GS1247 Improved Kitchen Regimes - Zoba Debub Community Boreholes, Eritrea

Monitoring Report

GS 5038, GS 5039, GS 5040, GS 5041,

GS 5042, GS 5043

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1. Monitoring Report Information

Monitoring Period	MP 1 GS5038: 20/10/2016 – 19/10/2017 GS5039: 20/10/2016 – 19/10/2017 GS5040: 22/10/2016 – 21/10/2017 GS5041: 22/10/2016 – 21/10/2017 GS5042: 25/10/2016 – 24/10/2017 GS5043: 21/10/2016 – 20/10/2017
Reference number of the project activity	GS 5038, GS 5039, GS 5040, GS 5041, GS 5042, GS 5043
Version number of the monitoring report	1.0
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2. Project Summary

In Eritrea over 45% of the rural population do not have access to safe water and rely exclusively on unprotected wells, lakes and other open water sources that are highly susceptible to contamination. Annexed from Ethiopia in 1962, the country has experienced periodic conflict and continuing tensions in the region.

Armed conflict, mandatory military service and external migration, takes men away from their villages and means that many rural families are headed by women, often widows. Female headed households in Eritrea face several disadvantages and as a result they cultivate less land and have fewer assets. These women then bear the burden of producing food as well as providing care for their families, including travelling to collect firewood and water.

Many existing boreholes in Eritrea and have fallen into disrepair because maintenance programmes have been poorly managed, or proven too expensive leaving people without access to clean water. CO2balance's project partner Vita has worked to identify broken down boreholes, renovate them and supply a maintenance programme to ensure that clean, safe water is delivered as a result of this project. The boreholes included under the project are entirely human operated and fitted with hand pump models that are commonly used in the area such as Afridev, U3 Modified and India Mark II pumps.

Zoba Debub is a largely rural district in which many 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 which can be avoided if a technology that does not require fuel (wood or fossil) supplies clean water desired by households. By providing safe water this project ensures that households consume less firewood during the process of water purification and therefore reduce greenhouse gas emissions from the combustion process. In total 68 boreholes were rehabilitated as part of this project between the 20th October 2016 and 25th March 2017. The date, location and number of people served by each borehole are given in the table below, which forms the project database:

VPA-DD	GS ID	Borehole ID	Village	Date	No. HHs	No. People	Capped people
65	5038	ZD 037	Adiembahsea	20/10/2016	137	590	590
65	5038	ZD 050	Adiferas-Maygoduf	27/10/2016	130	586	586
65	5038	ZD 103	Adideraghudi	27/12/2016	185	870	870
65	5038	ZD 107	Adiburkut	29/12/2016	210	877	877
65	5038	ZD 112	Betghebriel	26/01/2017	138	674	674
65	5038	ZD 114	Adenfi	29/01/2017	81	390	390
65	5038	ZD 127	Dekilefey	19/02/2017	197	782	782
65	5038	ZD 129	Arazn	22/02/2017	190	787	787
65	5038	ZD 132	Aditelae	24/02/2017	195	757	757

65	5038	ZD 135	Adikolakul	16/03/2017	48	217	217
65	5038	ZD 138	Adiraghenay	18/03/2017	70	314	314
66	5039	ZD 038	Adighubo	20/10/2016	124	535	535
66	5039	ZD 039	Kesadburka	21/10/2016	59	271.8	271.8
66	5039	ZD 040	Adichoka	21/10/2016	119	569	569
66	5039	ZD 045	Adimenekseyto	24/10/2016	110	356	356
66	5039	ZD 052	Saloda	28/10/2016	102	415	415
66	5039	ZD 101	Endagergis	25/12/2016	225	907	907
66	5039	ZD 108	Kuhulizbi	03/01/2017	224	877	877
66	5039	ZD 119	Adimesghan	18/01/2017	37	181	181
66	5039	ZD 133	Una Welesti	25/02/2017	35	136	136
66	5039	ZD 139	Adihans	19/03/2017	241	1095	1095
66	5039	ZD 142	Adihidug	20/03/2017	93	383	383
66	5039	ZD 143	Aditsetser	21/03/2017	224	1133	1133
67	5040	ZD 042	Adimighidereber	22/10/2016	55	225	225
67	5040	ZD 044	Adimesraha	23/10/2016	153	729	729
67	5040	ZD 104	Adi Guwur	27/12/2016	120	519	519
67	5040	ZD 105	Adibaresom	28/12/2016	99	449	449
67	5040	ZD 110	Kusmodengolo	24/01/2017	209	778	778
67	5040	ZD 115	Dembesilase	30/01/2017	194	988	988
67	5040	ZD 116	Adilghese	31/01/2017	177	833	833
67	5040	ZD 117	Adighad 2	17/01/2017	115	455	455
67	5040	ZD 124	Ghenetseba	28/02/2017	159	711	711
67	5040	ZD 125	Maichena	15/02/2017	186	796	796
67	5040	ZD 136	Endabaynas	17/03/2017	121	565	565
68	5041	ZD 043	Adiqelqelmelasa	22/10/2016	46	157	157
68	5041	ZD 049	Adiaregen	26/10/2016	156	669	669
68	5041	ZD 102	Himbar	25/12/2016	151	839	839
68	5041	ZD 111	Adihdug	25/01/2017	127	623	623
68	5041	ZD 113	Unagaaben	27/01/2017	182	798	798
68	5041	ZD 120	Adighodo	18/01/2017	140	569	569
68	5041	ZD 121	Adizebe	26/02/2017	74	297	297
68	5041	ZD 122	Adihabenat	27/02/2017	157	693	693
68	5041	ZD 130	Wulusho 1	23/02/2017	152	725	725
68	5041	ZD 147	Adimerobi	23/03/2017	171	778	778
68	5041	ZD 150	Gezaterer	24/03/2017	167	725	725
69	5042	ZD 046	Adigolo-Imbasoyra	25/10/2016	71	173	173
69	5042	ZD 047	Adimelhdaga	25/10/2016	139	590	590
69	5042	ZD 051	Adikaribosa maygoduf	27/10/2016	41	185	185
69	5042	ZD 106	Adiguer	28/12/2016	105	483	483
69	5042	ZD 118	Adighad 1	17/01/2017	115	491	491
69	5042	ZD 126	Adiflho	18/02/2017	195	757	757
69	5042	ZD 128	Chearegahit	20/02/2017	106	419	419

