *y*, determined as per paragraph 22.
2. $B_{y,new,KPT}$ = Annual quantity of woody biomass used in year *y* in tons per device, measured as per the Kitchen Performance Test (KPT) protocol. The KPT should be carried out in accordance with national standards (if available) or international standards or guidelines (e.g. the KPT procedures specified by the Partnership for Clean Indoor Air (PCIA) <http://www.pciaonline.org/node/1049)>.
3. $B_{y,new,survey}$ = Annual quantity of woody biomass used during the project activity in tons per device, determined through a survey.
4. $HG_{p,y}$ = Amount of thermal energy generated by the project devices in year *y* (TJ), if the thermal output of the devices can be directly measured.
5. $\eta_{new,y}$ = Efficiency of the device being deployed as part of the project activity (fraction), as determined annually using the water boiling test (WBT) protocol carried out in accordance with national standards (if available) or international standards or guidelines.[9] Use weighted average values if more than one type of system is being introduced by the project activity.
6. $SC_{new,y}$ = Specific fuel consumption or the fuel consumption rate in year *y* of the devices deployed as part of the project; i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively. Use weighted average values if more than one type of system is being introduced by the project activity.
7. $f_{NRB,y}$ = the fraction of woody biomass saved by the project activity in year *y* that can be established as non-renewable.

Annex 3 shows which parameters D&E Green decided to monitor in their CDM Component Project Activities (CPAs). Annex 4 shows Fraction of Non-Renewable Biomass for the D&E Enterprise PoA calculations under this methodology, while Annex 5 shows the D&E Enterprise calculations also under this methodology for ex ante Emission Reduction Calculations for the PoA. Both annexes represent excellent guidelines for establishing CDM monitoring guidelines, with a review of the related validation report available at http://cdm.unfccc.int/filestorage/l/_/75V2STK6BX4JU9E3N0GPH8IYFQARM1.pdf/Val%20Rep%20Haiti%20POA_%20V03_FINAL%2020130724.pdf?t=NVd8bXdmNGttfDAuOhZqocGcBjtlEOUGNmQl.

In terms of survey monitoring, the flow chart presented by D&E Green is an example that can be used as a guideline for new projects as it promotes an Electronic Data Archival System (EDAS) and QA/QC procedures.

[9] In all cases the testing protocol shall be the same for both the device being replaced and the device being deployed.

Figure 4 Monitoring Survey Flow Chart



Adding Gold Standard Guidelines

Designing a CDM+GS project not only brings more carbon revenues (average selling price $13/CER) but can also bring substantial benefits to local development. These benefits include transformative access to jobs for marginalized populations, socio-economic empowerment of women, improvements in health and local livelihoods linked to increased income, improved air quality, improved safety standards and better working conditions in local manufacturing facilities for staff, access to health insurance, commitment to no child labor, better waste management systems and better monitoring of all activities. Designing a CDM+GS entails a commitment to quality and positive values, thus engaging a continuous focus on areas that need improvement from social, economic and environmental perspectives.

This requires:

- Local Stakeholder Consultation (LSC),
- Comments from local people, NGOs, government and private entities are taken into account
- Sustainable matrix with 12 parameters is assessed
- GS Passport document
- Do No Harm (DNH) assessment which includes 11 parameters to be monitored
- Monitoring plan for a sustainability development matrix

Table 8 'Do No Harm' Assessment Safeguarding Principles

Safeguarding Principles	
Human Rights	
1	The project respects internationally proclaimed human rights including dignity, cultural property and uniqueness of indigenous people. The project is not complicit in Human Rights abuses.
2	The project does not involve and is not complicit in involuntary resettlement.
3	The project does not involve and is not complicit in the alteration, damage or removal of any critical cultural heritage.
Labor Standards	
4	The project respects the employees' freedom of association and their right to collective bargaining and is not complicit in restrictions of these freedoms and rights
5	The project does not involve and is not complicit in any form of forced or compulsory labor.
6	The project does not employ and is not complicit in any form of child labor.
7	The project does not involve and is not complicit in any form of discrimination based on gender, race, religion, sexual orientation or any other basis.
8	The project provides workers with a safe and healthy work environment and is not complicit in exposing workers to unsafe or unhealthy work environments
Environmental Protection	
9	The project takes a precautionary approach in regard to environmental challenges and is not complicit in practices contrary to the precautionary principle. This principle can be defined as: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."
10	The project does not involve and is not complicit in significant conversion or degradation of critical natural habitats, including those that are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value or (d) recognized as protected by traditional local communities
Anti-corruption	
11	The project respects the employees' freedom of association and their right to collective bargaining and is not complicit in restrictions of these freedoms and rights. The project does not involve and is not complicit in corruption.

Table 9 Sustainability Development Matrix[10]

Indicator	Mitigation measure	Relevance to achieving MDG	Chosen parameter and explanation	Preliminary score
Gold Standard indicators of sustainable development	*If relevant copy mitigation measure from "do no harm" - table, or include mitigation measure used to neutralize a score of '-'*	*Check www.undp.orlmdg and www.mdgmonitor.org Describe how your indicator is related to local MDG goals*	*Defined by project developer*	*Negative impact: score '-' in case negative impact is not fully mitigated score 0 in case impact is planned to be fully mitigated No change in impact: score 0 Positive impact: score '+'*
Air quality				
Water quality and quantity				
Soil condition				
Other pollutants				
Biodiversity				
Quality of employment				
Livelihood of the poor				
Access to affordable and clean energy services				
Human and institutional capacity				
Quantitative employment and income generation				
Balance of payments and investment				
Technology transfer and technological self-reliance				
Justification choices, data source and provision of references				
Air quality				
Water quality				

The two tables above are from the reference stated below.

[10]Gold Standard Foundation Submission to CDM EB as consulted on November 17, 2013: http://cdm.unfccc.int/public_inputs/2011/sustainability_benefits/cfi/YO7AGC7N4U4EO0LLKTS1UCWMU3Z3E9

Increased Costs and Revenues Related to CDM+GS

- Going through the CDM+GS option requires the following additional costs above the CDM process:
- Designated Organizational Entity (DOE) costs for validation = approximately $10,000
- Organizing the Local Stakeholder Consultation (LSC) and completing the report takes approximately 34 person-days
- Writing the GS Passport takes approximately 10 person-days
- GS registry fees are $0.10/CER

The entire process, from organizing the LSC, going through the validation process and registering the project, takes about ten months. Selling CER+GS credits generates more revenues than normal CERs (on average $13/CER versus $3/CER), but additional costs require upfront payments. The positive trend in voluntary markets of CER buyers making payments at the point of transaction rather than at offset delivery and pre-payment for future delivery if transferred to CDM+GS, could make the added costs more manageable. The D&E Green enterprise projections for emission reductions (see Annex 5 for initial numbers projected from data obtained through ICTP) projects that in 2013 it will generate over 60,000 CERs at 7$/CER. If these projections become actual CERs, this would represent over $420,000 in value (with 62,178 stoves). D&E Green enterprise projects that average annual emissions reductions during life of project will represent 125,660 tCO_2/y. This would represent $879,620. The likelihood of these numbers being attained may take more years than projected, as scale up of manufacturing, sales and monitoring is fine-tuned, but it is an objective other local stakeholders can aspire to. With households on average having 5-6 people, a potential access to 50% of the current Haitian population (over 800,000 stoves minimum, as many households use more than one stove), would represent an eventual yearly value of $5.6 million or more at $7/CER, a value of $3.2 million at $3/CER or $10.4 million at $13/CER+GS. As efforts to scale up occur, it is critical to monitor which sources of funding are contributing to the scale up to ensure that official development assistance (ODA) funding does not affect additionality, while still contributing to improving Haiti's access to emission reductions programs.

