

**GS1247 Southern Ethiopia Community Boreholes**

# **Monitoring Report**

**GS 5322, GS5323, GS5324, GS6037, GS6038**

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## 1. Monitoring Report Information

Monitoring Period	<b>MP 1:</b> GS5322: 07/06/2017 – 08/05/2018 GS5323: 10/06/2017 – 08/05/2018 GS5324: 14/06/2017 – 08/05/2018 GS6037: 22/06/2017 – 08/05/2018 GS6038: 14/06/2017 – 08/05/2018
Reference number of the project activity	GS5322, GS5323, GS5324, GS6037, GS6038
Version number of the monitoring report	3
Completion date of the monitoring report	11/05/2018
Prepared By	Emma Donnachie
Total Emissions Reductions (tCO <sub>2</sub> /y)	GS5322: 9155 GS5323: 9007 GS5324: 7305 GS6037: 8688 GS6038: 8891 Total: 43,046

## 2. Project Summary

The project will support the provision of safe water using borehole technology to hundreds of households within the Southern Nations, Nationalities and People's Region (SNNPR), Ethiopia. By providing safe water, the project will ensure that households consume less firewood during the process of water purification and as a result there shall be a reduction of carbon dioxide emissions from the combustion process.

The SNNPR is a largely rural district where local people typically use wood fuel on inefficient three stone fires to purify their drinking, cleaning and washing water. This process results in the release of greenhouse gas emissions from the combustion of wood - this can be avoided if a technology that does not require fuel (wood or fossil) supplies clean water desired by households.

Many existing boreholes are owned by community groups or community based organizations (CBOs) and have fallen into disrepair because maintenance programmes have been poorly managed, or proven too expensive. In this project CO2balance will work with our project partner and community groups in SNNPR, Ethiopia to identify broken down boreholes and renovate them so that they deliver clean, safe water and breakdowns are fixed rapidly. The boreholes included under the project will be entirely human operated and will be fitted with hand pump models that are commonly used in the area, such as India Mark II pumps. The depth of the boreholes will be limited to 100m or less.

25 boreholes were rehabilitated as part of this project between 6<sup>th</sup> June 2017 and 12<sup>th</sup> December 2017. The date, location and number of people served by each borehole is given in the table below, which forms the project database:

GS ID	Borehole ID	Village	Date	No. HHs	No. People
GS5322	VGIF-01-001	Gera - Wucha	09/06/2017	138	631
	VGIF 01-003	Menhariya	15/06/2017	135	661
	VGIF 01-004	Yeduro Gebeya 02	14/06/2017	147	695
	VGIF 01-006	Hayle	06/06/2017	125	677
	VGIF-02-014	Dentale Ber	30/08/2017	125	709
				<b>Total</b>	<b>3373</b>

GS ID	Borehole ID	Village	Date	No. HHs	No. People
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GS5323	VGIF-01-002	Safe - Lechare	10/06/2017	110	598
	VGIF -01 -005	Haerba Hollo	16/06/2017	66	287
	VGIF-01-008	Meda Sefer (Dorze 01)	09/06/2017	135	587
	VGIF-01-009	Afa Hizo	16/06/2017	116	483
	VGSF-01-011	Gebeya Sefer	15/09/2017	400	1400
				Total	<b>3355</b>

GS ID	Borehole ID	Village	Date	No. HHs	No. People
GS5324	VGIF-01-007	Sinsa gitara - Kinchaho	13/06/2017	66	424
	VGIF-01 -012	Tolola Dorsa Isa	17/11/2017	120	574
	VGIF-01-014	Ayira Ade	12/12/2017	155	541
	VGIF-02-003	Keme	17/06/2017	75	429
	VGIF-02-001	Algea Kebele Tima	16/06/2017	66	450
				Total	<b>2418</b>

GS ID	Borehole ID	Village	Date	No. HHs	No. People
GS6037	VGIF-02-002	Algea (Kokale)	21/06/2017	62	308
	VGIF-02-004	Shayita	23/06/2017	88	507
	VGIF-02-007	M/eyesus	18/07/2017	130	728
	VGIF-02-015	Dta ber	31/08/2017	117	617
	VGIF-02-006	Umo Lante (Shola Sir)	20/07/2017	125	667
				Total	<b>2827</b>

GS ID	Borehole ID	Village	Date	No. HHs	No. People
GS6038	VGIF-02-009	Kelateya	13/06/2017	125	684
	VGIF-02-012	Technique Sch. Police Gib	05/07/2017	110	665
	VGIF-02-016	Demashe	14/09/2017	64	386
	VGIF-02-017	Limat Budin 7	20/10/2017	73	358
	VGIF-02-011	Delbo (Tunkala ber)	11/07/2017	154	964
				Total	<b>3057</b>

The rehabilitation date of each borehole was recorded by CO2balance and documented by the Repair Completion Form (RCF); the RCF requires a signature from the borehole pump mechanic. The borehole technician confirms that the borehole is rehabilitated and therefore be eligible to earn carbon credits. Original and digital copies of the RCF are retained, so that the electronic data can be verified at any point.

The number of days each borehole credited for in this monitoring period was multiplied by the number of people using the borehole to give the total number of project technology days for that borehole. The individual project technology days for each borehole were totaled to give the total number of project technology days for this monitoring period.

### 3. Project Location

Below are details of the physical location to allow unique identification of the project. The Southern Nations, Nationalities and People's Region is marked in red below and the specific sub-districts are marked in red on the Google Earth image. The target area and the fuel collection area are defined as being contained within the project boundary, with the outer limits of the project boundary being clearly defined below, as the red and two smaller red regions on this Google Earth file. As the majority of beneficiaries collect their wood fuel locally in close proximity to their homesteads, the wood fuel collection area and target area are considered the same.

