

GS 1321

ISSUANCE 4

COMPREHENSIVE MONITORING REPORT

Monitoring Period: April 1st, 2016 to March 31st, 2018



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FOREWORD

This Comprehensive Monitoring Report documents the implementation activity, monitoring, and emissions reductions of GS1321 Ecofiltro Guatemala Improved Stove and Water Purification Project (“the Project”) during the Issuance 4 Monitoring Period of April 1st, 2016 to March 31, 2018, including all sales of Ecofiltro water filters and Ecoestufa efficient cookstoves to rural households in Guatemala from the Project’s inception through the end of the current monitoring period. It is designed to deliver all of the relevant data and descriptions required for complete review and verification of the Project and includes the following reports in their entirety:

- Kitchen Performance Test Report
- Water Consumption Field Test Report
- Water Quality Test Report
- NRB Leakage Report
- Monitoring and Usage Report

Rather than producing separate reports for each of the major areas of monitoring and then summarizing those reports in this document, Natural Capital Partners has elected to include full report content for all monitored parameters in one document, thereby reducing unnecessary duplication of information across various reports and decreasing the likelihood of errors caused by reporting data that is subject to change during the audit process and which must be tracked and edited across multiple documents through each successive round of review.

Similarly, the collection and analysis of data from field monitoring has been simplified by combining raw and analyzed data into a select few Microsoft Excel spreadsheets. Rather than presenting separate spread sheets for each of the above mentioned reports (many of which use data from the others in calculating key parameters) all required data for review and verification has been included in 2 key spreadsheets:

- ER Calculations Spreadsheet
- MS_US_WCFT_KPT_WQT Data Spreadsheet

As with the intent of the Comprehensive Monitoring Report, this reduction of source documents simplifies the review process and reduces possible errors by drawing all raw data into one place and pulling all analysis directly from raw data sources rather than manually transferring key data points from one spreadsheet to another when the outputs from one analysis are needed to complete another.

Where individual reference documents or spreadsheets from outside sources or from prior issuance periods are required to support outcomes presented in this issuance, those documents are presented in their original form, typically as distinct documents provided along with this report and the above key current issuance spreadsheets.

CONTINUOUS MONITORING

For Issuance 4, Natural Capital Partners continues the monitoring process called Continuous Monitoring implemented by The Paradigm Project for Issuance 3. In February of 2015, The Paradigm Project (a previous Project Participant) created a concept to monitor household activities within each of its programs continuously throughout the year rather than in a concentrated period of weeks each year. Although the Gold Standard (“GS”) Methodology - *Technologies and Practices to Displace Decentralized Thermal Energy Consumption (“TPDDTEC”) - 11/04/2011* does not specify the mode of collecting monitoring data (annual, periodic or continuous), for the sake of clarity, Paradigm requested an opinion from GS on the continuous monitoring concept and received clarification that it was indeed allowed by the methodology in an email dated 11 Feb 2015 and subsequently in an face to face meeting between Vikash Talyan (GS) and Neil Bellefeuille (The Paradigm Project) on Friday, June 5th 2015, in Minneapolis, Minnesota. Continuous Monitoring follows the TPDDTEC methodology exactly, but seeks to monitor households at various times throughout the monitoring period, capturing data that is more representative of actual usage patterns rather than relying on respondents to recall activities that may have happened far in the past.

Continuous Monitoring offers the following benefits:

- Greater depth of consumer insight.
- Improved data accuracy and consistency.
- Reduced disruption of ongoing field activities.
- Reduced risk via real-time refinement of activities derived through continuous field input.

Specifically, Continuous Monitoring offers improved data accuracy and consistency over traditional, short-term monitoring by replacing questions that previously relied on the respondent’s memory of past events with actual observation and collection of that data during the monitoring period. For instance, the TPDDTEC methodology seeks to ascertain the number of people each household cooks for through a Monitoring Survey. GS has historically required that the Project Proponent include questions within the monitoring survey to determine whether the number of meals cooked or the number of people cooked for fluctuates between the harvest, rainy and dry seasons. This logic clearly assumes monitoring that is conducted in a concentrated period of time annually (for instance within a 4-week period that may fall in any one season, but is unlikely to extend over several seasons) as it requires the surveyor to ask the respondent to recall whether those numbers have fluctuated historically. Within this mode of working, survey outcomes rely on the respondent’s recollection of the number of people cooked for in seasons and at times that could be 6 or more months removed. Self-reported data relying on the accuracy of human memory is dubious at best and thus Natural Capital Partners has continued this more accurate way to monitor the Project.

Continuous Monitoring reduces the possibility of error by eliminating such questions in favor of monitoring households across all seasons and all conditions, collecting data in real time that accurately reflects the activities of the household in those seasons. As such, some of the traditional seasonally-comparative data points are eliminated in favor of data that has been collected and averaged over the complete range of seasons,

circumstances and households represented in the project. Where such changes have been implemented, the data is noted as being Continuous Monitoring data that incorporates seasonality.

Additionally, surveys such as KPTs and WCFTs which are required to be conducted biennially are incorporated into the flow of the continuous, annual monitoring program. Doing so provides several benefits:

1. It increases the frequency and therefore accuracy of the data by incorporating recent changes into key parameters and calculations used to determine VER volumes.
2. It doubles the sampling size by achieving the minimum required sample annually instead of biennially. Here again, we believe this increases accuracy and robustness of the data.

The tables below summarize required and targeted survey output per project scenario:

Project Scenario 1: hh-wt	Ann Min Req	Ann Target
Water Consumption Field Test (WCFT)	30 (biennially)	30
Water Quality Test (WQT)	90/10 rule	20
Filter Monitoring & Usage Survey (MS/US)	100: 30/tech age	100 ¹

Project Scenario 2: hh-dual	Ann Min Req	Ann Target
Kitchen Performance Test (KPT)	30 (biennially)	30
Stove Monitoring & Usage Survey (MS/US)	100: 30/tech age	100 ²
Water Consumption Field Test (WCFT)	30 (biennially)	30
Water Quality Test (WQT)	90/10 rule	20 ³
Filter Monitoring & Usage Survey (MS/US)	100: 30/tech age	100

In every case throughout monitoring, as presented in this document, the PP assumed a minimum 1000 technologies in the field and thus elected to monitor at the highest minimum sample size requirements outlined by the methodology.

For Monitoring Period 4, the PP was able to cover a full 12 months of project activity. Monitoring took place over both dry and wet seasons, as well as during harvest and non-harvest seasons. While seasonal representation was

¹ Water filters older than 2 years of age are removed from crediting, thus annual sampling minimum is 100 units with at least 30 of each age.

² Currently the project has stoves ranging in age from 1 to 3 years of age, thus the minimum usage survey number is 100 (90 x 3 + 10). In the future this number will grow with the age range of stoves in the field.

³ Water Quality test results are combined across Project Scenario 1 and 2 as while usage may vary by Project Scenario, product performance is consistent.

stated with 11% of surveys being done during harvest, and 44% during rainy season, as reported by survey respondents in answer to the questions, “Is it currently the harvest season?” and “Is it currently the rainy or dry season?”, 1% and 3% or fewer of respondents reported that the number of people served changes for them by season when asked the question, “Does the number of people you serve daily change in the harvest/rainy/dry season?”. Thus the data presented within is fully representative of the project scenario throughout all of the varying seasons users’ experience.

DEVIATION FROM GOLD STANDARD

The PP proposed a deviation due to the lack of number of surveys for year 2017. The explanation of the deviation proposed was the following:

“The project began its fourth monitoring period in April 2016. The annual monitoring continued its normal course until May of 2017. At that point, the project participant The Paradigm Project elected to stop managing the project and related activities.

As project participant, The Paradigm Project was in charge of carrying out the monitoring and documentation necessary to maintain it as a Gold Standard carbon project, leaving the local partners without trained personnel or qualified people to carry out the management of the project or the monitoring activities.

As project owner, Ecofiltro undertook the search for a highly qualified company to carry out and manage the Gold Standard carbon project, taking many months to make the appropriate decision. An agreement was reached with Natural Capital Partners at the end of December 2017 to begin work on the project in 2018.

During almost all of 2017 it was impossible to monitor due to the lack of resources not only economic, but also of qualified personnel. Because of this the minimum number of Monitoring and Usage surveys couldn’t be reached (TPDDTEC V.2011 Section III.1.C.a),b). The required number is at least 100 surveys per year.

The results of the percentage of use of the technology in the 4th monitoring period, despite a slightly lower total number of surveys, is similar to previous monitoring periods and is statistically acceptable in the range of the results (% Usage) obtained during the past verifications, showing that the project has not undergone major changes over time. Current data also it demonstrate consistency in the use of filters and stoves by end-users.

An analysis of confidence limits (95%) for small samples was made to statistically study the difference between the results of the percentage of use, which is one of the most important data variables and the main purpose of the usage and monitoring survey.

The results for Issuance 4 are within the range of the limits, showing that there have been no substantial changes in the drop off rates of the technologies in the 4th monitoring period, and the project remains steady and the trends noted in previous monitoring periods are continuing.

Scenario	% Usage	
	Issuance	Stoves
Dual	1	92.39
	2	97.13
	3	97.29
	4	93.55
		Filters
	1	97.44
	2	97.27
	3	99.26
Water Technologies	4	99.63
		Filters
	1	97.44
	2	88.42
	3	96.17
	4	96.88

	Statistical Analysis	
% Usage Stoves	Lower Limit	92.106379
	Arithmetic Av	95.040813
	Upper Limit	97.9752471
% Usage Filters (Dual Scenario)	Lower Limit	96.9556499
	Arithmetic Av	98.3886958
	Upper Limit	99.8217417
% Usage Filters (Water T Scenario)	Lower Limit	89.5941832
	Arithmetic Av	94.579003
	Upper Limit	99.5638227

It is proposed to adopt the values obtained from data from the 4th monitoring period despite the slightly fewer number of surveys. Using less than 100 surveys per year. The data is still within the necessary confidence interval despite the difficulty involved in carrying out surveys in the period from May 2017 to January 2018."

The Deviation was accepted with some modifications, Gold Standard response was the following:

Approved with Modification

PD shall use the measured usage values for 1st year and an adjusted usage value for 2nd year for this issuance (MP4).

The adjusted usage value can be either:

- PD's proposal of a justifiably conservative value; or
- the value applied in the PDD (if the 1st year measured usage value matches or is less than the PDD's value for the same year).
-

Because of this, it is proposed to use conservative values for calculations for Year 2. The variables affected by surveys are:

- Persons per filter
- % LPG Users
- % Usage

It is proposed to use the lowest value in every issuance or the proposed in the PDD for the variables: Persons per filter & % Usage, and the highest value for % LPG Users.

Variable	Scenario		
Persons Per filter	<u>Dual</u>		<u>Water Technologies</u>
	5.18 (Iss 3)		5.03 (Iss 4 Year 1)
% LPG Users	1.00% (Iss 3)		6.06% (Iss 3)
% Usage	Stoves	Filters	88.42% (Iss 2)
	92.39 (Iss 1)	95 (PDD)	

SUMMARY PROJECT DESCRIPTION

The Project promotes the use of improved stoves and water treatment technologies, and in turn generates carbon credits in the voluntary market based on the greenhouse gas emissions reductions of these technologies. The Project works through local organizations, NGOs and distributors to provide healthy and efficient cooking technologies and greater access to safe drinking water. The revenues from carbon finance are invested into subsidies, social marketing, and the development of robust distribution channels to further support the growth and impact of the Project.

PROJECT PARTNERS

- **Natural Capital Partners** With 20 years' experience and a global network of project partners, Natural Capital Partners works with corporate clients to deliver high quality solutions that ensure immediate, positive impact on carbon emission reductions, renewable energy, low carbon sustainable development and the world's natural capital. Natural Capital Partners has partnered with Ecofiltro to finance the ongoing carbon asset development of this water filtration and improved cookstove project in Guatemala to ensure it meets its goals for emission reductions and the provision of clean water. Natural Capital Partners is responsible for the processes for tracking and monitoring the project's results.
- **Socorro Maya (SM)** is a non-profit Guatemalan organization with the goal of serving the humanitarian needs of the poor. Socorro Maya focuses on helping the "living Maya" with their greatest needs for health and well-being, including replacing open cooking fires with highly efficient cooking stoves and introducing water treatment technologies that significantly reduce water borne disease. Socorro Maya distributes the Ecoestufa and Ecofiltro to Guatemalan communities and provides training and follow-up to ensure technologies are used correctly. Socorro Maya distributes primarily under Project Scenario 2, wherein every household receives both an efficient stove and a water filter as part of a package, but will occasionally sell filters without an accompanying stove under Project Scenario 1.
- **Ecofiltro (EF)** is a Guatemalan business created to manufacture and market the locally designed Ecofiltro water purification device. Ecofiltro believes that business practices and sustainable markets can effectively address the lack of access to clean drinking water in Guatemala. Ecofiltro manufactures and distributes the Ecofiltro technology under Project Scenario 1 wherein households receive only a water filter. EcoFiltro conducts both bulk sales to non-profit and other organizations working in target communities, and direct sales to households and provides training and follow-up through both channels.

KEY DEVELOPMENT MILESTONES

- Local Stakeholder Consultation: September 4th, 2012
- Passport & LSC Report Submission: October 10th, 2012
- Official Registry Listing: November 13th, 2012
- Project Start Date as Described in PDD: January 1st, 2013
- Project Registration: June 28th, 2013
- Initial Crediting Period: January 1st, 2013 to December 31st, 2019

The Project was developed under the GS Methodology - *Technologies and Practices to Displace Decentralized Thermal Energy Consumption* - 11/04/2011, and includes a 7-year crediting period with an option to renew.

PROJECT TECHNOLOGIES

The Project provides clean cooking and safe water treatment technologies throughout Guatemala. The Project Design Document (“PDD”) includes descriptions of the two technologies included in the project activity, each of which is summarized below.

