



**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Stove Capital Guatemala Improved Stoves and Water Purification Project
Version number of the PDD	3
Completion date of the PDD	03/21/2013
Project participant(s)	Stove Capital, CEMEX, Ecofiltro, The Paradigm Project
Host Party(ies)	N/A
Sectoral scope and selected methodology(ies)	Sectoral scope: N/A Category: End use energy efficiency improvement Sub Category: Energy efficient cooking stove technologies and water treatment technologies Structure: Large-scale Gold Standard (GS) Voluntary Emission Reduction (VER) Project. GS Methodology: Technologies and practices to displace decentralized thermal energy consumption (version 1 - 11/04/2011)
Estimated amount of annual average GHG emission reductions	3,194,906 tCO ₂ e per year

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Project Scenario Prior to Project Activity – Guatemala

Household Cooking Practices

Guatemala's high population density and reliance on solid fuels for household cooking has significant impacts on both human and environmental health. According to the World Health Organization (WHO) country household survey data, 84.8% of rural households and 30.1% of urban households use solid biomass fuel, largely wood, as their primary household fuel for cooking.¹ The most recent Livings Standards Survey (ENCOVI 2011) conducted by the Guatemala National Institute of Statistics, found that 60% of urban and 94% of rural households report cooking with wood within the last month, and almost three quarters of all household's cook inside their house in a room that is not a partitioned kitchen.² Most households use traditional open fires (i.e. one on the ground) or a raised open fire (locally known as a polleto) to meet their domestic energy needs.³ The use of traditional open fire stoves releases harmful air pollutants which cause significant health effects to household members, particularly women and children who spend more time in and around the kitchen. Indoor air pollution, such as carbon monoxide and particulate matter, caused by burning solid biomass with inadequate ventilation is a major driver of death and disease.⁴ The UNDP and WHO (2009) estimate that every year 1,200 Guatemalan children under 5 die of pneumonia and 300 adults die prematurely of chronic obstructive pulmonary disorders resulting from solid fuel use.⁵ The Guatemala Ministry of Public Health and Social Assistance has identified respiratory illnesses as a national priority, given that there are between 80,000 and 250,000 cases reported each month.⁶

Most Guatemalan households spend a significant portion of their time and income acquiring fuel for cooking and water boiling.⁷ The widespread collection of firewood, due to the very low opportunity cost of collection labour time, adds to already strenuous working days without yielding monetary rewards.⁸ The predominant use of firewood for household cooking also puts additional pressure on Guatemalan forests, which have diminished from 77 to 27% of national territory between 1960 and 1990.⁹

Household Access to Safe Water & Treatment Practices

¹ Ekouevi, E., & V. Tuntivate. (2011). Household Energy Access for Cooking and Heating: Lessons Learned and the Way Forward. The World Bank, Energy and Mining Sector Board Discussion Paper No. 23, June 2011. Pg. 35.

http://siteresources.worldbank.org/EXTENERGY2/Resources/HouseHold_Energy_Access_DP_23.pdf

² Encuesta Nacional de Condiciones de Vida, ENCOVI 2011 –INE. Original survey data, analysis by Impact Carbon, and emails from INE confirming analysis is correct and that the survey data can be used for the purposes of this report has been provided to the DOE.

³ Joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP). 2004. Evaluation of Improved Stove Programs in Guatemala Final Report of Project Case Studies. ESMAP Technical Paper 060. Pg. 8
<http://www.esmap.org/sites/esmap.org/files/06004GuatemalaFinalEnglishforWeb.pdf>

⁴ Matthew, J., Taylor, M.J., Moran-Taylor, E.J., & Castellanos, S.E. (2011). Burning for sustainability: Biomass energy, international migration, and the move to cleaner fuels and cookstoves in Guatemala. Annals of the Association of American Geographers, 101(5). Pg. 919.

⁵ Ekouevi, E., & V. Tuntivate. (2011). Household Energy Access for Cooking and Heating: Lessons Learned and the Way Forward. The World Bank, Energy and Mining Sector Board Discussion Paper No. 23, June 2011. Pg. 35

http://siteresources.worldbank.org/EXTENERGY2/Resources/HouseHold_Energy_Access_DP_23.pdf

⁶ SIGSA, <http://sigsa.mspas.gob.gt/images/sala/sala-situacional/Prioritarias.swf>. 2008 – 2010 data.

⁷ Joint UNDP/World Bank. (2003). Household Fuel Use and Fuel Switching in Guatemala. Energy Sector Management Assistance Program (ESMAP). Pg. 2.

<http://www.esmap.org/sites/esmap.org/files/03603.%20Household%20Fuel%20Use%20and%20Fuel%20Switching%20in%20Guatemala%20June%202003.pdf>

⁸ Ibid, pg. 9.

⁹ Ludwinski, D., Moriarty, K., & Wydick, B. (2011). Environmental and health impacts from the introduction of improved wood stoves: Evidence from a field experiment in Guatemala Springer Netherlands. Pg.659. http://usf.usfca.edu/fac_staff/wydick/woodstove.pdf

According to the WHO, 92% of Guatemala's population has access to improved water sources. Access is slightly lower in rural areas (87%) and higher in urban areas (98%).¹⁰ According to the WHO, and improved water source is defined as one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with fecal matter. However, this definition makes no minimum requirements on the basis of water quality¹¹. Many Guatemalans who have access to an improved water source may face problems from contamination at the source, contamination in the piped distribution system, and/or recontamination in the home because of improper handling and storage.¹² Multiple studies have found that municipally provided tap water is unsafe for drinking.¹³ In a 2007 study of tap water across the country, 80% of the collected samples were contaminated with coliforms. In order to prevent water-borne diseases, government officials recommend boiling tap water and treating it with chlorine.¹⁴

Guatemala's National Survey of Living Conditions (ENCOVI, 2011) found the proportion of households that drink untreated water to be 30% nationally, and 35% and 22% in rural and urban areas, respectively¹⁵. The majority of households that drink treated water practice boiling: nearly 50 % nationally, over 61% in rural areas, and 36% in urban areas. The lack of safe water from source contamination contributes significantly to the high incidence of diarrheal disease and chronic malnutrition in Guatemala.¹⁶ The Ministry of Public Health and Social Assistance has identified and diarrhoea as a national priority, with 25,000 – 75,000 cases reported each month.¹⁷

Project Objective

The Stove Capital Guatemala Improved Stoves and Water Purification Project ("the Project") seeks to improve the health and incomes of Guatemalans by reducing time and money spent acquiring fuel for cooking and by providing local populations with improved access to clean water.

Project Plan

To achieve this goal, the project will provide high-quality, affordable improved cook stoves to replace inefficient traditional 3 stone and "polleto" open fires in rural and peri-urban areas. The project will also provide high quality, affordable water purification devices that will increase access to safe drinking water and reduce the need to boil for sanitation¹⁸. In order to reach a wide range of Guatemalans with the most appropriate technology, the project leverages carbon finance to enable the sale and distribution of project technologies, develop local sales support channels and work with NGOs as they create sustainable distribution networks of locally appropriate efficient stoves and water filters.

Household Stoves:

¹⁰ WHO/UNICEF (2012). Estimates for the Use of Improved Drinking-Water Sources: Guatemala. Joint Monitoring Programme for Water Supply and Sanitation, updated March 2012. http://www.wssinfo.org/fileadmin/user_upload/resources/GTM_wat.pdf

¹¹ Definition taken from the WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation website, <http://www.wssinfo.org/definitions-methods/introduction/>

¹² Kallman, E.N., et al. (2011). Ceramic Filters Impregnated with Silver Nanoparticles for Point-of-Use Treatment in Rural Guatemala. *Journal of Environmental Engineering*, Vol. 137, No. 6. Pg. 407

¹³ Vasquez, William F. (2011). Municipal Water Services in Guatemala: Exploring Official Perceptions. *Water Policy* 13, 362-374; pg. 363 and 367.

¹⁴ Ibid, Pg. 365

¹⁵ Encuesta Nacional de Condiciones de Vida, ENCOVI 2011 –INE. Original survey data, analysis by Impact Carbon, and emails from INE confirming analysis is correct and that the survey data can be used for the purposes of this report has been provided to the DOE.

¹⁶ Braghetta, A. (2006). Drawing the Connection between Malnutrition and Lack of Safe Drinking Water in Guatemala. *American Water Works Association Journal*. Pg. 98

¹⁷ SIGSA, <http://sigsa.mspas.gob.gt/images/sala/sala-situacional/Prioritarias.swf>. 2008 – 2010 data.

¹⁸ Please see PDD Section B.4 Establishment and description of baseline scenario for information on suppressed demand.

The project will continue to gather user feedback and confirm designs for the most appropriate improved cookstove models for Guatemalan contexts, but will start with and scale the distribution of efficient “plancha” stoves designed in conjunction with local Guatemalan households and made locally in Guatemala by Cementos de Mexico (“CEMEX”). The Project is collaborating with a range of local Guatemalan partners, including the Socorro Maya, to reach customers with models of efficient healthy cookstoves. Stove Capital and CEMEX have brought investment capital conditional on future carbon finance to design and manufacture a locally made cookstove, the eko-stove, with broad appeal that reduces the fuel use for an average Guatemalan family by 65%¹⁹. Additionally, the project is investing in local manufacturing capability to manufacture over 10,000 stoves per year. The project’s improved wood stoves can cut down the daily fuel consumed thus reducing indoor air pollution and necessitating fewer trips to collect fuel per week. Efficient, improved stoves are a more sustainable, economic and healthy way to cook.

Water Purification:

Simple, socially acceptable, low-cost household water purification technologies have the potential to significantly improve the microbial quality of drinking water and reduce the risk of diarrheal disease and death in Guatemala, particularly among children. Water purification products also avoid the need to boil, reducing greenhouse gas emissions. The project will provide access to safe water through the distribution of water purification technologies that removes all bacteria from contaminated water through a gravity fed ceramic filter. Carbon finance is being invested in the distribution, marketing, and subsidization of these products through local partners. The project will begin with local manufacturer and distributor Ecofiltro, which is partnered with NGOs and microfinance organizations operating throughout the country for training and distribution.

Project Partners:

Stove Capital LLC is leading the development and finance of the project. Stove Capital has partnered with The Paradigm Project and Impact Carbon to coordinate and manage the development of the carbon asset in order to enable the Project with carbon finance. Input to the design of this project was provided during the planning of this project by local stakeholders, NGOs, Government Agencies, and companies from all regions of Guatemala through the stakeholder consultation process.

Stove Capital LLC is a company established for the purpose of financing the project and bringing local partners together to scale the project through carbon financing.

CEMEX is an international cement manufacturing company with operations in Guatemala. CEMEX worked with local partner Socorro Maya and international improved stove design expert, Peter Scott, and Burn Design Lab to design the eko-stove and establish local manufacturing operations for the eko-stove.

Ecofiltro is a Guatemalan business created to manufacture and market the locally designed Ecofiltro water purification device. Ecofiltro is a company established on the belief that business practices and sustainable markets can more effectively address the lack of access to clean drinking water in Guatemala.

The Paradigm Project is an international social enterprise specializing in the development of clean cookstoves projects and leverage carbon finance for scale and sustainable supply chain development. The Paradigm Project has partnered with Stove Capital LLC to finance the development of a carbon program in Guatemala and to facilitate processes for tracking and monitoring of the project.

¹⁹ Please see official lab results of the eko-stove Water Boiling Test (provided to DOE)

Impact Carbon is a non-governmental organisation whose mission is to improve health and the environment through clean energy projects that reduce carbon emissions. *Impact Carbon*'s activities include developing relevant and comprehensive methodologies and instrumentation for evaluating stove performance, quantifying greenhouse gas emission reductions and building business models for reinvesting carbon revenues to increase stove distribution and dissemination.

Chronology

Carbon finance was formally leveraged for project development on 18th of June 2012 (signing of the first Voluntary GS ERPA of this project). Discussions with partners regarding carbon asset development and project design began in January 2011 and product design activities were launched in May 2011. After finalizing product design and partnerships, water filter manufacturing activities began in April 2012, with stove manufacturing activities launched in July 2012. A local stakeholder consultation meeting was conducted in September 2012, and a follow-up process took place as part of the feedback round. Project technology installation is planned to begin in January 2013, with initial project sales of household wood stoves and water purification products.

Estimate of annual average and total GHG emission reductions for the chosen crediting period.

	Water Treatment Technology		Improved Cookstove Technology	
	<i>Technology Units Distributed</i>	<i>Emission Reductions (tCO₂e)</i>	<i>Technology Units Distributed</i>	<i>Emission Reductions (tCO₂e)</i>
January 1st 2013 to December 31st 2013	38,000	358,484	8,000	31,177
January 1st 2014 to December 31st 2014	42,000	1,018,851	12,000	109,119
January 1st 2015 to December 31st 2015	82,000	1,839,095	14,000	210,444
January 1st 2016 to December 31st 2016	88,000	2,760,629	16,000	326,020
January 1st 2017 to December 31st 2017	128,000	3,707,981	16,000	448,129
January 1st 2018 to December 31st 2018	134,000	4,664,271	16,000	571,578
January 1st 2019 to December 31st 2019	174,000	5,623,539	16,000	695,026
Total 7 Years	686,000	19,972,850	98,000	2,391,493
Average 7 Years	98,000	2,853,264	14,000	341,642

Project Activity Contribution to Sustainable Development:

Environmental Benefits:

The project reduces the overall demand for non-renewable biomass required for cooking and boiling water for purification thus reducing the rate of deforestation connected to wood consumption and reducing the emission of greenhouse gases. In addition, the reduction in use of inefficient wood stoves will yield a reduction in local pollutant emissions from fuel combustion.