IMPLEMENTATION PROTOCOL AND METHODOLOGY USED TO CONDUCT SURVEYS/DATA COLLECTION

Review of National Baseline Study for Fuel Consumption

The baseline survey undertaken by Papyrus revealed that targeted households relied on charcoal to prepare their meals over 90% of the time, validating the need to develop and help mature the local improved cook stove supply. Apart from the months of October and December, when the amount of charcoal used is slightly higher (10%), there is virtually no difference for the other months. Households had 1 to 9 stoves and used on average 1.58 stoves at least once a week. A total of 42.93% consistently used more than one stove at a time, 94.15% of the households used more than one stove at least once a week but only 4.57% had a metal sheet to protect from the wind. This data confirms that access to improved Cookstoves represents a significant energy efficiency savings and also that households in general require more than one stove for their routine cooking needs. This is important information for future project monitoring purposes. About a third of all stoves were used indoors.

Papyrus survey teams were experienced and had implemented other studies, showing a proven track record as highly efficient and consistently thorough in their approach. It is critical to select experienced surveyors when collecting data for this type of survey. The survey tool was administered flawlessly, as any variance in responses obtained could greatly impact the analysis. A team of twenty surveyors and

five supervisors, each with at least five surveys' worth of experience, was selected and trained on the tools to be used. Papyrus worked closely with the ICTP team to refine these tools.

The surveyor training took place during the morning of June 27. Todd Wofchuck from the ICTP team participated in the training and demonstrated the use of the scales. Based on his presence at the survey pilot launch, Papyrus considered that the survey implementation plan was approved and therefore initiated the survey. An initial pre-pilot survey had eight surveyors each complete two examples of the "Fwaye" questionnaire and one of each of the "Machann Manje" and Machann Chabon" questionnaires.

After the questionnaires were delivered to the Survey Coordinator, she went over each one to ensure they were filled out properly. Some errors were found that were the result of misunderstanding of some of the questions in the questionnaires. These were brought up in the recap session.

On the afternoon of June 28, 2013, Elisha Moore-Delate and Todd Wofchuck, two members of the ICTP team, came to the Papyrus offices for a three hour recap session, during which both the Creole language and more substantive issues were discussed and the questionnaires revised for use in the main survey.

The baseline began with a pilot study that was conducted as described in the table below. Note that Papyrus intended to conduct 40 pilot surveys rather than the requisite 27 (15 of Q1, 5 of Q2 and 7 of Q3 as shown in the table below) so that each of the ten surveyors would had the opportunity to test all three survey tools (two of the *foyer* questionnaires and one each of the other two), thereby broadening the potential for identifying areas for improvement in terminology and/or format. One of the surveyors was unavailable and one was ill, resulting in 32 surveys completed. The two surveyors who were unable to participate were brought up to speed during the role-playing session for the main survey that was held with all 11 surveyors on July 4.

Figure 5 Pilot Survey Table

		PILOT SURVEY TABLE							
		Questionnaires:	Q1 - Houshold baseline charcoal questionnaire						
			Q2 - Charcoal vendor questionnaire - weights and measures						
			Q3 - Street food vendor questionnaire						
		Department	**Section Communale**	**Area**	**Q1**	**Q2**	**Q3**	**Total**	**Surveyors**
Friday 21 June	Team 1 and 2	**OUEST**	Pétion-Ville	Jalousie	10	0	0	0	10
			Pétion-Ville	Nerette	10	0	5	0	10
			Pétion-Ville	Marché de Pétion-Ville	0	10	5	0	10
		Totals			**20**	**10**	**10**	**40**	**10**

Final Questionnaire

The final questionnaires were reviewed by the ICTP team and approved for use during the field surveys. The pilot process was instrumental in the success of the study in the field. It served to ensure Papyrus surveyors had a solid grasp of the content of each questionnaire and to refine the language and content to suit the local context to the extent possible.

Completion of Four Surveys

The following four surveys were completed to establish the National Baseline for fuel consumption:

1. **Urban zone household charcoal consumption survey.** 300 surveys, 25 in each of the following locations: Anse d'Hainault, Cap-Haïtien, Desdunes, Gonaïves, Gros-Morne,

Hinche, Jérémie, Léogâne, Limonade, Port-de-Paix, Saint-Michel-de- l'Attalaye, and Trou-du-Nord

2. **Peri-urban Port-au-Prince zone household charcoal consumption survey.** 112 surveys, 28 in each of the following locations: 2ème Section des Varreux (Croix des Bouquets), 3ème Section Petit Bois (Croix des Bouquets), 3ème Section Bellevue (Quartier de la Croix des Missions), and Quartier de Thomassin
3. **Peri-urban Port-au-Prince zone food vendor charcoal consumption survey.** 112 surveys, 28 in each of the following locations: 2ème Section des Varreux (Croix des Bouquets), 3ème Section Petit Bois (Croix des Bouquets), 3ème Section Bellevue (Quartier de la Croix des Missions), and Quartier de Thomassin
4. **Charcoal weight and price survey.** 95 surveys, conducting 35 surveys in metropolitan Port-au- Prince, 5 in each of the following 12 locations: Anse d'Hainault, Cap-Haïtien, Desdunes, Gonaïves, Gros-Morne, Hinche, Jérémie, Léogâne, Limonade, Port-de-Paix, Saint- Michel-de- l'Attalaye, and Trou-du-Nord.

Implementation

The survey team was divided up into four groups and deployed simultaneous to all of the regions as per the Study Plan chart below. Each surveyor was able to complete 15 surveys over a two-day period in each of the requisite regions. The survey began on Monday July 29 and all surveys were complete on Sunday August 4, for a total of 6 days in the field, with 11 surveyors.