69	5042	ZD 131	Wulusho 2	23/02/2017	153	594	594
69	5042	ZD 137	Adiserenta	17/03/2017	104	434	434
69	5042	ZD 145	Mekabirtsabla	22/03/2017	198	864	864
69	5042	ZD 148	Adihawya	23/03/2017	227	1060	1060
69	5042	ZD 149	Adinaamn	23/03/2017	198	977	977
70	5043	ZD 041	Dibdib	21/10/2016	127	572	572
70	5043	ZD 048	Ambesetegeleba	26/10/2016	103	419	419
70	5043	ZD 109	Adishertai	04/01/2017	126	522	522
70	5043	ZD 123	Haddshadihalai	20/11/2016	141	896	896
70	5043	ZD 134	Adimesihal	06/03/2017	197	660	660
70	5043	ZD 140	Maighorzo 1	19/03/2017	204	955	955
70	5043	ZD 141	Maighorzo 2	20/03/2017	204	982	982
70	5043	ZD 144	Adiamine	22/03/2017	77	369	369
70	5043	ZD 146	Meztaeshenfae	22/03/2017	112	523	523
70	5043	ZD 151	Adishimandit	24/03/2017	98	401	401
70	5043	ZD 152	Aditesekemete	25/03/2017	215	872	872

The date of rehabilitation was confirmed by a Repair Confirmation Form which was signed by the mechanic carrying out the repair along with a village administrator from the local community. The date of rehabilitation was used as the start date of operation and crediting for each borehole; we have conservatively assumed that the first day of crediting is not counted.

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 totalled to give the total number of project technology days for this monitoring period.

Vita has rehabilitated more than 60 boreholes in Zoba Debub. The communities in the region previously suffered from limited access in clean water which resulted in high rates of water borne diseases especially among children.

A woman collects clean water from a newly rehabilitated borehole.