Ecoestufa Clean Cookstove

The EcoStove was designed by international efficient cook stove expert, Peter Scott, founder of Burn Design Lab, with the support of Cementos de Mexico (CEMEX), Stove Capital (Leon Reinhart) and local partner in Guatemala, Socorro Maya. Manufacturing has been carried out by CEMEX. The efficient wood burning stove continues to be produced in Guatemala with a manufacturer that has more than 10 years’ experience producing concrete cook stoves. The EcoStove has a large metal cooking surface (a griddle) with two long cast concrete pieces underneath (processing the heat), a unique clay combustion chamber and a concrete firewood support. The EcoStove sits on 9 cinder blocks. A flue is attached to extract any noxious gases and smoke from the home. The thermal efficiency of the stove is 15.4% and the stove has a power output of 8.95kW. The stove is very acceptable for all rural Guatemalan family cooking needs. The great majority are indigenous Maya who traditionally cook on the floor with open fires in their smoke filled homes. The EcoStove provides beneficiary families with ample surface space to cook traditional tortillas, beans and large meals. The stove has an estimated life of 10 years.



Ecofiltro Water Filter

The Ecofiltro is manufactured locally by Ecofiltro S.A. The filter purifies through a gravity-fed ceramic filtration element. The ceramic element has a porous surface size of 0.6 to 0.3 microns and is lined with colloidal silver to remove particles and disinfect the filtered water. The filter has a flow rate of 1-2 liters per hour, a maximum capacity of 20 liters, and meets drinking water standards set by the World Health Organization and Coguanor of Guatemala. The ceramic element has a lifespan of 2 to 3 years.



SUMMARY IN SUSTAINABLE DEVELOPMENT INDICATORS

The Guatemala Cookstoves and Water filters project aims to contribute to reach the UN Sustainable Development Goals and targets.

The specific information about the Sustainable Development indicators per each scenario of the project can be found later in this Report, a Summary is presented as Follows:

Air Quality

Target 3.9

“By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination”

Using the EcoStove the reported incidence of air quality show overwhelmingly positive changes in the household in comparison to the baseline. Respondents were first asked if they noticed any difference in the indicator being monitored. If they responded “yes”, then they were asked to quantify the degree of perceived difference from the baseline.

DEGREE OF PERCEIVED CHANGE IN AMOUNT OF SMOKE IN KITCHEN (FOR THOSE INDICATING A CHANGE)

Change in Smoke?	N	%
Yes	141	99%
No	1	1%
Total	142	100%
Much Less	135	96%
Less	6	4%
No difference	0	0%
More	0	0%
Much More	0	0%
Don't Know	0	0%
Total	141	100%

Livelihood of The Poor & Access to Energy Services

Target 1.2

“By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions”

Fuel sourcing and its impact on livelihood and access to energy were recorded by asking respondents to indicate how they sourced fuel prior to the introduction of the **EcoStove** efficient stove. As Project Scenario 2 combines the stove and filter, making it impossible for respondents to delineate between stove and filter savings, the following data includes outcomes for the combination of products, not just stoves. Data indicates little change in mode of sourcing fuel with extremely low variance between baseline and project behaviors. Financial and time savings measured as a percentage of money or time spent in the baseline, was significant.

FUEL SOURCING

Fuel Source	Baseline	%	Project	%	Variance %
Buy	112	79%	107	75%	-3.52%
Collect	22	15%	27	19%	3.52%
Both, Mostly Buy	4	3%	4	3%	0.00%
Both, Mostly Collect	4	3%	4	3%	0.00%
Total	142	100%	142	100%	0.00%

FUEL SAVINGS IN TIME AND MONEY

Savings/Week	Baseline	Project	Savings	%
Money (Q)	100.23	27.77	72.46	72%
Time (H)	12.81	6.43	6.38	50%

FUEL SAVINGS COMPARISON

Savings/Week	Week	Month	Annual
Money (USD, FX=\$0.13)	\$9.47	\$37.88	\$454.61
Time (H)	6.38	25.50	306.00

Fuel sourcing and its impact on livelihood were recorded by asking respondents to indicate how they sourced fuel prior to the introduction of the **Ecofiltro**. The following results are recorded from the use of the water filter:

FUEL SOURCING

Fuel Source	Baseline	%	Project	%	Variance %
Buy	62	53%	62	53%	-0.46%
Collect	47	41%	50	43%	2.22%
Both, Mostly Buy	3	3%	3	3%	-0.02%
Both, Mostly Collect	4	3%	2	2%	-1.74%
Total	112	100%	113	100%	0.00%

FUEL SAVINGS IN TIME AND MONEY

Savings/Week	Baseline	Project	Savings	%
Money (Q)	46.57	40.47	6.10	13%
Time (H)	6.99	5.53	1.46	21%

FUEL SAVINGS COMPARISON

Savings/Week	Week	Month	Annual
Money (USD, FX=\$0.13)	\$0.80	\$3.19	\$38.25
Time (H)	1.46	5.83	69.94

An overall evaluation for both scenarios is presented bellow:

FUEL SOURCING

Fuel Source	Baseline	%	Project	%	Variance %
Buy	174	67%	169	66%	-1.94%
Collect	69	27%	77	30%	3.10%
Both, Most Buy	7	3%	7	3%	0.00%
Both, Most Collect	8	3%	6	2%	-0.78%
Total	258	100%	259	100%	0.00%

FUEL SAVINGS COMPARISON

Savings/Week	Week	Month	Annual
Money (USD, FX=\$0.13)	\$10.27	\$41.07	\$492.86
Time (H)	7.84	31.33	375.94

Water Quality

Target 3.3

“By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases”

Self-reported indicators of water quality show positive changes in comparison to the baseline. Respondents were asked if they noticed a reduction in stomach illnesses with the Ecofiltro vs the baseline.

PERCEIVED CHANGES IN FREQUENCY OF STOMACH ILLNESSES

Incidence of Stomach Illness	HH-WT	%	HH-DUAL	%
Much Less	107	92%	123	87%
Less	2	2%	12	8%
No difference	7	6%	7	5%
More	0	0%	0	0%
Much More	0	0%	0	0%
Don't Know	0	0%	0	0%
Total	116	100%	142	100%

Safe drinking water access

Target 6.1

“By 2030, achieve universal and equitable access to safe and affordable drinking water for all”

Self-reported indicators of water quantity and access show positive changes in comparison to the baseline. Respondents were asked about the taste and access to clean drinking water in comparison to baseline.

PERCEIVED TASTE OF WATER IN COMPARISON TO BASELINE

Taste of Water	HH-WT	%	HH-DUAL	%
Better than before	116	99%	142	100%
Same as before	1	1%	0	0%
Worse than before	0	0%	0	0%
Total	117	100%	142	100%

PERCEIVED ACCESS TO WATER IN COMPARISON TO BASELINE

Access to Water	HH-WT	%	HH-DUAL	%
Better than before	116	99%	142	100%
Same as before	1	1%	0	0%
Worse than before	0	0%	0	0%
Don't know	0	0%	0	0%
Total	117	100%	142	100%

REDUCTION IN ECOESTUFA CLEAN COOKSTOVE PRODUCTION

For the last 24 months, 110 stoves have been produced and delivered. This reduction in stove production and delivery is due mainly to the following:

- **Agreement changes for stove production with CEMEX:** CEMEX was responsible for the EcoStove production for over 3 years. Manufacturing in Guatemala was supervised from CEMEX Monterrey, Mexico. This substantially increased the cost of production, putting the financial self-sufficiency of the EcoStove business at risk. That's why local partner Socorro Maya decided to move the production to an independent manufacturer in Guatemala. The company has more than 10 years of experience producing concrete stoves for NGOs. The efficient EcoStove design remains the same that's why it will use same materials and it will have the same lifespan and specifications for production so there will not be changes in efficiency. However, the cost will be substantially reduced, more in line with the financial capabilities of poor urban families to purchase the stove.
- **Monitoring & Evaluation of stoves installed:** Socorro Maya actively assisted families in 2017 with stove use and maintenance. Global Positioning Systems were also expanded to facilitate locating family homes in the mountainous environment. This has improved time and stove maintenance, enabling proper functioning of the EcoStoves.
- **Creation and Sale of EcoStove carbon credits:** Local partner Socorro Maya needed time for increased generation of carbon credits, where multiple years of stoves in place result in more carbon credits. This would financially benefit Socorro Maya to increase production, provide for more human resources, monitoring of stoves, and the expensive marketing, sales and delivery process of new stoves.

BASELINE & PROJECT SCENARIOS DEFINED IN THE PDD

The PDD states that the baseline scenario includes "household biomass users" a stakeholder group that consists of users of unimproved stoves or open fires fueled with biomass and used for domestic purposes.

PROJECT SCENARIO 1 (hh-wt): Water Treatment Only

Project Scenario 1 includes all filter distributions that are not disseminated along with an improved stove technology. This project scenario consists of household water treatment technologies that displace the use of biomass for water purification.

PROJECT SCENARIO 2 (dh-dual): Improved Cookstove & Water Treatment

Project Scenario 2 consists of the dual implementation of household improved wood stoves and water treatment technologies, which replace biomass for water purification and allow for the efficient use of biomass for cooking.

The emission reductions equation and target population for water treatment technologies in both Project Scenarios are identical. Thus, despite being monitored individually, water treatment monitoring data and analysis is presented together within this document for the sake of consistency and comparison.

PROJECT SCENARIO 3 (hh-lcs): Improved Cookstove Only

Project Scenario 3 consists of households using project improved cookstove technologies that allow for the efficient use of biomass for cooking, but not using water treatment technologies. Currently, Project Scenario 3 is not being implemented and is therefore not noted in additional sections of this Monitoring Report.

Below is a description of implementing partner roles related to the Project Scenarios above.

Organization	Role
Socorro Maya	Primarily distributes technologies under Project Scenario 2, occasionally under Project Scenario 1. Manages the manufacturing of, and is the sole distributor of, Ecoestufas. Sources filters from Ecofiltro.
Ecofiltro	Distributes exclusively under Project Scenario 1. Manufactures and distributes the Ecofiltro directly and through NGO/CBO partners.
Partner NGO/CBOs	Purchase filters from Ecofiltro in bulk and distribute them to end-users representative of the target population under Project Scenario 1.

MANUFACTURING & DISTRIBUTION

All product technologies implemented through the Project are manufactured locally. Various distribution channels are used in order to make products accessible to the target population. As the Project grows, the project partners plan to invest revenues generated by carbon finance to help further expand manufacturing and distribution and thereby increase the impact of the Project.

Socorro Maya is both a stove manufacturer and distributor of stoves and water filters. SM distributes improved stoves and water treatment technologies directly to consumers, often working with local banks to provide loans and payment plans which allow households to pay for the technologies over time. Socorro Maya began distribution in the Departments of Alta Verapaz, Baja Verapaz, and San Marcos, as these departments have the most need and demand, but will expand to other regions as resources allow.

Ecofiltro is both a filter manufacturer and distributor. Ecofiltro distributes filters directly to end consumers, through school programs, and through local NGOs/CBOs who provide filters to the target population free of charge or at a subsidized rate. Working with schools and NGOs/CBOs enables Ecofiltro to expand their reach and target end-users who otherwise may not be able to afford the technology. When working directly with end users, Ecofiltro often offers financing to make the filter more accessible for low-income families. Ecofiltro is currently distributing filters to all departments of Guatemala. Only direct filter sales to rural communities or bulk sales to NGOs/CBOs working in rural communities where the target population for the Project is located are included in the sales record. Filters sold to for-profit companies for resale to urban markets or for populations not representative of the Project target population are excluded from the Project sales database.

Within its school program, Ecofiltro sells and donates filters to schools in rural and peri-urban areas where the boiling of water is a common practice. Ecofiltro identifies schools in communities comprised of students from the same geographies and BOP socio-economic groups as the households targeted for direct stove and filter distribution to offer a donated filter for every classroom and school kitchen. These filters provide clean water for students, teachers and administrators and replace the boiling of water and/or the consumption of unclean water. To be part of the program, school directors and teachers must agree to take responsibility for the care and usage of the filters. Ecofiltro also asks that the teachers involve the students in a clean water education program before the day of delivery to communicate the importance of clean drinking water so students understand the importance of Ecofiltros in their schools. Then, with the help of the director of the schools, on the day of the donation, all of the parents of the students are gathered together in order to explain the importance of clean water in the schools and at home and Ecofiltro offers each household the ability to participate in Ecofiltro's "Water for Life" program, where they can purchase filters through a low-interest monthly payment plan. On average, for every filter placed in a classroom, Ecofiltro reaches 10 rural families who purchase the filters for their homes. Sales to, and use of filters within, schools are not included for crediting in this issuance. The sales process description is simply included for reference.

FORWARD ACTIONS REQUESTS

The following Forward Action Requests are documented in the ERM CVS Final Verification Report dated September 16th, 2016.

FAR 1: NEUTRAL AND UNBIASED SURVEY.

Issued: Verification Issuance 3

By: DOE

Description: During the site visit, whilst observing the monitoring team carrying out usage and monitoring surveys, ERM CVS observed some questions being asked in a slightly non-neutral manner. Whilst it is unlikely, in the opinion of the verifier, that this would have actually influenced the results of the surveys observed (which were in any case used for the DOE's cross check and where not the source of the results used for crediting), nevertheless it is important that surveyors ask questions in as neutral and unbiased way as possible, whilst still ensuring that the respondent understands the question.

Comment: The PP conducted additional training with the monitoring team via skype on Tuesday, May 17th 2016, and has reinforced the importance of asking questions exactly as written within the surveys. To maintain consistency the team has been instructed to contact the PP if they find any questions which are causing confusion when asked as written during surveying so that such questions can be revised properly to retain an unbiased format.

PROJECT RECORD KEEPING & DATABASES

SALES RECORDS & CARBON RIGHTS WAIVERS

Careful attention has been paid to the accuracy of all records within both Project Scenarios. The PP works closely with the local partners to assure that all data is complete and conservative. Three types of records are kept in differing formats for each project scenario:

1. **Total Sales Record (TSR):** A detailed record of individual and/or bulk sales.
2. **Detailed Customer Database (DCD):** A secondary record of resale or distribution transactions implemented when the TSR record lacks end-user data.
3. **Carbon Rights Waiver (CRW):** An individual release of rights to any VERs derived from the use of technologies sold within the program. Implemented as a document requiring signature, or a prominent product label when the former is not possible.