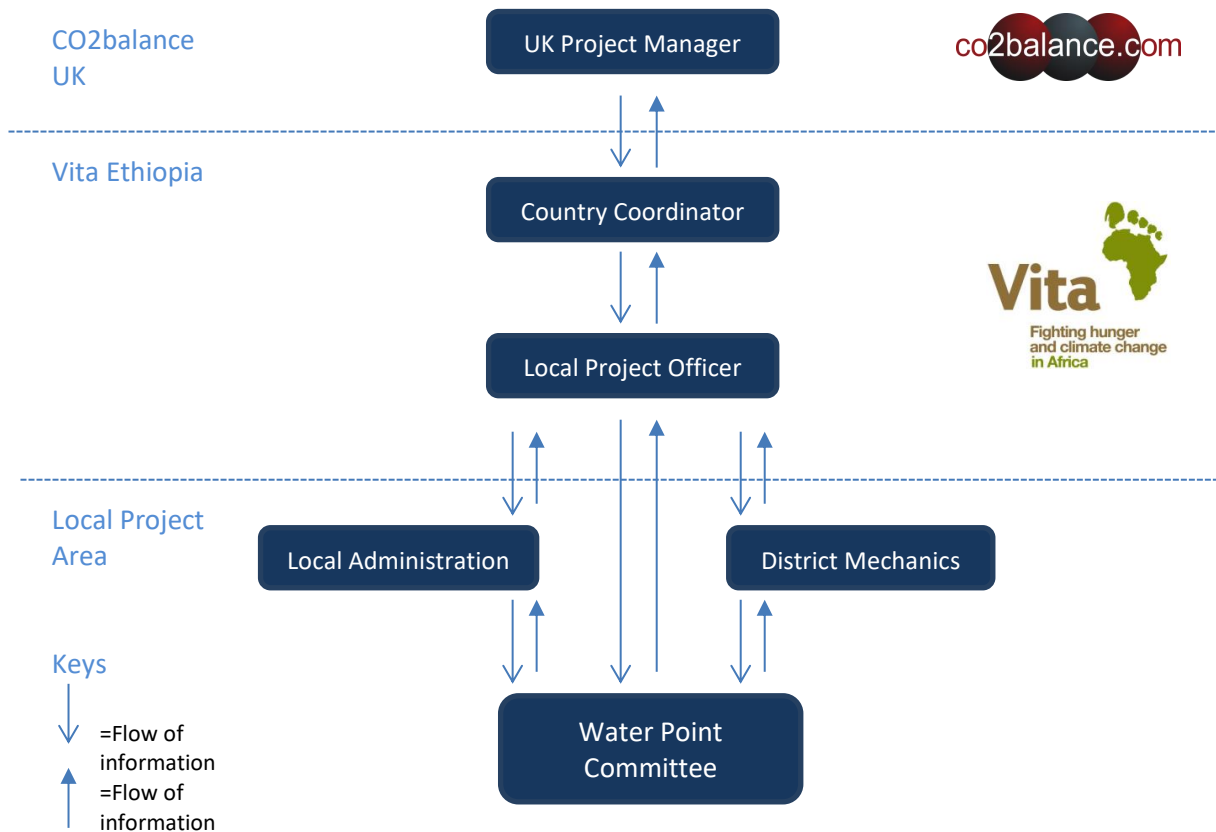




Project Area Coordinates		
	Latitude	Longitude
<b>North</b>	6.543464°	37.805167°
<b>East</b>	6.298847°	37.845369°
<b>South</b>	6.125352°	37.471529°
<b>West</b>	6.250965°	37.482652°

#### 4. Organisational Structure

In this project, CO2balance UK Ltd is the managing entity and is responsible for communication with the Gold Standard. CO2balance work together with project partner Vita and local project field staff who handle all monitoring data collection and processing.



Vita works with the local administration and district mechanics to coordinate rehabilitation and maintenance of the boreholes, as well as the collection of the data to support this process. A permanent project officer is located at the project sites to oversee and coordinate the work completed by the contractors. The project officer is also responsible for coordinating the WASH programme, conducting monitoring exercises and identifying any maintenance works. All data that is collected in the field is processed at the local office and put through a quality control check prior to sending the documents to the CO2balance UK projects team.

## 5. Description of monitoring system

All surveys are administered by trained CO2balance staff and in country partner NGO, Vita, that are local to the area and conversant in the local dialects to ensure that the responses are consistent and not biased by any regional language barriers. Each participant is provided with a briefing on the purpose of the survey and is assured that no individual names are used in the analysis.

The results of the surveys are collated in Excel spreadsheets and stored on a central server in an electronic format. These are then sent to the UK head office for data analysis. The documentation procedure that CO2balance has devised ensures a minimum chance of original data being lost – all original copies of our project documentation are retained in the Ethiopian office and are available scanned upon request of the UK team.

In accordance with the Gold Standard methodology “Technologies and Practices to Displace Decentralized Thermal Energy Consumption” (TPDDTEC), survey samples are randomly selected from the user record using a random sample group (RSG). A random number generator ranks the unique serial numbers of the boreholes in the project, generating the RSG which satisfies 90/30 precision. Each user in the RSG is assigned a unique random number from which survey participants are selected in accordance with the minimum sample size and confidence requirement for each survey. The RSG and survey participants are reselected for every monitoring period to ensure the selection remains random.

The surveys will be conducted so as to ensure that they are within the end date of the respective monitoring periods for each VPA.

Below is a summary of the key information that has been collected and monitored as part of this project.

### 5.1. Project database

The borehole installation/rehabilitation record includes the following information:

- Date of installation/rehabilitation
- Model of the borehole
- Quantity of boreholes installed
- The total number of people obtaining their water from each borehole
- Mode of use: commercial/domestic

The installation record will be backed up electronically, with original documentation being stored in the appropriate office for the respective VPAs.

The project database will be derived from the Installation Record, with project technologies differentiated by different project scenarios (if required).

All data collected in relation to the project will be held in the local office and/or on the Project Database for the entire life cycle of the project and a period of 2 years afterwards. The data may be archived during the project in order to maintain clarity and security

### 5.2. Ongoing Monitoring Studies

The following ongoing monitoring studies were conducted for each project scenario; the results are given in the data tables and analysis that follow in Section 6.

- **Water Consumption Field Test (WCFT):** WCFT is used to determine 3 key parameters:  $Q_{p,y}$  – quantity of safe water in litres supplied in the project scenario using the clean water supply technology;  $Q_{p,rawboil,y}$  – quantity of raw or unsafe water that is still boiled after installation of the water supply technology;  $Q_{p,cleanboil,y}$  – quantity of safe water boiled in the project scenario after installation of the water supply technology. WCFT is completed biennially, prior to first verification and then every other year subsequently.

The measurement method used is similar to the Kitchen Performance Test in which the volume of water consumed in each household is averaged over 3 days. The WCFT is carried out by staff trained by co2balance to meet the specific requirements of the methodology. All data presented in Excel is subject to checking and cross referencing of a sample of the raw data by co2balance UK Ltd.