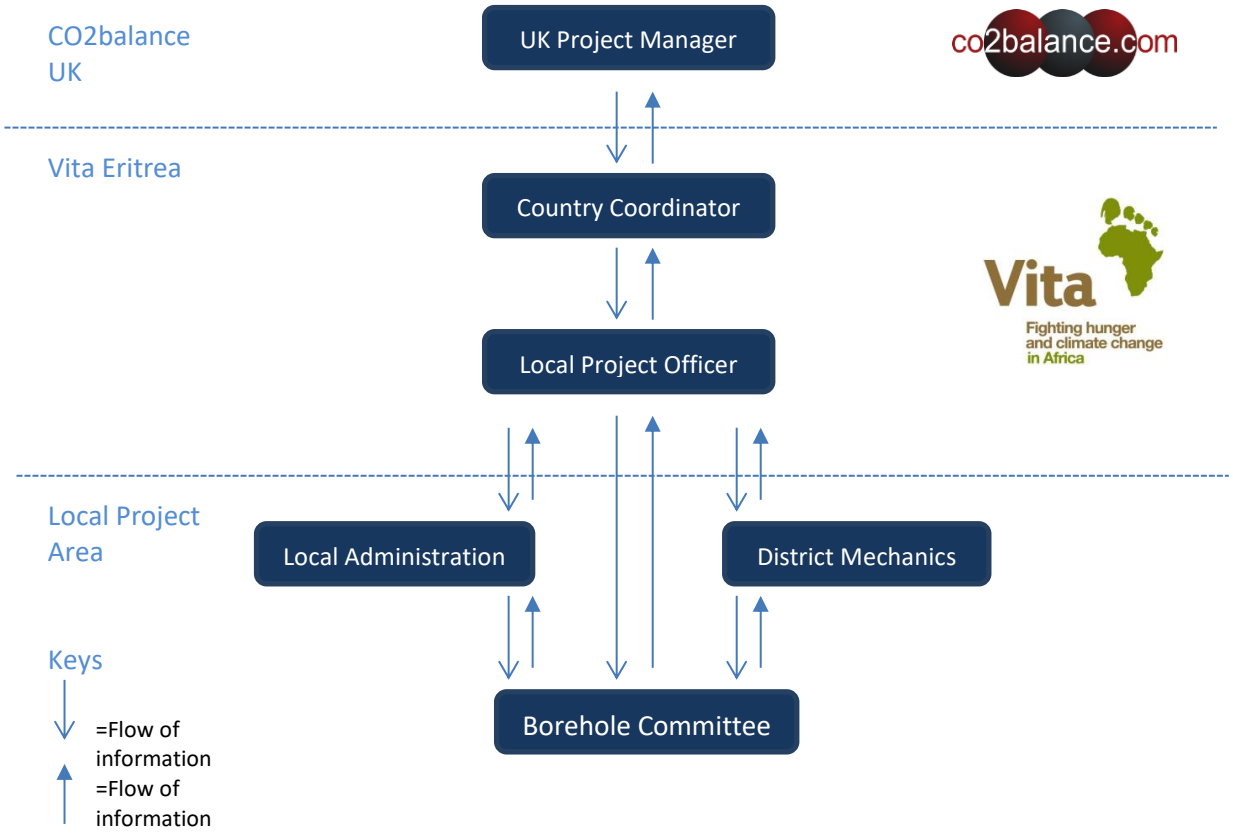
3. Project Location

Below is the geographic reference to allow unique identification of the project boundary for the project. The district is marked in green on the Google Earth images. The target area and the fuel collection area are defined as being contained within project boundary, with the outer limits of the project boundary being clearly defined below in green on the Google Earth images. As the majority of beneficiaries collect their wood fuel locally in close proximity to their homesteads, the woodfuel collection area and target area are considered the same.

Project Area Coordinates		
	Latitude	Longitude
GPS1	14.674048°	38.262243°
GPS2	14.912112°	38.222587°
GPS3	15.186781°	38.392505°
GPS4	15.270219°	39.083873°
GPS5	14.841412°	39.670669°
GPS6	14.404751°	39.282490°

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 staff 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 then is sent to the UK head office for data analysis. The documentation procedure ensures a minimum chance of original data being lost – all original copies of our project documentation are retained in the Eritrean 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, the survey samples are randomly selected from the borehole user record and are determined

in accordance with the required confidence/precision. The size of the sample is dependent on the methodological requirements and variance of the parameter being monitored to ensure the parameters measured satisfy 90/10 precision (90% confidence interval and 10% margin of error). The sample is reselected for every monitoring period to ensure the selection remains random.

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

5.1 Borehole database

The borehole installation/rehabilitation record includes the following information:

- Date of installation/rehabilitation
- Quantity of boreholes installed
- The total number of people obtaining their water from each borehole

The total number of households using each borehole has been determined through the lists supplied by the community group and or district water officer responsible for that borehole. Using this method, the total number of people using each borehole has been determined and hence a figure for person days can be calculated.

5.2 Ongoing Monitoring Studies

The following ongoing monitoring studies were conducted; the results are given in the parameter boxes tables in Section 6.

- **Water consumption field test** (Equation parameters Qp,y and Qp,rawboil,y) - Completed prior to first verification and then biennially after first verification

- **Quality of the treated water** - The quality of the treated water will be assessed to ensure that it is fit for human consumption. The parameters used to assess the water quality will be in line with Eritrean standards for potable water and all parameters will be shown to be within levels considered acceptable for domestic human consumption.

- **Usage Survey** - As all boreholes have been 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. Therefore the annual usage survey will be conducted using a minimum sample size of 100. The results from the usage survey are used to determine the proportion of beneficiaries that use the borehole which is factored into the emission reduction calculations.

- **Project Survey** – Conducted on 100 households, surveying end users currently using project technologies to explore changes in project scenario over time. 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 PDD has described which sources of leakage detailed within the methodology are relevant to this project and which have been discounted.

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 Zoba Debub (GS 5038-43; GS 5825-27; GS 5125). The samples for the survey listed below are randomly selected from the borehole information databases using the RSG procedure previously explained in line with the minimum sample size 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

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. Credible literature, studies, survey, reports, relevant to the project target area
Value applied:	0.00
Justification of the choice of data or description of measurement methods and procedures actually applied:	The portion of safe water users is determined though 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:	$EF_{b,co2}$
Data unit:	tco_2/TJ
Description:	co_2 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:	$EF_{b,non\ co2}$
Data unit:	tco_2/TJ
Description:	Non-co_2 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:	$EF_{p,co2}$
Data unit:	tco_2/TJ
Description:	co_2 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:	$EF_{p,non\ co2}$
Data unit:	tco_2/TJ
Description:	Non-co_2 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
Value applied:	0.97
Justification of the choice of data or description of measurement methods and procedures actually applied:	The default NRB was ratified by the Eritrean DNA on 29/03/2016 https://cdm.unfccc.int/DNA/fNRB/index.html
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	0.0003010
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: *Technologies and Practices to Displace Decentralized Thermal Energy Consumption* Version 1*, Draft General Guidelines On Sampling And Surveys*; EB37 Annex 27; and *Standard For Sampling And Surveys For CDM Project Activities and Programme of Activities* (Version 02); 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	0.0003010
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: *Technologies and Practices to Displace Decentralized Thermal Energy Consumption* Version 1*, Draft General Guidelines On Sampling And Surveys*; EB37 Annex 27; and *Standard For Sampling And Surveys For CDM Project Activities and Programme of Activities* (Version 02); 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:	0%
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 outline in annex 2. A fixed suppressed demand baseline has been opted for.
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:	Borehole Project Database
Value of data applied for the purpose of calculating expected emission reductions	GS5038: 1,892,876 GS5039: 1,937,097 GS5040: 1,937,849 GS5041: 1,813,144 GS5042: 1,783,091 GS5043: 1,830,266
Description of measurement methods	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.

and procedures to be applied:	
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:	Qp,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 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:	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 Resource Department from the Ministry of Land, Water & Environment 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

For the surveys, households were selected at random from the household lists. First, the hand pumps were randomly selected for monitoring; secondly, households served by those hand pumps were randomly selected for surveying.

