MONITORING REPORT FORM (FCDMMR)

Version 02.0

MONITORING REPORT

Title of the project activity	Integrated Biomass Energy Conservation Project, Malawi
Reference number of the project activity	Gold Standard 613
Version number of the monitoring report	Version 6
Completion date of the monitoring report	08/04/2015
Registration date of the project activity	01/10/2010
Monitoring period number and duration of this monitoring period	Monitoring period number 4 - 02/10/2012 to 01/10/2013 (inclusive of both dates).
Project participant(s)	Hestian Innovation Ltd.
Host Party(ies)	Malawi
Sectoral scope(s) and applied methodology(ies)	Scope 3 - Energy demand Methodology: Gold Standard Technologies and Practices to Displace Decentralised Thermal Energy Consumption version 1.0
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	77,500 tCO2e for year 5 as per registered PDD Version 6
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	80,496 tCO2e for year 02/10/2012 to 01/10/2013 (inclusive of both dates): 02/10/2012 to 31/12/2012 – 18,053 tCO2e 01/01/2013 to 01/10/2013 – 62,443 tCO2e

SECTION A. Description of project activity

A.1 Purpose and general description of project activity

The project reduces greenhouse gas emissions from non-renewable biomass fuel by dissemination of improved cook-stoves to replace existing inefficient stoves.

This Monitoring Report covers two of the five technologies which are progressively installed as part of the project activities. No VERs are claimed for the remaining three technologies (Urban Cook Stove, Fixed Esperanza and Rocket Barn[1]) for the monitoring period and as such these technologies are not included in this monitoring report. The two technologies which are detailed in the Monitoring Report are:

(1) Portable Ceramic Stoves and
(2) Institutional Cook Stoves.

	
(1) Portable Ceramic Stove	(2) Institutional Cook Stove

Kitchen Surveys and Aging Tests have been conducted for these fuel-efficient devices.

Project benefits include reduced exposure to indoor air pollution as well as relief from high fuel costs, less time spent hand-gathering domestic fuel-wood and reduced burden for some institutions to transport wood over distances that are increasing. Public benefits of the devices promoted come in the form of reduced pressure on Malawi's natural resources.

During the current monitoring period of 02/10/2012 to 01/10 2013 (inclusive of both dates) it is calculated that 80,496 tCO2e emission reductions have been generated.

A.2 Location of project activity

The project has activities in all the three regions of Malawi i.e. Northern, Southern and Central regions.

A.3 Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)

1 Under current conditions it is felt that the three technologies not included in the monitoring report have been omitted based on a cost-benefit analysis performed by the PP in consultation with project implementers.

Malawi (host)	Hestian Innovation Ltd., a private company registered in the British Virgin Islands	No

A.4 Reference of applied methodology

Please see revised monitoring plan.

The project follows the Gold Standard Methodology "technologies and practices to displace decentralised thermal energy consumption" (11/04/2011).

A.5 Crediting period of project activity

The current crediting period for the project is 24/11/2008 to 23/11/2015 (both days included).

SECTION B. Implementation of project activity

B.1 Description of implemented registered project activity

The project activity disseminated in the monitoring period Portable Ceramic Stoves (PCS) and Institutional Cook Stoves (ICS) as detailed in the box below with a calculated GHG offset of 80,496 tCO2e generated during the monitoring period.

	PCS	ICS
24/11/2008 – 01/10/2009	1,767	0
02/10/2009 – 01/10/2010	5,308	1
02/10/2010 – 01/10/2011	5,839	30
02/10/2011 – 01/10/2012	7,228	126
02/10/2012 – 31/12/2012	0	9
01/01/2013 – 01/10/2013	6,588	94
Total	26,730	260