- **Water Quality Test (WQT):** The quality of the treated water will be assessed to ensure that it is fit for human consumption. It is assessed in accordance with Ethiopian national standards. The parameters used to assess the water quality will be in line with Ethiopian standards for potable water and all parameters will be shown to be within levels considered acceptable for domestic human consumption.
- **Usage Survey:** Usage Survey is used to determine the  $U_{p,y}$  (usage rate in the project scenario  $p$  through year  $y$ ) parameter. As all boreholes will be installed within 1 year of the start of the crediting period and are expected to last the lifetime of the project, minimum samples of 30 for different aged technologies will not be necessary. The annual usage survey is conducted using a minimum sample size of 100
- **Project Survey** – Conducted annually to survey end users currently using project technologies to explore changes in project scenario over time. The annual project survey is conducted using a minimum sample

size of 100. Data collected during the project surveys explores the following characteristics:

- General information – Name, address, telephone number etc
  - Household socio-demographic information
  - Water use and purification characteristics
  - Sources and availability of fuel
- **Leakage** – The potential sources of leakage will be investigated ( $LE_{p,y}$ ). If the assessment quantifies an increase in fuel consumption by the non-project households attributable to the project activity, then calculations will be adjusted to account for this.
  - **Project Technology Days ( $N_{p,y}$ )**- Number of persons consuming water supplied by project scenario  $p$  through year  $y$ . Sum of the total number of people using each borehole in the project multiplied by the number of days crediting each borehole earns in this monitoring period. The total number of households using each borehole will be determined through information supplied by our NGO partner. Using this method, the total number of people using each borehole will be known and hence a figure for person days can be calculated. All monitoring tasks will be selected at random

Individual participants were selected from the borehole user data base using the random sampling process outlined in the monitoring plan. Sample sizes are in line with the Gold Standard requirements.

### 5.3. Cross Sampling

The project proponent has elected to cross- sample technologies across all its homogenous borehole VPAs located within Chenchu and Mirab Abaya woredas. Homogenous VPAs are defined as those that share a common baseline. Individual participants will be selected from the project database using the RSG process outlined in Section 5. Sample sizes are in line with the Gold Standard requirements as defined by the methodology.

Cross sampling will be applied to the following surveys:

- Project Surveys – completed annually
- Usage Surveys – completed annually
- Water Consumption Field Tests – completed biennially

As detailed in the Monitoring Plan, surveys are conducted through use of a Random Sample Group (RSG). The size of the sample group is selected so the number of boreholes to be sampled satisfies the 90/30 precision rule. A random number generator ranks the unique serial numbers of the boreholes in the project, generating a RSG. The sample group is reselected for every monitoring period to ensure the selection remains random. In this Monitoring Period, the minimum recommended sample size of the RSG to meet 90/30 precision was 7 boreholes. To ensure precision, 8 boreholes were selected for monitoring. The individual participants surveyed from the RSG are selected at random from the project database using the same random number generator process, in accordance with the minimum sample size requirement for each survey (as detailed in sections 8.2, 8.3, and 8.4 below).

## 6. Fixed Parameters

The following data was fixed at validation.

Data / Parameter:	$C_j$
Data unit:	Percentage

Description:	Portion of users of project safe water supply who were already in baseline using a non-boiling safe water supply.
Source of data used:	Baseline study.
Value applied:	15.07%
Justification of the choice of data or description of measurement methods and procedures actually applied:	The portion of safe water users is determined through the baseline project survey and refers to the number of users that already use safe water from water sources such as boreholes.
Any comment:	-

Data / Parameter:	EF <sub>b,co2</sub>
Data unit:	tco <sub>2</sub> /TJ
Description:	co <sub>2</sub> emission factor arising from use of fuels in baseline scenario
Source of data used:	IPCC default value
Value applied:	112
Justification of the choice of data or description of measurement methods and procedures actually applied:	Deemed valid by Methodology
Any comment:	-

Data / Parameter:	EF <sub>b,non co2</sub>
Data unit:	tco <sub>2</sub> /TJ
Description:	Non-co <sub>2</sub> emission factor arising from use of fuels in baseline scenario
Source of data used:	IPCC default value
Value applied:	8.692
Justification of the choice of data or description of measurement methods and procedures actually applied:	Deemed valid by Methodology
Any comment:	-

Data / Parameter:	EF <sub>p,co2</sub>
Data unit:	tco <sub>2</sub> /TJ
Description:	co <sub>2</sub> emission factor arising from use of fuels in project scenario
Source of data used:	IPCC default value
Value applied:	112
Justification of the choice of data or description of measurement methods and procedures actually applied:	Deemed valid by Methodology
Any comment:	-

Data / Parameter:	$EF_{p,non\ CO_2}$
Data unit:	tCO <sub>2</sub> /TJ
Description:	Non-CO <sub>2</sub> emission factor arising from use of fuels in project scenario
Source of data used:	IPCC default value
Value applied:	8.692
Justification of the choice of data or description of measurement methods and procedures actually applied:	Deemed valid by Methodology
Any comment:	-

Data / Parameter:	$NCV_b$
Data unit:	TJ/ton
Description:	Net calorific value of the fuels used in the baseline
Source of data used:	IPCC default value
Value applied:	0.0156
Justification of the choice of data or description of measurement methods and procedures actually applied:	Deemed valid by Methodology
Any comment:	-

Data / Parameter:	$NCV_p$
Data unit:	TJ/ton
Description:	Net calorific value of the fuels used in the project
Source of data used:	IPCC default value
Value applied:	0.0156
Justification of the choice of data or description of measurement methods and procedures actually applied:	Deemed valid by Methodology
Any comment:	-

Data / Parameter:	$f_{NRB,i,y}$
Data unit:	Fractional non-renewability
Description:	Non-renewability status of woody biomass fuel in scenario i during year y
Source of data used:	CDM Default National Figure - <a href="https://cdm.unfccc.int/DNA/fNRB/index.html">https://cdm.unfccc.int/DNA/fNRB/index.html</a>
Value applied:	0.88
Justification of the choice of data or description of measurement methods	The UNFCCC CDM default fNRB value for the Federal Democratic Republic of Ethiopia expired in April 2017. In absence of an updated value, the previously approved value shall be used, however this will be updated once a revised figure is put forward for the CDM default value. If the UNFCCC updated value is higher than the previously approved

and procedures actually applied:	value, then the previously approved value shall be used. In other circumstances, the updated value by the UNFCCC shall be used, maintaining conservativeness.
Any comment:	-