Sample sizes were chosen to meet the minimum requirements set in the methodology requirements.

8.2 Water Consumption Field Test

The Water Consumption Field Test was carried out on a randomly selected sample of 80 households from the borehole user list. This complies with the recommended minmum 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 26/09/2017 – 20/10/2017. 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 12.32 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 25/09/2017 - 23/10/2017. The households that participated in the survey were randomly selected from the borehole user lists. The results confirmed that 100% of the respondents and their family members use the boreholes that were rehabilitated by Vita.

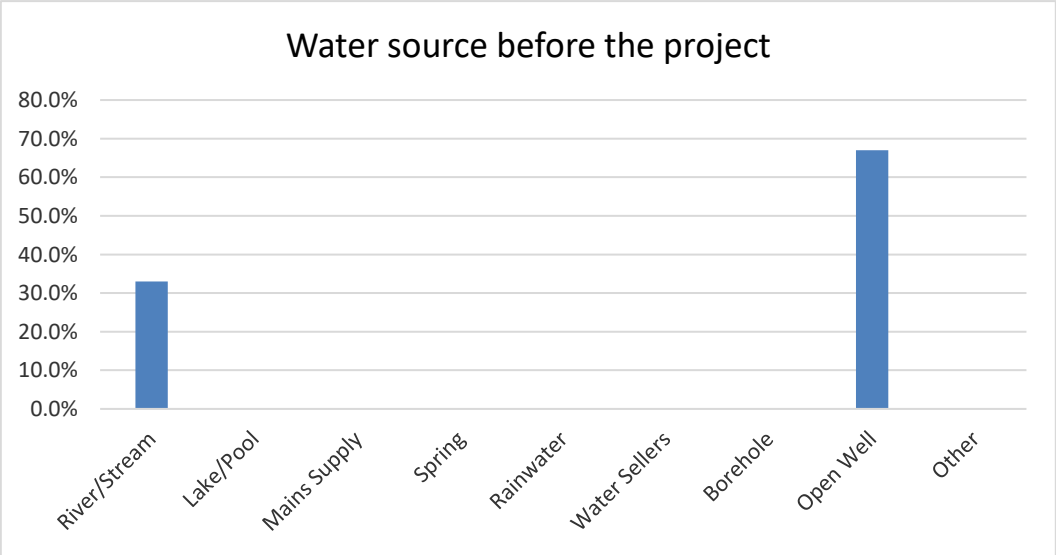
8.4 Project Survey Analysis

Project surveys were conducted by 8-12 staff between 25/09/2017 – 23/10/2017 on 200 randomly selected households from across the homogenous VPAs in Zoba Debub to explore changes in the project scenario (demographics, water use and purification practices etc) over time.

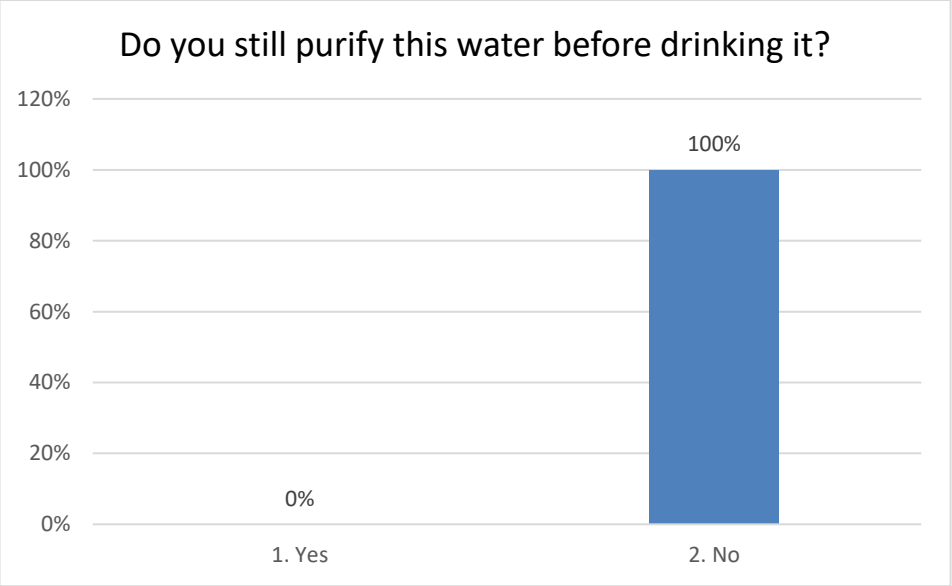
Data collected during the project surveys includes the following:

- 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 Zoba Debub, all 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 for 100% of respondents.