Organization	Summary Record Keeping Roles
Natural Capital Partners	Management of partner organizations data collection and analysis. Reviews and cleans all datasets. Stores and maintains database records provided by project partners electronically. Calculates Emission Reductions and writes all reports for carbon crediting purposes.
Socorro Maya	Collection and entry of end-user data and records via sales receipts and CRWs. Responsible for collection, updating and storage of hard copies of sales receipts and CRWs along with the transcribing of data into excel spreadsheets.
Ecofiltro	Collection and entry of bulk sales records used to populate TSR via sales invoices. Collection and compilation of Delivery Notes and end-user data collected by partner resellers used to populate DCD. Responsible for collection and storage of hard copies of Sales Invoices and Delivery Notes as well and transcription of data into excel spreadsheets.

PROJECT SCENARIO 1: HH-WT (Filters Only)

The TSR for filters sold under Project Scenario 1 (hh-wt) is compiled from sales invoices and later complimented by a Detailed Customer Database (DCD) compiled from registrations completed by resale partners. The TSR for filter sales under Project Scenario 1 includes the number of technology units sold, date of sale, and contact information for the wholesale purchaser. For transparency and ease of reporting, sales to subsidiaries and closely held organizations such as Ecofiltro S.A., are treated as any other sale and recorded within the TSR. All internal sales to subsidiary organizations are issued invoices and reconciled through Ecofiltro's accounting system which complies with Guatemalan regulations and is audited annually. All sales of filters to Socorro Maya are recorded in the TSR, but removed from crediting under Project Scenario 1 as these filters are credited under Project Scenario 2.

Like many stove and water projects around the world, Ecofiltro's primary mode of distribution is through bulk sales to distributors who then sell to end users. As a result, Ecofiltro's ability to collect end-user information is severely limited. While the TSR reflects a complete record of sales volumes eligible for crediting within the current monitoring period, it does not accurately reflect the specific date in which the individual technologies were distributed to end users, nor the detailed end-user information required for monitoring ongoing use. The Project Scenario 1 TSR is therefore complemented by a Detailed Customer Database (DCD), which seeks to collect individual product serial numbers, end-user information and specific date of delivery/sale to end users from distribution partners. Although Ecofiltro solicits end-user information from all resellers, including all NGOs/CBOs, most partners do not have sufficient time (or willingness) to register end-user details. In most instances, the collection of such data is additional to the resellers other duties and is often left neglected. Even when financial compensation to the reseller is offered, data collection is spotty at best.

The TPDDTEC requires that the PP collect end-user information that shall be "no less than 10 times the required survey and field-test sample size". In an effort to exceed this requirement, the PP seeks to collect end user information from as many end users as possible, targeting a minimum of 10% of total sales. The DCD is a compilation of all direct sales and end-user information successfully retrieved from distributors and partner

NGOs/CBOs, and contains well over 4000 entries, far exceeding the Gold Standard minimum of 1000 (10 times the minimum sample size).

In an effort to make all transactions fully transparent and accurate, Ecofiltro also tracks the date of delivery for bulk sales through the use of a Delivery Note, which corresponds to the sales invoice and indicates the date the filters were delivered to end users. Individual registrations in the DCD and Delivery Notes are used to conduct a lag analysis to determine the time differential between the date of sale and the receipt of the filters by end users. The lag analysis offering an accurate way to measure the average number of days each technology is actually in use for each crediting period.

For carbon rights waivers within Project Scenario 1, the PP, in line with guidance from the GS during Issuance 2, opted to apply carbon rights waiver stickers to the products in order to consistently and clearly communicate the carbon program to all participants. The PP has used similar stickers in other GS projects and believes the stickers are the clearest and surest way to communicate carbon rights across the entire supply chain. Stickers enable everyone who has contact with the product to have access to information regarding carbon rights, ensuring ownership of carbon rights is transparent to all end users. Ecofiltro also explains the CRW and guarantee to wholesale purchasers (including informing large-scale NGO purchasers in writing) at the time of purchase to ensure that they understand that all benefits of emission reductions associated with project technologies belong to the Project.

The CRW has been updated to reflect the updated project participants, you can see the actual one below in the figure:



Participación Programa Filtros de Agua

Este filtro de agua reduce la emisión de gases de efecto invernadero asociados con hervir el agua para su purificación. La fabricación y distribución de este producto de alta calidad están financiadas por los ingresos procedentes de las reducciones de emisiones de gases del efecto invernadero que se crearan desde el uso del producto, en consideración a todo ello, el usuario está de acuerdo que cualquier beneficio financiero y ambiental (incluyendo reducciones en emisiones de gases de efecto invernadero) creado a través del uso de este filtro de agua por el usuario pertenece a Ecofiltro, S.A.

Entiendo que, a cambio de recibir este filtro de agua de alta calidad, me comprometo a usar este producto de forma regular de acuerdo con las instrucciones recibidas durante la sesión informativa y a participar en el mantenimiento continuo del producto.

La dura duración de la unidad filtrantes es de dos años, para reemplazarla comuníquese con nosotros.

Fábrica y Ventas

Aldea San Lorenzo, El Cubo, Km. 77 Ciudad Vieja, Sacatepéquez. Teléfono: (502) 7955-8555

Capital

C.C. Eskala Roosevelt Local L-07 Sótano 1. Calz. Roosevelt (a la par de la Frater). Tel: (502) 2250-7224

Fecha de Vencimiento:

www.ecofiltro.com

PROJECT SCENARIO 2: HH-DUAL (Stoves & Filters)

Socorro Maya distributes all Ecoestufa technologies with an Ecofiltro as part of a package provided directly to end users. As Socorro Maya does not sell in bulk to wholesalers, their Total Sales Record and Detailed Customer Database are one in the same sales record (labeled as a TSR).

The TSR for stoves and filters sold under Project Scenario 2 is compiled from sales invoices executed directly with end-users, and includes a complete record of each individual stove and filter sold. The database includes the date of installation, end-user's name and contact information (when possible), product serial numbers, and the geographic location (community and department) of the household. Data is recorded on paper forms in the field then transcribed into an excel customer database. Socorro Maya's comprehensive record keeping ensures that all sales are accounted for, and allows for follow up with beneficiaries to ensure technologies are working properly.

Socorro Maya clearly communicates the transfer of carbon rights and the need to dismantle traditional stoves both verbally at the point of sale, and in writing on each sales contract signed by the end-user. Carbon rights waivers are signed by all end-users at the point of sale. A component of warranty registration informs the consumer that the warranty is invalid if they continue to utilize their baseline stove.

The TSRs and/or DCDs for both Project Scenarios are included in their entirety within the Excel spreadsheet, ER Calculations GS1321 Iss 4 Year1 07022018 & ER Calculations GS1321 Iss 4 Year 2 07022018.

MONITORING PLAN DESCRIPTION

All surveys required by the TPDDTEC Methodology were conducted simultaneously in randomly selected communities in order to simplify the process and reduce the costs associated with monitoring.

SUMMARY OF MONITORING REQUIRED & CONDUCTED

The TPDDTEC Methodology maintains the following sample size requirements for ex-post monitoring:

- **Usage Survey** - minimum total sample size of 100 per project scenario, with at least 30 samples of each technology age.
- **Monitoring Survey** - minimum sample size of 100 per project scenario for a group size > 1000. May be conducted in tandem with US Survey.
- **Biennial KPT Test** - min sample size of 30, if 90/10 confidence/precision not met, apply upper bound.
- **Biennial WCFT Test** - min sample size of 30, if 90/10 confidence/precision not met, apply upper bound.
- **Water Quality Test** - Follow 90/10 confidence/precision rule to determine sample size.

The PP conducted Usage Surveys, Monitoring Surveys, Water Consumption Field Tests, Kitchen Performance Tests and Water Quality Tests as required by the methodology. As Kitchen Performance and Water Consumption Field Test data is required to be monitored biennially, the PP conducts these surveys at a rate that allows for collection of data over the 2-year operating span.

The tables below summarize the number of households monitored and utilized for Issuance 4:

Type & Number of Surveys Conducted	hh-wt	hh-dual	TOTAL
Water Consumption Field Test (WCFT)	53	55	108
Water Quality Test (WQT)	79		79
Filter Monitoring & Usage Survey (MS/US)	120	149	265
Stove Monitoring & Usage Survey (MS/US)	N/A	149	149
Kitchen Performance Test (KPT)	N/A	50	50

Type & Number of Surveys Used	hh-wt	hh-dual	TOTAL
Water Consumption Field Test (WCFT)	51	49	100
Water Quality Test (WQT)	75		75
Filter Monitoring & Usage Survey (MS/US)	118	142	256
Stove Monitoring & Usage Survey (MS/US)	N/A	142	142
Kitchen Performance Test (KPT)	N/A	49	49

SAMPLING METHOD

The PP elected to use a simple random sampling approach for all monitoring conducted during this monitoring period. A detailed description of the sampling plan used for all surveys and tests is below:

1. The Total Sales Record (TRS) and/or Detailed Customer Database (DCD) for the entire project period (from 2013 to the date at the start of monitoring) is used to determine the total sales for each technology. In each case, sales exceeded 1000, and thus sampling requirements defaulted to the largest minimum sizes for each survey as required by the methodology.
2. For stoves, the Total Sales Record was used and stoves younger than 6 months at the time of monitoring were excluded from consideration.
3. For filters, the Detailed Customer Database was used and filters younger than 6 months and older than 24 months at the time of monitoring were excluded from consideration.
4. Relevant household and technology data from the TSR and DCD (respectively) was copied into a new Xcel sheet (Sampling Database) in order to work with the data without disturbing the formal database.
5. Research Randomizer (<https://www.randomizer.org/>) was then used to generate a list of random numbers matching the number of registrations in each database. A sample screen shot of inputs for 10,000 entries is included below for reference.

The screenshot shows the Research Randomizer website interface with the following settings:

- How many sets of numbers do you want to generate? [Help](#)
- How many numbers per set? [Help](#)
Specify how many numbers you want Research Randomizer to generate in each set. For example, a request for 5 numbers might yield the following set of random numbers: 2, 17, 23, 42, 50.
- Number range (e.g., 1-50) [Help](#)
- Do you wish each number in a set to remain unique? [Help](#)
- Do you wish to sort the numbers that are generated? [Help](#)
- How do you wish to view your random numbers? [Help](#)

6. A new column "A" is inserted in the Sampling Database and the randomized list of numbers generated by Research Randomizer is pasted into this new column A.
7. All of the data in the Sampling Database is then sorted numerically by column A (from 1 to 10,000 in the example above). This has the effect of randomizing the original data.

8. The data is then reduced to a more manageable size (Working Database) by selecting the first 1000 entries from the newly randomized list.
9. Those 1000 entries are then sorted by date of sale and the data is reviewed to confirm that it includes at least 60 registrations (double the required number) for each age of the applicable technology.
10. If the Working Database does not include at least 60 units of each technology age, the next 1000 entries (1001 to 2000) are pulled from the Sampling Database and added to the Working Database.
11. Step 7 and 8 are repeated as necessary, increasing the number of households selected from the Sampling Database until the Working Database includes at least 60 of each age of the monitored technology.
12. The Working Database is then color coded by technology age. And the data is sorted by Department with the data from each Department being placed on a unique tab.
13. On each Department tab, the data is then sorted by Community. This provides a reasonable geographic planning tool for monitoring, randomly clustering households by location to allow for monitoring multiple households simultaneously as KPTs and WCFTs require 4 days in a single location to complete the tests.
14. Starting with the first tab, the M&E team then work their way down the randomized lists contacting households to request a date for monitoring, clustering visit dates and times geographically as they go. If the team cannot successfully reach a household on the list or the household refuses to participate, they skip to the next person on the list.
15. The M&E team tracks the number of each technology age being monitored so that any shortfalls resulting toward the end of the monitoring period can be adjusted as needed by selecting more technologies of a certain age from the random Working Database lists.
16. The M&E Team travels to a location and stays locally for 4 consecutive days allowing for KPT and WCFT tests to be completed. At the same location, the team may complete varying numbers of tests based on available time and difficult. For instance, the team may conduct 10 KPTs or WCFTs over the course of the week while also conducting 20 MS/US and 5 WQTs, depending on household availability.
17. WQT samples are collected from the last 5 to 7 homes monitored in each area on the final day of monitoring (usually a Thursday) and transported back to Guatemala City for testing in a lab.

DATA COLLECTION, ANALYSIS AND QAQC

Natural Capital Partners oversees all monitoring of the project and coordinates activities for Monitoring & Evaluation, distribution partners and communities. Before Natural Capital Partners took part in the project, The Paradigm Project worked with a full-time Monitoring & Evaluation (M&E) associate, Gabriel Jerez who was hired to conduct Continuous Monitoring of efficient stoves and water treatment technologies. This employee was formerly employed by CO₂ Management, a local environmental consultancy firm specializing in environmental impact reporting, carbon footprint analysis, and carbon monitoring, that was contracted to conduct all monitoring for the Project in the Issuance 2 monitoring period. He was in charge of Monitoring and Evaluation from the beginning of this Issuance period until to 2017, when Natural Capital Partners assumed the responsibility for the project. To lead the technical monitoring and verification activities for the Project, Natural

Capital Partners hired Eddy Meléndez Mendizabal, a former employee of The Paradigm Project and CO₂ Management, who also was in charge of Monitoring & Evaluation for Issuance 2 and 3. He's deeply experienced in Gold Standard TPDDTEC Methodology and all of the required monitoring activities, having completed all project, and some baseline, monitoring activities in the priors monitoring periods. Eddy Meléndez is in charge of calculating Emission Reductions and authors all reports for carbon crediting purposes.

Surveys utilized in the previous monitoring period were refined by the former M&E team (Eddy Meléndez & Gabriel Jerez) and the PP in line with their experience with similar projects. The surveys were then piloted and further refined by the PP and the former M&E team to assure functionality and ease of use in the field. Where possible, US, MS, KPTs, WCFTs and WQTs were conducted in tandem on the same households for consistency and validation of data.