Figure 6 Study Plan

		STUDY PLAN												
		CODES :	Q1 - Fwaye											
			Q2 - Machann Chabon											
			Q3 - Machann Manje Kwit											
		Department	**Section Communale**	**CITY**	**Q1**	**Q2**	**Q3**	**Total**	**Enq.**	**Days**	**Nights**	**Surv-nites**	**Chrono**	**Dates**
1st phase	5 teams of 2	**OUEST**	2ème Section de Varreux	Croix des Bouquets	28	5	28	61						
			3ème Section Petit Bois	Croix des Bouquets	28	5	28	61						
			3ème Section Bellevue	Croix des Missions	28	5	28	61						
				Quartier de Thomassin	28	5	28	61						
				Léogâne	25	5		30						
			7 urban sections of Port-au-Prince			35		35						
		Total Voyage A			**137**	**60**	**112**	**309**	**10**	**5**	**0**	**0**	**5**	
2nd phase	tm 2	**GRANDE-ANSE**		Anse d'Hainault	25	5		30						*Mon 29 to Sun 4*
				Jérémie	25	5		30						
		Total team 1			***50***	***10***	***0***	***60***	***2***	***7***	***6***	***12***	***7***	
	tm 1	**NORD-OUEST**		Port-de-Paix	25	5		30						*Wed 24 to Sat 27*
		Total team 2			***25***	***5***	***0***	***30***	***2***	***4***	***3***	***6***	***4***	
	tm 3	**NORD and NORD-EST**		Cap-Haïtien	25	5		30						*Mon 29 to Sun 4*
				Limonade	25	5		30						
				Trou-du-Nord	25	5		30						
		Total team 3			***75***	***15***	***0***	***90***	***3***	***7***	***6***	***18***	***7***	
	tm 4	**ARTIBONITE**		Desdunes	25	5		30						*Mon 29 to Sat 3*
				Gonaïves	25	5		30						
				Gros Morne	25	5		30						
				Saint Michel de l'Attalaye	25	5		30						
		Total team 4			***100***	***20***	***0***	***120***	***4***	***6***	***5***	***20***	***6***	
	tm 1	**CENTRE**		Hinche	25	5		30	2					*Mon 29 to Thu 1*
		Total team 2			***25***	***5***	***0***	***30***	***2***	***4***	***3***	***6***	***3***	
		Totals			**412**	**115**	**112**	**639**				**62**		
		team 1	Olguine and Guilène											
		team 2	Patrick and Josué											
		team 3	Sheldy, Ginelove and Mustapha											
		team 4	Roseline, Myrtho, Kasparov and Mike											

Data Entry

Jean-Francois Tardieu, well-known Haitian statistician and member of the survey team, created data entry portals to look exactly like the survey tools, making the data entry easier for the entry team. A team of four data entry personnel worked on four Papyrus dedicated laptop computers that were not connected to the internet in order to ensure the security of the data. Once all three surveys were

entered a first time, they were then re-entered by a different data entry person and compared in Excel. Any differences that were noted in comparing the double entry data were rectified and three clean data sets were then submitted to the ICTP team in Excel as a third deliverable. Clean data is data with zero data entry errors. Libre Office is the software that was used. These clean data sets were used to perform the required analysis as is reflected in the next section.

Data review

Data quality of survey results and process was reviewed by Dr. Ubalijoro, with Jean Francois Tardieu, Papyrus' statistician, at the Papyrus offices. Extraction of data from the survey to support baseline assessment of fuel consumption at national level was undertaken.

In addition to surveys conducted by Papyrus, Dr. Ubalijoro also reviewed data from the CQC survey (data entry by Papyrus). Three surveys were collected last year by CQC targeting the following three categories of respondents: "Fwaye" (Household) Data, "Machann Manje Kwit" (Food Vendors), and "Lekòl" (Schools). Papyrus was asked to create three data entry portals and to enter this data. These data were entered twice, compared and corrected and three separate clean data files were submitted to the ICTP team on Friday October 18, 2013. Analysis was then performed from this clean data. The sample consisted of 161 respondents. Five questionnaires were unusable, thus the operational sample was 156 respondents, living in the communes of Tabarre (44%), Pétion-Ville (33%), Port-au-Prince (12%) and Delmas (12%).

These surveys represented a smaller dataset and revealed similar trends of charcoal use while also extending data to include schools.

The following information was extracted:

Table 10 CQC Survey Data Review

Commune	Frequency	%	Valid %	Cumulate %
Tabarre	68	42.24	43.59	43.59
Petionville	51	31.68	32.69	76.28
Delmas	19	11.80	12.18	88.46
Port-au-Prince	18	11.18	11.54	100.00
	5	3.11	Missing	
Total	161	100.00		

Figure 7 Household Consumption – "Fwaye"

Households surveyed in the Papyrus study counted 5.5 members on average. Food is made primarily for household members. The CQC survey showed an average of 5.9 members (data available in deliverable 6). The ratio of adult women by adult men is very high (1.47).

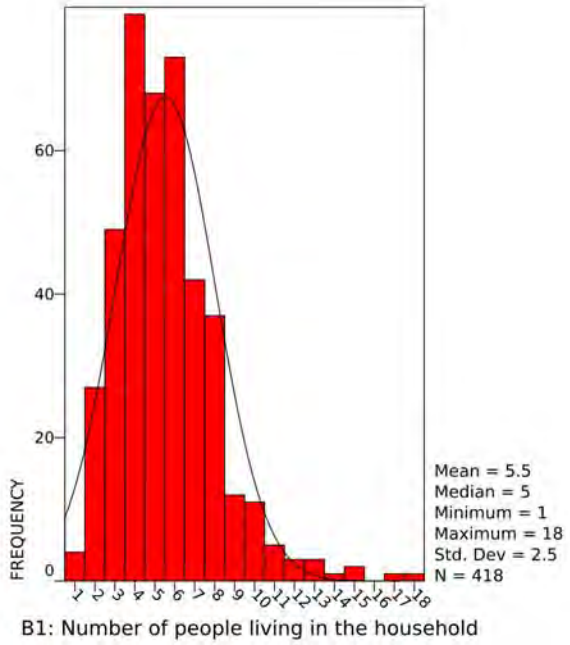


Figure 8 Household Charcoal Expense per day from Papyrus Data

Assuming that charcoal price is, on average, 17.37 HTG per kg (see "Machann chabon" survey raw data), use of charcoal per household is 2.07 kg per day. Data points representing charcoal expenses per day of 85 gourdes and over were considered outliers (2% of sample).

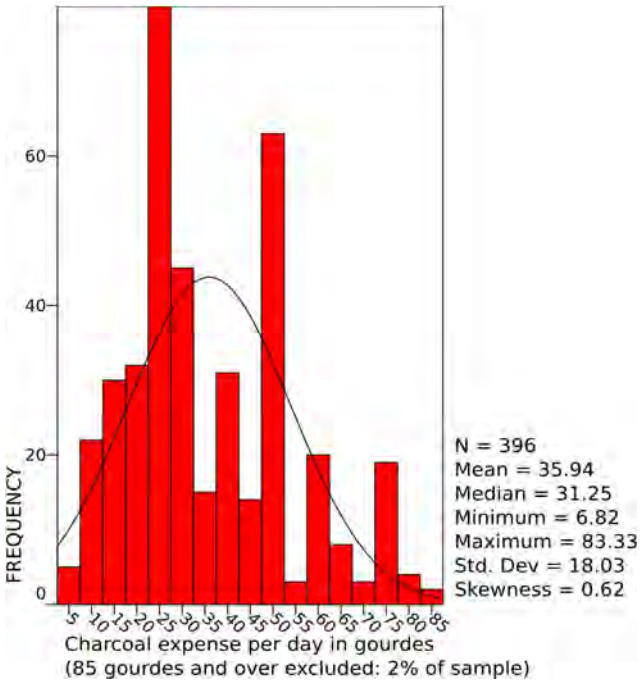


Figure 9 Charcoal Expense per Person per day from Papyrus Survey

At a cost of 17.37 HTG per kg, average charcoal expense per person per day is HTG 7.47.