Data / Parameter:	$W_{b,y}$
Data unit:	T/litre
Description:	Quantity of fuel that is used to treat 1 litre of water in the baseline scenario b during year y
Source of data to be used:	Baseline Water Boiling Test
Value of data applied for the purpose of calculating expected emission reductions	0.001270
Description of measurement methods and procedures to be applied:	The baseline water boiling test is used to determine the amount of wood used to purify 1 litre of water by boiling. This data is gathered according to: <i>Technologies and Practices to Displace Decentralized Thermal Energy Consumption Version 1, Draft General Guidelines On Sampling And Surveys</i> ; EB37 Annex 27; and <i>Standard For Sampling And Surveys For CDM Project Activities and Programme of Activities (Version 02)</i> ; EB65 Annex 2
Any comment:	

Data / Parameter:	$W_{p,y}$
Data unit:	T/litre
Description:	Quantity of fuel that is used to treat 1 litre of water in the project scenario p during year y
Source of data to be used:	Baseline Water Boiling Test
Value of data applied for the purpose of calculating expected emission reductions	0.001270
Description of measurement methods and procedures to be applied:	The baseline water boiling test is used to determine the amount of wood used to purify 1 litre of water by boiling. This data is gathered according to: <i>Technologies and Practices to Displace Decentralized Thermal Energy Consumption Version 1, Draft General Guidelines On Sampling And Surveys</i> ; EB37 Annex 27; and <i>Standard For Sampling And Surveys For CDM Project Activities and Programme of Activities (Version 02)</i> ; EB65 Annex 2
Any comment:	

Data / Parameter:	Non Suppressed demand
Data unit:	Percentage
Description:	Percentage of premises that in the absence of the project activity would have used non-GHG emitting technologies like chlorine treatment techniques (if available) in the project boundary,
Source of data used:	Baseline study. Credible literature, studies, survey, reports, relevant to the project target area
Value applied:	10.60%

Justification of the choice of data or description of measurement methods and procedures actually applied:	Suppressed demand will be determined through a set of questions in the project survey that establish the method households use to purify their water, if any, and how they would choose to purify if they were not subject to monetary and access barriers. This is in line with the Gold Standard principles of suppressed demand outlined in Annex 2. A fixed suppressed demand baseline has been opted for, however, in the event the project surveys show a substantial change in fuel use characteristics, a new baseline shall be conducted.
Any comment:	-

## 7. Monitored Parameters

As outlined in section 5.2 the following parameters are monitored in line with the methodological requirements and monitoring plan. The results are given in the parameter boxes below followed by an analysis of the surveys in section 8.

Data / Parameter:	$N_{p,y}$
Data unit:	Project Technology Days
Description:	Number of persons consuming water supplied by project scenario p through year y
Source of data to be used:	Project Database
Value of data applied for the purpose of calculating expected emission reductions	GS5322: 1,059,661 GS5323: 974,027 GS5324: 603,876 GS6037: 823,647 GS6038: 882,051
Description of measurement methods and procedures to be applied:	Sum of the total number of people using each borehole in the project multiplied by the number of days crediting each borehole earns in a given monitoring period.
Any comment:	

Data / Parameter:	$U_{p,y}$
Data unit:	Percentage
Description:	Usage rate in project scenario p through year y
Source of data to be used:	Annual Usage Survey
Value of data applied for the purpose of calculating expected emission reductions	100%
Description of measurement methods and procedures to be applied:	The usage survey has been carried out by trained local staff to meet the specific requirements of the methodology. All data presented in excel is subject to checking and cross referencing of a sample of the raw data by CO2balance UK Ltd
Any comment:	

Data / Parameter:	$Q_{p,y}$
Data unit:	Litres per person per day

Description:	Quantity of safe water supplied in the project scenario p during the year y using the zero or low emissions clean water supply technology
Source of data to be used:	Water Consumption Field Test (WCFT)
Value of data applied for the purpose of calculating expected emission reductions	7.5
Description of measurement methods and procedures to be applied:	Method used similar to Kitchen Performance Test in which the volume of water consumed in each household is averaged over 3 days. Volume capped at 7.5 litres per person per day as per the methodology The WCFT will be carried out by trained local staff to meet the specific requirements of the methodology. All data presented in excel is subject to checking and cross referencing of a sample of the raw data by CO2balance UK Ltd
Any comment:	

Data / Parameter:	Qp,cleanboil,y
Data unit:	Litres per person per day
Description:	Quantity of safe water boiled in the project scenario p during the year y using the zero or low emissions clean water supply technology
Source of data to be used:	Water Consumption Field Test (WCFT)
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied:	Method used similar to Kitchen Performance Test in which the volume of water consumed in each household is averaged over 3 days. The WCFT has been carried out by trained localstaff to meet the specific requirements of the methodology. All data presented in excel is subject to checking and cross referencing of a sample of the raw data by CO2balance UK Ltd.
Any comment:	

Data / Parameter:	Qp,rawboil, y
Data unit:	Litres per person per day
Description:	The raw of unsafe water that is still boiled after installation of the water treatment technology
Source of data to be used:	
Value of data applied for the purpose of	0

calculating expected emission reductions	
Description of measurement methods and procedures to be applied:	Method used similar to Kitchen Performance Test in which the volume of water consumed in each household is averaged over 3 days. The WCFT has been carried out by trained local staff to meet the specific requirements of the methodology. All data presented in excel is subject to checking and cross referencing of a sample of the raw data by CO2balance UK Ltd
Any comment:	

Data / Parameter:	Quality of Treated Water
Data unit:	Parameters as per national standards
Description:	Performance of the treatment technology
Source of data to be used:	Laboratory Tests
Value of data applied for the purpose of calculating expected emission reductions	Pass
Description of measurement methods and procedures to be applied:	The Water and Irrigation Development Bureau has certified each water supply as line with national standards.
Any comment:	

Data / Parameter:	LEp,y
Data unit:	tCO2e per year
Description:	Leakage in project scenario p during year y
Source of data to be used:	Baseline and monitoring surveys
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied:	Assessed every two years using baseline and monitoring surveys
Any comment:	

## 8. Survey Analysis

### 8.1. Sampling

Surveys are conducted through use of a Random Sample Group (RSG) in accordance with 90/30 precision. The individual participants surveyed from the RSG are selected at random from the project database, in accordance

with the methodology's minimum sample size requirement for each survey, as detailed in Section 8.2, 8.3, and 8.4 below.