M&E team; Gabriel (Paradigm), and Eddy (Natural Capital Partners) completed 100% of surveys conducted. No additional enumerators were used to collect data for this monitoring period. Data entry was completed and synched to the cloud real-time using ODK digital data collection software on Android phones. If cellular service was unavailable in the field, data was stored locally on the phone and synched at the end of each day via wifi. Incoming raw data was exported to the "MS_US_WCFT_KPT_WQT Data" spreadsheet for review and analysis. The PP reviewed the data and conducted completeness checks to ensure that household responses were internally consistent. The PP then worked with the M&E Team to clean the data by clarifying and correcting data entry mistakes as appropriate.

Ivan Hernandez former GS Regional Manager was contracted to complete a QA/QC check on the data and processes to confirm the validity of the M&E approach and outcomes.

With more than a decade of experience in the Climate Change and Sustainability industry, Ivan Hernandez has participated in the audit and certification of more than 350 projects of Renewable Energy, Energy Efficiency, Waste Management and Forestry activities. With real international experience, he has developed professional duties in more than 25 countries in 4 continents. Ivan has worked closely with Governments, NGOs and Private companies to develop strategic plans to reduce GHG emissions and he has dedicated efforts to create capacities in developing countries to contribute in the fight against climate change.

Below is a description of entities participating in monitoring and their respective responsibilities.

Organization	Responsibilities
Natural Capital Partners	Development of surveys, training, data analysis, QAQC and reporting. Report writing, Emission Reduction Calculation, GS and DOE communications. Refinement of surveys for local context, conducting all monitoring, entering raw data from surveys via ODK. Works with local project partners to schedule household visits and manage M&E process.
Socorro Maya & Ecofiltro	Logistical support for M&E.
Ivan Hernandez, Senior Consultant Sustainability and Climate Change⁴	QAQC analysis of monitoring plan and systems.

SURVEY EQUIPMENT CALIBRATION

Calibration Procedure for Scales:

According to the manual of the Scales SR-Series, *“Adjustment is performed professionally at the factory. Only advanced users should perform calibration using the required weight if the scale is not weighing properly”⁵*

Our trained and expert field personnel has done the monitoring continuously, and have not noticed any unusual reading for the equipment, or anything that could make us think that the scale is not weighing properly to make an adjustment.

Calibration Procedure for Moisture Meters:

The moisture meters do not have specification for calibration.

PROCEDURES FOR MINIMIZING NON-SAMPLING ERRORS & INTERNAL QAQC

The following internal QAQC checks were utilized by the PP to assure quality and consistency of data:

⁴ Ivan Hernandez has plenty experience in auditing and certification of carbon project (participation in more than 350 worldwide) in his former positions Standard Certification Officer/Regional Manager Americas at Gold Standard Foundation (2009-2017) and GHG Lead Auditor accredited by the UNFCCC at TUV SUD (2005-2009).

⁵ American Weigh Scales Users Manual, model SR-Series.

- Survey questions were coded, multiple choice and/or list-generated where possible to facilitate data entry and minimize enumerator error.
- A quality check on all data was conducted weekly by The Natural Capital Partners to ensure accuracy of entries.
- Basic analysis was conducted to check for any abnormalities in the data.

OUTLIER REMOVAL

During the detailed data review, the PP removed surveys as outliers if one or more of the following occurred:

- Households refused to participate in the survey or were not able to provide access or responses for one or more days in a multi-day test.
- Survey was incomplete/missing data for a significant number of questions.
- Information was inconsistent or did not make sense (negative data values, for example).
- Data value(s) was outside of two standard deviations above or below the mean.
- Households reported using the stove or filter for commercial or institutional uses, as such households would skew key data points such as person-meals.

KEY FIXED (EX-ANTE) DATA & PARAMETERS

DATA/PARAMETERS DERIVED FROM IPCC DEFAULTS

Data/parameter	EFb,wood,CO2
Unit	kg CO2/TJ
Description	The CO2 emission factor arising from use of fuels in baseline scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	112,000
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	EFb,wood,CH4
Unit	kg CH4/TJ
Description	The CH4 emission factor arising from use of fuels in baseline scenario

Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	300
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	EF_b,wood,N₂O
Unit	kg N ₂ O/TJ
Description	The N ₂ O emission factor arising from use of fuels in baseline scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	4
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	EF_p,wood,CO₂
Unit	kg CO ₂ /TJ
Description	The CO ₂ emission factor arising from use of fuels in project scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	112,000
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	EF_p,wood,CH₄
Unit	kg CH ₄ /TJ
Description	The CH ₄ emission factor arising from use of fuels in project scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	300
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	EF_{p,wood,N2O}
Unit	kg N ₂ O/TJ
Description	The N ₂ O emission factor arising from use of fuels in project scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	4
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	NCV_{b, wood}
Unit	TJ/tonne
Description	Net calorific value for fuel used in the baseline scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	0.0156/Gg
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	NCV_{p, wood}
Unit	TJ/tonne
Description	Net calorific value for fuel used in the project scenario
Source of data	2006 IPCC guidelines for national greenhouse gas inventories
Value(s) applied	0.0156/Gg
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

DATA/PARAMETERS DERIVED FROM BASELINE MONITORING

Data/parameter	Wb,y
Unit	tonne/liter
Description	Quantity of fuel in tonnes required to treat 1 liter of water using technologies representative of baseline scenario during project year y, as per BWBT.
Source of data	BWBT Field Report GS1321 Iss 2 dated 9/3/2015
Value(s) applied	0.00072
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	Wp,i,y
Unit	tonne/liter
Description	Quantity of fuel required to treat 1 liter of water using unimproved stove technologies during project year y, as per BWBT.
Source of data	BWBT Field Report GS1321 Iss 2 dated 9/3/2015
Value(s) applied	0.00072
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	Cj
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	MS_US Filter (hh-wt, hh-dual) Report GS1321 Iss 2 dated 9/3/2015
Value(s) applied	hh-wt: 9.32 hh-dual: 9.17
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

Data/parameter	fNRB,y,ics-nb
Unit	Percentage
Description	Non-renewability status of woody biomass fuel in scenario i during year y
Source of data	NRB Assessment. Fixed in PDD by baseline study for a given crediting period, updated if necessary as specified in Methodology section III.1.
Value(s) applied	95.74
Choice of data or measurement methods and procedures	
Purpose of data	
Additional comments	

KEY MONITORED (EX-POST) DATA & PARAMETERS

EFFICIENT STOVE TECHNOLOGIES

Data/parameter	Np,1,ics-nb
Unit	technology-days
Description	Cumulative number of days of technology use for project scenario p against baseline scenario b, in year 1.
Measured/calculated/ default	Calculated
Source of data	ER Calculations GS1321 Iss 4Year1 070218
Value(s)	1,263,145
Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Technology-days = sum of (recorded sale date of each technology –closing date of the monitoring period), in days.
QA/QC procedures	
Purpose of data	
Additional comments	The PP has revised the units of measure from project technologies credited as specified in the parameter box in the PDD to technology-days (as specified in the equations in the PDD and methodology) in order to be in line with definition of the parameter in the ER equation.

Data/parameter	Np,2,ics-nb
Unit	technology-days
Description	Cumulative number of days of technology use for project scenario p against baseline scenario b, in year 2.
Measured/calculated/ default	Calculated
Source of data	ER Calculations GS1321 Iss 4Year2 070218
Value(s)	1,275,754
Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Technology-days = sum of (recorded sale date of each technology –closing date of the monitoring period), in days.
QA/QC procedures	
Purpose of data	
Additional comments	The PP has revised the units of measure from project technologies credited as specified in the parameter box in the PDD to technology-days (as specified in the equations in the PDD and methodology) in order to be in line with definition of the parameter in the ER equation.

Data/parameter	P,p,b,y,ics-nb
Unit	tonnes/technology-day
Description	Specific fuel savings for an individual technology in the project scenario against an individual technology in baseline scenario in year y.
Measured/calculated/ default	Calculated
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4.
Value(s)	0.02068
Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Person Meals (MS/KPT) * Fuel savings per meal (KPT).
QA/QC procedures	
Purpose of data	
Additional comments	The PP has revised the units of measure from kg/household-day as specified in the parameter box in the PDD to tonnes/technology-day (as specified in the equations in the PDD and methodology) in order to be in line with definition of the parameter in the ER equation. This parameter was not included in the parameter section of the methodology and the PDD, but was included in the ER equations of both. Thus the PP has included the parameter in the monitoring report, in line with the information noted in the PDD under P,b,y and P,p,y. P,p,b,y,ics-nb is equivalent to the difference in the specific fuel consumption for an individual technology in baseline scenario b (P,b,y) and the specific fuel consumption for an individual technology in project scenario p (P,p,y). Since as by definition P,p,b,y is the difference between P,p,y and P,b,y the PP has adopted the similar parameter descriptions for P,p,b,y as those used for P,p,y and P,b,y in the PDD.

Data/parameter	Up,1,ics-nb
Unit	Percentage
Description	Cumulative, weighted usage rate in project scenario, for technology during year 1
Measured/calculated/ default	Calculated
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4. Usage Survey.
Value(s)	93.55
Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Sum of (Binary reported usage frequency by technology age * % of total sales by technology age)
QA/QC procedures	
Purpose of data	

Additional comments	The usage rate accounts for non-usage of the Ecoestufa as well as continued use of baseline stoves, and usage frequency weighted by sales per age of stove.
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Data/parameter	Up,2,ics-nb
Unit	Percentage
Description	Cumulative, weighted usage rate in project scenario, for technology during year 1
Measured/calculated/ default	Selected
Source of data	Conservative approach (lowest value from every issuance, Iss1)
Value(s)	92.39
Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Sum of (Binary reported usage frequency by technology age * % of total sales by technology age)
QA/QC procedures	
Purpose of data	
Additional comments	The usage rate accounts for non-usage of the Ecoestufa as well as continued use of baseline stoves, and usage frequency weighted by sales per age of stove.

Data/parameter	LEp,y,ics-nb
Unit	tCO2e/yr
Description	Leakage in project scenario for technology in year y
Measured/calculated/ default	Measured
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4.
Value(s)	0.00
Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Biennial Survey and Desk Review
QA/QC procedures	
Purpose of data	
Additional comments	All leakage sources noted in the PDD were determined to be negligible

WATER TREATMENT TECHNOLOGIES

Data/parameter	Np,1,wt	
Unit	person-days	
Description	Cumulative number of person-days of water consumed in project scenario p through year 1.	
Measured/calculated/ default	Calculated	
Source of data	ER Calculations GS1321 Iss 4Year 1 070218	
Value(s)	hh-wt: 22,200,433	hh-dual: 3,961,230
Monitoring equipment		
Measuring/recording frequency		
Calc. method (if applicable)	Person-days = sum of ((recorded sale date of each technology – closing date of the monitoring period – lag adjustment factor), in days * number of persons utilizing the filter per HH).	
QA/QC procedures		
Purpose of data		
Additional comments	Adjusted to account for households who use LPG and other appropriate HWT technologies.	

Data/parameter	Np,2,wt	
Unit	person-days	
Description	Cumulative number of person-days of water consumed in project scenario p through year 2.	
Measured/calculated/ default	Calculated	
Source of data	ER Calculations GS1321 Iss 4Year 2 070218	
Value(s)	hh-wt: 50,690,548	hh-dual: 859,558
Monitoring equipment		
Measuring/recording frequency		
Calc. method (if applicable)	Person-days = sum of ((recorded sale date of each technology – closing date of the monitoring period – lag adjustment factor), in days * number of persons utilizing the filter per HH).	
QA/QC procedures		
Purpose of data		
Additional comments	Adjusted to account for households who use LPG and other appropriate HWT technologies.	

Data/parameter	Up,1,wt	
Unit	Percentage	
Description	Cumulative, weighted usage rate in project scenario, for technology during year 1	
Measured/calculated/ default	Calculated	
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4	
Value(s)	hh-wt: 96.88	hh-dual: 99.63
Monitoring equipment		
Measuring/recording frequency		
Calc. method (if applicable)	Sum of (percent of respondents that meet all criteria in the “Guidelines for carrying out usage survey for projects implementing household water filtration technologies”, by technology age * % of total sales by technology age * % of technologies passing Water Quality Test by technology age)	
QA/QC procedures		
Purpose of data		
Additional comments	The usage rate accounts for non-usage of the Ecofiltro. Filters over 2 years of age are considered past performing age range and thus are removed from crediting.	

Data/parameter	Up,2,wt	
Unit	Percentage	
Description	Cumulative, weighted usage rate in project scenario, for technology during year 2	
Measured/calculated/ default	Selected	
Source of data	Conservative approach (lowest value of every issuance or PDD)	
Value(s)	hh-wt: 88.42 (Iss2)	hh-dual: 95 (PDD)
Monitoring equipment		
Measuring/recording frequency		
Calc. method (if applicable)	Sum of (percent of respondents that meet all criteria in the “Guidelines for carrying out usage survey for projects implementing household water filtration technologies”, by technology age * % of total sales by technology age * % of technologies passing Water Quality Test by technology age)	
QA/QC procedures		
Purpose of data		
Additional comments	The usage rate accounts for non-usage of the Ecofiltro. Filters over 2 years of age are considered past performing age range and thus are removed from crediting.	