Social Benefits:

Project beneficiaries using the improved cookstoves reduce their exposure to the harmful pollutants that are emitted during the incomplete combustion of wood in traditional stoves. Improved indoor air quality has been proven to reduce rates low birth weights, risk of acute respiratory disease, chronic lung disease and eye infection, among other threats to public health. The project will increase access to safe drinking water in Guatemala through the distribution of water purification technologies, helping to reduce incidences of water borne illnesses and disease.

Economic Benefits:

From an economic perspective, the project will contribute to the scale-up of local businesses and organizations, creating jobs in project management/training, manufacturing, marketing, and distribution. The current project design features project technologies made in Guatemala using local resources. The scaling of the project activity, leveraged by carbon finance, will provide a range of employment opportunities to the local population.

In addition, the project technologies reduce the amount of time and money spent procuring fuel for cooking and water boiling, allowing for households to reduce their household costs and allow for more time spent on productive purposes such as education and work.

A detailed discussion of the impact of the project on sustainable development can be found in the Project Gold Standard Passport (provided to DOE).

A.2. Location of project activity

A.2.1. Host Party(ies)

N/A to Gold Standard VER Project. Any country can host a Gold Standard voluntary carbon market project. This is not a CDM project, hence there is no formal “host party” and no DNA approval is required (although the project developer has voluntarily informed the DNA of the intention to implement the project). Currently, Guatemala is not subject to any GHG emission caps.

A.2.2. Region/State/Province etc.

The project will operate in all 8 Regions and 22 Departments of Guatemala:

<i>Region</i>	<i>Departments</i>
Metropolitana	Guatemala
Norte	Alta Verapaz, Baja Verapaz
Noreste	Izabal, Chiquimula, Zacapa, El Progreso
Sureste	Jutiapa, Jalapa, Santa Rosa
Central	Chimaltenango, Sacatepequez, Escuintla
Suroeste	San Marcos, Quetzaltenango, Totonicapán, Sololá, Retalhuleu, Suchitepequez
Noroeste	Huehuetenango, Quiché
Petén	Petén

A.2.3. City/Town/Community etc.

The project will operate in all 322 Municipalities or townships within the 22 Departments in Guatemala:

Guatemala	Santa Rosa	Quetzaltenango	Huehuetenango
Amatitlán	Barberena	Almolonga	Aguacatán
Chinautla	Casillas	Cabricán	Chiantla
Chuarrancho	Chiquimulilla	Cajolá	Colotenango
Fraijanes	Cuilapa	Cantel	Concepcion Huista
Guatemala City	Guazacapán	Coatepeque	Cuilco



Resume	New Santa Rosa	Colomba	Huehuetenango
Palencia	Oratory	Conception Chiquirichapa	Ixtahuacán
Petapa	Pueblo Nuevo Viñas	El Palmar	Jacaltenango
San Jose Gulf	San Juan Tecuaco	Flores Costa Cuca	La Democracia
San Jose Pinula	San Rafael Las Flores	Genoa	La Libertad
San Juan Sacatepequez	Santa Cruz Naranjo	Huitan	Malacatancito
San Pedro Ayampuc	Santa Maria Ixhuatán	La Esperanza	Nentón
San Pedro Sacatepequez	San Rosa de Lima	Olintepeque	San Antonio Huista
San Raymundo	Taxisco	Ostuncalco	San Gaspar Ixchil
Santa Catarina Pinula	Chimaltenango	Palestina de Los Altos	San Juan Atitlan
Villa Canales	Acatenango	Quetzaltenango	San Juan Ixcay
Villa Nueva	Chimaltenango	Salcá	San Mateo Ixtatán
Alta Verapaz	El Tejar	San Carlos Sija	San Miguel Acatan
Cahabón	Parramos	San Francisco La Union	San Pedro Necta
Chahal	Patzicá	San Martin Sacatepequez	San Rafael La Independencia
Chisec	Patzún	San Mateo	San Rafael Petzal
Coban	Pochuta	San Miguel Sigüilá	San Sebastian Coatan
Fray Bartolome de las Casas	San Andres Itzapa	Sibilia	San Sebastian Huehuetenango
Lanquín	San Jose Poaquil	Zunil	Santa Ana Huista
Panzós	San Juan Comalapa	Totonicapán	Santa Barbara
Raxruha	San Martin Jilotepeque	Momostenango	Santa Cruz Barillas
San Cristobal Verapaz	Santa Apolonia	San Andres Xecul	Santa Eulalia
San Juan Chamelco	Santa Cruz Balanyá	San Bartolo	Santiago Chimaltenango
San Pedro Carchá	Tecpán Guatemala	Totonicapán	Soloma
Santa Cruz Verapaz	Yepocapa	San Francisco El Alto	Tectitán
Senahú	Zaragoza	Santa Lucía La Reforma	Todos Santos
Tactic	Sacatepéquez	Santa Maria Chiquimula	Quiché
Tamahú	Alotenango	Totonicapán	Canillá
Tucurú	Antigua	Sololá	Chajul
Santa Catarina La Tinta	Ciudad Vieja	Conception	Chicamán
Baja Verapaz	Jocotenango	Nahualá	Chiché
Cubulco	Magdalena Milpas Altas	Panajachel	Chichicastenango
Granados	Pastores	San Andres Semetabaj	Chinique
Purulhá	San Antonio Aguas Calientes	San Antonio Palopo	Cunén
Rabinal	San Bartolomé Milpas Altas	San Jose Chacaya	Ixcán
Salama	San Lucas Sacatepequez	San Juan La Laguna	Joyabaj
St. Jerome	San Miguel Dueñas	San Lucas Toliman	Nebaj
San Miguel Chicaj	Santa Catarina Barahona	San Marcos La Laguna	Pachalum
Santa Cruz El Chol	Santa Lucia Milpas Altas	San Pablo La Laguna	Patzite
Chiquimula	Santa Maria de Jesus	San Pedro La Laguna	Sacapulas
Camotán	Santiago Sacatepéquez	Santa Catarina Ixtahuacan	San Andres Sajcabajá
Chiquimula	Santo Domingo Xenacoj	Santa Catarina Palopo	San Antonio Ilotenango
Concepción Las Minas	Sumpango	Santa Clara La Laguna	San Bartolomé Jocotenango
Esquipulas	Izabal	Santa Cruz La Laguna	San Juan Cotzal
Ipala	El Estor	St. Lucia Utatlán	San Pedro Jocopilas
Jocotán	Livingston	Santa María Visitación	Santa Cruz
Olopa	Los Amates	Santiago Atitlan	Uspantán
Resume	Morales	Sololá	Zacualpa
San Jacinto	Puerto Barrios	Retalhuleu	Petén
San José La Arada	San Marcos	Champerico	Dolores
San Juan Ermita	Ayutla	El Asintal	Flores
Zacapa	Catarina	Nuevo San Carlos	La Libertad
Cabins	Comitancillo	Retalhuleu	Melchor de Mencos
Estanzuela	Conception Tutuapa	San Andres Villa Seca	Poptún
Gualán	El Quetzal	San Felipe	San Andres
Huité	El Rodeo	San Martin Zapotitlán	San Benito
La Unión	El Tumbador	San Sebastian	San Francisco
Rio Hondo	Esquipulas Palo Gordo	Santa Cruz Muluá	San Jose
San Diego	Ixchiguan	Suchitepéquez	San Luis
Teculután	La Reforma	Chicacao	Santa Ana
Usumatlán	Malacatán	Cuyotenango	Sayaxché
Zacapa	Nuevo Progreso	Mazatenango	Las Cruces
El Progreso	Ocos	Patulul	Jutiapa
El Jícaro	Pajapita	Pueblo Nuevo	Agua Blanca
Guastatoya	Río Blanco	Rio Bravo	Asuncion Mita
Morazán	San Antonio Sacatepéquez	Samayac	Atescatempa
St. Augustine Acasaguastlán	San Cristobal Cucho	San Antonio Suchitepéquez	Comapa
San Antonio La Paz	San Jose Ojetenam	San Bernardino	Conguaco
San Cristobal Acasaguastlán	San Lorenzo	San Francisco Zapotitlan	El Adelanto
Sanarate	San Marcos	San Gabriel	El Progreso

Escuintla			
Escuintla	San Miguel Ixtahuacán	San José El Idolo	Jalpatagua
Guanagazapa	San Pablo	San Juan Bautista	Jerez
Iztapa	San Pedro Sacatepequez	San Lorenzo	Jutiapa
La Democracia	San Rafael Pie de La Cuesta	San Miguel Panan	Moyuta
La Gomera	San Sibinal	San Pablo Jocopilas	Pasaco
Masagua	Sipacapa	Santa Barbara	Quezada
Nueva Concepción	Tacaná	Santo Domingo Suchitepequez	San Jose Acatempa
Palin	Tajumulco	Santo Tomas La Union	Santa Catarina Mita
San Jose	Tejutla	Zunilito	Yupiltepeque
San Vicente Pacaya			Zapotitlán
St. Lucia Cotzumalguapa			
Siquinalá			
Tiquisate			

A.2.4. Physical/Geographical location



The project boundary is defined nationally as the country of Guatemala. The project's target population within this boundary is rural and peri-urban domestic fuel wood users, the majority of whom use traditional unimproved stoves. Local distribution partners that are familiar with local conditions and have access to remote communities will be progressively added to the project throughout the crediting period. This model of distribution allows project technologies to reach households in all regions of the country, further enabling access to improved technologies that otherwise would not be available. The project's

country-based management team continually seeks new distribution partners to further provide access to the project's improved technologies. The project facilitates the distribution and delivery of technologies through Community Based Organization (CBOs) and NGOs, and ensures transparent and verifiable sales, as well as end-user follow-up and technical support.

The fuel collection area is also defined nationally as it follows the national pattern of deforestation that permeates all regions of Guatemala. Biomass fuel is part of a national market that forms a fungible market for fuel; as demand pressures on forests growth in one region they are transferred to other regions as supply and availability of fuel wood shifts to meet the needs of the country. National data and fuel assessments are described in the non-renewability of biomass (NRB) section of the PDD.

Unique Identification of Project Activity

Each improved cookstove and water purification product sold through the project shall be assigned a unique identification number so as to demonstrate that the technology is a part of the project activity. The unique identification information will be electronically archived in The Project Database and the information will be made available for DOE during verification.

A.3. Technologies and/or measures

The project intends to make available to all 22 departments of Guatemala each of the project technologies. Additional distribution partners and networks are progressively added to the project activity. Both international NGOs and CBOs act as conduits for technologies to penetrate into rural and peri-urban communities. The project actively seeks local partnerships to enable access to communities that previously have had limited exposure to new technologies. The project activity will continually assess technology options with the goal of providing the highest performing, most affordable, and most locally appropriate technologies to Guatemalans. These objectives will be carefully balanced to identify the best technology for the project. The first technologies presented for crediting are the following:

Improved Household Stoves



CEMEX eko-stove

- Power Output: 8.95 kW
- Thermal Efficiency: 15.4%²⁰
- Average lifetime: 10 years
- The eko-stove was designed by CEMEX and consists of a large metal plancha stove made up of cinder blocks and concrete. The stove will be manufactured and assembled in Guatemala. Cellular concrete, as opposed to pumice, is used as the

²⁰ Please see official lab results of the eko-stove Water Boiling Test (provided to DOE)

insulation material and is installed at the factory.

Water Purification Technologies

Ecofiltro Water Filter



- Purifies water by a gravity fed porous ceramic filter infused with colloidal silver.
- Meets drinking water standards set by the WHO and Coguanor of Guatemala²¹
- Filters 1-2 liters per hour
- 20 liter model offers more than 22 gallons of water per week, enough for a family of 5 or 6
- Manufactured in Guatemala with local materials
- Expected lifetime: 18-24 month filter life²²
- Filtration efficiency: 0.6-0.3 microns

²¹ Please see official lab results of the Ecofiltro Water Quality Test (provided to DOE)

²² Kallman, E.N., et al. (2011). Ceramic Filters Impregnated with Silver Nanoparticles for Point-of-Use Treatment in Rural Guatemala. *Journal of Environmental Engineering*, Vol. 137, No. 6. Pg. 408.
And Baide, J.M. (2011). Prueba de la aceptación de filtros cerámicos impregnados con plata coloidal. Escuela de Agricultura de la Universidad El Zamorano. Honduras. Pg. 26. http://www.ecofiltro.com/wp-content/uploads/2010/02/universidad_zamorano_honduras.pdf

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Not Applicable (N/A) to voluntary Gold Standard VER project in Guatemala	Stove Capital LLC (Private)	No
Not Applicable (N/A) to voluntary Gold Standard VER project in Guatemala	Ecofiltro (Private)	No
Not Applicable (N/A) to voluntary Gold Standard VER project in Guatemala	Paradigm Project (Private)	No

A.5. Public funding of project activity

>> No ODA financing is used.

This project does not receive public funding from Annex I parties that could result in a diversion of official development assistance. Please see PDD Annex 29.

SECTION B. Application of selected approved baseline and monitoring methodology**B.1. Reference of methodology**

>>The Project uses the Gold Standard Methodology “Technologies and practices to displace decentralized thermal energy consumption (version 1 - 11/04/2011)

B.2. Applicability of methodology

>> As per the GS VER this methodology is applicable to programs or activities introducing technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of biomass users.

The Project Proponent is initiating a project in Guatemala to promote the sale of improved energy-saving wood stoves and water purification products. According to page 3 of the GS VER Methodology:

*“This methodology is applicable to programs or activities **introducing technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and non-domestic premises.** Examples of these technologies include the **introduction of improved biomass or fossil fuel cook stoves, ovens, dryers, space and water heaters (solar and otherwise), heat retention cookers, solar cookers, bio-digesters, safe water supply and treatment technologies that displace water boiling, thermal insulation in cold climates, etc.**”*

*“**Shifts in technology may occur in a gradual manner and adoption can increase over the project period.** The project activity is implemented by a project proponent and potentially with additional project participants. The individual households and institutions do not act as project participants.”*

The Project adopts a phased approach to transitioning Guatemalan households towards cleaner kitchen regimes. As carbon financing is made available, the Project Proponent will expand the availability of new technologies to include other types of improved stoves (e.g. high efficiency wood-burning stoves) and water treatment technologies, which accomplish emissions reductions in accordance with the approved

GS VER Methodology. When necessary the Project will monitor new baselines and will redefine clusters as new technologies and new customer groups are introduced to the project.