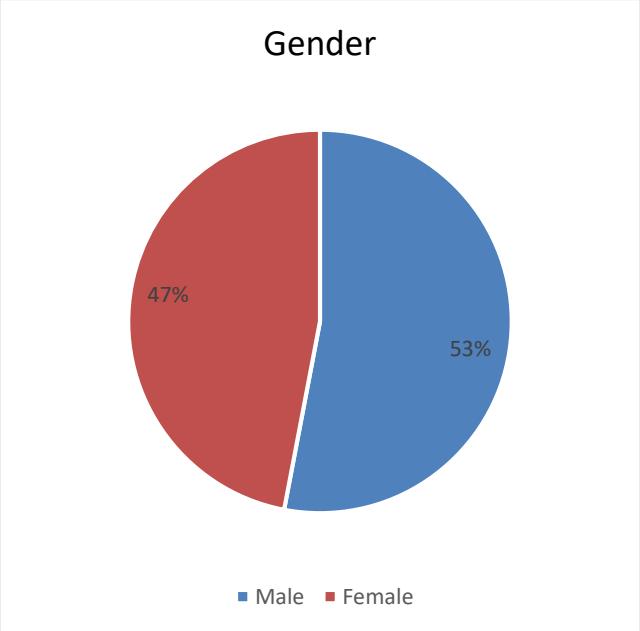


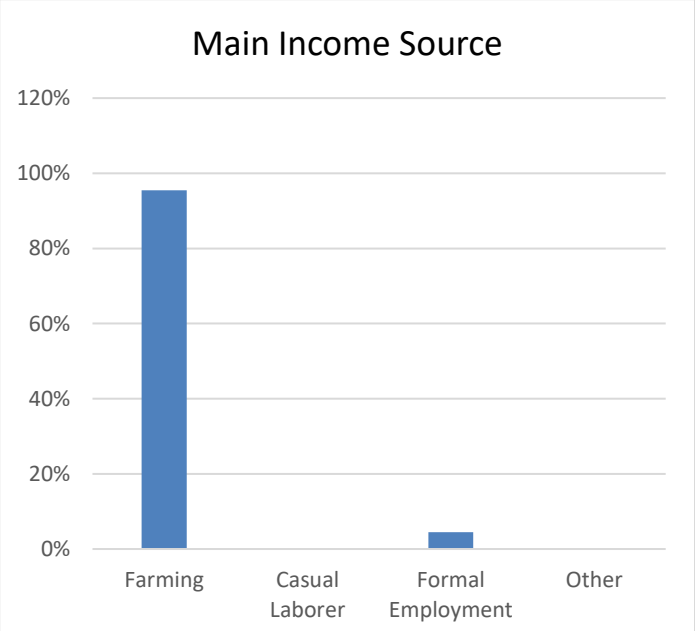
The results from the usage survey conducted on the same households showed that 100% of the respondents now collect their water from boreholes, which indicates a major improvement over the baseline and highlights that there is no longer a need for people to purify their water, further demonstrated by the graph below.

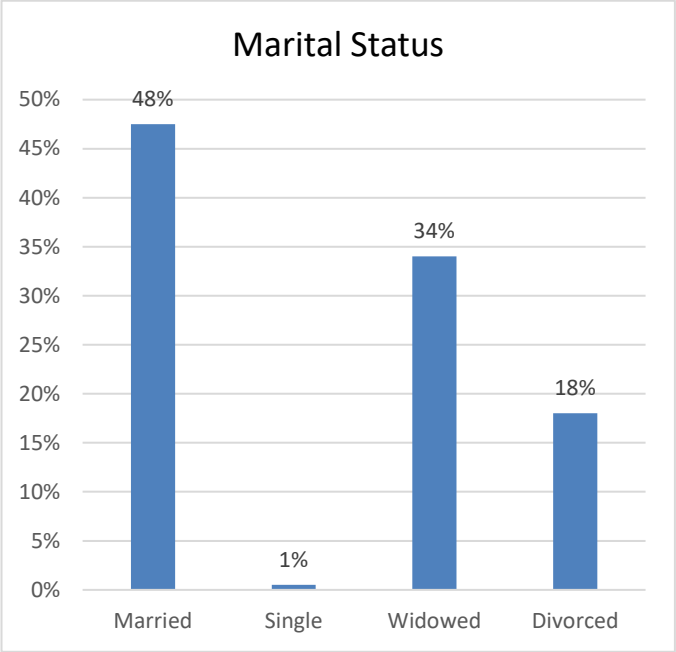


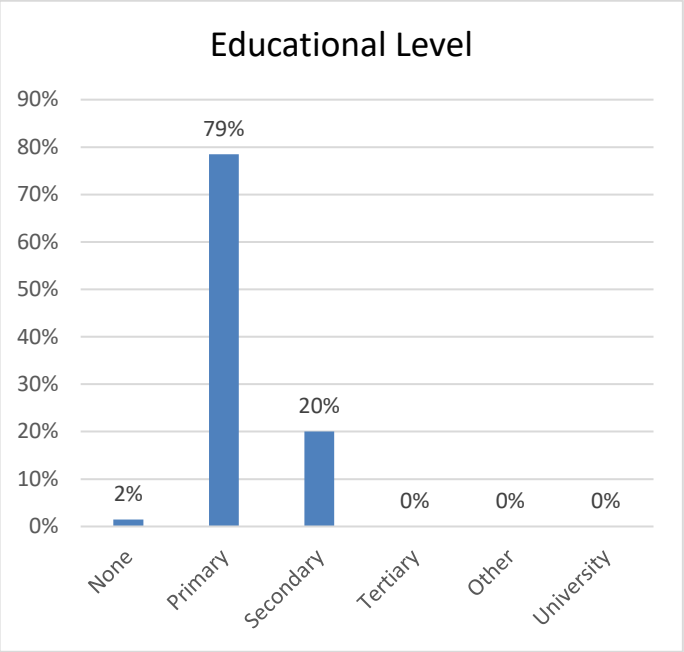
Socio-Demographic Characteristics

Analysis of the Project Survey results found that there have not been any significant changes in the socio-demographic characteristics such as gender, marital status, education and employment among the borehole users as shown in the following graphs.