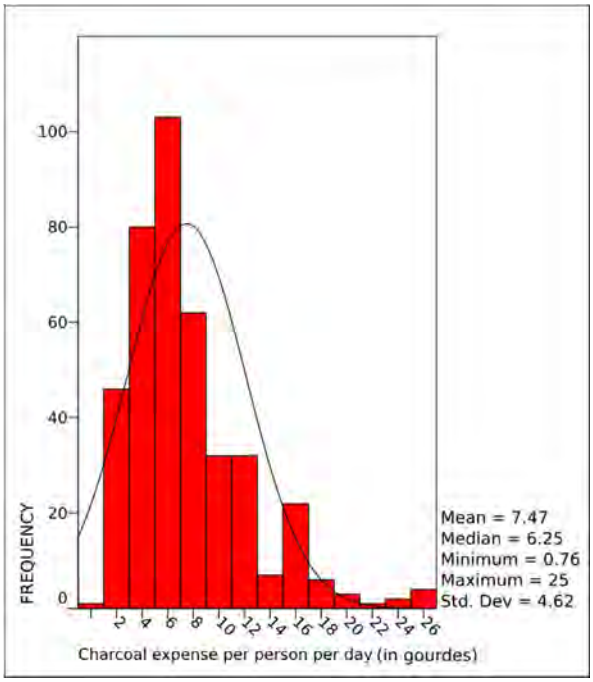
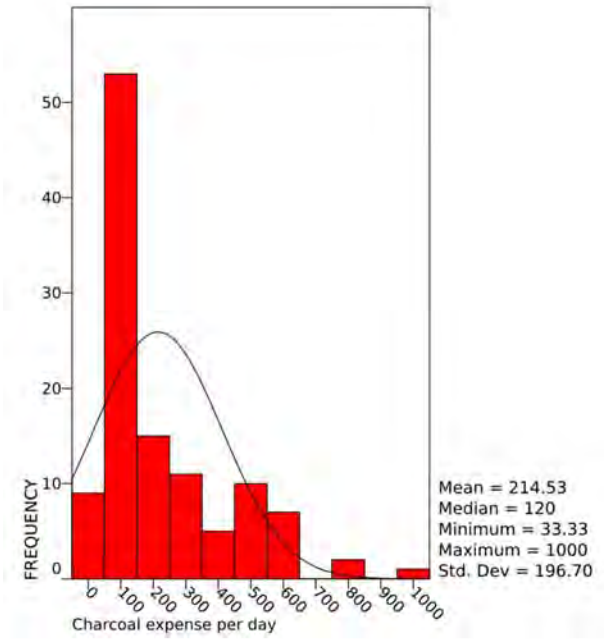


Figure 10 Street Vendor Charcoal Expense per day from Papyrus Survey

Assuming that charcoal price is on average 17.37 HTG per Kg, these merchants use on average 12.35 Kg of charcoal a day.



The CQC survey revealed that on average, vendors use 2 stoves to conduct business. The maximum number of stoves used was 5. Most vendors worked 5 to 7 days per week (at a rate of 99%). Vendors used 3.2 burners on average per day for an average of 6 hours a day. We can therefore measure the number of burners multiplied by the number of hours of use. On average, this equates to 19 burner

hours per day. Some merchants (38%) use their stoves for other purposes other than selling food. Generally they cook for their family, heat water for their bath, make coffee or tea and/or boil water for drinks.

Figure 11 Number and Composition of Schools

The survey covered 50 schools of which 44 were primary schools and 6 others not specified. On average these schools have 442 students and 24 teachers.

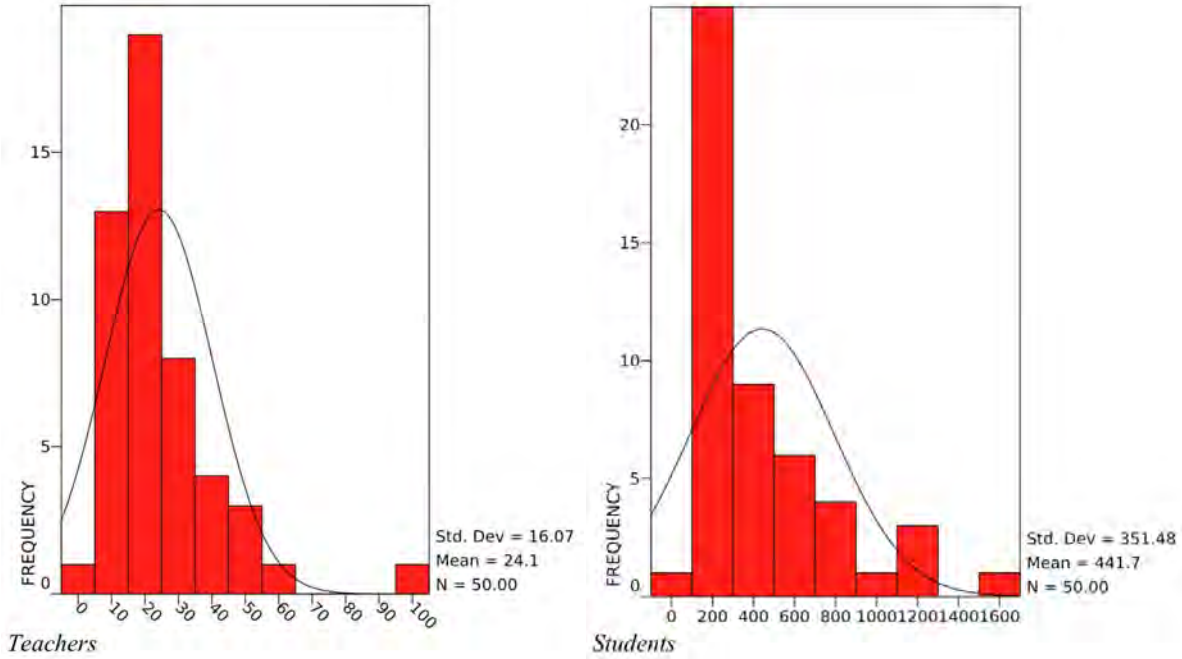


Figure 12 School Weeks per Year

The average number of weeks of school is 34.

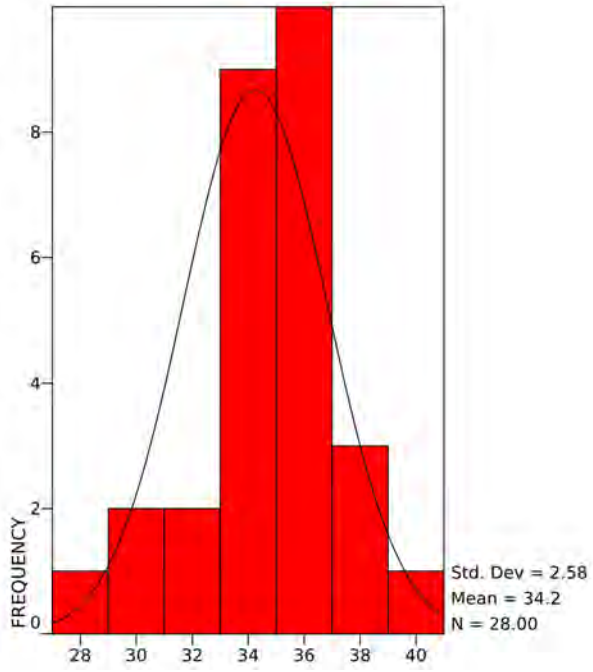


Figure 13 School Meals Cooked per Year

The kitchens operate 157 days a year on average and serve an average of 27,168 meals a year.