Data/parameter	Qp,y	
Unit	Liters per person per day (L/p/d)	
Description	Quantity of raw water treated with water treatment technology and used for hygienic purposes in the project scenario p and supplied by project technology per person per day	
Measured/calculated/ default	Calculated	
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4	
Value(s)	hh-wt: 2.66	hh-dual: 2.44
Monitoring equipment		
Measuring/recording frequency		
Calc. method (if applicable)	Average hygienic water consumption per day per hh — average non- hygienic water consumption per day per hh / average persons consuming treated water per day per hh	
QA/QC procedures		
Purpose of data		
Additional comments		

Data/parameter	Qp,cleanboil,y	
Unit	Liters per person per day (L/p/d)	
Description	Quantity of treated water still boiled in project scenario after installation of project technology, per person per day	
Measured/calculated/ default	Calculated	
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4	
Value(s)	hh-wt: 0.00	hh-dual: 0.00
Monitoring equipment		
Measuring/recording frequency		
Calc. method (if applicable)	Average liters boiled for purification after filtering per HH / average persons consuming treated water per day per hh	
QA/QC procedures		
Purpose of data		
Additional comments		

Data/parameter	LEp,i,y
Unit	tCO2e/yr
Description	Leakage in project scenario 2 for technology i in year y
Measured/calculated/ default	Measured
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4.
Value(s)	0.00

Monitoring equipment	
Measuring/recording frequency	
Calc. method (if applicable)	Biennial Survey and Desk Review
QA/QC procedures	
Purpose of data	
Additional comments	All leakage sources noted in the PDD were determined to be negligible

Data/parameter	Water Quality (WQT)	
Unit	Percentage	
Description	Performance of the treatment technology	
Measured/calculated/ default	Measured	
Source of data	MS_US_WCFT_KPT_WQT Data GS1321 Iss4.	
Value(s)	hh-wt: 96.97	hh-dual: 95.12
Monitoring equipment		
Measuring/recording frequency	Quarterly	
Calc. method (if applicable)	Number of passing filters divided by total number of filters tested	
QA/QC procedures		
Purpose of data		
Additional comments	3 rd party lab tests were conducted on randomly selected filter units. Two WQT percentage were measured in each project scenario, even if the product is identical in both scenarios and the performance characteristics of the product is identical across both project scenarios, the PP decides to separate two different values for a more accurate value in ER's calculations.	

HOUSEHOLD DEMOGRAPHICS: ALL MONITORING

Continuous monitoring allows the PP to conduct all required surveys—KPT, WCFT, MS/US and WQT tests—in large number of common households. While more MS/US surveys were done than other survey types, all surveys types were conducted in all communities surveyed. The below demographics represent the average demographic characteristics of the monitored households by Project Scenario (rather than by survey type) across all surveys performed. Because ERs for GS-1321 are calculated on a person-meal basis, household size does not affect ER volumes directly and changes in household size relative to the baseline are accounted for through person-meal values as household size changes. Household demographics shown below are reported for informational purposes only.

AVERAGE HH SIZE

HH Size	hh-wt	hh-dual
Average Persons Total	4.85	5.04

RESPONDANT GENDER

Gender	hh-wt	hh-dual
Female	89	124
Male	29	18
Total	118	142

KPT MONITORING RESULTS: HH-DUAL EFFICIENT STOVES

OVERVIEW OF KPT'S CONDUCTED

50 project KPT surveys were conducted in-person by the local M&E Team across 3 Departments representing more than 65% of efficient stove sales to date. 1 outlier was identified and removed from the raw data during analysis. The results for the main quantitative parameters determined in the KPTs are used in Emissions Reductions (ER) calculations for the Issuance 4 Monitoring Period.

KPT SURVEYS CONDUCTED AND OUTLIERS REMOVED

Surveys Conducted	Outliers Removed	Surveys Used
50	1	49

KPT HOUSEHOLDS BY DEPARTMENT

Department	N	%	Department	N	%
Alta Verapaz	10	20%	Peten	0	0%
Baja Verapaz	29	59%	Quetzaltenango	0	0%
Chimaltenango	0	0%	Quiche	0	0%
Chiquimula	0	0%	Retalhuleu	0	0%
El Progreso	0	0%	Sacatepequez	0	0%
Escuintla	0	0%	San Marcos	0	0%
Guatemala	10	20%	Santa Rosa	0	0%
Huehuetenango	0	0%	Solola	0	0%
Izabal	0	0%	Suchitepequez	0	0%
Jalapa	0	0%	Totonicapan	0	0%
Jutiapa	0	0%	Zacapa	0	0%

Within the Continuous Monitoring framework, a full MS/US is conducted within every KPT household. MS/US surveys are also conducted on households that do not participate in KPTs as the sampling requirement for MS/US surveys is much higher than for KPTs. Including a MS/US survey in every KPT household allows the PP to replace many of the redundant qualitative questions normally included with the KPT with the more comprehensive MS/US survey questions. This has two benefits:

1. Every household surveyed receives the most comprehensive monitoring available, producing more robust and complete data.
2. MS/US results between KPT and non-KPT households can be compared and analyzed to identify trends or anomalies.

PROJECT FUEL CONSUMPTION AND SAVINGS

On each day of the test, KPT households were asked how many people ate at each meal, the age and gender of those eating, type of food that was prepared, and stove(s) used. Enumerators measured the quantity of fuel consumed by taking daily measurements in kilograms (kg) of the fuel supply. The KPT is a subsumed KPT and measures wood consumed from all stoves present and in use in the home during the test period. The tables below present the average fuel consumption per day, average person meals per day, and average fuel per person meal per day for both the baseline, project, and the calculated savings between the two.

AVERAGE DAILY MOISTURE ADJUSTED FUEL CONSUMPTION & SAVINGS PER HH (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

HH Consumption	Avg. (kg)	SDEV	90% CI	Precision	90/10?	N
Baseline	19.77	4.35	1.24	6.30%	Yes	35
Project	5.15	1.97	0.47	9.16%	Yes	49
Savings	14.62					

AVERAGE PERSON-MEALS PER DAY, MEAL ADJUSTED (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

Parameter	Avg. (kg)	SDEV	90% CI	Precision	90/30?	N
Person Meals	14.15	5.46	1.31	9.26%	Yes	49

AVERAGE DAILY PER-PERSON-MEAL FUEL CONSUMPTION & SAVINGS (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

PM Consumption	Avg. (kg)	SDEV	90% CI	Precision	90/30 or 90/10?	If Upper bound	N
Baseline	1.40	0.77	0.22	15.81%	Yes	N/A	35
Project	0.40	0.18	0.04	10.43%	No	0.45	49
Savings	1.00						

AVERAGE DAILY PER-PERSON-MEAL FUEL CONSUMPTION & SAVINGS

Parameter	Value	Definition
Fuel Savings (t)	0.001462	Specific fuel savings for an individual technology of project p against an individual technology of baseline b in year y, in tonnes/meal/day, as derived from the statistical analysis of the data collected from the field tests.

The project field KPT data confirms fuel savings of **0.001462** tonnes of fuelwood/person meal/day. Consistent with the previous monitoring periods, the PP elected to quantify fuel savings on a per-person meal basis due to the Guatemalan context of cooking an entire meal on a single stove. Fuel consumption savings were calculated by comparing baseline fuel consumption to project fuel consumption. Meals cooked per day included two snack meals weighted at 0.25 of a regular meal. To determine the fuel savings per household per day the PP multiplied the fuel savings per meal value by the number of person meals cooked per day reported in the KPT. Person Meal data is also collected in the MS/US report, even for households participating in the KPT. Conducting MS/US on KPT households allows comparison of outcomes based on self-reported use over time (MS/US) and self-reported use immediately following a monitored cooking test. Not surprisingly, MS/US reported person-meals trended slightly higher (**17.23**) than KPT reported person-meals (**14.15**). For the sake of conservatism, the PP has elected to utilize the KPT person-meal figure for all ER calculations.

MS/US MONITORING RESULTS: HH-DUAL EFFICIENT STOVES

OVERVIEW OF SURVEYS CONDUCTED

149 project Monitoring & Usage surveys were conducted across 4 Departments representing more than 99% of Project Scenario 2 sales to date. If the stated household usage was “none”, the MS/US was halted, but the survey was utilized in the calculation of the final usage parameter. Seven outliers were identified and removed from the raw data during analysis. From the 142 surveys used, 10 were done for Year 2, deciding to get a conservative approach for this year.

Project Scenario 2 MS/US monitoring covers both efficient stoves and water filters, however, for the sake of consistency and comparison, all MS/US data related to water filters from Project Scenario 2 is presented within this report in section “MS/US MONITORING: HH-WT & HH-DUAL WATER FILTERS”. This allows for direct comparison of filter use between households that receive only a filter and those that receive both a filter and a stove. Only parameters related to efficient stoves are presented in this section.

As per methodological allowance, all MS and US Surveys were conducted on the same sample population and in-person by the local M&E Team. This includes only households with dual technologies distributed by Socorro Maya in tandem with each other within Project Scenario 2 (hh-dual). The data collected through MS/US monitoring provides the average value of person-meals prepared per household per day used for ER calculations as well as critical information on year-to-year trends in end user characteristics such as stove use, cooking practices, baseline stove/fuel type, leakage and sustainable development Indicators, along with demographic information. The main monitored parameters results are reviewed below.

MS/US HOUSEHOLDS BY COMMUNITY

Department	N	%	Department	N	%
Alta Verapaz	64	45%	Peten	0	0%
Baja Verapaz	44	31%	Quetzaltenango	0	0%
Chimaltenango	0	0%	Quiche	0	0%
Chiquimula	0	0%	Retalhuleu	0	0%
El Progreso	0	0%	Sacatepequez	0	0%
Escuintla	0	0%	San Marcos	12	8%
Guatemala	22	15%	Santa Rosa	0	0%
Huehuetenango	0	0%	Solola	0	0%
Izabal	0	0%	Suchitepequez	0	0%
Jalapa	0	0%	Totonicapan	0	0%
Jutiapa	0	0%	Zacapa	0	0%

Stove MS US Surveys Conducted & Outliers Removed

Surveys Conducted	Outliers Removed	Surveys Used
149	7	142

USAGE RATE & PERSON MEALS

The GS methodology requires that “a usage parameter be established to account for drop off rates as project technologies age and are replaced”. The survey used a combination of self-reported usage questions and enumerator assessment of the improved stove to determine both the binary usage parameter (Yes/No) and the frequency of use. For enumerator assessment, the enumerator commented on whether the stove showed signs of being in recent use: signs of partially burned wood/ash and lack of spider webs in the fire chamber, stove warm or in use. The frequency of improved stove use was estimated by asking respondents how many days per week they use the stove, and which stoves were typically used to cook each meal of the day. This final set of questions allowed for clarity on stove types in use and the specific frequency of use of the project technology.

Per the GS methodology TPDDTEC, a single usage parameter that is weighted based on drop off rates that are representative of the age distribution for project technologies in the total sales record is used to calculate ERs. The total usage rate is determined by dividing the households that meet all usage criteria by the total number of households surveyed, and takes into account continued use of baseline stoves for certain cooking practices.

The monitoring results are used for year 1 and a conservative approach is used for year 2 as it’s explained in Section “Deviation from Gold Standard” in page 6.

TOTAL CUMULATIVE WEIGHTED USAGE RATE (Up,i,y)

Parameter	Value	Definition
Up,i,y	93.55%	Cumulative usage rate for technologies in project scenario p, for technology i, in year y, based on cumulative frequency of use rate weighted by technology age.

SALES-WEIGHTED USAGE BY AGE

Technology Age	Active Units	% of Sales	% In Use	Weighted Usage
Age 0 - 1	118	3%	100%	3.37%
Age 1 - 2	342	10%	100%	9.76%
Age 2 - 3	1,673	48%	100%	47.75%
Age 3-4	1,202	34%	100%	34.30%
Age 4-5	169	5%	100%	4.82%
Total	3,504	100%	100%	100%

Continuous Monitoring allows for a direct comparison of measured vs. reported responses to key parameters such as person-meals. Within the MS/US respondents are asked how many people, on average, they cook for on a typical day and then asked which stove they use to cook each meal during the day, giving the PP data on both

the number of meals cooked and the use of the improved stove per meal. Thus the MS/US allows the PP to determine an average number of people served at each meal. Although the KPT also relies on self-reported data, such data is recorded by the respondent on a meal-by-meal basis for a 24-hour period. In addition, breakfast, lunch, and dinner are weighted equally, but snacks and teas are weighted as a quarter of a meal, as less cooking is conducted to prepare these meals. KPT data is therefore much more specific and accurate, recording the exact number of people served at each individual meal over the course of 3 days. Not surprisingly, the MS/US person-meal data is slightly higher than the person-meal data derived from the KPT. For the sake of conservatism, the PP has elected to use the KPT person-meal figure for all ER calculations.

COMPARISON OF PERSON MEALS FROM KPT AND MS/US

Parameter	Value	Definition
KPT Person Meals	14.15	Average number of people per household per day served across all meals and adjusted with snacks and tea as 0.25 of a meal, as determined by KPT analysis.
MS/US Person Meals	17.23	Average number of people per household per day served across all meals, as determined by MS/US analysis.

FREQUENCY OF USE

Households were asked to report the frequency with which they use their stove (in days) and to clarify which stove(s) were typically used to cook which meals in order to calculate an accurate frequency measurement. The results of frequency of use questions are shown below.

WEEKLY FREQUENCY OF USE

Frequency: Weekly	N	%
Every day	137	96.48%
4 to 6 days per week	3	2.11%
2 to 3 days per week	2	1.41%
1 day per week	0	0%
Never	0	0%
Total	142	100%

MEAL FREQUENCY OF USE

Meal Use	Ecoestufa	Other	%
Breakfast	137	4	97.16%

Morning Tea	119	3	97.54%
Lunch	139	3	97.89%
Afternoon Tea	115	1	99.14%
Dinner	142	0	100.00%
Total Meals/Use	652	11	98.34%

BASELINE FUEL & STOVE PRACTICES

To calculate accurate emission reductions and understand leakage from fuel switching and/or heating practices, the survey asked household respondents about baseline fuel and stove type as well as heating practices.

The overwhelming majority of households used only wood fuel in the baseline. A small minority of users switched from LPG to firewood as their primary fuel source after receiving the Ecoestufa. Specifically, in reviewing the data from Monitoring Period 4, 2 survey respondents reported LPG as their primary baseline stove. Of those 2, both of them report that they still have their LPG stove and are still using it. The PP would submit that the reported ownership of the stove may be a more accurate indicator of actual usage as historically respondents have tended to answer the question of use of an old stove with what they believe the surveyor may want to hear. Additional questions in the MS/US asking about stoves and fuels used to cook specific meals support this position showing that about 1.36% of respondents reported cooking at least one meal per day on LPG. In comparison, the 2 respondents that reported still owning an LPG stove would equate to just over 1% of the surveyed sample. At 1% fuel switching, the PP would suggest that leakage from fuel switching is negligible. Before receiving the Ecoestufa, the vast majority of the population reported using a biomass stove of some type. These include open fires and plancha-style stoves like those measured in the additional KPT tests conducted for Issuance 2, which performed on par with, or below the level of a 3-stone fire and thus have been classified by the PP as unimproved stoves within the baseline for the purposes of calculating ER reductions.