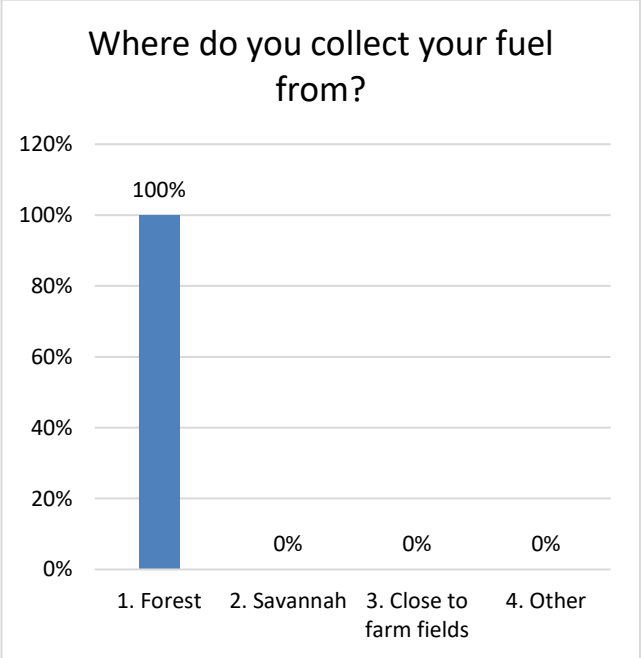


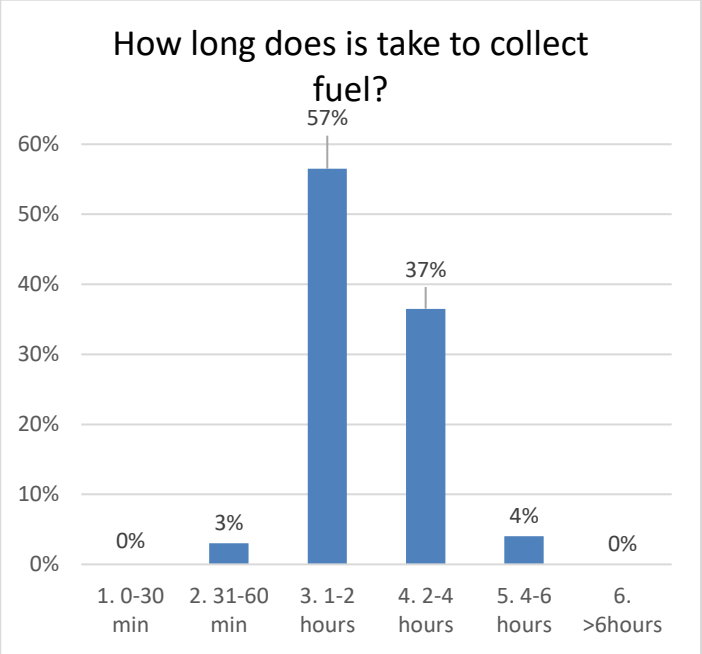






100% of households collect fuel from local forests for cooking. This takes the majority of respondents between 1-2 hours and 2-4 hours. 4% of participants record it can take them up to 6 hours to collect wood fuel. However, since the introduction of the project, households no longer have to collect fuel for water purification and thus can save energy and time, enabling them to pursue other economic and domestic activities.





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.

As the majority of participants collect wood from within the project boundary, it is not expected that the NRB in other areas will be affected. There are currently no other CDM or VER projects in the project area.

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.

Therefore, a value of 0 is applied for leakage.

Data / Parameter:	$LE_{p,y}$
Data unit:	tCO2e per year
Description:	Leakage
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:	Leakage will be assessed after the first verification

Any comment:	

9. Sustainable Development Indicators

The following indictors 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
Repeat for each parameter		
Chosen parameter		Total suspended matter (TSPM)- measured indirectly by wood consumption
Current situation of parameter		As determine 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 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. 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		Access to affordable and clean energy services
Mitigation measure		None
Repeat for each parameter		
Chosen parameter		Change in volume of traditional fuel consumption
Current situation of parameter		Total fuel consumption (wood) is known to be high amongst the project area population
Estimation of baseline situation of parameter		Wood consumption to boil water is estimated to around 0.7 kg in order to boil 1 litre of water
Future target for parameter		Reduce wood use to boil water by at least 50%
Way of monitoring	How	Project surveys, Usage surveys
	When	Annually
	By who	Expert surveying team

The baseline survey showed that 100% boiled water as a method of purification; many also indicated reasons that they were not able to purify all the water they consumed, for example lack of fuel, which can be attributed to suppressed demand. 100% of people state in the project survey that they do not purify their water and no

combustion technologies are used which far exceeds the target for this parameter and we score this indicator positively as a result.

No		3
Indicator		Livelihood of the poor
Mitigation measure		None
Repeat for each parameter		
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 water and wood fuel is significant within the project boundary.
Estimation of baseline situation of parameter		At least 3 hours per day is spent collecting wood, although this is for cooking use. At least 2 hours is devoted to collecting water
Future target for parameter		Time and effort spent purifying and collecting water is reduced by at 50%.
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 28% of respondents spent between 2-4 hours collecting firewood each day and a further 46% spent 1-2 hours. This represents a significant amount of time and much of this firewood will have been used for water purification. The monitoring surveys showed that all respondents gave reasons why they could not always purify their water, for example a lack of fuel wood, and we can derive from this that the time spent collecting wood would be considerably more were it not for suppressed demand. The usage survey shows all households use the borehole and the project survey shows that no households feel the need to boil the water to purify it, far exceeding the target for this parameter and we score the indicator positively as a result.