For water treatment technologies, the GS VER Methodology further states:

*“In many developing countries the level of energy service is not sufficient to meet human development needs due to lack of financial means and/or access to modern energy infrastructure. **The methodology therefore allows for a variation to the evolving baseline option, applicable if the project activity is implemented under a situation where energy services provided are insufficient to meet the needs of stakeholders.***

*The underlying principle of the suppressed demand argument is: Where a group of people are deprived of a reasonable level of human development to their peers, and the opportunity to achieve a satisfactory level of service is available through carbon financing calculated from the baseline level of service of their peers or from the project level of service achievable, then the appropriate adjustment to baseline can be made. **This principle implies that the equations presented above for emission reduction be adapted for cases of suppressed demand on a case-by-case basis.***

For water treatment technologies, the Project applies a suppressed demand approach (as detailed in Annex 2 of GS VER Methodology) to the baseline. The availability and use of water treatment is directly related to poverty and access to technologies. Suppressed demand is seen nationally throughout Guatemala, where rural households are dependent on wood for cooking and boiling water for purification. Considerable time and resources are spent searching for fuel and/or income spent on fuel, notwithstanding the time needed to fetch water from sources outside of the home. By providing new water treatment technologies, the Project makes available clean water to poor populations previously deprived of access to clean water under suppressed demand conditions.

Finally, the GS VER methodology is applicable to the project because:

Figure B.1: Project Justification for choice of methodology:

GS VER Methodology Measure	Project Justification
The project boundary can be clearly identified, and the technologies counted in the project are not included in another voluntary market or CDM project activity (i.e. no double counting takes place). Project proponents must have a survey mechanism in place together with appropriate mitigation measures so as to prevent double-counting in case of another similar activity with some of the target area in common	The project location is defined as the country of Guatemala, as described in PDD A.2. The geographic boundaries of Guatemala are defined as administrative departmental boundaries set by government entities. The Project applies sales only to the GS VER registry, and no CDM or alternative registry is used for project technologies. Publicly available information on GS VER and CDM stove and water projects can confirm that technologies installed by the project are not used by other groups and that double counting has been avoided. The project proponent will use a serialization system to ensure that no technology is double counted. Filters will be marked with the brand of the filter, as well as the date of fabrication, batch letter, and a four digit serial number unique to each batch. Similarly a metal placard will be affixed to each eko-stove, displaying the brand, the date of fabrication and a four digit identification number. The project proponent has provided the DOE with detailed descriptions and examples of this serialization.

The technologies each have continuous useful energy outputs of less than 150kW per unit (defined as total energy delivered usefully from start to end of operation of a unit divided by time of operation). For technologies or practices that do not deliver thermal energy in the project scenario but only displace thermal energy supplied in the baseline scenario, the 150kW threshold applies to the displaced baseline technology.	The cook-stoves promoted by the project deliver thermal energy in the project scenario. Thus, its continuous useful energy output is assessed to ensure each unit implemented has a capacity of less than the maximum 150kW: -Household eko-stove average output = 8.95 kW²³ The water filters promoted by the project do not deliver thermal energy in the project scenario but only displace thermal energy supplied in the baseline scenario. Thus, the 150kW threshold applies to the displaced baseline technology: Displaced baseline technology (unimproved open fire) = 6.4 kW²⁴
The use of the baseline technology as a backup or auxiliary technology in parallel with the improved technology introduced by the project activity is permitted as long as a mechanism is put into place to encourage the removal of the old technology (e.g discounted price for the improved technology) and the definitive discontinuity of its use. The project documentation must provide a clear description of the approach chosen and the monitoring plan must allow for a good understanding of the extent to which the baseline technology is still in use after the introduction of the improved technology, whether the existing baseline technology is not surrendered at the time of the introduction of the improved technology, or whether a new baseline technology is acquired and put to use by targeted end users during the project crediting period. The success of the mechanism put into place must therefore be monitored, and the approach must be adjusted if proven unsuccessful. If an old technology remains in use in parallel with the improved technology, corresponding emissions must of course be accounted for as part of the project emissions.	Project training and installation encourages the discontinuation/dismantling of traditional technologies. When the use of the baseline technology is used as a backup or auxiliary technology in parallel with the improved technology introduced a mechanism will be put in place to encourage the removal of the old technology and the definitive discontinuity of its use. The initial measures to be taken are: • Ongoing kitchen survey monitoring will account for mixed use. • KPT subsumes the use of any traditional stove/fuel used. • Additionally, we will rely on feedback loops that help to improve the improved stove technology. • Likewise, project participants will be required to attend trainings explaining why they should cease to use 3 stones or any other previous technology. Additionally, project participants will sign a contract agreeing to use the project technology on a regular basis according to the instructions given in the training sessions. • If the above measures do not show a positive result over time we may offer a discount on a new stove or an extended warranty if the old one is disposed of.
The project proponent must clearly communicate to all project participants the entity that is claiming ownership rights of and selling the emission reductions resulting from the project activity. This must be communicated to	The project proponent will clearly communicate to all project participants that Stove Capital LLC is claiming ownership rights and selling the emission reductions resulting from the distribution of project technologies through the following mechanisms: • Transfer of carbon rights will be explained at

²³ Please see official lab results of the eko-stove Water Boiling Test (provided to DOE).

²⁴ Please see official lab results of Baseline Water Boiling Test (provided to DOE). 6.4kW represents the average thermal efficiency of the three baseline stoves tested that were found to be the most common in target households (three stone open fire, raised polleto open fire with metal grate, raised polleto open fire with three sided cinder block support).

the technology producers and the retailers of the improved technology or the renewable fuel in use in the project situation by contract or clear written assertions in the transaction paperwork. If the claimants are not the project technology end users, the end users should be notified that they cannot claim for emission reductions from the project.	local consultations and end-user technology trainings • Credit waiver agreements that stipulate the transfer of carbon rights from the end-user to Stove Capital LLC will distributed and agreed upon with each technology at the point of distribution • Claimants rights will be explained and agreed upon with the technology producers and retailers of improved technologies through contracts or clear written assertions. Finally, given that the technology end users are not the claimants they will be also notified through the waivers that they cannot claim for emission reductions from the project. Upon receiving the technology, the project proponent will explain to end users that the manufacture and distribution of the technologies is supported by payments for emissions reductions that it creates, and in accepting the technology the end user acknowledges that the rights to the emission reductions belong to Stove Capital, LLC. The end users will sign a Carbon Rights Waiver acknowledging their understanding that they are foregoing all rights to emission reductions. The project proponent has provided the DOE with examples of Carbon Rights Waivers that end users will be required to sign.
Water treatment products reduce the amount of fuelwood consumed by changing kitchen practice from water boiling as a purification technique to the introduction of new zero emission technology that treats water.	The Project distributes water treatment technologies that reduce reliance on stoves for water boiling under suppressed demand conditions. Improved water treatment systems do not require fuel combustion to purify water. See PDD A.3 for details and references for improved technology performance.

B.3. Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Emissions from combustion in baseline	CO ₂	Yes	Main source of emission in the baseline
		CH ₄	Yes	Main source of emission in the baseline
		N ₂ O	Yes	Minor source of emission in the baseline
Project scenario	Emissions from combustion in project	CO ₂	Yes	Main source of emission in the project activity
		CH ₄	Yes	Main source of emission in the project activity
		N ₂ O	Yes	Minor source of emission in the project activity

B.4. Establishment and description of baseline scenario

The following studies are completed for the project activity to determine the baseline scenario at the validation stage:

- Baseline non-renewable biomass (NRB) assessment, as biomass is one of the project fuels
- Baseline survey (BS) of target population characteristics

Baseline survey (BS) of target population characteristics

Berkeley Air and its field partner, Universidad del Valle (UVG), were hired by the project proponent to conduct a nationally representative baseline survey focusing on the project's target population demographics.²⁵ The survey was conducted in July and August 2012. The aim of the baseline survey is to compile data on household energy practices, including technologies, methods, and fuels used to cook food and purify water for domestic use, as well as those employed to cook food commercially, where applicable. The scope is expected to be national with results representative of the strata of the national population who depend on solid fuels for a significant portion of their domestic energy.

Baseline Survey Representativeness and Sample Size

The Baseline survey²⁶ followed the sampling guidance of the GS methodology and is representative of end users targeted in the program activity. This survey targeted 150 baseline households to fulfil the Gold Standard sampling methodology (v3) requirement of 100 surveys for a project of this size. A clustering approach was used to ensure the participating communities were nationally representative. The communities were selected by local partners, in accordance with criteria developed by Berkeley Air in partnership with the project implementers and based on target population demographics for the program. Within each community, households were randomly selected and a consent form explaining the purpose and scope of the study was used to recruit participants. A total of 146 surveys were collected in seven sampling locations.

Data Collected

²⁵ Neither Berkeley Air Monitoring Group, which is an independent research firm and a registered service partner of The Gold Standard Foundation, nor the project field partner, UVG, has any financial investment in the project beyond the fees paid to them by the project developers for the survey activities.

²⁶ Full Baseline Survey Report has been provided to the DOE

The data collected through the BS provides information about specific characteristics of each baseline scenario in the project such as end user follow up, demographic characteristics, and baseline technology and fuels. Below is a summary of the key information that was collected through the survey:

Household Demographics:

- The average household size was just over 6 persons (6.10 people per household)
- The average number of people eating in the household (6, 2.6 SD) is congruent with the average family size. It remains steady throughout the year and across regions.

Stove Types:

- 118 of the 146 households (80.8%) used either a traditional open fire (i.e. one on the ground) or a raised open fire (locally known as a polleton) to meet their domestic energy needs, either as their only stove (n=100), or in combination with a plancha (n = 8) or an LPG stove (n = 8), or in combination with both a plancha and an LPG stove (n = 2). No households reported using charcoal, kerosene or electricity as their primary fuel.

Table B.4.1 Stove use for all purposes by Department and total study sample

	Stove type	Alta Verapaz		Huehuetenango		San Marcos		Total	
		n	%	n	%	n	%	n	%
One type of stove only	Open/raised Fire	50	98.0	22	50.0	28	54.9	100	68.5
	Plancha	0	-	19	43.2	6	11.8	25	17.1
	LPG stove	0	-	0	-	0	-	0	-
Combination of 2 stove types	Open fire and plancha	0	-	3	6.8	5	9.8	8	5.5
	Open fire and LPG	0	-	0	-	8	15.7	8	5.5
	Plancha and LPG	0	-	0	-	3	5.9	3	2.1
Combination of 3 stove types	Open fire, plancha, & LPG	1	2.0	0	-	1	2.0	2	1.4

Fuel Types:

- Wood was overwhelmingly the primary fuel for all surveyed households, and is used by all households surveyed. None of the households surveyed met any of their domestic energy needs with charcoal, kerosene or electricity. 13 households used gas for at least some applications, and four families used non-wood biomass, including crop residues and pine cones, in addition to regular wood. LPG use was present in all four San Marcos communities, with the highest concentrations of users in San Francisco Chichicaste. The geographical concentration of LPG users in San Marcos is consistent with the household purchasing power, which is highest in San Marcos.
- In general, there was very little difference in fuel use patterns between the wet and dry seasons, and where there were small differences, almost all of them suggested a trend towards using wood for more applications in the dry season than in the wet season.

Table B.4.2 Fuel use by department and total sample

Fuel type	Alta Verapaz	Huehuetenango	San Marcos	Total
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	n	%	n	%	n	%	n	%
Wood only	50	98.0	41	93.2	38	74.5	129	88.4
Wood and LPG	1	2.0	0	-	12	23.5	13	8.9
Wood and other biomass	0	-	3	6.8	1	2.0	4	2.7

Nationwide among the rural population, the general situation is similar to the results of this survey. Woodfuel remains critically important to rural families, with 95% of households in the national survey using at least some wood as compared with 100% in our survey (see Table B.4.3). Our survey detected only 9% of household using any LPG and no transitional fuels at all. Not surprisingly, the overall rural rates for these fuels were higher than in the project's economically disadvantaged strata: 20% use some LPG, 8% some kerosene, and 3% some charcoal.

Table B.4.3 Summary of all fuels used for cooking – comparison of survey results with national data²⁷

Fuel Use Type	National (%)	Urban (%)	Rural (%)	This survey, all (%)
Electricity	2.5	4.8	0.8	0
LPG	45.3	78.0	20.3	8.9
Kerosene	5.4	1.4	8.4	0
Charcoal	12.6	24.6	3.4	0
Firewood	73.6	45.2	95.4	100

Table B.4.4 shows that wood procurement methods documented in this survey are representative of the primary national trends. More families collect wood (49% of all rural families and 43% of our surveyed households) than purchase it (36% and 34% respectively), and significant portion (11% and 23% respectively) use both procurement methods.

Table B.4.4 Means of fuel collection – comparison of survey results with national data²⁸

	National		Urban		Rural		BS Survey	
	N	%	N	%	N	%	N	%
Collect Only	4452	41.2%	805	23.9%	3647	49.1%	62	42.5%
Purchased Only	4846	44.9%	2168	64.3%	2678	36.1%	50	34.2%
Both Collect & Purchase	1071	9.9%	269	8.0%	802	10.8%	34	23.3%
Other	427	4.0%	132	3.9%	295	4.0%	N/A	N/A
Total	10796	100%	3374	100%	7422	100%	146	100%

The baseline survey found that the majority (88.3%) of households boil water for purification, which is higher than the national average of 28% (see Table B.4.5)

²⁷ Ahmed, K. et al. (2005). Environmental Health and Traditional Fuel Use in Guatemala. Rep. Washington DC: World Bank. Table 2.5, p. 20. Source data ENCOVI 2000.

http://www.esmap.org/sites/esmap.org/files/SR_Guatemala_EnvironmentalHealthandTraditional.pdf

²⁸ Encuesta Nacional de Condiciones de Vida, ENCOVI 2011 –INE. Original survey data, analysis by Impact Carbon, and emails from INE confirming analysis is correct and that the survey data can be used for the purposes of this report has been provided to the DOE.