## **8.2. Water Consumption Field Test**

The Water Consumption Field Test was carried out on a randomly selected sample of 40 households from the project database. This complies with the recommended minimum sample size of 30 in the Gold Standard requirements. Furthermore, the sample confidence interval is within 10% of the mean.

Between 8-12 staff carried out the test over a period of four days (1 day preparation and 3 days measurement) following a similar method as the Kitchen Performance Test, and all tests were conducted between 18/04/2018 – 21/04/2018. The total litres of water consumed each day was measured and divided by the number of people consuming water in that day – this measurement was repeated over 3 consecutive days and an overall average per household was calculated. The results showed that on average 8.85 litres of non-boiled clean water used only for drinking, hand washing and food preparation (capped at 7.5l) and 0 litres of boiled clean water is consumed per person per day.

The total amount of water credited for in this monitoring period is equal to the average amount of clean non-boiled water consumed per person per day (7.5l), minus the average amount of boiled clean water consumed per person per day (0).

## **8.3. Usage Survey**

The usage survey establishes the proportion of beneficiaries that use the boreholes, a key parameter in the emission reduction calculations. As all the boreholes were installed within 1 year of the start of the crediting period and are expected to last the lifetime of the project, minimum samples of 30 for different aged technologies are not necessary. Therefore the annual usage survey has been conducted using a minimum sample size of 100.

The first usage surveys in this monitoring period were carried out by 8-12 staff between the 18/04/2018 – 21/04/2018. The households that participated in the survey were randomly selected from the project database. The results confirmed that 100% of the respondents and their family members use the boreholes that were rehabilitated by Vita.

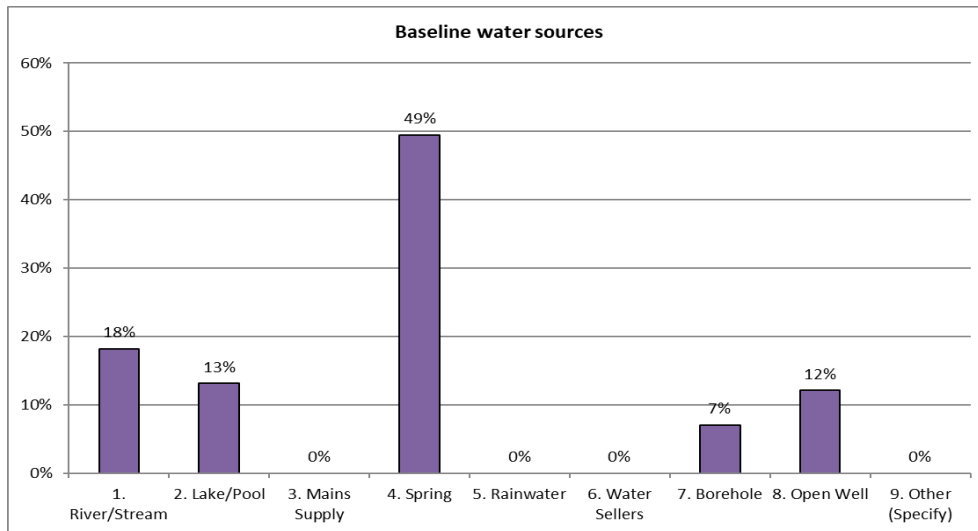
## **8.4. Project Survey Analysis**

Project surveys were conducted by 8-12 staff between 18/04/2018 – 21/04/2018 on 100 randomly selected households from across the homogenous VPAs in Mirab Abaya and Chenchaworedas to explore changes in the project scenario (demographics, water use and purification practices etc) over time.

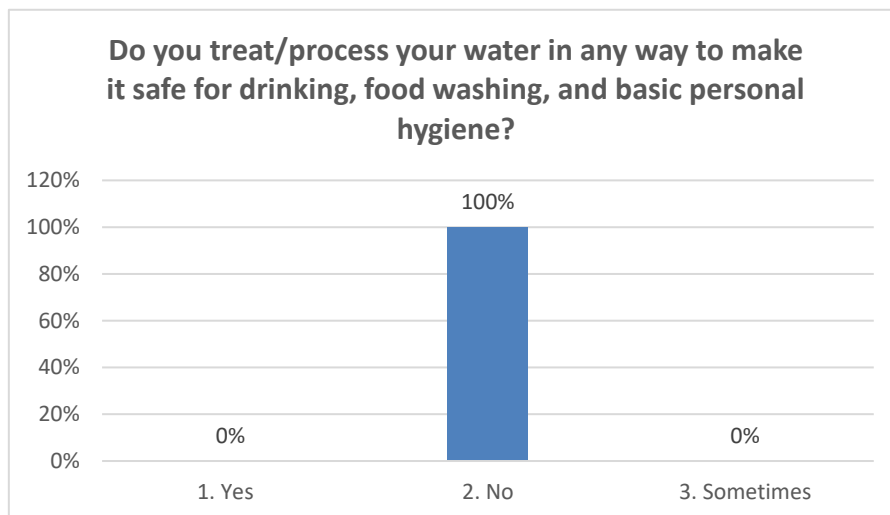
Data collected during the project surveys includes the following:

- General information - Name, address, telephone number etc.
- Household socio-demographic information.
- Water use and purification characteristics.
- Sources and availability of fuel.

Prior to the rehabilitation of the boreholes in Mirab Abaya and Chenchaworedas 43% of the respondents considered their water to be unsafe to drink and collected their water from contaminated sources such as open wells and rivers. Boiling water was the preferred method used to make water safe to drink.



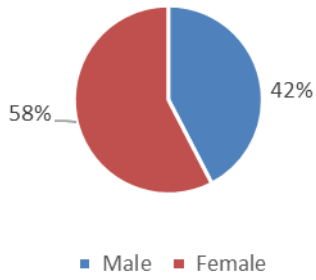
The results from the usage survey conducted showed that 100% of the respondents now collect their water from improved sources which have been rehabilitated as part of the project activity. This indicates a major improvement over the baseline and highlights that there is no longer a need for people to purify their water, further demonstrated by the graph below.



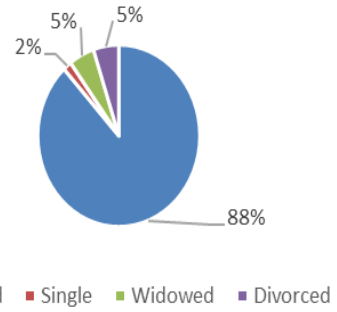
### Socio-Demographic Characteristics

Analysis of the Project Survey results found that there have not been any significant changes in the socio-demographic characteristics of marital status, education and employment among the users. The Project Survey showed an increase of female users, who represented 58% of users as opposed to 24% in the baseline.