No		4
Indicator		Human and Institutional capacity
Mitigation measure		None
Repeat for each parameter		
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. 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 the local Zoba Administration 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

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

Where:

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

Where:

$N_{j,y}$	Number of person.days consuming water supplied by project scenario p through year y[47]
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

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

Where:

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

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

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

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.

The results also consider the discounted fraction of non-suppressed demand users (xboil). For full calculations please see accompanying 'ER Calcs' Spreadsheets.

Baseline Fuel Use

Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	
Person Days	Njy		
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	
Quantity fuel consumed in baseline scenario	Bb,y	T	

The portion of safe water users prior to the start of the project was removed from the baseline (Cj) before the amount of wood used to boil 1 litre of water (Wb,y) was multiplied by the number of litres of safe and raw water consumed per person per day (Qp,y) by the total number of project technology days (Njy). This gives the total tonnes of wood used in the baseline (Bb,y).

Project Fuel Use

Project Fuel Use (Pby)			
Portion users	Cj	fraction	
Person Days	Njy		
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	

Quantity of safe water boiled	Qp, cleanboil, y	L/pd	
Quantity of fuel consumed in project scenario per HH	Bp,y	T	

The portion of safe water uses was removed from the project scenario (Cj) before the amount of wood used to boil 1 litre of water (Wp,y) was multiplied by the number of litres of raw and safe water boiled per person per day (Qp) by the total number of project technology days (Njy). This gives the total tonnes of wood used in the project (Bp,y).

Constants			
NRB	NRB	Fraction	
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	
Net calorific value of fuel	NCV,b,fuel	TJ/T	

Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	
Project emissions per year	PEp,y	tCO2/y	
Usage rate	Up,y	fraction	
Leakage	LEp,y	tCO2/y	
Emission Reductions	Ery	tCO2/y	

The baseline and project emissions were calculated by multiplying the amount of wood used in these scenarios by the emissions factors (EFb) for CO_2 (corrected by the fNRB value), non CO_2 and the net calorific value of biomass (NCV,b). The difference in baseline and project emissions were then adjusted using the usage rate observed in the project (Up,y)) and any leakage subtracted from the total (LEp,y).

Suppressed Demand Assessment			
Percentage of suppressed demand users			
Percentage of **non**-suppressed demand users	Xboil	Percentage	
Emission Reductions	**Ery**	**tCO2/y**	

The emissions reductions were then corrected for the levels of suppressed demand observed in the project by multiplying by (1-Xboil) to give the a total of emission reductions (ERy) for this monitoring period.

Emission Reduction Cap			
Emission Reduction Cap	Ery	tCO2/y	10,000

Emission reductions will be capped at 10,000 tCO_2e for each 12 month period.

11. Summary of Emissions Reductions per VPA

GS 5038

Total Emission Reductions			
Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	0
Person Days	Njy		1,892,876
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	0.000310
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	7.5
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	0
Quantity fuel consumed in baseline scenario	Bb,y	T	4399
Project Fuel Use (Pby)			
Portion of safe users	Cj	fraction	0
Person Days	Njy		1,892,876
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	0.0003099
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	0
Quantity of safe water boiled	Qp, cleanboil, y	L/pd	0
Quantity of fuel consumed in project scenario per HH	Bp,y	T	0
Constants			
NRB	NRB	Fraction	0.97000
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	112
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	8.692
Net calorific value of fuel	NCV,b,fuel	TJ/T	0.0156
Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	8,051
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Total Emission Reductions	Ery	tCO2/y	8051
Suppressed Demand Assessment			
Percentage of suppressed demand users			100.00%
Percentage of **non**-suppressed demand users	Xboil	Percentage	0.00%
Emission Reductions Corrected for Suppressed Demand	**Ery**	**tCO2/y**	**8051**

Capped Emission Reductions		**tCO2/y**	**8051**

Emissions Reductions by Vintage

Emission Reductions by Vintage-Capped	
Year	**Ers**
2016	364
2017	7687
Total	**8051**

Total Emission Reductions

Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	0
Person Days	Njy		1,937,097
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	0.000310
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	7.5
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	0
Quantity fuel consumed in baseline scenario	Bb,y	T	4502

Project Fuel Use (Pby)			
Portion of safe users	Cj	fraction	0
Person Days	Njy		1,937,097
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	0.0003099
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	0
Quantity of safe water boiled	Qp, cleanboil, y	L/pd	0
Quantity of fuel consumed in project scenario per HH	Bp,y	T	0

Constants			
NRB	NRB	Fraction	0.97000
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	112
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	8.692
Net calorific value of fuel	NCV,b,fuel	TJ/T	0.0156

Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	8,240
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Total Emission Reductions	Ery	tCO2/y	8240

Suppressed Demand Assessment			
Percentage of suppressed demand users			100.00%
Percentage of **non**-suppressed demand users	Xboil	Percentage	0.00%
Emission Reductions Corrected for Suppressed Demand	**Ery**	**tCO2/y**	**8240**

Capped Emission Reductions		**tCO2/y**	**8238**

Emissions Reductions by Vintage

Emission Reductions by Vintage-Capped	
Year	Ers
2016	655
2017	7583
Total	**8238**

Total Emission Reductions

Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	0
Person Days	Njy		1,937,849
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	0.000310
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	7.5
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	0
Quantity fuel consumed in baseline scenario	Bb,y	T	4504