Table B.4.5 Water treatment data – comparison of survey results with national data²⁹

Treatment Method	Urban		Rural		BS Survey	
	N	%	N	%	N	%
Boil	1,562	28	3117	39	128	88.3
Filter	196	4	192	2	3	2.1
Chlorine	478	9	1,046	13	1	0.7
Buy Purified Water	2,101	38	742	9	N/A	N/A
No Treatment	1,237	22	2,787	35	3	2.1
Combination of Treatments	N/A	N/A	N/A	N/A	10	7

Baseline Scenario Description:

In order to assess the woody biomass used in the absence of the project activity, it is necessary to group the targeted project beneficiaries. Based on the results of the Baseline Survey detailed above, the project identifies the following baseline scenario:

Baseline scenario 1 (hhb): “Household biomass users”, which consists of households using biomass fuel in unimproved open fires for domestic purposes³⁰. The PP will add additional baseline scenarios to the project activity as communities and end-users are progressively added to the project throughout the crediting period upon approval of a request for design changes. A baseline or project scenario does not necessarily apply uniquely to one technology. Thus, different improved stove models or water treatment technologies may be compared to the same baseline scenario.

The project proponent considers the baseline fixed by default upon field testing prior to verification. Additionally, whenever the project applies for a renewable crediting period, the baseline must be reassessed as per the rules on renewal of crediting periods.

Suppressed Demand

According to the Baseline Survey, the average water consumption is 1.43 liters per person per day³¹. It is evident that suppressed demand exists for safe water in Guatemala, due to infrastructure and poverty constraints, as 1.43 l/p/dis well below WHO recommendation of 4.5 liters of water per person per day to maintain hydration in hot tropical environments with manual labour (i.e. agricultural work).³²

In order to account for suppressed demand for water services in Guatemala, where there is not a satisfactory level of service in terms of treated water available for consumption in the baseline, inhibited by insufficient energy, income or infrastructure to meet basic water treatment needs, the baseline is the total amount of water that would have been treated in the absence of suppressed demand for consumption per person per day in the project scenario.³³

²⁹ Encuesta Nacional de Condiciones de Vida, ENCOVI 2011 –INE. Original survey data, analysis by Impact Carbon, and emails from INE confirming analysis is correct and that the survey data can be used for the purposes of this report has been provided to the DOE.

³⁰ Baseline stove type for water treatment technologies will be monitored through on-going monitoring surveys. If the surveys find that households have an improved stove (not credited in this project activity) as their baseline, appropriate testing and adjustment factors will be applied. In all cases the baseline scenario will be reassessed at the time of crediting period renewal

³¹ Please see Berkeley Air Baseline Survey Data & Analysis for water volume data and calculation (provided to DOE).

³² WHO. (2003) Domestic Water Quantity, Service Level and Health. WHO/SDE/WSH/03.02. Pg 4-5. Report states that households in developing countries, with least access to water supplies are more likely to be engaged in at least moderate activity and often in above-average temperatures. http://www.who.int/water_sanitation_health/diseases/WSH03.02.pdf

³³ Please see PDD Section B.6.1 Explanation of methodological choices for details on how the project addresses the cross effects of water technologies and stove technologies

Project Scenario Description:

Based on the results obtained from the studies conducted to establish the baseline scenarios and in light of the technologies that will be implemented as part of the project activity, the following are the indicative project scenarios:

Project scenario 1 (hh-wt): “Household Water Treatment”, which consists of households using project water treatment technologies that displace the use of biomass for water purification.

Project scenario 2 (hh-dual): “Household Improved Cookstoves + Water Treatment”, which consists of dual implementation of project improved cookstoves and water treatment technologies that displace the use of biomass for water purification and allow for the efficient use of biomass for cooking.

Project scenario 3 (hh-ics): “Household Improved Cookstoves”, which consists of households using project improved cookstove technologies that allow for the efficient use of biomass for cooking.

Additional project scenarios may be added to a project activity at any time during the project period upon approval of a request for design changes. Emission reductions will not be credited for a new project scenario or in relation to a new baseline scenario until the respective project studies or baseline studies have been conducted. Appropriate studies will be conducted prior to verification. Alternatively, adjustment factors may be applied to existing baseline and project scenarios to account for less significant variability in fuel consumption or technology, without the need to create a new baseline or project scenario.

Establishment of description of Baseline Non-Renewable Biomass Assessment

The PP has assessed the fractional Non Renewability of Biomass used in the absence of the project activity according to the principles of renewability outlined by the CDM AMS II.G methodology.

Please see NRB report and analysis³⁴ that includes both the qualitative and quantitative assessments that establish fNRB as 95.74%.

B.5. Demonstration of additionality

The most recent version of the UNFCCC “Attachment A to Appendix B of 4/CMP.1 Annex II”³⁵ is used to demonstrate that the project is additional and therefore reduces anthropogenic emissions of greenhouse gases below those that would have occurred in the absence of the registered Gold Standard Project. According to the latest version of the guidance (EB68 Annex 27), the project “shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

- (a) *Investment barrier:* a financially more viable alternative to the project activity would have led to higher emissions;
- (b) *Technological barrier:* a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

³⁴ NRB report and calculations have been provided to the DOE

³⁵ According to the Gold Standard Toolkit (version 2.2) Table 2.3 List of approved additionality tools (refer latest version of tools). Latest version of tool is EB68 Annex 27 Guidelines on the demonstration of additionality of small-scale project activities Version 09.

http://cdm.unfccc.int/filestorage/c/p/I5FZTH0DK3O2QLA1VRWU9X7SE6MBY8.pdf/eb68_repan27.pdf?t=OVR8bWMyNW4xfDD-7sKd7pwEKeOHNApFG4m

- (c) *Barrier due to prevailing practice:* prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- (d) *Other barriers:* without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The PP has chosen the barrier due to prevailing practice to prove additionality.

Prevailing Practice: First of its Kind (Improved Stoves & Water Filters)

Habitual use of traditional stoves imposes a very strong influence on the baseline scenario, resulting in continuation of use of traditional inefficient stoves. There have been some efforts to introduce improved cookstoves in Guatemala however these programs have not resulted in the widespread implementation of improved cookstoves by households that the project will yield.

Improved Cookstove Projects Implemented in Guatemala to date:

- These projects expanded the use of improved cook stoves in Guatemala; however they represent highly subsidized projects that are not financially sustainable without international support.³⁶
 - *Social Investment Fund (SIF):* A Government agency that mainly implements infrastructure projects (and has local offices in every department of Guatemala), SIF carries out Guatemala's largest, most extensive stove project. To date, SIF has installed more than 90,000 improved, metal-plancha stoves throughout the country. The Fund subsidizes about 90% of the cost of each improved stove.³⁷
 - *Tezulutlán:* An NGO supported by the European Union (EU) and the Government of the Republic of Guatemala, Tezulutlán carried out a stove project in the northern department of Baja Verapaz. By the time it ended, the project had constructed more than 4,129 improved, metal-plancha stoves.³⁸
 - *INTERVIDA:* An international NGO established in Spain, INTERVIDA is active in six departments of western Guatemala. The organization has constructed about 9,000 improved metal-plancha stoves, with users contributing an estimated 30% of total stove costs.³⁹
 - *Helps International/ONIL:* Currently the largest commercial stove program by far is run by Helps International, a non-profit that has been providing social services in Guatemala since 1982. Helps primarily sells the ONIL stove, an installed plancha-style indoor stove made of cement.⁴⁰ From 2001 to 2004 Helps slowly began rolling out sales of the ONIL. Having sold more than 10,000 stoves in each of the years 2005– 08, Helps projected 45,000 stove sales in 2009 and 90,000 in 2010.⁴¹
- One of the main challenges of disseminating improved cookstove in Guatemala is the lack of a national cookstove program. According to a 2011 World Bank report, "Guatemala has never initiated a lasting, centralized national cookstoves program that might direct government

³⁶ Joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP). (2004). Evaluation of Improved Stove Programs in Guatemala Final Report of Project Case Studies. ESMAP Technical Paper 060. Pg. xvi.
<http://www.esmap.org/sites/esmap.org/files/06004GuatemalaFinalEnglishforWeb.pdf>

³⁷ Ibid, pg. xv

³⁸ Ibid, pg. xv

³⁹ Ibid, pg. xvi

⁴⁰ World Bank & Energy Sector Management Assistance Program (ESMAP). 2011. Household Energy Access for Cooking and Heating: Lessons Learned and the Way Forward. Energy and Mining Sector Board Discussion Paper No.23, June 2011. Pg. 23. http://siteresources.worldbank.org/EXTENERGY2/Resources/HouseHold_Energy_Access_DP_23.pdf

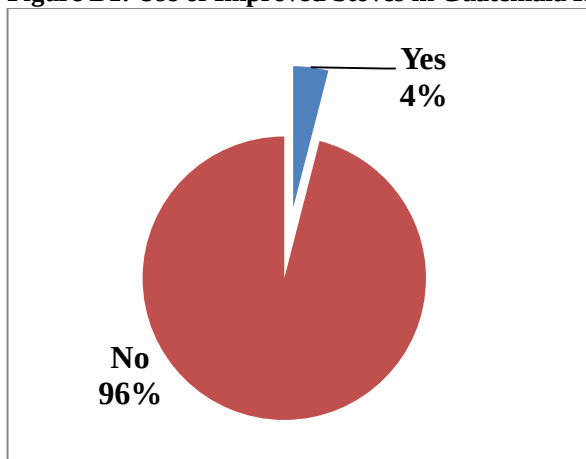
⁴¹ Ibid, pg. 38

resources and administrative capacity to disseminating cookstoves and creating an enabling environment for cookstove markets to take root (without high subsidies)”.⁴²

Penetration Rate of Improved Cookstoves in Guatemala to date:

In 2011 the Economic Commission for Latin America (ECLAC) and the Guatemala Ministry of Energy and Mines (MEM), conducted a national survey of household firewood and stove use in 1,264 households within 85 municipalities distributed throughout 22 departments.⁴³ The report found that only 4% of households use an improved stove (see Figure 1).

Figure B1: Use of Improved Stoves in Guatemala Households⁴⁴



Penetration Rate of Water Filter Use in Guatemala to date:

The prevailing practices in Guatemala for water treatment have been surveyed by the National Institute of Guatemala (INE) through the 2011 Living Standards Survey (ENCOVI 2011). The national survey data shows that only 3% of the population use filters to purify their water (see Table 6). Guatemala has the second lowest percentage (only 25%) of urban systems with water treatment for drinking purposes among Latin American nations, being only above Haiti⁴⁵. In a 2010 study on the microbiological effectiveness of disinfecting water by boiling in Guatemala, researchers observed that “there was a general community consensus that it is not acceptable to drink untreated water directly from the tap and that it should be boiled before consumption”.⁴⁶

Table 6: Water Treatment- ENCOVI 2011 Living Standards Survey⁴⁷

Water Treatment	Rural		Urban		All	
	#	%	#	%	#	%
Boiling	3,117	39%	1,562	28%	4,679	35%
Filter	192	2%	196	4%	388	3%

⁴² Ibid, pg. 39

⁴³ Comisión Económica para América Latina (CEPAL) y Ministerio de Energía y Minas de Guatemala (MEM). 2011. Encuesta Nacional de Leña (consumo de la leña en hogares y pequeña industria en la República de Guatemala). Pg. 11. Report obtained by Impact Carbon from Oswaldo Garcia, Depto. Energías Renovables Dirección General de Energía –MEM and provided to the DOE.

⁴⁴ Ibid, pg. 26, Gráfico 2: Uso de estufas mejoradas

⁴⁵ Vasquez, William F. (2011). Municipal Water Services in Guatemala: Exploring Official Perceptions. Water Policy 13, 362-374; pg. 365.

⁴⁶ Rosa, G. et al. (2010). Microbiological Effectiveness of Disinfecting Water by Boiling in Rural Guatemala. American Journal of Tropical Medicine and Hygiene. Pg. 474.

⁴⁷ Encuesta Nacional de Condiciones de Vida, ENCOVI 2011 –INE. Original survey data, analysis by Impact Carbon, and emails from INE confirming analysis is correct and that the survey data can be used for the purposes of this report has been provided to the DOE.

Chlorine	1,046	13%	478	9%	1,524	11%
Buy Purified Water	742	9%	2,101	38%	2,843	21%
No treatment	2,787	35%	1,237	22%	4,024	30%
Other	17	0%	8	0%	24	0%
Total	7,901	100%	5,582	100%	13,482	100%

Thus, the project can be described as a “first of its kind” project as less than 20% of the population currently use improved cookstoves or water filters. This is in line with Gold Standard additionality assessment which states that if “the project technology has been adopted by less than 20% of the population in the target area, the technology can be qualified as “first of its kind” and hence a realistic and credible barrier due to prevailing practice can be claimed.”

A significant amount of sensitization, marketing, demonstration and personal anecdote are required to overcome this prevailing practice. Carbon revenues will fund these activities which are required to shift the common practice from inefficient traditional stoves to improved ones under the Project Activity.

The analysis concludes that barriers due to prevailing practice do exist.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

The Project follows the methodological steps for estimating emission reduction as outlined in the Gold Standard Methodology “Technologies and practices to displace decentralized thermal energy consumption” (version 1 - 11/04/2011).