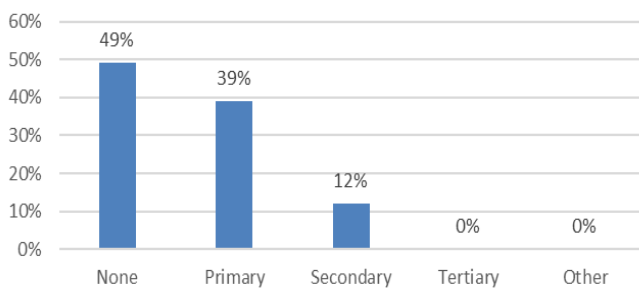
Gender



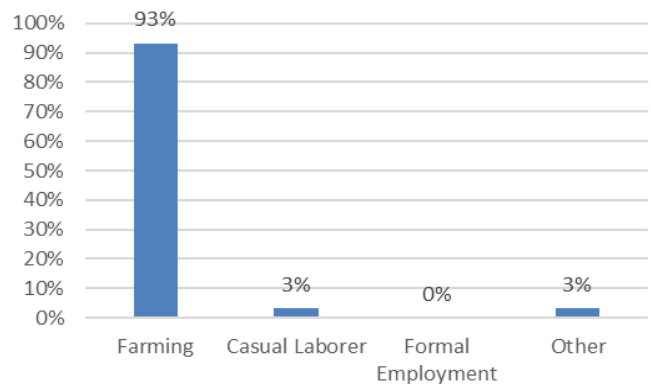
Marital Status



Education Level

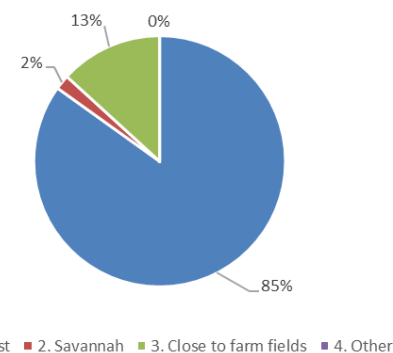


Main Income Source

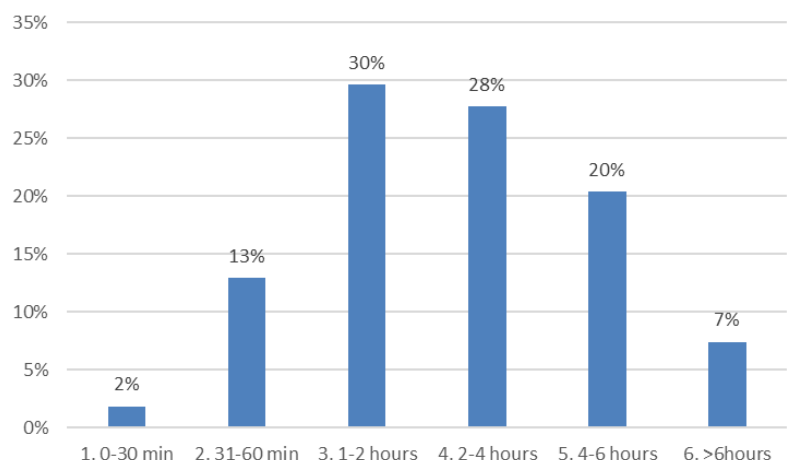


98% of households collect fuel from local forests, or close to farm fields. This takes the majority of respondents (57%) between 1-2 hours and 2-4 hours. 7% of participants record it can take them up to 6 hours to collect wood fuel. The average amount of time spent collecting wood fuel is 2.84 hours, the average amount of time spent collecting wood in the baseline was 3.02 hours. This represents a time saving on 0.18 hours per day (or 6% time reduction). This saved energy and time can enable households to pursue other economic and domestic activities.

Woodfuel collection source



Time spent collecting fuel per day



## 8.5. Leakage Assessment

The potential sources of leakage listed in the methodology have been investigated, and addressed below:

*a) 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.*

In all cases the baseline technologies displaced are three stones; these have no market value and are not a product as such. There is nothing limiting the use of three stone cooking across the country (the technology is lowest rung on the energy ladder and the price is zero), which is why this cooking method is so widespread. In any case the primary purpose of these three rocks is for cooking so they will not be replaced/displaced in their entirety as a result of this project - which means they will not be reused outside the project boundary. This leakage source can therefore be discounted.

*b) 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.*

There is no evidence to suggest significant (if any) use of renewable energy for purifying water in the project region as found in the Baseline Water Surveys. As solar purification devices are not used, renewable energy used for purifying water would likely be animal dung or crop residues which will be used due to ease of availability/proximity to the home rather than due to a shortage of wood fuel, therefore it is an independent factor. This leakage source can therefore be discounted.

*c) 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.*

There are currently no other CDM or VER projects in the project area, however, this will be reviewed biennially.

*d) 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.*

The space heating effect of boiling water for purification purposes will be minimal, as the predominant use of baseline technology is for cooking. Therefore it is highly unlikely that another technology will be used for heating when users no longer boil water.

*e) By virtue of promotion and marketing of 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.*

This project is not marketing efficient technology; it is eliminating the need for a fuel based technology to deliver pure water. Lower emission technology substitution within households is therefore not possible and this leakage source can therefore be discounted.

A value of 0 is applied for leakage, which will be monitored biennially, following first verification as per the requirements of the methodology.

## 9. Sustainable Development Indicators

The following indicators were considered by an independent objective observer to be of most importance to this project and were accordingly monitored:

No	1
Indicator	Air quality
Mitigation measure	None

<i>Repeat for each parameter</i>		
Chosen parameter		Total suspended matter (TSPM)- measured indirectly by wood consumption
Current situation of parameter		As determined by research and field staff, traditional methods used for boiling water with biomass fuel produce large amounts of TSPM. It is not justifiable to measure this quantitatively but it will be measured qualitatively as described below
Estimation of baseline situation of parameter		Quantitatively, the baseline situation is one which smoke is emitted by fires used to boil water.
Future target for parameter		The project aims to reduce wood consumption and hence make a reduction in the defined parameter. This will be indicated by any reported reduction in wood fuel use in the project scenario as determined by surveys of the target population
Way of monitoring	How	Project surveys, Usage surveys
	When	Annually
	By who	Expert surveying team

As reported by the project survey, no combustion technologies are now used in this project to purify water and 100% of people state that they do not still purify their water. The baseline survey revealed use of combustion technologies as the main method for purifying water (81%). The baseline survey also indicated a number of people who highlighted reasons that they did not always purify their water which can be attributed to suppressed demand. As the project has eliminated the need for combustion of wood to purify water, it is self-evident that wood consumption will be dramatically reduced and we score this indicator positively.