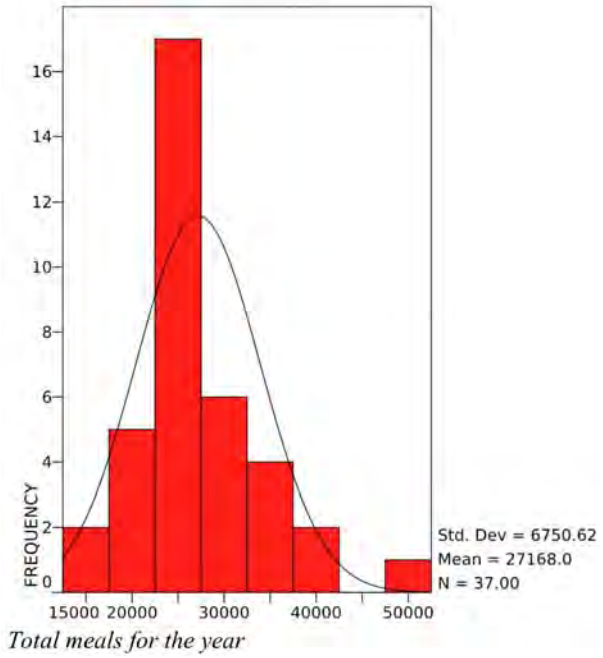
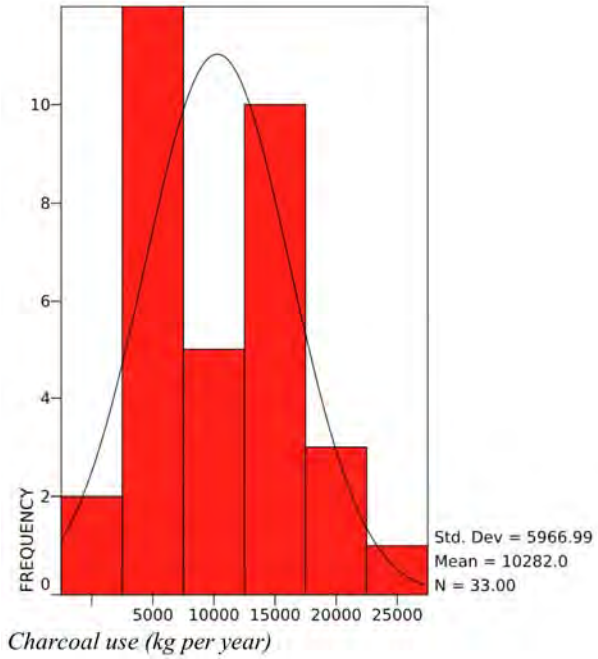


Figure 14 Charcoal Usage

The estimated weight of charcoal used is on average 10 metric tons (10,282 kg).



Adherence to CDM Baseline Reporting Requirements and Review of all Data to Ensure Compliance with CDM Baseline Reporting

The PoA from D&E Green Enterprises was validated independently with minimal suggestions for improvement and none was related to quality of data presented. Present data has great value to the CQC PoA-DD in preparation, based on a desk review of Paolo Lopes' assessment and recommendations. The data sets are of great value to any new project considering a CDM, CDM+GS or VGS.

Baseline data is now available for households, street food vendors and schools from the surveys that were implemented and reviewed through this ICTP initiative. With the additional data that is presented in this document, estimations can be made on a national basis for schools, households and street vendors taking a 30% improved energy efficiency standard as guided by ICTP stove evaluations.

CONCLUSIONS AND RECOMMENDATIONS

Lessons learned

Potential average savings that a household can make from adopting a single improved cook stove can represent an average of $100, based on Annex 4 data on improved Cookstoves tested by ICTP. Haiti's gross domestic product based on purchasing-power-parity (PPP) per capita GDP for 2012 according to the International Monetary Fund is $1,242.81 while per capita GDP, current price, is $758.85. Adoption of improved Cookstoves under these conditions represents income savings that can significantly affect the 80% of households in Haiti that depend on charcoal and fuel wood for cooking.

Table 11 Potential savings from adoption of Improved Cookstoves

Papyrus Survey	Yearly consumption	30% energy savings in Kg of charcoal	Potential Income saved in HTG/year	Potential Income saved in US$/year
FWAYE (Household)	789 kg	236.70 kg	4,111.48	94.56
MANJE KWIT (Vendors)	4,508 kg	1,352.40 kg	23,491.19	540.30
CQC Survey	-	-	-	-
FWAYE	988 kg	296.40 kg	5,148.47	118.41
LEKOL (schools)	10,282 kg	3,084.60 kg	53,579.50	1,232.33
MANJE KWIT	5,526 kg	1,657.80 kg	28,795.99	662.31

With 17,390 schools in Haiti, the income savings from improved energy efficiency could average more than $21 million per year, if the schools cooked for their students. This represents an extrapolation that assumes all schools use charcoal and cook for their students. According to the CQC data analyzed by Papyrus, 30% of schools had enough charcoal and food to cook for their students. If we use this 30% of schools figure, the actual savings will realistically be much lower but could still represent over $6 million in savings. For the estimated 6,417 street food vendors in Port-au-Prince alone, the yearly energy savings would be more than $3 million if all were using charcoal and switched to improved Cookstoves.

Because 16% of vendors now use LPG and only 64.5% (4,139 vendors) use significant charcoal or kerosene, actual saving would also be significantly lower. According to the National Baseline Study for Fuel Consumption completed by Papyrus in September 2013, 77% of the second category of street vendors (those using significant charcoal or kerosene) uses charcoal exclusively for cooking their merchandise. This would represent a savings of more than $1.7 million per year in energy costs.

What this shows is that improved energy savings alone could inject significant funds back in Haiti's economy. This is an opportunity that also requires mitigating potential losses in charcoal sales locally that represent significant revenues for charcoal wholesalers, producers and vendors. Conversion of jobs from this sector into sustainable energy opportunities represents a critical factor in scale up and long-term success. If we consider Ticadaie, one of the local manufacturers of improved Cookstoves and also a producer of briquettes from waste (including charcoal dust), the capacity to bridge an old charcoal based economy to a new sustainable and environmentally friendly economy represents a significant opportunity to establish a new paradigm.

On a micro scale, the "tontines" piggybanks in the shape of mini-stoves that the women use to hold the savings they make with the improved stoves from decreased charcoal purchases over a two week period is also an excellent opportunity to change consumer narratives from the bottom up. The opportunity that each women in the self-help groups is given with each two-week rotation of the tontines to put aside the savings made from decreased charcoal purchases is a way to initiate dialogue that can be transformative, especially for the most economically vulnerable. This aspect of the longitudinal study represents an excellent opportunity to influence the market and pull demand for improved Cookstoves.