1. Continued Boiling in Project Households

According to the GS TAC June 2012 Update, the following revision was made to Annex A (safe water supply) of the methodology ‘Technologies and Practices to Displace Decentralized Thermal Energy Consumption’:

- a. *It was decided to allow project developers to choose between the following two options with respect to the consideration of raw water boiled in the project situation:*
 - i. *Apply the current provisions of the methodology whereby data is collected on ‘raw water boiled after introduction of water treatment technology’ and a cap of 7.5 l/p/d is applied on the total amount of treated water for consumption per person per day, including water needed for cooking. In this situation the definitions of Lbl,i,y and Lpj,i,y remain as described in the methodology.*
 - ii. *Do NOT monitor the raw water boiled in the project situation and apply a cap of 6 l/p/d is applied on the amount of water treated by the water treatment technology for drinking water, hand washing and food washing. The 6 l/p/d cap is set so as to account for the crediting of water used for hand and food washing, in the absence of figures from WHO on minimum service level for hand and food washing (basic hygiene). In such a case, the definitions of Lbl,i,y and Lpj,i,y are therefore revised. Lbl,i,y is defined as the total amount of raw water treated with the water treatment technology. Lpj,i,y is defined as the total amount of treated water that is still boiled.*

The PP has chosen option ii, and will apply a cap of 6 l/p/d will be applied on the amount of water treated by the water treatment technology for drinking water, hand washing and food washing.

2. Methods used to address double counting of fuel savings in households with dual technologies

The project will work with a variety of local distributors to disseminate project improved stoves and water treatment technologies to Guatemalan households. Initial sales and distribution will be through Socorro Maya and Ecofiltro and their NGO partners. Improved stoves and water filters

will be sold by Socorro as a package (installed on the same day), while Ecofiltro will also sell filters separately, with no stove, through their own established distribution channels.

To date, there are no issued GS projects that are implementing both water and stove technologies in the same household. There also does not exist official guidance on how to account for potential cross effects or double counting (over counting and under counting of Emission Reductions (ER) due to dual technology implementation).

Implications of Dual Technologies in KPT Baseline and Project Scenario Testing:

In GS Methodology V3 “Technologies and Practices to Displace Decentralized Thermal Energy Consumption”, the fuel savings and associated emissions reductions from improved cookstoves is quantified by a baseline and project KPT, while the fuel savings from displaced water boiling are quantified through monitoring the project scenario in an ex-ante WCFT. Measuring fuel consumption in this manner may lead to double counting emission reductions from water displacement because the fuel used to boil water is captured in both the baseline KPT and WCFT. For example, consider a household whose baseline scenario is a three stone fire used for cooking and water boiling and whose project scenario is an improved stove and water filter. The baseline KPT for this household would capture all fuel used (including water boiling), while the project KPT would only be capturing the fuel used for cooking because the presence of a filter eliminates (most of) the need to boil water. Therefore, fuel savings from water would be counted both in the efficient use of fuel use from the KPT and in fuel displacement of the WCFT. In order to capture an accurate comparison of baseline-project KPTs, the testing must disaggregate how much fuel is being used in the baseline for cooking and how much fuel is being used to boil water (if any). Since this is a difficult task that has the potential to disturb “normal household practices”, **the project will conduct baseline KPTs in households with filters in order to capture the quantity of fuel that is consumed in the baseline exclusive of the fuel used for purifying water by boiling⁴⁸**. The results of the baseline KPT will be applied to Project scenario 2 (hh-ics +nb).

Leakage Assessment

A leakage investigation will be conducted every two years using relevant survey methods that can be combined with monitoring surveys as is applicable.

The following potential sources of leakage are investigated:

- 1) *The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or in a manner suggesting more usage than would have occurred in the absence of the project.*
 - a) Justification: No leakage. There is no evidence that the project increases the use of higher emitting technologies outside the project boundary where lower emitting technologies are in place (i.e. 3 stones fires). Wood fuels remain a valuable and declining resource. This trend will not be reversed by the project activity.
 - b) The baseline technology used in Guatemala is three stone cook stoves, which are the same type of technology that is used outside the project boundary (Guatemala) i.e. Honduras, El Salvador, etc.

⁴⁸ Homes with only improved stoves (no improved water technology) will not include filters in baseline KPTs.

- c) Given that the leakage assessment does not expect an increase in fuel consumption by the non-project households/users attributable to the project activity, calculations do not need to be adjusted to account for this leakage
- 2) *The non-renewable biomass or fossil fuels saved under the project activity are used by non-project users who previously used lower emitting energy sources.*
 - a) Justification: No leakage. There is no evidence that the project increases the use of higher emission fuel outside the project boundary where lower emitting energy sources take in place. Wood fuels remain a valuable and declining resource. This trend will not be reversed by the project activity.
 - b) Given that the leakage assessment does not expect an increase in fuel consumption by the non-project households/users attributable to the project activity, calculations do not need to be adjusted to account for this leakage.
- 3) *The project significantly impacts the NRB fraction within an area where other CDM or VER project activities account for NRB fraction in their baseline scenario.*
 - a) The project boundary covered in this project does not overlap with any other registered CDM or and VER project activities. If other future CDM or GS VER projects claim the same baseline as this project, a mechanism will be put in place to distinguish the biomass saved for each individual stove to ensure none of the project stoves are not accounted within another project's activities (as described in the monitoring plan).
- 4) *The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of heating or by retaining some use of inefficient technology.*
 - a) Justification: No leakage. No evidence exists that the project will result in increased fuel use for heating from inefficient stoves.
 - b) If this condition changes during the crediting period and homes start requiring heating for the main home, the project stoves are capable of providing heating that is released both from the combustion chamber, as well as from residual heat captured in the liner post-combustion. In this manner the stove may in fact act as a more efficient heat source than 3-stone fires. The scarcity and/or cost of fuel is an additional incentive to not use multiple stoves for heating and thus reducing the likelihood that space heating is compensated by inefficient stoves.
- 5) *By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution within households who commonly used a technology with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.*
 - a) Justification: No leakage. Project stoves shift cooking fuels only from high emission to low emission cooking. The type of cooking typically done on traditional stoves is replaced with the improved stoves. Cooking tasks that were typically done on LPG (fast boiling of water, cooking for guests) will continue because of their ease and speed of cooking, or will be reduced due to the additional appeal and fuel savings associated with the use of the efficient stoves distributed. The design of the kitchen test captures multiple stove and fuel use.

B.6.1.1 Project scenario crediting in relation to the appropriate baseline scenario

Emission reductions are verified and credited by comparing the emissions for a given project scenario to the emissions for the applicable baseline scenario. As explained in this document, multiple project scenarios may be credited in comparison to different baseline scenarios, and multiple project scenarios may be credited in comparison to the same baseline scenario, as is applicable along the crediting period.

The initial emissions profile of each baseline scenario and project scenario is determined by the results of the respective baseline studies and project studies. Over the project period the results are updated as needed and adjusted depending on results of the on-going monitoring studies.

The following scenarios are outlined below:

1. **Project scenario 1 (hh-wt):** “Household Water Treatment”, which consists of households using project water treatment technologies that displace the use of biomass for water purification.
2. **Project scenario 2 (hh-dual):** “Household Improved Cookstoves + Water Treatment”, which consists of dual implementation of both project improved cookstoves *and* water treatment technologies that displace the use of biomass for water purification.
3. **Project scenario 3 (hh-ics):** “Household Improved Cookstoves”, which consists of households using project improved cookstove technologies that allow for the efficient use of biomass for cooking.

ER Crediting for Project Scenario 1 (hh-wt): Household Water Treatment

Baseline Scenario Fuel Consumption Calculation

The total safe water consumed in the project scenario is the amount of safe water supplied by the project technology and consumed in the project scenario (defined as $Q_{p,y}$), plus the amount of raw water boiled after introducing the project technology (defined as $Q_{p,rawboil,y}$). As stated in PDD section B.6.1, the project chooses to exclude measurement of raw water boiled after introducing the project technology (respectively represented in the methodology as $Q_{p,rawboil,y}$) and thus caps crediting at 6 L/p/d. Therefore, the definition of $Q_{p,y}$ has been revised to be the total amount of raw water treated with the ‘zero or low emissions’ water treatment technology for household drinking water, hand washing and food washing.⁴⁹ This total is assumed to be equivalent to water boiled in the baseline. *If this volume exceeds the cap of 6 L/p/d stipulated in the section on suppressed demand above, the project proponent’s claim for emission reductions may not exceed the cap.*

$B_{by,wt}$ = Number of person-days x Baseline Fuel used to Treat Water (T/L) x Total Raw Water treated with water treatment technology in project scenario (L/p/d)

$$B_{by,wt} = (1 - C_j) * N_{p,y,wt} * W_{b,y} * (Q_{p,y} + Q_{p,rawboil,y}) \quad (1)$$

Where:

$N_{p,y,wt}$ Number of person-days consuming water supplied by project scenario p through year y

⁴⁹ In June 2012, the Gold Standard Technical Advisory Committee (TAC) agreed to allow this alternative definition of $Q_{p,y}$ as the total amount of raw water treated with the water treatment technology. <http://www.cdmgoldstandard.org/project-certification/tac-update#>

C_j	Expressed as a percentage, this is the portion of users of the project technology j who in the baseline were already consuming safe water without boiling it
$B_{b,y,wt}$	Quantity of fuel consumed in baseline scenario b during the year y in tons
$Q_{p,y}$	Quantity of raw water treated with water treatment technology and used for hygienic purposes ⁵⁰ in the project scenario p and supplied by project technology per person per day, capped at 6 L/p/d
~~$Q_{p,rawboil,y}$~~	~~Quantity of raw water boiled in the project scenario p per person per day~~
$W_{b,y}$	Quantity of fuel in tons required to treat 1 litre of water using technologies representative of baseline scenario b during project year y , as per Baseline Water Boiling Test.

Project Scenario Fuel Consumption Calculation

$B_{p,y,wt}$ = Number of person.days x Project Fuel used to boil water (T/L) x Total volume of water boiled in project scenario (L/p/d)

$$B_{p,y,wt} = (1 - C_j) * N_{p,y,wt} * W_{p,y} * (\cancel{Q_{p,rawboil,y}} - Q_{p,cleanboil,y}) \quad (2)$$

Where:

$N_{p,y,wt}$	Number of person.days consuming water supplied by project scenario p through year y
C_j	Expressed as a percentage, this is the portion of users of the project technology j or who in the baseline were already consuming safe water without boiling it
$B_{p,y}$	Quantity of fuel consumed in project scenario p during the year y in tons
~~$Q_{p,rawboil,y}$~~	~~Quantity of raw water boiled in the project scenario p per person per day~~
$Q_{p,cleanboil,y}$	Quantity of treated water still boiled and used for hygienic purposes in the project scenario p per person per day
$W_{p,y}$	Quantity of wood fuel or fossil fuel in tons required to treat 1 litre of water using technologies representative of the project scenario p during project year y

⁵⁰ Hygienic purposes is defined as “for drinking water, hand washing and food washing” in accordance with the June 2012 TAC update

Emission Reductions

$$BE_{b,y,wt} = B_{b,y,wt} * ((f_{NRB,b,y} * EF_{b,fuel, CO2}) + EF_{b,fuel, nonCO2}) * NCV_{b, fuel} \quad (3)$$

$$PE_{p,y,wt} = B_{p,y,wt} * ((f_{NRB,p,y} * EF_{p,fuel, CO2}) + EF_{p,fuel, nonCO2}) * NCV_{p, fuel} \quad (4)$$

Where the parameters are defined as in equations 1 and 2 above.

The overall GHG reductions are calculated as follows:

$$ER_{y, hh-wt} = (\sum BE_{b,y,wt} - \sum PE_{p,y,wt}) * U_{p,y} - \sum LE_{p,y} \quad (5)$$

Where:

$U_{p,i,y}$ Cumulative usage rate for technologies in project scenario p, for technology i, during year y, based on cumulative installation rate and drop off rate.