No	2	
Indicator	Livelihood of the poor	
Mitigation measure	None	
<i>Repeat for each parameter</i>		
Chosen parameter		Time and effort spent purifying and collecting water. This project will supply pure water and for those that previously had to purify water, it will mean that less time and effort is spent collecting fuel for this purpose and also for the act of purifying itself.  Boreholes are usually located in a central place, so the rehabilitation of them should mean that, overall, the time and effort spent collecting water is reduced for the community.
Current situation of parameter		The time and effort spent collecting wood fuel is significant within the project boundary.
Estimation of baseline situation of parameter		On average, 3.02 hours per day is spent collecting wood fuel.
Future target for parameter		Time and effort spent collecting wood fuel to purify water is reduced significantly
Way of monitoring	How	Project KPT or usage survey and/or monitoring survey
	When	Annually
	By who	Expert surveying team

The baseline survey indicated that 49% of respondents spent between 2-4 hours collecting firewood each day and a further 25% spent over 4 hours per day. The baseline survey indicated that on average respondents spent 3.02 hours collecting wood fuel a day. This represents a significant amount of time and much of this firewood will have been used for water purification. The monitoring surveys showed that 57% of respondents gave reasons why they could not always purify their water, including 'it takes too long to collect fuel', and 'it is hard to find fuel', we can derive from this that the time spent collecting wood would be considerably more if not for suppressed demand. The usage survey shows all households use water sources improved by the project activity, and the project survey

shows that no households now purify water as the water is already safe. The project survey shows that the average amount of time spent collecting wood fuel is 2.84 hours, which represents a time saving on 0.18 hours per day (or 6% time reduction). This contributes to a time saving and we score the indicator positively as a result.

No	3	
Indicator	Human and Institutional capacity	
Mitigation measure	None	
<i>Repeat for each parameter</i>		
Chosen parameter	WASH and environmental awareness training	
Current situation of parameter	Prior to the Project the communities received no Water, Sanitation and Health (WASH) training	
Estimation of baseline situation of parameter	0 WASH trainings	
Future target for parameter	1 WASH training	
Way of monitoring	How	WASH training records, Usage Survey
	When	Annually
	By who	Expert surveying team

The quality of water is vital for the communities. The WASH programme provides training and education regarding hygiene and sanitation. Bad hygiene and lack of education are serious causes for water diseases. Following the repair of each borehole CO2balance's project partner Vita conducted a WASH meeting with the borehole resource committee and community members during which all the key aspects of sustainable borehole management were discussed. The agenda has been uploaded to the Gold Standard Registry along with the participant's lists. As the target for this parameter has been met, the indicator has been scored positively.

### 9.1. Greivance mechanism

Field staff are in regular contact with the communities and the Water Committees. A log book for any feedback and comments is held at each borehole, and comments are collected once a week from all beneficiary kebeles and given to the woreda water and energy development office and the office of our project partner; no feedback has been received in the log books but field staff report positive feedback from the community.

## 10. Calculations

### Baseline Emissions

$$BE_{b,y} = B_{b,y} * \left( (fNRB_y * EF_{b,fuel,co2}) + EF_{b,fuel,nonco2} \right) * NCV_{b,fuel}$$

Where:

$$B_{b,y} = (1 - C_j) * N_{j,y} * W_{i,y} * (Q_{p,y} + Q_{p,rawboil,y}) \quad (11)$$

Where:

$N_{j,y}$	Number of person.days consuming water supplied by project scenario p through year y <sup>47</sup>
$C_j$	Expressed as a percentage, this is the portion of users of the project technology j who in the baseline were already consuming safe water without boiling it
$B_{b,y}$	Quantity of fuel consumed in baseline scenario b during the year y in tons
$Q_{p,y}$	Quantity of safe water in litres consumed in the project scenario p and supplied by project technology per person per day
$Q_{p,rawboil,y}$	Quantity of raw water boiled in the project scenario p per person per day
$W_{b,y}$	Quantity of fuel in tons required to treat 1 litre of water using technologies representative of baseline scenario b during project year y, as per Baseline Water Boiling Test.

### Project Emissions

$$PE_{p,y} = B_{p,y} * \left( (fNRB_y * EF_{p,fuel,co2}) + EF_{p,fuel,nonco2} \right) * NCV_{p,fuel}$$

Where:

$$B_{p,y} = (1 - C_j) * N_{p,y} * W_{p,y} * (Q_{p,rawboil,y} + Q_{p,cleanboil,y})$$

Where:

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

### Overall Emission Reductions

$$ER_y = ((\Sigma BE_{b,y} - \Sigma PE_{p,y}) * U_{p,y} - \Sigma LE_{p,y}) * (1 - X_{boil})$$

Where:

$U_{p,y}$	Cumulative usage rate for technologies in project scenario p during year y, based on cumulative installation rate and drop off rate.
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The results also consider the discounted fraction of non-suppressed demand users (xboil). For full calculations please see accompanying 'ER Calcs' Spreadsheets.

**Application of the 10,000 tCO<sub>2</sub>e/year ER cap:**

The total emission reductions for each VPA have been capped where they would exceed 10,000 tCO<sub>2</sub>e/year. The cap is applied based on calculating the Capped ER per PTD based on a 365 day crediting period for each VPA. The Capped ER/ PTD is then multiplied by the the total amount of PTDs credited in this monitoring period for each VPA.