What the above data show is that if scaling of production is possible, Haiti can benefit from improved Cookstoves with or without a carbon offset opportunity. However, it is unlikely that manufacturers will see the benefit to fully engage in scale up unless they are also able to benefit from the prospect of increased income.

Challenges and Opportunities

Effective partnerships are needed to ensure that Haiti harnesses Gold Standard and CDM mechanisms to reduce pressure on reforestation efforts while mitigating local use of charcoal. No deal has been reached with the four manufacturers contacted by CQC, however D&E Green Enterprise, with the registration of Haiti's first CDM project, can produce a shift that could engage more manufacturers to join their PoA or design their own and even strive to establish a CDM+GS project with added revenue.

According to Paolo Lopes, Entrepreneurs du Monde is developing a voluntary Gold Standard project for Haiti. In their work in Burkina Faso, they have entered into a partnership with the specialized consultancy, Carbonium, to register their "Save for a Stove" project activities with the Gold Standard Foundation. CQC is still working towards completing a deal with Haitian manufacturers. In the meantime, the local improved stove supply chain still needs to be built (scale up of manufacturing, sellers, after sales services, distribution, etc.). This represents a challenge that all improved stove manufacturers are facing.

There is great enthusiasm for the economic prospects of this market by manufacturers, but the lack of understanding of carbon markets and what constitutes win/win partnerships can make building trust difficult. Educating manufacturers on the complexity of carbon markets and related regulatory processes is needed to ensure they see value in partnerships within established and upcoming PoAs and their opportunities for growing their businesses. Understanding how to structure co-benefits to put in place a CDM+GS project and what that will entail for manufacturers in terms of responsibilities, value and accountability is needed. As manufacturers gain greater awareness of their strengths and weaknesses, partnerships that compensate for their weaknesses will happen more naturally. A greater sense of urgency to establish partnerships can then be enabled. This can accelerate access to grant funding and build capacity of all local improved stove manufacturers and re-sellers. Coordination is also needed to leverage and integrate the whole value chain.

Recommendations

As stated in the trip report, there is a strong need to strengthen the market chain. Harnessing more grant opportunities and creating partnerships to leverage these is needed. Capacity to leverage the Spark Fund of the Global Alliance for Clean Cookstoves needs to be explored. Another opportunity beyond current USAID grants available locally is the IDEAS Energy Innovation Contest, through the Inter-American Development Bank. Successful grantees should be encouraged to mentor others through speaking opportunities at future ICTP workshops. This will establish their leadership as well as guide others on effective ways forward. Standardization, collaboration and coordination remain critical to scale up production, establish local quality control facilities and link financial support with greater ease to manufacturers. Growing the demand potential is a clear win, but smoothly linking this to higher production capacity will remain a challenge.

Technical and business growth assistance remain the urgent priorities to help local stove makers develop PoAs of their own and/or advise them on connecting to potential carbon buyers and/or joining existing open access PoA for win/win partnerships. This report has helped establish a baseline level of understanding of how carbon markets work. This information needs to be communicated with local manufacturers so they can actively be part of the solution of how best to establish Carbon Asset based partnerships with their businesses. With choice, they will feel freer in selecting partnerships that fit their values and vision for growth with trust and empowered knowledge for long term benefit to all stakeholders and Haiti's fragile forest ecosystems.

Potential partnerships beyond current ones could include:

- The Paradigm Project: "The Paradigm Project intends to implement five million stoves in developing countries worldwide by 2020." The paradigm project currently has a stove that would be imported into Haiti, however their website shows an interest in helping save households in Haiti $60,000,000 in energy costs and their PoA could accommodate local partnerships http://theparadigmproject.net/why-stoves.
- Associating energy savings to afforestation as well as energy rotation plantations is also an area that could be explored.
- Yunus Social Business in Haiti has expressed interest in sustainable energy plantations but has yet to identify suitable partners.

A number of global partners could be explored to move this forward. One example is Brinkman Forest Restoration. "Brinkman seeks to be a world leader in using forest restoration to combat climate change, restore ecosystems and alleviate poverty." They have planted one billion trees over the last 40 years http://www.brinkmanforest.com/brinkman_forest_restoration.php.

ANNEXES

Annex 1 List of documents shared by ICTP and studied for report

1. 7-Owen-ANSI-Global-Standardization-Systems.pdf
2. 2010HEDONCookstoveReport[1].pdf
3. 2013-ICS 1 pager - Updated.pdf
4. Berkeley Cook Stove doc part 1.pdf
5. Berkeley Cook stove doc part 2.pdf
6. Biomass Calculation.pdf
7. Carbon_finance_guide.pdf
8. Charcoal In Haiti 1978 doc.pdf
9. Cookstoves market analysis Final.pdf
10. CRS Policy Brief.pdf
11. EB70_repan30_AMS-II.G_ver05.0.pdf
12. ESMAP_Stratégie_Haiti_07.pdf
13. Fieldwork_Guidelines_National Baseline study_CHARCOAL_V3_130619.pdf
14. Fieldwork_Guidelines_National Baseline study_STREET VENDORS_CHARCOAL_V4_130625.pdf
15. Final CCT and Tooling.pdf
16. Fwd_ Community for Clean Cookstoves Update_[Field Testing] Monitoring & evaluation of cookstoves.pdf
17. Haiti Cookstoves CCT Report FINAL.pdf
18. Haiti EcoRecho CER Credit Calculations.pdf
19. Haiti Poverty Strategy Update 2012.pdf
20. Market Analysis annexes.pdf
21. National_Energy_Plan_Haiti_Revised20_12_2006VM.pdf
22. Nexant_Final_Report_Annexes[1].pdf
23. Nexant_Final_Report_Haiti_2011[1].pdf
24. Papyrus Deliverable 1-1(2).pdf
25. PCIA-Bulletin-Issue-29-EECL[1].pdf
26. QPR March 2013 - final April 30.pdf
27. Rapport Final--ACCESS TO CREDIT.pdf
28. RechoMirak.pdf
29. Relevant Data and Trends for Haiti and the DR_UN and FAO Data Sources.pdf
30. sei-wp-2013-01-cookstoves-carbon-markets.pdf
31. Street vendors charcoal baseline survey_ENGLISH_v2_130625.pdf
32. TR_11207_Haiti Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources_112-07.pdf
33. usaid-kenya_stoves20101.pdf
34. wfp_wrc_haiti_safe_report_03_2010_r2.pdf
35. Bahusya Stove Study Participants.jpg
36. burn stove photo.JPG
37. Envirofit Stove Pic.JPG
38. Haiti Metal.JPG
39. La Pleine Photo of Stove Users.jpg
40. Plop Plop Stove made by ILF.JPG
41. Prakti explained by BIkson from AMURT.JPG
42. stove photo 2.jpg
43. ICS 1-Pager - French Version - CD1.ppt
44. Detailed Survey Draft ENGLISH - Version 1.130722 - use to copy.doc

45. Final Tarification des RA à biomasse.doc
46. IAP monitoring datasheet survey V05.doc
47. National Household Baseline Charcoal Survey_130619.doc
48. National_Strategy_for_Improved_Stoves_Draft_3_March22_2011.doc
49. PaP Charcoal vendor survey 130626_Cleaned v09.doc
50. Prix des Rechauds et Payback period.doc
51. rapport_final_carbon_credit_assignment_march_2012.doc
52. RFP 109 National Baseline (revised) JL changes.doc
53. ROSCAs.doc
54. Sales points and contacts.doc
55. SOW National Baseline Writer 22.07.13.doc

Annex 2 Understanding the Carbon Market

From the Mid-Term Evaluation of the State of Carbon Finance for the Haiti Improved Cooking Technology Program (Paulo Lopes, consultant to Chemonics International, September 2013).