ER Crediting for Project Scenario2 (hh-dual): Household Improved Cookstoves and Water Treatment Technologies (Dual Technology Implementation)

Crediting for the Household Improved Cookstoves

When the baseline fuel and the project fuel are the same and the baseline emission factor and project emission are considered the same, the overall GHG reductions achieved by the improved cookstoves in the project activity in scenario 2, year y are calculated as follows:

$$ER_{y, hh-dual, ics-nb} = \sum_{b,p} (N_{p,y,ics} * U_{p,y} * P_{p,b,y,ics-nb} * NCV_{b,fuel} * ((f_{NRB,b,y} * EF_{fuel,CO2}) + EF_{fuel,nonCO2}) - \sum LE_{p,i,y}) \quad (6)$$

Where:

$\sum_{b,p}$	Sum over all relevant (baseline b/project p) couples
$N_{p,y,ics}$	Cumulative number of project technology-days included in the project database for project scenario p for technology i against baseline scenario b in year y
$U_{p,i,y}$	Cumulative usage rate for technologies in project scenario p, for technology i, in year y, based on cumulative adoption rate and drop off rate revealed by usage surveys (fraction)
$P_{p,b,y,ics-nb}$	Specific fuel savings for an individual technology of project p against an individual technology of baseline b in year y, in tons/day, as derived from the statistical analysis of the data collected from the field tests
$f_{NRB,b,y}$	Fraction of biomass used in year y for baseline scenario b that can be established as non--renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{b,fuel}$	Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{b,fuel,CO2}$	CO2 emission factor of the fuel that is substituted or reduced. 112 tCO2/TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{b,fuel,nonCO2}$	Non-CO2 emission factor of the fuel that is reduced
$LE_{p,i,y}$	Leakage for project scenario p, technology i, in year y (tCO2e/yr)

If statistical analysis is performed on a single data set obtained from performance field tests in the project scenario, then the baseline emission calculations are conducted as follows:

$$BE_{b,y,ics-nb} = B_{b,y,ics-nb} * ((f_{NRB,y} * EF_{b,fuel,CO2}) + EF_{b,fuel,nonCO2}) * NCV_{b,fuel} \quad (7)$$

Where:

$BE_{b,y,ics-nb}$	Emissions for baseline scenario b during the year y in tCO2e
$B_{b,y,ics-nb}$	Quantity of fuel consumed (excluding fuel that would have been used to boil water, “NB”) ⁵¹ in baseline scenario b during year y, in tons

⁵¹ Please see Section B.6.1. Explanation of methodological choices for further explanation on the methods used to address double counting of fuel savings in households with dual technologies

$f_{NRB,y}$	Fraction of biomass used during year y for the considered scenario that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{b,fuel}$	Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{b,fuel,CO2}$	CO ₂ emission factor of the fuel that is substituted or reduced. 112 tCO ₂ /TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{b,fuel,nonCO2}$	Non-CO ₂ emission factor of the fuel that is substituted or reduced

And:

$$B_{b,y,ics-nb} = N_{p,y,ics} * P_{b,y,ics-nb} \quad (8)$$

Where:

$N_{p,y,ics}$	Project technology-days in the project database for project scenario p, for improved cookstove technologies, through year y for project scenario i
$P_{b,y,ics-nb}$	Quantity of fuel consumed by improved cookstove (excluding fuel used for purifying water by boiling- “NB”) in project scenario p during year y, converted to tons/day

Project emission calculations are conducted as follows:

$$PE_{p,y,ics-nb} = B_{p,y,ics-nb} * ((f_{NRB,y} * EF_{p,fuel,CO2}) + EF_{p,fuel,nonCO2}) * NCV_{p,fuel} \quad (9)$$

Where:

$PE_{p,y,ics-nb}$	Emissions for project scenario p, for improved cookstove technologies during year y in tCO ₂ e
$B_{p,y,ics-nb}$	Quantity of fuel consumed (excluding fuel used for purifying water by boiling) in project scenario p during year y, in tons, and as derived from the analysis conducted on the data collected during the project performance field tests (cases when no baseline performance field test are performed, e.g. by-default baseline factors)
$f_{NRB,y}$	Fraction of biomass used during year y that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{p,fuel}$	Net calorific value of the project fuel (IPCC default for wood fuel, 0.015 TJ/ton). This is equal to the baseline fuel NCV in projects which use the same fuel.
$EF_{p,fuel,CO2}$	CO ₂ emission factor of the project fuel. This is equal to the baseline fuel EF in projects which use the same fuel, 112 tCO ₂ /TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{p,fuel,nonCO2}$	Non-CO ₂ emission factor of the project fuel. This is equal to the baseline fuel EF

in projects which use the same fuel.

And:

$$B_{p,y,ics-nb} = N_{p,y,ics} * ((P_{p,y,ics-nb} * U_{p,i,y})) + (P_{b,y,ics-nb} (1 - U_{p,i,y}))$$

Where:

$N_{p,y,ics}$ Project technology-days in the project database for project scenario p through year y for project scenario i

$P_{p,y,ics-nb}$ Specific fuel consumption for an individual improved cookstove technology in project scenario p during year y converted to tons/day

$P_{b,y,ics-nb}$ Specific fuel consumption for an individual cookstove technology in baseline scenario b during year y converted to tons/day

$U_{p,i,y}$ Cumulative usage rate for technologies in project scenario p, for project technology I, during year y, based on cumulative installation rate and drop-off rate.

Therefore, the household Improved Cookstove GHG reductions (excluding fuel use for purifying water by boiling) are calculated as follows:

$$ER_{y, hh-dual, ics} (\sum BE_{b,y,ics-nb} - \sum PE_{p,y,ics-nb}) - \sum LE_{p,i,y} \quad (10)$$

Crediting for the Water Treatment Technology in Project Scenario2 (hh-dual):

$ER_{y, hh-dual-wt}$ is calculated as established in section B.6.1.1., sub-section “ER Crediting for Project Scenario 1 (hh-wt): Household Water Treatment”.

Total crediting for both the Household Improved Cookstove and Water Treatment Technology in Project Scenario 2 (hh-dual):

The Overall Household Improved Cookstove and Water Treatment Technology GHG reductions are calculated as follows:

$$ER_{y, hh-dual} = ER_{y, hh-dual-ics} + ER_{y, hh-dual-wt},$$

ER Crediting for Project Scenario 3 (hh-ics): Household Improved CookstovesCrediting for the Household Improved Cookstoves

When the baseline fuel and the project fuel are the same and the baseline emission factor and project emission are considered the same, the overall GHG reductions achieved by the improved cookstoves in the project activity in year y are calculated as follows:

$$ER_{y, hh-ics} = \sum_{b,p} (N_{p,y,ics} * U_{p,i,y} * P_{p,b,y,ics} * NCV_{b,fuel} * ((f_{NRB,b,y} * EF_{fuel,CO2}) + EF_{fuel,nonCO2}) - \sum LE_{p,i,y}) \quad (11)$$

Where:

$\sum_{b,p}$	Sum over all relevant (baseline b/project p) couples
$N_{p,y,ics}$	Cumulative number of project technology-days included in the project database for project scenario p, improved cookstove technologies, against baseline scenario b in year y
$U_{p,i,y}$	Cumulative usage rate for technology i in project scenario p in year y, based on cumulative adoption rate and drop off rate revealed by usage surveys (fraction)
$P_{p,b,y,ics}$	Specific fuel savings for an individual technology of project p against an individual technology of baseline b in year y, in tons/day, as derived from the statistical analysis of the data collected from the field tests
$f_{NRB,b,y}$	Fraction of biomass used in year y for baseline scenario b that can be established as non--renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{b,fuel}$	Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{b,fuel,CO2}$	CO2 emission factor of the fuel that is substituted or reduced. 112 tCO2/TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{b,fuel,nonCO2}$	Non-CO2 emission factor of the fuel that is reduced
$LE_{p,i,y}$	Leakage for project scenario p, technology i, in year y (tCO2e/yr)

If statistical analysis is performed on a single data set obtained from performance field tests in the project scenario, then the baseline emission calculations are conducted as follows:

$$BE_{b,y} = B_{b,y,ics} * ((f_{NRB,y} * EF_{b,fuel,CO2}) + EF_{b,fuel,nonCO2}) * NCV_{b,fuel} \quad (12)$$

Where:

$BE_{b,y}$	Emissions for baseline scenario b during the year y in tCO2e
$B_{b,y,ics}$	Quantity of fuel consumed in baseline scenario b during year y, in tons, as per-default factors (cases with project performance field test only)

$f_{NRB,y}$	Fraction of biomass used during year y for the considered scenario that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{b,fuel}$	Net calorific value of the fuel that is substituted or reduced (IPCC default for wood fuel, 0.015 TJ/ton)
$EF_{b,fuel,CO2}$	CO ₂ emission factor of the fuel that is substituted or reduced. 112 tCO ₂ /TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{b,fuel,nonCO2}$	Non-CO ₂ emission factor of the fuel that is substituted or reduced

And:

$$B_{b,y,ics} = N_{p,y,ics} * P_{b,y,ics} \quad (13)$$

Where:

$N_{p,y,ics}$	Project technology-days in the project database for project scenario p through year y, for project scenario i
$P_{b,y,ics}$	Specific fuel consumption for an individual technology in baseline scenario b during year y converted to tons/day

Project emission calculations are conducted as follows:

$$PE_{p,y,ics} = B_{p,y,ics} * ((f_{NRB,y} * EF_{p,fuel,CO2}) + EF_{p,fuel,nonCO2}) * NCV_{p,fuel} \quad (14)$$

Where:

$PE_{p,y,ics}$	Emissions for project scenario p during year y in tCO ₂ e
$B_{p,y,ics}$	Quantity of fuel consumed in project scenario p during year y, in tons, and as derived from the analysis conducted on the data collected during the project performance field tests (cases when no baseline performance field test are performed, e.g. by-default baseline factors)
$f_{NRB,y}$	Fraction of biomass used during year y that can be established as non-renewable biomass (drop this term from the equation when using a fossil fuel baseline scenario)
$NCV_{p,fuel}$	Net calorific value of the project fuel (IPCC default for wood fuel, 0.015 TJ/ton). This is equal to the baseline fuel NCV in projects which use the same fuel.
$EF_{p,fuel,CO2}$	CO ₂ emission factor of the project fuel. This is equal to the baseline fuel EF in projects which use the same fuel, 112 tCO ₂ /TJ for Wood/Wood Waste, or the IPCC default value of other relevant fuel
$EF_{p,fuel,nonCO2}$	Non-CO ₂ emission factor of the project fuel. This is equal to the baseline fuel EF in projects which use the same fuel.

And:

$$B_{p,y,ics} = N_{p,i,y,ics} * ((P_{p,y,ics} * U_{p,y,ics})) + (P_{b,y,ics} (1 - U_{p,i,y,ics})) \quad (15)$$

Where:

$N_{p,y,ics}$	Project technology-days in the project database for project scenario p through year y for project scenario i
$P_{p,y,ics}$	Specific fuel consumption for an individual improved cookstove technology in project scenario p during year y converted to tons/day
$P_{b,y,ics}$	Specific fuel consumption for an individual cookstove technology in baseline scenario b during year y converted to tons/day
$U_{p,i,y}$	Cumulative usage rate for technologies in project scenario j during year y, based on cumulative installation rate and drop-off rate, for project scenario i.

Therefore, the household Improved Cookstove GHG reductions are calculated as follows:

$$ER_{y,hh-ics} = (\sum BE_{b,y,ics} - \sum PE_{p,y,ics}) - \sum LE_{p,i,y,ics} \quad (16)$$

B.6.2. Data and parameters fixed ex ante

The following data and parameters are fixed ex-ante and do not need to be monitored over the crediting period:

Data / Parameter	$EF_{b,fuel,CO2}$
Unit	kg CO ₂ /TJ
Description	CO ₂ emission factor arising from use of fuels in baseline scenario
Source of data	IPCC defaults
Value(s) applied	112,000
Choice of data or Measurement methods and procedures	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of baseline emissions
Additional comment	When EF is in units of tCO₂/t_{fuel}, NCV term will be removed from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use. Measuring emission factors from stove technologies is costly and difficult to do accurately. Lacking measurable emission factors from the project technologies, PP applies default IPCC emission values.

Data / Parameter	$EF_{b,fuel,CH_4}$
Unit	kg CH ₄ /TJ
Description	CH ₄ emission factor arising from use of fuels in baseline scenario
Source of data	-IPCC defaults in Second Assessment Report, 1996.
Value(s) applied	300
Choice of data or Measurement methods and procedures	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of baseline emissions
Additional comment	<i>Term can include a combination of emission factors from fuel production, transport, and use.</i> Measuring emission factors from stove technologies is costly and difficult to do accurately. Lacking measurable emission factors from the project technologies, PP applies default IPCC emission values.

Data / Parameter	$EF_{b,fuel,N_2O}$
Unit	kg N ₂ O/TJ
Description	N ₂ O emission factor arising from use of fuels in baseline scenario
Source of data	-IPCC defaults in Second Assessment Report, 1996.
Value(s) applied	4
Choice of data or Measurement methods and procedures	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of baseline emissions
Additional comment	<i>Term can include a combination of emission factors from fuel production, transport, and use.</i> Measuring emission factors from stove technologies is costly and difficult to do accurately. Lacking measurable emission factors from the project technologies, PP applies default IPCC emission values.



Data / Parameter	$EF_{p,fuel,CO_2}$
Unit	kg CO ₂ /TJ
Description	CO ₂ emission factor arising from use of fuels in project scenario
Source of data	IPCC 2006 Guidelines for National Greenhouse gas Inventories
Value(s) applied	112,000
Choice of data or Measurement methods and procedures	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of project emissions
Additional comment	When EF is in units of tCO₂/t_{fuel}, NCV term will be removed from emission calculations. Term can include a combination of emission factors from fuel production, transport, and use. Measuring emission factors from stove technologies is costly and difficult to do accurately. Lacking measurable emission factors from the project technologies, PP applies default IPCC emission values.

Data / Parameter	$EF_{p,fuel,CH_4}$
Unit	kg CH ₄ /TJ
Description	CH ₄ emission factor arising from use of fuels in project scenario
Source of data	Options: IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific field tests prior to first verification. Chosen: - IPCC defaults in Second Assessment Report, 1996. - IPCC 2006 Guidelines for National Greenhouse gas Inventories
Value(s) applied	300
Choice of data or Measurement methods and procedures	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of project emissions
Additional comment	Term can include a combination of emission factors from fuel production, transport, and use. Measuring emission factors from stove technologies is costly and difficult to do accurately. Lacking measurable emission factors from the project technologies, PP applies default IPCC emission values.



Data / Parameter	$EF_{p,fuel,N_2O}$
Unit	kg N ₂ O/TJ
Description	N ₂ O emission factor arising from use of fuels in project scenario
Source of data	-IPCC defaults in Second Assessment Report, 1996.
Value(s) applied	4
Choice of data or Measurement methods and procedures	Options: IPCC defaults, credible published literature, project-relevant measurement reports, or project-specific field tests prior to first verification. Chosen: IPCC defaults in Second Assessment Report, 1996. IPCC 2006 Guidelines for National Greenhouse gas Inventories
Purpose of data	Calculation of baseline emissions
Additional comment	<i>Term can include a combination of emission factors from fuel production, transport, and use.</i> Measuring emission factors from stove technologies is costly and difficult to do accurately. Lacking measurable emission factors from the project technologies, PP applies default IPCC emission values.