BASELINE FUEL TYPE

Baseline Fuel Type	N	%
Wood	140	98.59%
Charcoal	0	0%
Gas	2	1.41%
Other	0	0%
Total	142	100%

BASELINE STOVE TYPE

Baseline Stove Type	N	%
Open Fire	135	92%

Plancha	1	1%
Charcoal	1	1%
Gas	4	3%
Block	6	4%
Total	147	100%

HEATING PRACTICES

For leakage associated with heating, respondents were asked (a) whether they use their stove to heat their home and (b) how they fuel the stove for heating purposes (i.e. do they specifically light a fire in the stove for heating or simply allow cooking fuel to burn out). While about half of all users indicate that they use the stove for heating, the majority also indicate that they tend to use only the fuel burning for cooking purposes and that they use the same amount or less fuel for heating relative to their old stove. Furthermore, KPTs are subsumed, and include any changes in increased use of the new stove for heating purposes. Thus it can be concluded that there are negligible changes in the amount of fuel used for heating after the introduction of the Ecoestufa.

BASELINE STOVE TYPE

Home Heating	N	%
Yes	39	27%
No	103	73%
Total	142	100%
If yes, no fuel added?	35	90%
If yes, fuel added?	4	10%
Total	39	100%

SUSTAINABLE DEVELOPMENT INDICATORS

Air Quality & Health Effects

Self-reported incidence of air quality and health indicators show overwhelmingly positive changes in the household in comparison to the baseline. In each case, respondents were first asked if they noticed any difference in the indicator being monitored. If they responded “yes”, then they were asked to quantify the degree of perceived difference from the baseline.

DEGREE OF PERCEIVED CHANGE IN AMOUNT OF SMOKE IN KITCHEN (FOR THOSE INDICATING A CHANGE)

Change in Smoke?	N	%
Yes	141	99%
No	1	1%
Total	142	100%

Much Less	135	96%
Less	6	4%
No difference	0	0%
More	0	0%
Much More	0	0%
Don't Know	0	0%
Total	141	100%

DEGREE OF CHANGE IN AMOUNT OF EYE IRRITATION (FOR THOSE INDICATING A CHANGE)

Change in Eye Irritation	N	%
Yes	141	99%
No	1	1%
Total	142	100%
Much Less	139	99%
Less	2	1%
No difference	0	0%
More	0	0%
Much More	0	0%
Don't Know	0	0%
Total	141	100%

DEGREE OF CHANGE IN FREQUENCY OF COUGHING (FOR THOSE INDICATING A CHANGE)

Change in Coughing	N	%
Yes	139	98%
No	3	2%
Total	142	100%
Much Less	136	98%
Less	2	1%
No difference	0	0%
More	0	0%
Much More	1	1%
Don't Know	0	0%
Total	139	100%

Livelihood of The Poor & Access to Energy Services

Fuel sourcing and its impact on livelihood and access to energy were recorded by asking respondents to indicate how they sourced fuel prior to the introduction of the Ecoestufa efficient stove. As Project Scenario 2 combines the stove and filter, making it impossible for respondents to delineate between stove and filter savings, the

following data includes outcomes for the combination of products, not just stoves. Data indicates little change in mode of sourcing fuel with extremely low variance between baseline and project behaviors. Financial and time savings measured as a percentage of money or time spent in the baseline, was significant.

FUEL SOURCING

Fuel Source	Baseline	%	Project	%	Variance %
Buy	112	79%	107	75%	-3.52%
Collect	22	15%	27	19%	3.52%
Both, Mostly Buy	4	3%	4	3%	0.00%
Both, Mostly Collect	4	3%	4	3%	0.00%
Total	142	100%	142	100%	0.00%

FUEL SAVINGS IN TIME AND MONEY

Savings/Week	Baseline	Project	Savings	%
Money (Q)	100.23	27.77	72.46	72%
Time (H)	12.81	6.43	6.38	50%

FUEL SAVINGS COMPARISON

Savings/Week	Week	Month	Annual
Money (USD, FX=\$0.13)	\$9.47	\$37.88	\$454.61
Time (H)	6.38	25.50	306.00

Customer Satisfaction

2 key customer satisfaction indicators are monitored: A gross satisfaction scale wherein respondents are asked to rate their happiness with the stove on a scale of 1 to 100%, and a Net Promoter Score which measures the number of people strongly predisposed to recommending the product to a friend. Both indicate very high degrees of user satisfaction.

User Satisfaction	Net Promoter Score
99.73%	10.0

WCFT MONITORING RESULTS: HH-WT & HH-DUAL WATER FILTERS

OVERVIEW OF SURVEYS CONDUCTED

WCFT monitoring of the water filter component of Project Scenarios 1 and Scenario 2 was conducted separately, but results are presented together for the sake of easy comparison since both Project Scenarios use the same water filter technology, have the same target population, use the same water Emission Reduction equation, and utilize identical water-related survey questions. This allows for easier analysis of reported filter use between households that receive only a filter and those that receive both a filter and a stove.

For WCFT Monitoring, **51** surveys were conducted under Project Scenario 1 and **49** surveys were conducted under Project Scenario 2. All surveys were conducted in-person by the local M&E Team. 6 outliers were identified removed from the Project Scenario 2, and 2 outliers were found from Project Scenario 1. The results for the main quantitative parameters determined in the WCFTs are used in Emissions Reductions (ER) calculations for the Issuance 4 Monitoring Period. The purpose of this monitoring is to investigate and report on the following:

- Filtered water consumption for hygienic purposes ($Q_{p,y}$)
- Continued boiling of filtered water ($Q_{p, \text{cleanboil}}$)
- Seasonal variation in water treatment and consumption (incorporated into Continuous Monitoring)
- Baseline treatment mechanisms

WCFT HOUSEHOLDS BY DEPARTMENT

Department	HH-DUAL	%	HH-WT	%
Alta Verapaz	10	20%	10	19%
Baja Verapaz	29	59%	0	0%
Guatemala	10	20%	0	0%
Chimaltenango	0	0%	12	23%
Escuintla	0	0%	29	55%
Total	49	100%	51	100%

Within the Continuous Monitoring framework, a full MS/US is conducted within every WCFT household. MS/US surveys are also conducted on households that do not participate in WCFTs as the sampling requirement for MS/US surveys is much higher than for WCFTs. Including an MS/US survey in every WCFT household allows the PP to replace many of the redundant qualitative questions normally included with the WCFT with the more comprehensive MS/US survey questions. This has two benefits:

1. Every household surveyed receives the most comprehensive monitoring available, producing more robust and complete data.

2. MS/US results between WCFT and non-WCFT households can be compared and analyzed to identify trends or anomalies.

WATER CONSUMPTION AND BOILING

On each day of the test, WCFT households were asked to quantify the number of people using treated water over the previous 24 hours and to list the various uses for treated water. Each respondent was then asked pour the amount of water utilized over the previous 24 hours for drinking, washing hands and washing fruits and vegetables into a measuring container to ascertain the amount of treated water used for hygienic purposes, and then to pour the amount of water utilized over the previous 24 hours for cooking, washing dishes and bathing into a measuring container to ascertain the amount of treated water used for non-hygienic purposes. Finally, respondents were asked whether (other than for the purposes of cooking already quantified) they had boiled any treated water over the previous 24 hours, and if so, for what purposes.

Enumerators measured the total quantity of water consumed by measuring the amount of water in liters (L) in the household prior to the 24-hour use period and then measuring the amount of water remaining after that period. Enumerators measured various uses of water by taking daily measurements of each specific use. The tables below present the average hygienic water consumption per person per day (L) and the average quantity of treated water that is still boiled for both Project Scenarios.

QUANTITY OF SAFE WATER CONSUMED & BOILED, PER PERSON, PER DAY (L) (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

Parameter	HH-WT	HH-DUAL	Definition
Q _{p,y}	2.66	2.44	Quantity of safe water supplied by project technology (in Liters) and consumed for hygienic purposes in the project scenario p per person per day.
Q _{p,cleanboil}	0.00	0.00	Quantity of treated water supplied by project technology (in Liters) and still boiled in the project scenario p per person per day

Q_{p,y} STATISTICAL ANALYSIS (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

Q _{p,y}	Avg. (L)	SDEV	90% CI	Precision	90/10?	N
hh-wt	2.66	1.10	0.25	9.56%	Yes	51
hh-dual	2.44	0.99	0.24	9.73%	Yes	49

Qp, cleanboil STATISTICAL ANALYSIS (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

Qp, cleanboil	Avg. (L)	SDEV	90% CI	Precision	90/10?	N
hh-wt	0.00	0.00	0.00	0.00%	Yes	51
hh-dual	0.00	0.00	0.00	0.00%	Yes	49

Qp, cleanboil measured zero for both Project Scenarios. While in previous issuances Qp, cleanboil was measurable, it was extremely small. In this issuance the PP sought to clarify whether respondents previously understood the question regarding Qp, cleanboil clearly. In reviewing previous surveys it became clear that some respondents considered the cooking of soup or tea as having boiled treated water. However all cooking activity is already captured in non-hygienic uses which include cooking, and therefore Qp, cleanboil was, in essence, double counting some water use. For issuance 4, the PP refined the WCFT question on boiling to read, *“Other than for cooking soups or hot beverages like coffee or tea, did you boil any of the water you filtered in the last 24 hours in order to purify it?”*. If the respondent answered “yes”, they were then asked why they chose to boil the water and to list the purposes for which the water was boiled. This refined line of questioning clarified the issue for respondents and resulted in a more accurate outcome for the parameter.

A breakdown of water consumption by Project Scenario, day and use is presented below:

HH-WT CONSUMPTION BY DAY AND TYPE (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

HH-WT	Day 1	Day 2	Day 3	AVG
TOT Water Consumed/HH	12.90	11.16	14.09	12.72
TOT Non-Hygienic Use/HH	1.08	1.22	0.98	1.09
Avg # of Users/HH	4.86	4.49	4.48	4.86

HH-DUAL CONSUMPTION BY DAY AND TYPE (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

HH-DUAL	Day 1	Day 2	Day 3	AVG
TOT Water Consumed/HH	13.52	12.82	13.16	13.17
TOT Non-Hygienic Use/HH	2.14	2.52	3.12	2.59
Avg # of Users/HH	4.80	4.92	4.92	4.80

MS/US MONITORING RESULTS: HH-WT & HH-DUAL WATER FILTERS

OVERVIEW OF SURVEYS CONDUCTED

As with WCFTs, MS/US monitoring is conducted for both Project Scenario 1 & 2 separately. However, as the demographics for both groups are similar, all MS/US data related to both project scenarios is presented side by side below for the sake of easy comparison.

For MS/US Monitoring, 120 surveys were conducted under Project Scenario 1 and 149 surveys were conducted under Project Scenario 2. From the 118 surveys used, 16 were done for Year 2, deciding to get a conservative approach for this year. As per methodological allowance, all MS and US Surveys were conducted on the same sample population and in-person by the local M&E Team. Two outliers were identified and were removed from the Project Scenario 1 raw data during analysis. Seven outliers were identified and removed from the Project Scenario 2 raw data during analysis. The results for the key quantitative and qualitative parameters determined in the MS/US Surveys are used in Emissions Reductions (ER) calculations for the Issuance 4 Monitoring Period and presented below. The purpose of this monitoring is to investigate and report on the following:

- Cumulative sales-weighted usage rate (Up,i,y)
- Number of persons consuming treated water per household
- Seasonal variation in water treatment and consumption (incorporated into Continuous Monitoring)
- Baseline treatment methods & technologies
- Sustainable development indicators

MS/US HOUSEHOLDS BY DEPARTMENT

Department	HH-WT	%	HH-DUAL	%
Alta Verapaz	21	18%	64	46%
Baja Verapaz	8	7%	44	31%
Chimaltenango	12	10%	0	0%
Escuintla	61	52%	0	0%
San Marcos	0	0%	12	8%
Jalapa	12	10%	0	0%
Guatemala	0	0%	22	15%
Sacatepequez	4	3%	0	0%
Total	118	100%	142	100%

USAGE RATE & USERS PER FILTER

The GS methodology requires that “a usage parameter be established to account for drop off rates as project technologies age and are replaced”. The survey used a combination of questions to determine the weighted usage parameter based on several factors. For enumerator assessment, the enumerator commented on whether the

filter was filled or wet, in working condition and whether the respondent was using it properly. To determine binary and rate of usage, the enumerator requested a cup of water to drink and observed whether the respondent used the filter to provide it. The enumerator then asked how often the respondent used the filter (pre-determined list of options) and if there was ever a time when the respondent did not use the filter.

Per the GS methodology TPDDTEC, a single usage parameter that is weighted based on drop off rates that are representative of the age distribution for project technologies in the total sales record is used to calculate ERs. Although the PP has strong evidence of filters working effectively in the field as long as 4 years, for the sake of conservatism the PP has elected to include only filters 2 years of age or less for crediting purposes and thus only two age groups of filters are considered in the surveys. As filters reach 25 months of age they are automatically excluded from crediting. The total usage rate is determined by dividing the households that meet all usage criteria by the total number of households surveyed, and takes into account continued use of baseline stoves for certain cooking practices.

The monitoring results are used for year 1 and a conservative approach is used for year 2 as it's explained in Section "Deviation from Gold Standard" in page 6.