Developing a carbon project is a complex task and it is important to understand the different types of markets and standards available. This will help to make a proper decision over the strategy of the program.

There are two types of carbon markets:

- Compliance market (where the CDM operates)
  - Corporations are obliged to buy carbon credits if they don't meet the targets to reduce carbon emissions
  - It is mandatory for thousands of large corporations operating in Europe (EU-ETS)
  - It is worth $175 bn/year
  - Approximately 30 ICS projects registered
- Voluntary market
  - Organizations buy carbon credits on a voluntary basis mainly for CSR purposes
  - It is worth $150M/year
  - Approximately 70 projects registered in the Markit[11] registry

Within these two carbon markets lies the Gold Standard. The GS is a standard that certifies the co-benefits (social, economic and environment) of a project. It is very common for ICS projects to use the GS because it certifies all the co-benefits associated with this type of projects.

It is possible to develop a CDM and add the GS certification for the co-benefits; the project becomes CDM+GS. It is also possible to develop a Voluntary Gold Standard (VGS) project as a standalone project.

Comparison of carbon standards describes the main differences between CDM, CDM+GS and VGS.

Description	CDM	CDM + GS	VGS
Emissions Reductions	CDM uses many defaults values = less credits than VGS	CDM uses many defaults values = less credits than VGS	VGS' methodology reflects better the reality on the ground and therefore it is possible to claim more credits
Market size	The market is valued at $175bn/year, therefore there is a lot of liquidity	The market is valued at $175bn/year, therefore there is a lot of liquidity	The market is valued at $500M/year, thus much less liquidity than CDM
Price of carbon credits	CERs are trading at S0.30/CER and averaging $3, however ICS project can be sold at a higher price but there is no estimate at the moment	CERs + GS trade at a higher price than standalone CERs. The carbon credits are trading at an average of $13 (min S2, max-$35)	VERs from GS trade between $5-$35 and an average price of $9
Buyer's demand	This is a compliance market; therefore there is guaranteed demand until the carbon mechanisms are operating.	This is a compliance market; therefore there is guaranteed demand until the carbon mechanisms are operating.	This is a voluntary market and buyers can decide to change their strategy and stop buying carbon credits. There is growing demand

[11] Markit is a registry where carbon projects developed in the voluntary market are registered. This includes projects under Gold Standard, Verified Carbon Standard, Social Carbon, CarbonFix, etc.

Description	CDM	CDM + GS	VGS
	It is also possible to sell CERs in the voluntary market; therefore it gives the option to access the best price from the compliance or voluntary market	It is also possible to sell CERs in the voluntary market; therefore it gives the option to access the best price from the compliance or voluntary market	for voluntary credits but there are risks in the long term.
Letter of Approval (LoA)	Mandatory	Mandatory	Not necessary
Attract investors	It is a compliance market; therefore it is easier to raise funding for the project. Some large institutions only provide finance to CDM projects and not to VGS	It is a compliance market; therefore it is easier to raise funding for the project. Some large institutions only provide finance to CDM projects and not to VGS. It will be easier to access finance if the CDM has the added GS certification	It is more difficult to raise funding for VGS projects. The main sources would be private donors or foundations
Fungibility	CERs can be sold in several carbon markets around the world and there are discussions to allow the sales of CERs into new carbon markets. CERs can also be sold in the voluntary market	CERs can be sold in several carbon markets around the world and there are discussions to allow the sales of CERs into new carbon markets. CERs can also be sold in the voluntary market	VERs can only be sold in the voluntary market and cannot be traded in compliance markets
Development/ co-benefits	CDM only accounts for emissions reductions and does not focus on development and co-benefits	CDM+GS not only certifies the emissions reduction, but also all the co-benefits, providing more leverage to the project/donors/ investors/buyers	VGS not only certifies the emissions reduction, but also all the co-benefits providing more strengths to the project/donors/ investors/buyers
Methodology	The methodology uses several default values which lower the need to complete studies thus it becomes cheaper however it generates less credits	On top of the CDM methodology, the GS requires more monitoring and studies to assess the co-benefits. This increases the costs of running the program	VGS methodology is more suitable for the local conditions and provides a more accurate picture of the reality on the ground. As the co-benefits are also certified, the monitoring costs increase
Executive Board/Gold Standard	The EB can be very slow and bureaucratic. Delays are common, even though process is getting faster.	On top of dealing with the EB, the project proponent will work with the GS as well. This requires additional work thus increase costs.	The VGS process is more flexible than CDM and more open to understand the local conditions. The staff is highly knowledgeable about developing ICS projects.
PoA	The small scale methodology caps project until they reach a certain size. Therefore PoAs are more suitable for the project in Haiti. A Coordinating Management	The small scale methodology caps project until they reach a certain size. Therefore PoAs are more suitable for projects in Haiti. A CME needs to be set up which increases costs.	There is no difference between small and large scale. Therefore there is no need for PoAs. One single project can cover the entire country without the

Description	CDM	CDM + GS	VGS
	Entity (CME) needs to be set up which increases costs.		need of a CME thus reducing costs
DOE	The DOE fees do not differ much between CDM and VGS	The DOE fee may be slightly more expensive than CDM alone because they need to certify the co-benefits as well	The DOE fees do not differ much between CDM and VGS

Annex 3 Data and parameters that are to be reported ex-ante in D&E Green SSC CPA

Data / Parameter	$Q_{biomass}$
Unit	MT/stove/year
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 confidence/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. CPA01 will target the markets in metropolitan Port-au-Prince where the HHBS was conducted in 2011. Therefore, results of the HHBS are precise enough to give an actual estimate of the baseline biomass consumption for CPA01.
Purpose of data	Calculation of baseline emissions
Additional comment	Used for calculation of B_{old}. Parameter is fixed for the entire crediting period

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	Parameter is fixed for the entire crediting period

Data / Parameter	η_{old}
Unit	-
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 3
Value(s) applied	20%
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. Both traditional charcoal stoves (RechoTol and RechoFer) have no chimney, but both stoves have an "elevated" grate to facilitate the flow of air. Therefore, the value of 0.2 is deemed appropriate.
Purpose of data	Calculation of project emissions.
Additional comment	Parameter is fixed for the entire crediting period

Data / Parameter	$NCV_{biomass}$
Unit	TJ/MT
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	AMS II.G Version 3
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	Parameter is fixed for the entire crediting period