Data / Parameter	$NCV_{b,fuel}$
Unit	TJ/ton
Description	Net calorific value of the fuel used in the baseline
Source of data	- IPCC default value. Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html
Value(s) applied	15.6TJ/Gg = TJ/ton
Choice of data or Measurement methods and procedures	Adopt IPCC default values. Net Calorific Values were not measured in actual baseline, thus the project uses IPCC default values.
Purpose of data	Calculation of baseline emissions
Additional comment	When EF is in units of tCO ₂ /t _{fuel} , the NCV term will be removed from emission calculations.



Data / Parameter	NCV _{p,fuel}
Unit	TJ/ton
Description	Net calorific value of the fuel used in the project scenario p
Source of data	- IPCC default value. Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html
Value(s) applied	15.6TJ/Gg = TJ/ton
Choice of data or Measurement methods and procedures	Adopt IPCC default values. Net Calorific Values were not measured in the project, thus the project uses IPCC default values.
Purpose of data	Calculation of baseline emissions
Additional comment	When EF is in units of tCO ₂ /t _{fuel} , the NCV term will be removed from emission calculations. This has same value as NCV baseline as the project reduces use of the same fuel.

Data / Parameter	W _{b,y}
Unit	Kilograms/Litre
Description	Quantity of wood fuel or fossil fuel required to boil 1 litre of water using technologies representative of baseline scenario b during project year y
Source of data	Baseline water boiling test BWBT; either conducted freshly or as reported/published in reliable literature relevant to project target population
Value(s) applied	0.919
Choice of data or Measurement methods and procedures	Baseline only; should be updated if on-going monitoring surveys show that baseline water boiling technologies change over time. Should be updated whenever new water boiling technologies are introduced over time. QA/QC: Transparent data analysis and reporting
Purpose of data	Calculation of baseline water emissions
Additional comment	Please see official lab report of Baseline Water Boiling Test, and lab data analysis (both documents provided to the DOE) showing that the average temperature corrected specific fuel consumption meets the 90/10 rule for confidence and precision.

Data / Parameter	$W_{p,i,y}$
Unit	Kilograms/Litre
Description	Quantity of wood fuel or fossil fuel required to boil 1 litre of water using technology i representative of the project scenario p during project year y
Source of data	Project water boiling test following same procedure as BWBT
Value(s) applied	0.919
Choice of data or Measurement methods and procedures	Should be updated whenever new water boiling technologies are introduced over time. QA/QC Procedure: Transparent data analysis and reporting
Purpose of data	Calculation of project water emissions
Additional comment	Please see official lab report of Baseline Water Boiling Test, and lab data analysis (both documents provided to the DOE) showing that the average temperature corrected specific fuel consumption meets the 90/10 rule for confidence and precision.

Data / Parameter:	C_j
Data unit:	Percentage
Description:	Portion of users of project safe water supply who were already in baseline using a non-boiling safe water supply
Source of data:	Berkeley Air Baseline Study, Table A3.3
Value(s) applied	9.655%
Choice of data or Measurement methods and procedures	Baseline Study see Annex 1 Berkeley Air Guatemala Kitchen Survey Report (Provided to the DOE) Should be updated if on-going monitoring shows that the baseline water treatment practices change over time QA/QC Procedure: Transparent data analysis and reporting
Purpose of Data	Calculation of project water emissions
Additional Comment	

B.6.3. Ex ante calculation of emission reductions

As per allowance by the GS Methodology, the Project Fuel Tests will be submitted post-registration, on time for verification and prior to the request for issuance. Thus, the project documentation submitted for validation and registration review provides an estimation of expected project emissions using conservative assumptions for baseline and project scenario variables supported by appropriate and credible sources of information.

For the purposes of this document, the PP has estimated project Emissions Reductions by using default values for emission factors, pertinent and credible literature for baseline fuel consumption, lab test results for project fuel estimates, typical useful lifetimes for the improved technologies, and project size and duration (projected sales over crediting period).

A variety of technologies will be deployed along the crediting period leading to different efficiency and displacement values. For the purpose of estimation at the validation stage, the thermal efficiency of the eko-stove, as determined by the WBT⁵², will be used for the thermal efficiency of all improved

⁵² Please see official lab results of the eko-stove Water Boiling Test (provided to DOE).

technologies implemented, which anticipates leading to a theoretical average of approximately 65% of fuel consumption compared to the systems being replaced.

B.6.4. Summary of ex ante estimates of emission reductions

Project Emission Reduction Projection Calculations have been provided to the DOE.

Year	Leakage	Emission reductions	Emission reductions
		(ICS)	(WT)
	(t CO ₂ e)	(t CO ₂ e)	(t CO ₂ e)
2013	0	31,177	358,484
2014	0	109,119	1,018,851
2015	0	210,444	1,839,095
2016	0	326,020	2,760,629
2017	0	448,129	3,707,981
2018	0	571,578	4,664,271
2019	0	695,026	5,623,539
Total	0	2,391,493	19,972,850
Total number of crediting years	7		
Annual average over the crediting period	0	341,642	2,853,264

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data and parameters to be monitored for the crediting of all project technologies over the crediting period:

Parameter subscript definitions:

Scenarios: hh-wt = household water treatment, hh-ics+wt = household improved cookstoves and water treatment, hh-ics = household improved cookstoves

Technologies: wt =water treatment, ics =improved cookstove

Data / Parameter:	$f_{nr,i,y}$
Data unit:	Fractional non-renewability
Description:	Non-renewability status of woody biomass fuel in scenario i during year y
Source of data:	Applicable NRB assessment or literature
Value(s) applied	95.74%
Measurement methods/ procedures	Project study, see NRB Report, data and calculations (provided to the DOE)
Monitoring frequency:	Fixed by baseline study for a given crediting period, updated if necessary as specified in Methodology section III.1.
QA/QC procedures	Transparent data analysis and reporting. Publicly available and verifiable data will be



to be applied:	used to determine NRB.
Purpose of data:	Calculation of baseline/project stove and water emissions
Any comment:	NRB assessment may be used for multiple scenarios.

Data / Parameter:	$U_{p,i,y}$
Data unit:	Percentage
Description:	Usage rate in project scenario p, for technology i, during year y
Source of data:	Annual usage survey
Value(s) applied	$U_{hh-wt,wt,1}$: 95% $U_{hh-dual,wt,1}$: 95% $U_{hh-dual,ics,1}$: 99% $U_{hh-ics,ics1}$: 99% <i>*The values applied are an ex-ante estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on Usage survey objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	Annual or more frequently, in all cases on time for any request for issuance
QA/QC procedures to be applied:	Transparent data analysis and reporting
Purpose of Data	Calculation of project stove emissions, Calculation of project water emissions
Any comment:	A single usage parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario – see section III.1 of the core methodology

Data / Parameter:	$N_{p,i,y}$
Data unit:	Project technologies credited (units)
Description:	Technologies in the project database for project scenario p, technology i, through year y
Source of data:	Total sales report
Value(s) applied	$N_{hh-wt,wt1}$: 30,000 $N_{hh-dual,wt1}$: 8,000 $N_{hh-dual,ics1}$: 8,000 $N_{hh-ics,ics1}$: 0 <i>*The values applied is an estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on the Sales Record
Monitoring frequency:	Continuous
QA/QC procedures	Transparent data analysis and reporting.



to be applied:	
Purpose of Data	Calculation of project stove emissions, Calculation of water project emissions
Any comment:	The total sales record is divided based on project scenario to create the project database

Data / Parameter:	$LE_{p,i,y}$
Data unit:	t_CO2e per year
Description:	Leakage in project scenario p, for technology i, during year y
Source of data:	Monitoring surveys
Value(s) applied	$LE_{hh-wt,wt1}$: TBD $LE_{hh-dual,wt1}$: TBD $LE_{hh-dual,ics1}$: TBD $LE_{hh-ics,ics1}$: TBD
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on Leakage Assessment.
Monitoring frequency:	Every two years
QA/QC procedures to be applied:	Transparent data analysis and reporting. See PDD Section B.7.2
Purpose of Data	Calculation of project stove emissions, Calculation of water project emissions
Any comment:	Aggregate leakage can be assessed for multiple project scenarios, if appropriate

Data and parameters to be monitored for the crediting of improved cookstove technologies over the crediting period:

Data / Parameter:	$P_{b,ics-nb}$
Data unit:	kg/household-day
Description:	Quantity of fuel (excluding fuel used for purifying water by boiling) ⁵³ that is consumed in baseline scenario b, during year y
Source of data:	Baseline FT, baseline FT updates, and any applicable adjustment factors
Value(s) applied	$P_{hhb,ics-nb1}$: 20.85 <i>*The value applied is an estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on Fuel Test objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures to be applied:	Transparent data analysis and reporting.
Purpose of data	Calculation of baseline stove emissions

⁵³ Please see Section B.6.1. Explanation of methodological choices for further explanation on the methods used to address double counting of fuel savings in households with dual technologies



Any comment:	A single baseline fuel consumption parameter is weighted to be representative of baseline technologies being compared for project crediting. Baseline FT Update– Completed every other year, or more frequently, except in cases where a fixed baseline is adopted. The BFT update requirements are the same as for the PFT update
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Data / Parameter:	$P_{b,y,ics}$
Data unit:	kg/household-day
Description:	Quantity of fuel that is consumed in baseline scenario b, during year y
Source of data:	Baseline FT, baseline FT updates, and any applicable adjustment factors
Value(s) applied	$P_{hhb,ics1}$: TBD
Measurement methods/ procedures	Please refer to PDD Section B.7.2 Sampling Design for details on Fuel Test objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures to be applied:	Transparent data analysis and reporting.
Purpose of data	Calculation of baseline stove emissions
Any comment:	A single baseline fuel consumption parameter is weighted to be representative of baseline technologies being compared for project crediting. Baseline FT Update– Completed every other year, or more frequently, except in cases where a fixed baseline is adopted. The BFT update requirements are the same as for the PFT update

Data / Parameter:	$P_{p,y,ics-nb}$
Data unit:	kg/household-day
Description:	Quantity of fuel (excluding fuel used for purifying water by boiling) ⁵⁴ that is consumed in project scenario p, during year y
Source of data:	Total sales record, Project FT, project FT updates, and any applicable adjustment factors
Value(s) applied	$P_{hh-dual,1,ics-nb}$: 7.27 <i>*The value applied is an estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on Fuel Test objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures to be applied:	Transparent data analysis and reporting.
Purpose of Data	Calculation of project stove emissions

⁵⁴ Please see Section B.6.1. Explanation of methodological choices for further explanation on the methods used to address double counting of fuel savings in households with dual technologies



Any comment:	A single project fuel consumption parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario
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Data / Parameter:	$P_{p,y,ics}$
Data unit:	kg/household-day
Description:	Quantity of fuel that is consumed in project scenario p, during year y
Source of data:	Total sales record, Project FT, project FT updates, and any applicable adjustment factors
Value(s) applied	$P_{hh-ics,1,y}$: TBD
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on Fuel Test objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	Updated every two years, or more frequently
QA/QC procedures to be applied:	Transparent data analysis and reporting.
Purpose of Data	Calculation of project stove emissions
Any comment:	A single project fuel consumption parameter is weighted to be representative of the quantity of project technologies of each age being credited in a given project scenario

Data and parameters to be monitored for the crediting of water treatment technologies over the crediting period:

Data / Parameter:	$Q_{p,y}$
Data unit:	Litres per person per day
Description:	Total amount of raw water treated with the ‘zero or low emissions’ water treatment technology for household drinking water, hand washing and food washing in the project scenario p, during year y
Source of data:	Water consumption field test WCFT
Value(s) applied	$Q_{hhp,1}$: 6.00* As per the June 2012 GS TAC Update, the project will apply a cap of 6/l/d to this parameter. The cap is set so as to account for the crediting of water used for hand and food washing, in the absence of figures from WHO on minimum service level for hand and food washing (basic hygiene) <i>*The value applied is an estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on WCFT objectives and reliability requirements, target population, sampling method, sample size and



	precision requirements, and sampling frame.
Monitoring frequency:	As per FT updates
QA/QC procedures to be applied:	Transparent data analysis and reporting
Purpose of Data	Calculation of project water emissions
Any comment:	Please see PDD Section B.6.1. Explanation of methodological choices for information on GS TAC Rule update that modifies the GS definition of this parameter.

Data / Parameter:	$Q_{p, \text{cleanboil}, y}$
Data unit:	Litres per person per day
Description:	Quantity of treated water still boiled in the project scenario p, after installation of project technology
Source of data:	Water consumption field test WCFT
Value(s) applied	$Q_{hh-wt, \text{cleanboil}, 1}: 0.05^*$ <i>*The value applied is an ex-ante estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on WCFT objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	As per FT updates
QA/QC procedures to be applied:	Transparent data analysis and reporting
Purpose of Data	Calculation of project water emissions
Any comment:	

Data / Parameter:	Quality of the treated water
Data unit:	As appropriate in alignment with QA/QC procedures
Description:	Performance of the treatment technology
Source of data:	FT updates
Value(s) applied	N/A
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on WCFT objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	As per FT updates
QA/QC procedures to be applied:	Water quality testing may be conducted either in the field or by transportation to laboratories; in all cases the testing approach must be described fully in monitoring reports, credible 3rd party endorsement must be included, and the appropriateness of

	the testing approach must be justified. In cases where the effectiveness of project technologies may be indicated reliably through proxies, such as reliable evidence that they are being maintained and used correctly in accordance with manufacturers' or installers', then the FTs may capture such evidence of water quality in place of chemical and biological indicator tests. Again, credible 3rd party endorsement of FT reports are required.
Purpose of Data	
Any comment:	

Data / Parameter:	$N_{p,y,wt}$
Data unit:	Person.days
Description:	Number of persons consuming water supplied by project scenario p through year y for project scenario i
Source of data:	Water consumption field test WCFT
Value(s) applied	$N_{hh-wt,wt1}$: 231,800* $N_{hh-dual,wt1}$: 231,800* <i>*The value applied is an ex-ante estimate of the data/parameter that will be monitored during the crediting period, but is used for the purpose of calculating estimated emission reductions in section B.6 above.</i>
Measurement methods/procedures	Please refer to PDD Section B.7.2 Sampling Design for details on WCFT objectives and reliability requirements, target population, sampling method, sample size and precision requirements, and sampling frame.
Monitoring frequency:	As per FT updates
QA/QC procedures to be applied:	Transparent data analysis and reporting
Purpose of Data	
Any comment:	

B.7.2. Sampling plan

The following on-going monitoring is conducted for the project activity. The monitoring activity provides a framework for project preparation and monitoring processes that will be undertaken, as required by the GS rules. This schedule takes into account the key parameters that are needed during the crediting periods of the project. All required monitoring and documentation will be implemented, reported, consolidated and managed by the project proponent or a qualified expert partner to meet verification requirements.