Project Fuel Use (Pby)			
Portion of safe users	Cj	fraction	0
Person Days	Njy		1,937,849
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	0.0003099
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	0
Quantity of safe water boiled	Qp, cleanboil, y	L/pd	0
Quantity of fuel consumed in project scenario per HH	Bp,y	T	0

Constants			
NRB	NRB	Fraction	0.97000
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	112
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	8.692
Net calorific value of fuel	NCV,b,fuel	TJ/T	0.0156

Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	8,244
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Total Emission Reductions	Ery	tCO2/y	8244

Suppressed Demand Assessment			
Percentage of suppressed demand users			100.00%
Percentage of **non**-suppressed demand users	Xboil	Percentage	0.00%
Emission Reductions Corrected for Suppressed Demand	**Ery**	**tCO2/y**	**8244**

Capped Emission Reductions		**tCO2/y**	**8241**

Emissions Reductions by Vintage

Emission Reductions by Vintage-Capped	
Year	**Ers**
2016	294
2017	7947
Total	**8241**

Total Emission Reductions

Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	0
Person Days	Njy		1,813,144
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	0.000310
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	7.5
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	0
Quantity fuel consumed in baseline scenario	Bb,y	T	4214

Project Fuel Use (Pby)			
Portion of safe users	Cj	fraction	0
Person Days	Njy		1,813,144
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	0.0003099
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	0
Quantity of safe water boiled	Qp, cleanboil, y	L/pd	0
Quantity of fuel consumed in project scenario per HH	Bp,y	T	0

Constants			
NRB	NRB	Fraction	0.97000
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	112
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	8.692
Net calorific value of fuel	NCV,b,fuel	TJ/T	0.0156

Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	7,713
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Total Emission Reductions	Ery	tCO2/y	7713

Suppressed Demand Assessment			
Percentage of suppressed demand users			100.00%
Percentage of **non**-suppressed demand users	Xboil	Percentage	0.00%
Emission Reductions Corrected for Suppressed Demand	**Ery**	**tCO2/y**	**7713**

Capped Emission Reductions		**tCO2/y**	**7710**

Emissions Reductions by Vintage

Emission Reductions by Vintage-Capped	
Year	Ers
2016	254
2017	7456
Total	**7710**

Total Emission Reductions

Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	0
Person Days	Njy		1,783,091
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	0.000310
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	7.5
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	0
Quantity fuel consumed in baseline scenario	Bb,y	T	4144

Project Fuel Use (Pby)			
Portion of safe users	Cj	fraction	0
Person Days	Njy		1,783,091
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	0.0003099
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	0
Quantity of safe water boiled	Qp, cleanboil, y	L/pd	0
Quantity of fuel consumed in project scenario per HH	Bp,y	T	0

Constants			
NRB	NRB	Fraction	0.97000
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	112
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	8.692
Net calorific value of fuel	NCV,b,fuel	TJ/T	0.0156

Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	7,585
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Total Emission Reductions	Ery	tCO2/y	7585

Suppressed Demand Assessment			
Percentage of suppressed demand users			100.00%
Percentage of **non**-suppressed demand users	Xboil	Percentage	0.00%
Emission Reductions Corrected for Suppressed Demand	**Ery**	**tCO2/y**	**7585**

Capped Emission Reductions		**tCO2/y**	**7584**

Emissions Reductions by Vintage

Emission Reductions by Vintage-Capped	
Year	**Ers**
2016	274
2017	7310
Total	**7584**

Total Emission Reductions

Baseline Fuel Use (Bby)			
Portion using safe water	Cj	fraction	0
Person Days	Njy		1,830,266
Fuel to treat 1 litre of water using baseline tech	Wb,y	T/L	0.000310
Quantity safe water litres consumed in project scenario supplied by project technology	Qp,y	L/pd	7.5
Quantity of raw water boiled in addition to project technology water	Qp, raw, y	L/pd	0
Quantity fuel consumed in baseline scenario	Bb,y	T	4254

Project Fuel Use (Pby)			
Portion of safe users	Cj	fraction	0
Person Days	Njy		1,830,266
Fossil fuel required to treat 1 litre for water in project scenario	Wp,y	T/L	0.0003099
Quantity of raw water boiled in addition to project tech water	Qp, raw, y	L/pd	0
Quantity of safe water boiled	Qp, cleanboil, y	L/pd	0
Quantity of fuel consumed in project scenario per HH	Bp,y	T	0

Constants			
NRB	NRB	Fraction	0.97000
Emissions factor fuel (co2)	EFb,fuel,co2	tCO2/TJ	112
Emissions factor fuel (non-co2)	EFb, fuel, non-co2	TCO2/TJ	8.692
Net calorific value of fuel	NCV,b,fuel	TJ/T	0.0156

Emissions Reductions			
Baseline emissions per year	BEb,y	tCO2/y	7,786
Project emissions per year	PEp,y	tCO2/y	0
Usage rate	Up,y	fraction	1
Leakage	LEp,y	tCO2/y	0
Total Emission Reductions	Ery	tCO2/y	7786

Suppressed Demand Assessment			
Percentage of suppressed demand users			100.00%
Percentage of **non**-suppressed demand users	Xboil	Percentage	0.00%
Emission Reductions Corrected for Suppressed Demand	**Ery**	**tCO2/y**	**7786**

Capped Emission Reductions		**tCO2/y**	**7785**

Emissions Reductions by Vintage

Emission Reductions by Vintage-Capped	
Year	**Ers**
2016	446
2017	7339
Total	**7785**