ACTIVE FILTER UNITS BY AGE

Project Scenario	Age 0-1	%	Age 1-2	%
hh-wt	16,569	50%	16,220	50%
hh-dual	227	22%	806	78%

KEY USAGE PARAMETERS USED IN THE CALCULATION OF ERS (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

Parameter	HH-WT	HH-DUAL	Definition
Up,y	96.88%	99.63%	Cumulative usage rate for technologies in project scenario p, for technology i, during year y, based on cumulative installation rate and drop off rate.
Persons per filter	5.03	5.24	Number of persons consuming water supplied by project scenario per technology per day.
LPG Users who Boil	3.57%	1.01%	Portion of users of project safe water supply who were boiling water using LPG

PERSONS PER FILTER (CONTINUOUS MONITORING SEASONALITY-INCORPORATED DATA)

Persons per filter	Avg. (L)	SDEV	90% CI	Precision	90/10?	N
hh-wt	5.03	1.95	0.30	5.91%	Yes	118

hh-dual	5.24	1.96	0.27	5.21%	Yes	142
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The usage rates of both Project Scenarios represent the percentage of households meeting all usage criteria that align with the GS rule update, “Guidelines for carrying out usage surveys for projects implementing household water filtration technologies”. The fixed Cj parameter from baseline and previous issuance monitoring indicates that 9.32% of the population in hh-wt and 9.17% of the population in hh-dual were already using a non-boiling safe water supply. The PP has thus applied a Cj adjustment factor to each Project Scenario accordingly.

USAGE CRITERIA FROM GS RULE UPDATE, “GUIDELINES FOR CARRYING OUT USAGE SURVEYS FOR PROJECTS IMPLEMENTING HOUSEHOLD WATER FILTRATION TECHNOLOGIES”

Topic	HH-WT	HH-DUAL	Question(s)
Binary Usage	100%	100%	Is there ever a time when the respondent does not use the filter? (answers transposed to reflect positive vs. negative)
Water treated?	100%	100%	Request a glass of water and note the source from which the water is taken. Is the water sourced from the filter?
Correct Use?	100%	99.02%	Observe whether the respondent is using the filter correctly. Is the filter being used correctly?
Filter Has Water/Wet?	98.75%	100%	Check the interior of the filter. Does it have water or is the ceramic filter wet?
Filter is Functional?	100%	100%	Is the filter functioning properly? Is the ceramic broken or cracked? Are the spigot and bucket working as intended?
Frequency of Use?	100%	98.72%	Is frequency of use greater than 50% of usable days?

BASELINE STOVE & FUEL TYPE

The MS/US also sought to confirm baseline stove and fuel used for boiling water for the purpose of ER calculations. The majority of households used only wood fuel in the baseline as their main fuel for boiling water.

BASELINE FUEL USED FOR BOILING

Baseline Fuel for Boiling	HH-WT	%	HH-DUAL	%
Wood	48	87%	97	98%
Coal	0	0%	0	0%
Gas	2	4%	2	2%
Biogas	0	0%	0	0%
Other	5	9%	0	0%
TOTAL	55	100%	99	100%
Users who boiled with LPG	2	4%	1	1%

Of those households who boiled water in the baseline, only a small minority used gas (LPG) to complete the task. The % of LPG users who treated water by boiling in the baseline have been deducted from ER calculations by adjusting the parameter $N_{p,y}$ as applicable.

BASELINE STOVE USED FOR BOILING

Baseline Stove for Boiling	HH-WT	%	HH-DUAL	%
Open Fire	48	87%	97	98%
Plancha	5	9%	0	0%
Unimproved Charcoal	0	0%	0	0%
Gas	2	4%	2	2%
Other	0	0%	0	0%
TOTAL	55	100%	99	100%

Similarly, before receiving the filter, the vast majority of the population used a wood burning stove (either open fire or plancha-style stove) to boil water.

SUSTAINABLE DEVELOPMENT INDICATORS

Water Quality & Quantity

Self-reported indicators of water quality and quantity show positive changes in comparison to the baseline. Respondents were asked about the taste of treated water, if they felt like they had more or less access to clean water and whether they noticed a reduction in stomach illnesses with the Ecofiltro vs the baseline.

PERCEIVED TASTE OF WATER IN COMPARISON TO BASELINE

Taste of Water	HH-WT	%	HH-DUAL	%
Better than before	116	99%	142	100%
Same as before	1	1%	0	0%
Worse than before	0	0%	0	0%
Total	117	100%	142	100%

PERCEIVED ACCESS TO WATER IN COMPARISON TO BASELINE

Access to Water	HH-WT	%	HH-DUAL	%
Better than before	116	99%	142	100%
Same as before	1	1%	0	0%
Worse than before	0	0%	0	0%
Don't know	0	0%	0	0%
Total	117	100%	142	100%

PERCEIVED CHANGES IN FREQUENCY OF STOMACH ILLNESSES

Incidence of Stomach Illness	HH-WT	%	HH-DUAL	%
Much Less	107	92%	123	87%
Less	2	2%	12	8%
No difference	7	6%	7	5%
More	0	0%	0	0%
Much More	0	0%	0	0%
Don't Know	0	0%	0	0%
Total	116	100%	142	100%

Livelihood of The Poor

Fuel sourcing and its impact on livelihood were recorded by asking respondents to indicate how they sourced fuel prior to the introduction of the Ecofiltro. Unlike the rest of this section of the document, the following data is reported only for HH-WT filters. HH-DUAL filter is inextricably linked to the stove in terms of fuel and time savings, and thus that data can be found in the section “MS/US MONITORING RESULTS: HH-DUAL EFFICIENT STOVES”. Data indicates extremely low variance between baseline and project behaviors.

FUEL SOURCING

Fuel Source	Baseline	%	Project	%	Variance %
Buy	62	53%	62	53%	-0.46%
Collect	47	41%	50	43%	2.22%
Both, Mostly Buy	3	3%	3	3%	-0.02%
Both, Mostly Collect	4	3%	2	2%	-1.74%
Total	112	100%	113	100%	0.00%

FUEL SAVINGS IN TIME AND MONEY

Savings/Week	Baseline	Project	Savings	%
Money (Q)	46.57	40.47	6.10	13%
Time (H)	6.99	5.53	1.46	21%

FUEL SAVINGS COMPARISON

Savings/Week	Week	Month	Annual
Money (USD, FX=\$0.13)	\$0.80	\$3.19	\$38.25
Time (H)	1.46	5.83	69.94

Customer Satisfaction

2 key customer satisfaction indicators are monitored: A gross satisfaction scale wherein respondents are asked to rate their happiness with the technology on a scale of 1 to 100%, and a Net Promoter Score which measures the number of people strongly predisposed to recommending the product to a friend. Both indicate very high degrees of user satisfaction.

USER SATISFACTION

	Satisfaction	Net Promoter Score
HH-WT	99.66%	9.98
HH-DUAL	98.85%	10.0

WATER QUALITY MONITORING

The PP conducted microbiological Presence/Absence (P/A) tests to determine the effectiveness of the project technologies as they age. Ecofiltro's manufacturer's specifications state that the filter has a minimum lifespan of 2 years, and has been shown to last for more than 4 years when used and maintained correctly. For the sake of conservatism, the PP has elected to include only filters 2 years of age or younger for crediting, and thus testing.

The last 5 to 7 households monitored in each region from the randomly selected monitoring list were used for water quality testing, assuring the selection of households was unbiased and representative of the population.

Surveyors collected 100ml samples of water directly from the filter using a sterilized beaker and latex gloves. The samples were then sealed and placed in a protective box for transport to laboratories for testing. Independent, 3rd party laboratories were selected to conduct testing based on geographic proximity to the field sample collection point to minimize possible contamination during travel and to assure that all samples were delivered within 8 hours of sampling.

WHO and Guatemalan standards consider safe drinking water as containing less than 1 Colony Forming Unit (CFU) of E.Coli/100 ml of water. The labs used for testing conducted a controlled analysis of water samples to measure for the levels of Ecoli in the water samples. As per Guatemalan and World Health Organization Standards, and as consistent with the methodology and PDD, any filter samples exceeding 1 CFU of Ecoli per 100 ml were considered to have failed the test.

WQT HOUSEHOLDS BY DEPARTMENT

Department	N	%	Department	N	%
Alta Verapaz	10	14%	Peten	0	0%
Baja Verapaz	29	41%	Quetzaltenango	0	0%
Chimaltenango	0	0%	Quiche	0	0%
Chiquimula	0	0%	Retalhuleu	0	0%
El Progreso	0	0%	Sacatepequez	0	0%
Escuintla	21	30%	San Marcos	0	0%
Guatemala	10	15%	Santa Rosa	0	0%
Huehuetenango	0	0%	Solola	0	0%
Izabal	0	0%	Suchitepequez	0	0%
Jalapa	0	0%	Totonicapan	0	0%
Jutiapa	0	0%	Zacapa	0	0%

WQT LAB TESTING PASS RESULTS

Passing Filter %	HH-DUAL	HH-WT
Age 0-1	95.00%	89.00%
Age 1-2	95.24%	100.00%

PROJECT LEAKAGE ASSESSMENT

Below is the leakage assessment for each potential source of leakage as defined in the GS TPDDTEC methodology and PDD:

LEAKAGE SOURCE 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.

Assessment: No leakage.

Justification: 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 and this trend is not reversed by the project activity. 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. 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.

LEAKAGE SOURCE 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.

Assessment: No leakage.

Justification: There is no evidence that the project increases the use of higher emission fuels outside the project boundary where lower emitting energy sources were formerly used. Wood fuels remain a valuable and declining resource and this trend is not reversed by the project activity. 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.

LEAKAGE SOURCE 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.

Assessment: No leakage.

Justification: The Project Proponent has determined that total number of people reached by all activities of GS1321 is less than 1.4% of the total Guatemalan population, and thus its effects on the national NRB value are currently negligible.

In addition to GS 1321, there are currently two registered efficient stove projects in Guatemala that account for NRB in their baseline:

- GS 1377 Utsil Naj —Casa saludable para todos, located in Sacatepaquez, Guatemala, is a Gold Standard project activity registered under a Latin American PoA.
- CDM 8480 Distribution of Onil Stoves, Guatemala, a CDM PoA with project activities managed by Helps International country-wide in Guatemala.

Despite each having been registered for several years, neither the Utsil Naj, nor the Onil project have requested issuance, suggesting that neither has been successful implementing meaningful numbers of stoves. The Utsil Naj project was initially projected as a small scale project that would produce fewer than 10,000 tonnes of VERs per year, and thus even at full-scale implementation, would have a negligible impact on NRB. The Onil PDD projects the sale of up to 50,000 stoves per year from a base of 4,500 in the first year of the project (2008). Richard Grinnell, former President of Helps International, estimates that the organization has distributed approximately 10,000 stoves per year since 2009, but has not been able to exceed that level of annual sales to date. Conservative estimates of technology distribution through these two projects are placed at 15,000 per annum. Adding GS 1321 sales figures for 2014 to this base amount, total annual stove distribution volumes are estimated to be below 20,000 units per year. Annual water filter volumes are estimated at 30,000 per year.

Third party baseline analysis completed for GS 1321 placed annual NRB at 15,006,365 tonnes per year in Guatemala. With a population of approximately 15,000,000, this equates roughly to one tonne per person per year, or 5.66 tonnes per household per year. Guatemala's annual growth rate is estimated to be 2.5% by the Population Reference Bureau⁶. That growth rate equates to 66,000 additional households per year, and a corresponding increase of approximately 375,000 tonnes in annual NRB. Conservatively assuming a 70% reduction in fuel use per technology-household, project interventions would need to achieve a distribution rate of 94,000 units per year to offset the current annual rate of increase in NRB.

Using a simpler point of comparison, total annual technology distribution from GS1321 and other projects currently impacts only 1.4% of the population, approximately 1.1% below the annual growth rate, rendering the effects on NRB negligible in that they merely slow the increase in annual NRB rather than reducing it.

Given all of these factors, the Project Proponent has determined that GS1321 does not significantly affect the national NRB value and is unlikely to within its projected crediting period.

See detailed values used for calculating NRB leakage assessments on the following page.

⁶ <http://www.prb.org/Publications/Datasheets/2011/world-population-data-sheet/guatemala.aspx>

NRB Leakage Analysis	Value	Unit	Source
Current NRB in Guatemala	15,006,365	t/year	3 rd party baseline analysis
Population of Guatemala	15,073,375	persons	http://www.ine.gob.gt/sistema/uploads/2014/02/26/5eTCcFIHErnaNVeUmm3iabXHaKgXtw0C.pdf
Average HH Size	5.69	persons	Annex 6 GS1321 Iss 1 HH WCFT MS US Report
Population of Guatemala (households)	2,649,099	HHs	Calculated
Approximate NRB allocation/HH	5.66	t/year	Calculated
Annual Population Growth Rate	2.50%	%	http://www.prb.org/Publications/Datasheets/2011/world-population-data-sheet/guatemala.aspx
Annual HH Growth Rate Equivalent (HHs)	66,227	HHs	Calculated
Annual NRB Contribution from Pop. Growth	375,159	t/year	Calculated
Households Receiving Technologies (GS 1321)	30,000	units/year	ISS 2 Total Sales Record Average
Households Receiving Technologies (other)	15,000	units/year	Conservatively Estimated
Average Fuel Savings/Technology	70%	%	ISS 3 ER Calculations rounded up
Annual NRB Reduction from Technology Dist.	178,438	t/year	Calculated
% of population represented by current sales	1.70%	%	Calculated
Annual Distribution Required to Offset NRB Growth Rate	94,611	units/year	Calculated

LEAKAGE SOURCE 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.

Assessment: No leakage.

Justification: MS/US monitoring determined that more than 27% of stove users use the Ecoestufa to heat their home. However, the overwhelming majority of these households indicated that they achieve heating by letting the fire from cooking die out (i.e. they do not specifically light a fire in the stove for this purpose), also indicating that they use the same or a lesser amount of fuel for heating relative to the amount they used on their old stove. Further, the large majority of users have removed their old stove technology from the home in consideration of warranty requirements that stipulate that the warranty is only valid if the old technology is removed from the home. Thus it can be concluded that there are negligible changes in the amount of fuel used for heating after the introduction of the Ecoestufa.

LEAKAGE SOURCE 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.

Assessment: No leakage.