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 3
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	Parameter is fixed for the entire crediting period

Data / Parameter	$f_{NRB,y}$
Unit	Fraction
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	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". Please refer to Appendix 4 for detailed calculation.
Purpose of data	Calculation of baseline emissions
Additional comment	Parameter is fixed for the entire crediting period

Data / Parameter	Leakage Adjustment Factor (LAF)
Unit	-
Description	Diversion or use of non-renewable biomass saved under the project activity by non-project households or users that previously used renewable energy sources.
Source of data	AMS II.G Version 3
Value(s) applied	0.95
Choice of data or Measurement methods and procedures	Assessment and quantification of the LAF parameter requires a survey to be conducted, which is extremely difficult to design and conduct since charcoal consumed is sourced from various locations in Haiti. Hence, the alternative default leakage value of 0.95 suggested in the AMS.II.G ver3 methodology has been used in the calculation of ER.
Purpose of data	Calculation of leakage.
Additional comment	Parameter is fixed for the entire crediting period

Annex 4 Table in French showing pricing of improved Cookstoves tested by ICTP

Cookstove Name	Cookstove Photograph	Manufacturer	Description of Manufacturer	Minimum Sales Price	Warranty (Months)	Number of months to payoff through fuel savings	Minimum annual savings from reduced fuel consumption
Prakti Wouj		Prakti Haïti SA	Private enterprise assembling imported stove components in Haiti (with Manutech)	1975 HTG	12	6	5040 HTG
Plop-Plop Petit		ILF	NGO with production facility in Haiti	550 HTG	6	1.5	4452 HTG
Plop-Plop Moyen		ILF	NGO with production facility in Haiti	750 HTG	6		
Nouveau Eco-recho Moyen		D&E Green Enterprise	Private enterprise manufacturing in Haiti	500 HTG	6	1.5	4284 HTG
Nouveau Eco-recho Gros		D&E Green Enterprise	Private enterprise manufacturing in Haiti	700 HTG	6		
Men recho		Haïti Metal SA	Private enterprise manufacturing in Haiti	500 HTG	6	2	3654 HTG
Rena		Charbon Ticadaie	Private enterprise manufacturing in Haiti	850 HTG	6	3.5	4288 HTG

Exchange rate as of November 2013 is about 43.5 HTG : $1 US.

Annex 5 Fraction of Non-Renewable Biomass Calculation[a]

Parameter	Unit	Description	Value
F [b]	ha	Extent of Forest	101,000
GR [c]	t/ha-yr	Annual Growth rate of biomass	7.88
MAI	t/yr	Mean annual Increment of Biomass growth	796,234
ΔF [d]	t/yr	Annual change in living forest biomass	-
R	t/yr	Total Biomass Removal	796,234
PA [e]	ha	Protected Area Extent of Forest	4,000
DRB	t/yr	Demonstrable Renewable Biomass	31,520
NRB	t/yr	Non-Renewable Biomass	764,714
$f_{NRB,y}$	Fraction	Fraction of Non-Renewable Biomass	96.04%
$f_{NRB,y}$	**Fraction**	**Value provided by EB 67, Annex 22 - Default values of fraction of non-renewable biomass for least developed countries and small island developing States**	**96.00%**

[a] In accordance with EB 67 Annex 22 - Default values of fraction of non-renewable biomass for least developed countries and small island development
[b] FAO Forest Resource Assessment (FRA) 2010, Global Table, Table 2
[c] 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)
[d] Annual change in carbon stock in living forest biomass 2005-2010 (FAO Forest Resource Assessment 2010 Global Tables, Table 11)
[e] FAO Forest Resource Assessment (FRA) 2010 Global Tables, Table 6

Annex 6 Ex-ante Emission Reduction Calculations for PoA

Parameter	Unit	Description	Year									
			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
$Q_{charcoal}$	t/(y-stove)	Average annual consumption of charcoal per stove	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
$F_{wood\ to\ charcoal}$[b]	kg/kg	Ratio of mass (kg) of wood used to the mass (kg) of charcoal produced	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67
$Q_{biomass}$	t/y	Average annual consumption of woody biomass per stove	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31
NS_{CP}	number	Total number of stoves in operation that are included for ER calculation during crediting period (1 year)	25,908	62,178	83,423	106,092	129,668	152,065	170,808	183,415	192,586	202,215
$f_{traditional}$	%	Fraction of (traditional) stoves in baseline still in use	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
SOF	%	Stove Operational Fraction representing the fraction of stoves in operation	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
SOP	y	Stove Operating Period representing the length of monitoring period	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LAF	Fraction	Leakage Adjustment Factor or Net-to-gross adjustment factor for NRB Leakage	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
B_{old}	**t/y**	**Quantity of woody biomass used in the absence of the project activity in period y**	**34,835**	**176,008**	**236,144**	**300,313**	**367,050**	**430,449**	**483,504**	**519,192**	**545,151**	**572,409**
η_{old}	%	Thermal efficiency of the baseline system being replaced	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
η_{new}[c]	%	Thermal efficiency of the new system being deployed as part of the project activity	28.24%	28.24%	28.24%	28.24%	28.24%	28.24%	28.24%	28.24%	28.24%	28.24%
$B_{y,\ savings}$	**t/y**	**Quantity of woody biomass that is saved through the CPA in period y**	**10,164**	**1,356**	**68,903**	**87,627**	**107,099**	**125,598**	**141,079**	**151,492**	**159,067**	**167,020**
$f_{NRB,\ y}$	%	Fraction of woody biomass saved by the project activity in period y that can be established as non-renewable biomass	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
$NCV_{biomass}$	TJ/t	Net calorific value of the non-renewable woody biomass that is substituted	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
$EF_{projected_fossilfuel}$	t CO_2/TJ	Emission factor for the substitution of non-renewable woody biomass by similar consumers	81.60	81.60	81.60	81.60	81.60	81.60	81.60	81.60	81.60	81.60
ER_y	**tCO2/y**	**Emission reductions from project activity during period y**	11,943	60,346	80,964	102,965	125,846	147,583	165,774	178,009	186,910	196,255
ER_{cum}	**tCO2/y**	**Cumulative emission reductions**	11,943	72,289	153,253	256,218	382,064	529,648	695,421	873,431	1,060,340	1,256,596
ER_{avg}	**tCO_2/y**	**Average annual emission reductions**	125,660									

Note: Calculations shown assume the fraction of Medium to Large stoves sold is: 0.8 to 0.2

[a] *Actual CERs for each crediting period will be determined based on ex-post monitoring of parameters used in calculations as highlighted in the CPA Design Documents.*

[b] *This parameter was obtained from the 2007 ESMAP report, "Haiti Strategy to Alleviate the Pressure of Fuel Demand," which states, on page 41, 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 kg wood /kg charcoal*

[c] *The estimated thermal efficiency for CER calculation is dependent on the number of medium and large stoves sold. The calculated efficiency is the average of the efficiencies of each type of stove weighted by the assumed fraction of medium and large stoves sold. In practice, the actual fraction of each type of stove sold under the CPA during each crediting period will be used to estimate η_{new}*