The following is a summary of baseline and project studies that are undertaken for the monitoring and evaluation of the project and calculation of emission reductions.

The testing approach taken will accommodate the following requirements:

- It is transparent and can easily be replicated,
- It is evidently conservative,
- The sample is randomly selected so as to not introduce a material bias,
- And the impact of daily and seasonal variations on the expected average fuel consumption savings is accounted for.

Baseline & Project Fuel Tests (FTs)

The baseline and project performance field tests (BFT and PFT) measure real, observed technology performance in the field. The FTs will be undertaken by using either testing a paired sample (baseline and project performance measured for same subjects) or by independent sampling (different subjects, and usually different sample sizes, for baseline and project scenarios); where applicable a single sample test may be conducted.

FT Sampling Design

- i. *Objectives and Reliability Requirements:* to determine the average amount of project technology fuel savings by measuring mean values for $P_{b,y}$ (quantity of fuel that is consumed in baseline scenario b, during year y) and $P_{p,y}$ (quantity of fuel that is consumed in project scenario p, during year y)
- ii. *Target population:*
 - a. BFT: sample of end users without project stove technologies that are representative of end users targeted in the project activity. Where applicable, end users will be given a project water treatment technology in order to disaggregate baseline fuel consumption from baseline fuel consumption for purifying water by boiling
 - b. PFT: sample of end users with project stove technologies
- iii. *Sampling Method:* Both the BFT and PFT households will be chosen using appropriate sampling techniques that are random and representative.
- iv. *Sample Size and Desired Precision:* Sample size will be sufficient to meet 90/30 confidence/precision (90/10 for single sample tests). The lower bound of the one-sided 90% confidence interval may optionally be used as an alternative to the 90/30 rule.
- v. *Sampling Frame:*
 - a. BFT: Representative households within the project boundary using biomass fuel in unimproved stoves for the purposes of domestic use
 - b. PFT: Project Database as defined by sales date, appliance type, serial number, and end-user information.

Water Consumption Fuel Tests (WCFT)

The water consumption field test (WCFT) is similar to the FTs, except project-supplied clean water consumption volumes and boiling is measured rather than fuel consumption.

WCFT Sampling Design

- i. *Objectives and Reliability Requirements:* to determine $Q_{p,y}$ (average volume of water treated with project technology per person per day), $Q_{p, \text{cleanboil}, y}$ (average volume of treated water still boiled after installation of project technology), and $N_{p,y}$ (average number of people consuming water supplied by the project, or household size).
- ii. *Target population:* end users representative of the project scenario target population and currently using the project water treatment technology
- iii. *Sampling Method:* project households will be chosen using appropriate statistical sampling techniques that ensure random and representative results
- iv. *Sample Size and Desired Precision:* Sample size will be sufficient to meet 90/30 confidence/precision (90/10 for single sample tests). The lower bound of the one-sided 90% confidence interval may optionally be used as an alternative to the 90/30 rule.

- v. *Sampling Frame*: Project Database as defined by sales date, appliance type, serial number, and end-user information.

The test data will be analysed in combination with the BWBT to estimate the average annual emission reductions or average fuel savings per unit.

Monitoring Surveys (MS)

Monitoring surveys provide critical information on trends in end user characteristics (project surveys, PS), leakage assessment (LA) and water quality (WQ). Project Survey data will be used to confirm that the household characteristics identified and parameters fixed per the baseline study are still representative of the technology end-users in the project scenario.

MS Sampling Design

- i. *Objectives and Reliability Requirements*: to determine changes over time in a project scenario and provides critical information on year-to-year trends in end user characteristics such as technology use, fuel consumption and seasonal variations.
- ii. *Target population*: by surveying end users with project technologies for PS and WQ. Target populations for LA will be determined according to the leakage type and monitored as necessary.
- iii. *Sampling Method*: households will be chosen using appropriate statistical sampling techniques that ensure random and representative results
- iv. *Sample Size*:
 - Group size <300: Minimum sample size 30 or population size, whichever is smaller
 - Group size 300 to 1000: Minimum sample size 10% of group size
 - Group size > 1000 Minimum sample size 100
- v. *Sampling Frame*: For PS and WQ the sampling frame is drawn from the Project Database as defined by sales date, appliance type, serial number, and end-user information. Sampling frame for LA will be determined according to leakage type.
- vi. *Frequency*: PS and WQ completed annually, LA completed every other year.

Project Technology Usage Survey: [Parameter U_y] estimates the percentage of project technologies still in use within the sales population. The usage survey provides a single usage parameter that is weighted based on drop off rates that are representative of the distribution of stove vintages in the total sales record. A minimum of 50% of usage surveys will be confirmed by visual inspection.

Frequency: Completed at least every 2 years.

Baseline Water Boiling Test (BWBT)

The baseline water boiling test (BWBT) is conducted to calculate the quantity of fuel required to purify by boiling one litre of water for 10 minutes using technologies and fuels representative of the baseline scenario ($W_{b,y}$). The BWBT was conducted in September 2012 by Zamarana University on the three baseline stoves typical of Guatemala (as supported by the findings of the Baseline Survey)⁵⁵. Average

⁵⁵ The BWBT report has been provided to the DOE

results from all three baselines stoves tests meet the 90/30 rule for selection samples and therefore are statistically valid according to the GS methodological requirements.

If the monitoring surveys reveal that the same water boiling technologies are prevalent in the baseline and project scenarios, $W_{b,y}$ and $W_{p,y}$ are equal. The BWBT will be updated if monitoring surveys show that baseline water boiling technologies change over time.

Data & Implementation

The source of data is based on the sales of project stove and water treatment technologies up to the date when monitoring is conducted. Monitored data will be stored in a suite of monitoring databases including the Total Sales Record, the Project Database, and the Stove Monitoring Database. These will be updated each monitoring period. All data monitored and required for verification and issuance are to be kept for a minimum of two years after the end of the crediting period or the last issuance of VERs for this project activity, whichever occurs later.

Although the monitoring team will undertake monitoring of various parameters simultaneously and on the same sample, the project proponent may decide to stop monitoring of a particular parameter during the campaign once the required precision for this parameter is achieved. The monitoring team will continue to monitor appliances in the sample with respect to the remaining parameter(s) until the required precision for these parameters is achieved again.

Total Sales Record: [Parameter $N_{p,y}$] the project activity will have a Total Sales Record that records each project stove or water treatment technology crediting in the project activity. The record will be kept electronically and/or in paper records and provided at verification. The sales record will contain the following information:

From the product distribution partner:

- a. Distribution partner name and contact information
- b. Model/type of project technology sold
- c. Quantity of project technology sold
- d. Date of sale
- e. Date of installation
- f. Unique project technology serial number(s)
- g. End user name, phone number, and address (if possible)

Frequency: Ongoing

Non-Renewable Biomass Assessment Update: The non-renewable biomass fraction is fixed based on the results of the NRB assessment. Over the course of a project activity it may at any time choose to re-examine renewability by conducting a new NRB assessment. In case of a renewal of the crediting period the NRB fraction will be reassessed as any other baseline parameters and updated in line with most recent data available.

B.7.3. Other elements of monitoring plan

Ongoing project data will be collected and archived by appropriately trained staff to ensure accurate monitoring and emission reductions. An Operations Manual will be created for each technology

distributor to ensure that there are processes in place to implement technologies sales activities, track pertinent data and train their staff in procedures, including Quality Assurance and Quality Control (QAQC)⁵⁶. Relevant staff will receive the training necessary to ensure competencies in these tasks are developed and maintained.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>January 1, 2013

C.1.2. Expected operational lifetime of project activity

>>21 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>7 years renewable

C.2.2. Start date of crediting period

>> January 1st, 2013

C.2.3. Length of crediting period

>> 7 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>A generic analysis based on the existing precedents of similar activities⁵⁷ and the context of the present activity. It has been concluded that no adverse environmental impacts will take place as a result of the activity.

D.2. Environmental impact assessment

>> As of the date of document submission to the DOE, an environmental impact assessment is not required for this project. The PP will continue to review and ensure compliance with relevant legislation.

SECTION E. Local stakeholder consultation

Please see LSC Report for more information on the Local Stakeholder Consultation

E.1. Solicitation of comments from local stakeholders

The Project Proponent introduced the project activity to stakeholders during the Local Stakeholder Consultation (LSC), which took place on the 10th of September 2012 at Ecofiltro's factory in Antigua, Guatemala. Invitations were sent to all individuals and organizations which could be identified as having experience working with improved cookstoves or safe water technologies in Guatemala. This included government authorities, NGOs, as well as end users. Invitations were sent via several means of communication including email (when applicable), an advertisement in "La Presna", local postings (on university campuses and in local communities), as well as personal invitations. It was ensured that

⁵⁶ Please see Ecofiltro Operations Manual (provided to DOE)

⁵⁷ See project registry sites of CDM and GS websites.

stakeholders represented both genders and diverse ethnic groups. The project proponent used the meeting to explain the project and solicit feedback and suggestions on possible project improvements to help ensure that it will promote sustainable development.

Individuals who were unable to attend the consultation will be provided with the LSC report (in the appropriate language) and will be encouraged to submit feedback via email or the various continuous input mechanisms established at the consultation. The report will also be posted in locally accessible areas for public comment.

Project implementers will continue to hold smaller consultations in communities to introduce the technologies, explain the project, and clarify that the carbon rights will be transferred to the project proponent. During these meetings additional feedback will be solicited from stakeholders.

E.2. Summary of comments received

The meeting was moderated by Elisabeth Gomez from Impact Carbon and was well attended by a diverse group of stakeholders including end-users from local communities, government officials, NGOs, and local businesses. The consultation included an explanation of the project plan, impact, and roles and responsibilities of project partners (Ecofiltro, CEMEX, Socorro Maya), as well as an explanation of the role of carbon finance. The facilitator answered questions for clarification about the project and then proceeded with conducting the blind Sustainable Development exercise for both the improved cookstove and water treatment project technologies.

Stakeholder comment	Was comment taken into account	Explanation (Why? How?)
How many people will the subsidy reach?	Yes	The subsidy will reach all household end-users involved with the project. Due to certain factors like transportation cost, number of products, and payment mechanisms, the subsidy amount may vary in different areas.
How much fuelwood is saved from using the filter?	Yes	We are uncertain of the exact amount, but an Ecofiltro study indicated that about 60 Quetzales a month would be saved due to a reduction in the purchase of fuelwood
What are the sources of water pollution?	Yes	Can come from a number of sources including sewage, agricultural contamination, industrial contaminations, etc
Does the filter need to be changed?	Yes	The filter should be changed every 18 months. There have been studies from Universities that demonstrate that this can be longer, as there are 3 and 4 year old filters which are still effective. But this not recommended, and Ecofiltro only guarantees them for 18 months. Currently Ecofiltro is helping users save money to purchase a replacement after 18 months
Is the stove certified? There should be a standardized certification process for the stoves to ensure that it meets certain criteria.	Yes	We are looking to certify it through the Gold Standard in the certification of reduction of carbon. CEMEX will internally have the stoves certified by the quality control and cement experts of CEMEX. The stoves will also be

		tested in laboratories to certify their efficiency. The project proponent will also look for local certifications to guarantee that the technologies are in line with all national and international guidelines/regulations
Is the stove portable?	Yes	Yes, it is not more than 40kg, so people can move them.
Does the cement break?	Yes	Cemex can ensure that with their expertise in cement they are using the best technology which will last the longest and this will reduce the breaking of stoves including in transportation
Have a longer period to pay for the stove	Yes	This comment will be taken into account when the project proponent designs the payment mechanism for each community. The project proponent will ensure that flexible payment mechanisms are established so that the technologies are affordable to various income quartiles.
Socorro Maya has always followed up on the project, and they have had continuous training. The technicians are always available and we are in constant contact with them. They also have asked for recommendations on how to improve the technology	Yes	The project will continue to monitor and follow-up on technologies which it has distributed, in order to ensure the sustainability of the project

E.3. Report on consideration of comments received

All Stakeholder comments were positive, while a few comments recommended a more affordable payment plan. The project proponents have not yet formed a fixed payment plan, and such plans will be designed according to the costs of the stoves and the needs of the communities. The project proponent will take all stakeholder suggestions into account when designing said payment plans.

Through the stakeholder meeting it is seen that the project activity will contribute strongly to sustainable development in Guatemala.

The project is designed to incorporate feedback continuously in order to maximize the positive impact on communities in Guatemala, and this will ensure that the project is sustainable and takes stakeholder opinion into account.



SECTION F. Approval and authorization

>> N/A

**Appendix 1: Contact information of project participants**

Organization name	The Paradigm Project
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Salutation	Ms.
Last name	Matocha
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Direct tel.	
Personal e-mail	

**Appendix 2: Affirmation regarding public funding**

Please see PDD Annex 23 provided to the DOE

Appendix 3: Applicability of selected methodology

Please see PDD Section B.2. Applicability of methodology

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

Please see Emissions Reduction Projections (provided to the DOE)

Appendix 5: Further background information on monitoring plan

N/A

Appendix 6: Summary of post registration changes

N/A



History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
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