Justification: MS/US monitoring shows that a small percentage (<5%) of users have switched from using fuels and technologies considered higher efficiency in the baseline to only using firewood after receiving the Ecoestufa. The overwhelming majority of respondents reported using fuelwood on a stove with lower efficiency than the Ecoestufa in the baseline. Since the percentage of respondents using technologies with lower emissions than the Ecoestufa in the baseline (LPG and biogas stoves) is so small (<5%), leakage from fuel switching is considered negligible.

NEXT MONITORING PERIOD:

FAR FOR NEXT ISSUANCE

Issued: Deviation Request The Gold Standard.

By: The Gold Standard

Description: PD shall reassess the ERs obtained from the adjusted value using a measured value for the same age-groups at the time of next issuance request (MP5). If the issued ERs for 2nd year (MP4) using the adjusted value are more than those using the reassessed, measured value (MP5), PD will be asked to compensate the emission reductions from MP5. If less, no extra emission reductions can be claimed. PP shall note that the Usage Survey requirements will apply for MP5, however, for the purposes of comparing the adjusted value, the cap will not apply.

EMISSIONS REDUCTIONS EQUATIONS & CALCULATIONS

IMPROVED COOKSTOVES

$$ER_y = (N_{p,y,ics} * U_{p,l,y} * P_{p,b,y,ics} * NCV_{b,fuel} * ((f_{NRB,b,y} * EF_{wood,CO2} + EF_{wood,nonCO2}) - \sum LE_{p,y})^7$$

Where:

Parameter	Value	Unit	Definition
$f_{nr,b,y,ics-nb}$	96%	Percentage	Non-renewable fraction of the woody biomass harvested in the project collection area in year y
$P_{p,b,y,ics-nb}$	0.02068	tons/technology-day	Specific fuel savings for an individual technology of project scenario 2 against an individual technology of baseline scenario in year y, in tons/technology-day, as derived from the statistical analysis of the data collected from the field tests
$U_{p,1,ics-nb}$	93.55%	Percentage	Usage rate in project scenario p, for technology ics-nb, during year 1
$U_{p,2,ics-nb}$	92.39%	Percentage	Usage rate in project scenario p, for technology ics-nb, during year 2
NCV_{wood}	0.0156	TJ/ton	Net calorific value of wood (TJ/Gg)
$EF_{b,wood,CO2}$	112,000	kg CO ₂ /TJ	IPCC default value for wood fuel CO ₂ emission factor
$EF_{b,wood,CH4}$	300	kg CH ₄ /TJ	CH ₄ emission for wood fuel
$EF_{b,wood,N2O}$	4	kg N ₂ O/TJ	N ₂ O emission factor for wood fuel
GWP_{CO2}	1	kg CO ₂ /kg CO ₂	Global warming potential of CO ₂
GWP_{CH4}	21	kg CO ₂ /kg CH ₄	Global warming potential of CH ₄
GWP_{N2O}	310	kg CO ₂ /kg N ₂ O	Global warming potential of N ₂ O
$N_{p1,ics-nb}$	1,263,145	technology-days	Cumulative number of project technology-days included in the project database for project scenario p for technology ics-nb against baseline scenario b in year 1
$N_{p2,ics-nb}$	1,275,754	technology-days	Cumulative number of project technology-days included in the project database for project scenario p for technology ics-nb against baseline scenario b in year 2

⁷ Note to convert EF_{fuel,nonCO2} to CO₂ equivalents the following formula is used: $EF_{fuel,nonCO2} = (EF_{wood,CH4} * GWP_{CH4}) + (EF_{wood,N2O} * GWP_{N2O})$

$LE_{p,y,ics-nb}$	0	tCO ₂ e/yr	Leakage for project scenario p, technology ics-nb, in year y (tCO ₂ e/yr)
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WATER FILTERS

Project Scenario Fuel Consumption Calculation:

The PP eliminated $Q_{p,rawboil,y}$ from the equation as per the guidance in GS June 2012 TAC update which allows the PP to apply a cap of 6 l/p/d for the amount of water treated by the water treatment technology for drinking water, hand washing and food washing instead of monitoring the raw water boiled in the project situation.

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

Where:

HH-WT

Parameter	Value	Unit	Definition
C_j	9.32%	percentage	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
$N_{p,1,wt}$	22,200,433	persons/day/technology	Number of person consuming water supplied by project scenario per technology per day in year 1
$N_{p,2,wt}$	50,690,548	persons/day/technology	Number of person consuming water supplied by project scenario per technology per day in year 2
$W_{b,y,unimproved}$	0.00072	tons wood / liter	Existing biomass stove performance in baseline for water treatment unit l in year y in cluster c
$Q_{p,y}$	2.66	Litres / person / day	Quantity of safe water in liters consumed in the project scenario p and supplied by project technology per person per day.
$Q_{p, rawboil, y}$	NA	liters / person / day	Quantity of raw water still boiled in the project scenario

HH-DUAL

Parameter	Value	Unit	Definition
C_j	9.17%	percentage	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
$N_{p,1,wt}$	3,961,230	persons/day/technology	Number of person consuming water supplied by project scenario per technology per day in year 1

$N_{p,2,wt}$	859,558	persons/day/technology	Number of person consuming water supplied by project scenario per technology per day in year 2
$W_{b,y,unimproved}$	0.00072	tons wood / liter	Existing biomass stove performance in baseline for water treatment unit I in year y in cluster c
$Q_{p,y}$	2.44	Litres / person / day	Quantity of safe water in liters consumed in the project scenario p and supplied by project technology per person per day.
$Q_{p, rawboil, y}$	NA	liters / person / day	Quantity of raw water still boiled in the project scenario

EMISSION REDUCTIONS

$$BE_{b,y,wt} = B_{b,y,wt} * ((f_{NRB,b,y,wt} * EF_{b,fuel, CO2}) + EF_{b,fuel, nonCO2}) * NCV_{b, fuel} \text{ (3)}^8$$

$$PE_{p,y,wt} = B_{p,y,wt} * ((f_{NRB,p,y,wt} * EF_{p,fuel, CO2}) + EF_{p,fuel, nonCO2}) * NCV_{p, fuel} \text{ (4)}^9$$

Where:

DEFAULT VALUES

Parameter	Value	Unit	Definition
$f_{nr,b,y,wt}$	95.74%	Percentage	Non-renewable fraction of the woody biomass harvested in the project collection area in year y
NCV_{wood}	0.0156	TJ/ton	Net calorific value of wood (TJ/Gg)
$EF_{b,wood,CO2}$	112,000	kg CO2/TJ	IPCC default value for wood fuel CO2 emission factor
$EF_{b,wood,CH4}$	300	kg CH4/TJ	CH4 emission for wood fuel
$EF_{b,wood,N2O}$	4	kg N2O/TJ	N2O emission factor for wood fuel
$EF_{p,wood,CO2}$	112,000	kg CO2/TJ	IPCC default value for wood fuel CO2 emission factor
$EF_{p,wood,CH4}$	300	kg CH4/TJ	CH4 emission for wood fuel
$EF_{p,wood,N2O}$	4	kg N2O/TJ	N2O emission factor for wood fuel

⁸ Note to convert EF $EF_{b,fuel,nonCO2}$ to CO₂ equivalents the following formula is used: $EF_{b,fuel,nonCO2} = (EF_{b,wood,CH4} * GWP_{CH4}) + (EF_{b,wood,N2O} * GWP_{N2O})$

⁹ Note to convert EF $EF_{p,fuel,nonCO2}$ to CO₂ equivalents the following formula is used: $EF_{p,fuel,nonCO2} = (EF_{p,wood,CH4} * GWP_{CH4}) + (EF_{p,wood,N2O} * GWP_{N2O})$

GWPCO2	1	kg CO2/kg CO2	Global warming potential of CO2
GWpch4	21	kg CO2/kg CH4	Global warming potential of CH4
GWPN2O	310	kg CO2/kg N2O	Global warming potential of N2O

HH-WT

Parameter	Value	Unit	Definition
Bb,y,wt	124,203.99	Tonnes	Quantity of fuel consumed in baseline scenario b during year y in tonnes
Bp,y,wt	0.00	Tonnes	Quantity of fuel consumed in project scenario b during year y in tonnes

HH-DUAL

Parameter	Value	Unit	Definition
Bb,y,wt	14,094.75	Tonnes	Quantity of fuel consumed in baseline scenario b during year y in tonnes
Bp,y,wt	0.00	Tonnes	Quantity of fuel consumed in project scenario b during year y in tonnes

Overall Water Filter GHG reductions are calculated as follows:

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

Where:

BE_{b,y,wt} and PE_{p,y,wt} are calculated from the parameters above and:

HH-WT

Parameter	Value	Unit	Definition
Up,1,wt	96.88%	Percentage	Usage rate in project scenario p, for technology wt, during year 1
Up,2,wt	88.42%	Percentage	Usage rate in project scenario p, for technology wt, during year 2
LEp,y,wt	0	tCO2e/yr	Leakage for project scenario p, technology wt, in year y

HH-DUAL

Parameter	Value	Unit	Definition
Up,1,wt	99.63%	Percentage	Usage rate in project scenario p, for technology wt, during year 1
Up,2,wt	95%%	Percentage	Usage rate in project scenario p, for technology wt, during year 2
LEp,y,wt	0	tCO2e/yr	Leakage for project scenario p, technology wt, in year y

SUMMARY SALES & DISTRIBUTION USED FOR ER CALCULATIONS

The total sales on which ER Calculations are based for each technology are presented below by Department. Cumulative sales include all sales of stoves from the inception of the program to date as well as all filters 2 years of age and younger. ER Calculations start with these gross sales figures and apply the myriad of parameters derived from monitoring and presented above in order to arrive at a final VER volume for issuance.

The table below indicates cumulative sales by department and Project Scenario.

DEPARTMENT	HH-DUAL	HH-WT	DEPARTMENT	HH-DUAL	HH-WT
Alta Verapaz	1,259	1,324	El Progreso	0	0
Baja Verapaz	1,161	2,164	Quetzaltenango	0	604
Chimaltenango	0	5,663	Quiche	0	5,238
Chiquimula	0	1,740	Retalhuleu	0	576
Escuintla	9	4,683	Sacatepequez	0	1,579
Guatemala	155	2,867	San Marcos	890	286
Huehuetenango	3	1,987	Santa Rosa	0	1,595
Izabal	2	948	Solola	5	2,060
Jalapa	0	1,973	Suchitepequez	20	1,838
Jutiapa	0	1577	Totonicapan	0	115
Peten	0	884	Zacapa	0	1,792
TOTAL				3504	41,492

TOTAL CALCULATED ERs: MONITORING PERIOD 4

Xcel Document *ER Calculations GS1321 Iss 4Year1 070218 & ER Calculations GS1321 Iss 4Year2 070218* contains all Emissions Reductions (ER) calculations for each of the technologies described in this report. There are two tabs for each Project Scenario:

1. "Project Scenario" ER Eqs.
 - a. Provides calculation of the ERs based equations listed above and project monitoring conducted to date and default values (as listed in the Parameter boxes in this report).
 - b. Follows ER equations as listed in the TPDDTEC Methodology.
2. "Project Scenario" Calcs.
 - a. Technology days accrued during this monitoring period are calculated using total sales database.
 - b. Stock turnover rate or inventory lag days are accounted for (where applicable) by the calculation of an inventory lag date (sales date + inventory lag days) which is used to determine the technology years accrued during this MP. The analysis used to determine the number of inventory lag days is found in the Excel file DCD Iss4 Lag Analysis. Where a weighted average was done separating Ecofiltro Sales and NGO's. The result for year 1, was +19 days and it was chosen also for Year 2 in order to get a conservative approach (Real value +1).

The tables below show total CO₂e emissions reductions achieved by the Project during the Monitoring Period by product type and by project scenario, each with Vintage breakdowns.

Cumulative ERs by Project Scenario & Vintage Year 1			2016	2017
hh-dual	54,911	tCO ₂ e	41,251	13,660
hh-wt	66,876	tCO ₂ e	40,667	26,209
Total	121,787	tCO ₂ e	81,917	39,869

Cumulative ERs by Project Scenario & Vintage Year 2			2017	2018
hh-dual	45,858	tCO ₂ e	34,537	11,321
hh-wt	139,364	tCO ₂ e	95,155	44,209
Total	185,222	tCO ₂ e	129,692	55,530

Cumulative ERs by Project Scenario & Vintage Totals			2016	2017	2018
hh-dual	100,769	tCO ₂ e	41,251	48,197	11,321
hh-wt	206,240	tCO ₂ e	40,667	121,364	44,209
Total	307,009	tCO ₂ e	81,917	169,561	55,530

Emission reductions or GHG removals by sinks (t CO ₂ e)	HH-WT	HH-DUAL
Actual values achieved during this monitoring period	206,240	100,769
Values estimated in ex ante calculation of registered PDD	3,707,981	448,129

LIST OF SUPPORTING DOCUMENTS PROVIDED WITH THIS REPORT

- ER Calculations GS 1321 Iss 4Year1 070218
- ER Calculations GS 1321 Iss 4Year2 070218
- MS_US_WCFT_KPT_WQT Data GS1321 Iss4 20180411. xlsx
- Reference Docs [Folder]
 - Guatemala PDD V5_2013-09-20.pdf
 - GS 1321_3-Week Review_II MP_Round II_23092015.pdf
 - Paradigm_GS 1321_FVR 28Sep1015_signed.pdf
 - Ecofiltro_Operations_Manual_V3_20150518.pdf
 - Socorro Maya_Operations_Manual20150518.pdf
 - Sales Data [Folder]
 - FAR Documentation [Folder]
 - Meter Calibration [Folder]
 - WQT Lab Reports [Folder]
 - Continuous GS Monitoring Concept.docx
 - Continuous Monitoring Approval.pdf
 - Annex 5 GS1321 Iss 1 KPT Data v3.xlsx
 - Eko-Stove Manual.pdf
 - Monitoring Report GS1321 Iss 2 20150928FIN
 - NRB Leakage Analysis GS1321 Iss 3 _20160429.xlsx
 - Photos of HH Training [Folder]