## 11. Summary of Emissions Reductions per VPA

### MP 1

#### GS 5322

#### Emission Reductions

2017 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	8,498
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Emission Reductions	Ery	tCO2/y	8,498
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	Xboil	Percentage	10.60%
<b>Emission Reductions</b>	<b>ERy</b>	<b>tCO2/y</b>	<b>7597</b>
Capped ERs			
<b>Capped Emission Reductions</b>	<b>ERy</b>	<b>tCO2/y</b>	<b>5425</b>

2018 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	5,843
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Emission Reductions	Ery	tCO2/y	5,843
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	Xboil	Percentage	10.60%
<b>Emission Reductions</b>	<b>ERy</b>	<b>tCO2/y</b>	<b>5223</b>
Capped ERs			
<b>Capped Emission Reductions</b>	<b>ERy</b>	<b>tCO2/y</b>	<b>3730</b>

Total Capped ERs for MP 1		
Emissions Reductions		
<b>2017</b>		<b>5425</b>
<b>2018</b>		<b>3730</b>
<b>Total ERs for MP 1</b>		<b>9155</b>

Emission Reductions by Vintage-Capped	
Year	Ers
<b>2017</b>	5425
<b>2018</b>	3730
<b>Total</b>	<b>9155</b>

**GS 5323**

**Emission Reductions**

<b>2017 Emission Reductions</b>			
<b>Emissions Reductions</b>			
Baseline emissions per year	BE <sub>b,y</sub>	tCO <sub>2</sub> /y	7,370
Project emissions per year	PE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Usage rate	Up,y	fraction	1
Leakage	LE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Emission Reductions	E <sub>ry</sub>	tCO <sub>2</sub> /y	7,370
<b>Suppressed Demand Assessment</b>			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	X <sub>boil</sub>	Percentage	10.60%
<b>Emission Reductions</b>	<b>E<sub>Ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>6589</b>
<b>Capped ERs</b>			
<b>Capped Emission Reductions</b>	<b>E<sub>Ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>5036</b>

<b>2018 Emission Reductions</b>			
<b>Emissions Reductions</b>			
Baseline emissions per year	BE <sub>b,y</sub>	tCO <sub>2</sub> /y	5,811
Project emissions per year	PE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Usage rate	Up,y	fraction	1
Leakage	LE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Emission Reductions	E <sub>ry</sub>	tCO <sub>2</sub> /y	5,811
<b>Suppressed Demand Assessment</b>			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	X <sub>boil</sub>	Percentage	10.60%
<b>Emission Reductions</b>	<b>E<sub>Ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>5195</b>
<b>Capped ERs</b>			
<b>Capped Emission Reductions</b>	<b>E<sub>Ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>3971</b>

<b>Total ERs for MP 1</b>			
<b>Emissions Reductions</b>			
<b>2017</b>			<b>5036</b>
<b>2018</b>			<b>3971</b>
<b>Total ERs for MP 1</b>			<b>9007</b>

<b>Emission Reductions by Vintage-Capped</b>	
<b>Year</b>	<b>Ers</b>
<b>2017</b>	5036
<b>2018</b>	3971
<b>Total</b>	<b>9007</b>

## GS 5324

### Emission Reductions

2017 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	3,984
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Emission Reductions	Ery	tCO2/y	3,984
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	Xboil	Percentage	10.60%
<b>Emission Reductions</b>	<b>Ery</b>	<b>tCO2/y</b>	<b>3561</b>

2018 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	4,188
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Emission Reductions	Ery	tCO2/y	4,188
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	Xboil	Percentage	10.60%
<b>Emission Reductions</b>	<b>Ery</b>	<b>tCO2/y</b>	<b>3744</b>

Total ERs for MP 1		
Emissions Reductions		
<b>2017</b>		<b>3561</b>
<b>2018</b>		<b>3744</b>
<b>Total ERs for MP 1</b>		<b>7305</b>

Emission Reductions by Vintage-Capped	
Year	Ers
<b>2017</b>	3561
<b>2018</b>	3744
<b>Total</b>	<b>7305</b>

## GS 6037

### Emission Reductions

2017 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BE <sub>b,y</sub>	tCO <sub>2</sub> /y	6,249
Project emissions per year	PE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Usage rate	Up <sub>y</sub>	fraction	1
Leakage	LE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Emission Reductions	E <sub>ry</sub>	tCO <sub>2</sub> /y	6,249
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	X <sub>boil</sub>	Percentage	10.60%
<b>Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>5586</b>
<b>Capped Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>4871</b>

2018 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BE <sub>b,y</sub>	tCO <sub>2</sub> /y	4,897
Project emissions per year	PE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Usage rate	Up <sub>y</sub>	fraction	1
Leakage	LE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Emission Reductions	E <sub>ry</sub>	tCO <sub>2</sub> /y	4,897
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	X <sub>boil</sub>	Percentage	10.60%
<b>Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>4378</b>
<b>Capped Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>3817</b>

Total ERs for MP 1		
Emissions Reductions		
<b>2017</b>		<b>4871</b>
<b>2018</b>		<b>3817</b>
<b>Total ERs for MP 1</b>		<b>8688</b>

Emission Reductions by Vintage-Capped	
Year	Ers
<b>2017</b>	<b>4871</b>
<b>2018</b>	<b>3817</b>
<b>Total</b>	<b>8688</b>

## GS 6038

### Emission Reductions

2017 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BE <sub>b,y</sub>	tCO <sub>2</sub> /y	6,642
Project emissions per year	PE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Usage rate	Up <sub>y</sub>	fraction	1
Leakage	LE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Emission Reductions	E <sub>ry</sub>	tCO <sub>2</sub> /y	6,642
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	X <sub>boil</sub>	Percentage	10.60%
<b>Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>5938</b>
Capped ERs			
<b>Capped Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>4947</b>

2018 Emission Reductions			
Emissions Reductions			
Baseline emissions per year	BE <sub>b,y</sub>	tCO <sub>2</sub> /y	5,295
Project emissions per year	PE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Usage rate	Up <sub>y</sub>	fraction	1
Leakage	LE <sub>p,y</sub>	tCO <sub>2</sub> /y	0
Emission Reductions	E <sub>ry</sub>	tCO <sub>2</sub> /y	5,295
Suppressed Demand Assessment			
Percentage of suppressed demand users			89.40%
Percentage of <b>non</b> -suppressed demand users	X <sub>boil</sub>	Percentage	10.60%
<b>Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>4734</b>
Capped ERs			
<b>Capped Emission Reductions</b>	<b>E<sub>ry</sub></b>	<b>tCO<sub>2</sub>/y</b>	<b>3944</b>

Total ERs for MP 1		
Emissions Reductions		
<b>2017</b>		<b>4947</b>
<b>2018</b>		<b>3944</b>
<b>Total ERs for MP 1</b>		<b>8891</b>

Emission Reductions by Vintage-Capped	
Year	Ers
<b>2017</b>	4947
<b>2018</b>	3944
<b>Total</b>	<b>8891</b>