Table 1: Devices sold generating emission reductions in MP4

1. Note:
2. GS613's small scale limit is reached by including PCS and ICS sales up to September 8, 2012. Other devices which were sold in MP4 but are not included in MR4 will either be grouped into a new project or will be included as necessary for MR5, with the understanding that the emission reductions those devices would have generated in monitoring period 4 cannot be claimed in monitoring period 5.
3. The values for PCS and ICS disseminated 02/10/2011 – 01/10/2012 presented in MR4 reflect an increase on values presented in MR3. Technologies disseminated in monitoring period 3 exceeded the small scale limit for GS613; therefore, only as many technologies were included in MR3 as necessary to reach small scale limit. PCS were included up to Dec. 5, 2011 and

ICS up to Sept. 29, 2011. First year emission reductions for these additional stoves which were generated in MP3 are not being claimed in MR4; rather, ONLY their second year emission reductions which occurred in MP4 are claimed in MR4, and year two usage rates and efficiencies are appropriately applied. This approach adds to the conservativeness of GS613.

4. As per MR3, UCS and FES stoves are not actively promoted under GS613 at the moment, therefore no device sales are recorded in MR4, nor emission reductions claimed for any devices sold in previous monitoring period which may still be in use.
5. For MR4, Rocket Barns are also excluded from emission reduction claims. GS613's Rocket Barns may be claimed for separately as a new project with retroactive crediting.

In parallel with sales of stoves, a rigorous monitoring of the project activity has been ongoing per schedule below:

Date	**Activity**	**Purpose**
October 2, 2012 to October 1, 2013	Sales recording	Establish sales database to track number of devices sold and determine clusters for kitchen surveys.
Ongoing	Non-Renewable Biomass – monitoring for official credible publicly available value	Determine percentage of non- renewable biomass.
22nd January to 12th March, 2013 Ongoing (PCS)	Aging Stove Tests – Water Boiling Tests (PCS)	To measure efficiency changes for aging stoves (PCS).
November 25th – November 28th 2013 (PCS)[2]	Usage & Monitoring Surveys (PCS)	Determine if clusters are still representative. To establish drop-off rates in PCS performance & other relevant factors in aging PCS, to establish the average lifespan of the PCS.
September 25th – October 28th 2013 (ICS)	Usage & Monitoring Surveys (ICS)	Determine if clusters are still representative. To establish drop-off rates in ICS performance & other relevant factors in aging ICS.

In response to FAR P4 of MR3, Monitoring Surveys were revised to explicitly address the issue of leakage for domestic stove, and enumerators retrained to effectively address this issue. As per FAR Q1 of MR3, while it is not feasible to conduct a simple random sample of the entire sales database, a simple random sample was applied to select a number of geographic areas for survey. A simple random sample was then conducted from among these sampled geographic areas to determine the average lifespan of the PCS stoves.

Where necessary, new cluster(s) shall be formed and a new baseline shall be established and validated, based on results of ongoing monitoring activities.

B.2 Post registration changes

[2] Some monitoring activity may occur after end of the monitor period to ensure that stoves meet the requirements for minimum length of time in use. This lends to the conservativeness of the single weighted usage parameter.

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

N/A

B.2.2. Corrections

N/A

B.2.3. Permanent changes from registered monitoring plan or applied methodology

The PP has become aware of revised values for CO2 and non CO2 emission factors which are used in calculation of emission reductions. Values used in MR4 reflect both old GWP valid up to December 31, 2012, as well as the most up to date emission factors based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, effective January 1, 2013.

B.2.4. Changes to project design of registered project activity

On 31/10/2012 the GSF approved PP's request to change the scale of the project from Large Scale to Small Scale.

As of MR3, validated by GSF on September 23, 2013, UCS, RBs and FES stoves are not currently included under GS613.

B.2.5. Changes to start date of crediting period

N/A

B.2.6. Types of changes specific to afforestation or reforestation project activity

N/A

SECTION C. Description of monitoring system

Monitoring equipment:

The following instruments are used to conduct Water Boiling Tests on stoves of each age group to determine if stoves become less efficient over time – a factor which is taken into account in the calculation of project emission reductions.

Equipment	*Manufacturer*	*Type*	*Accuracy*
Wood humidity measuring device	Voltcraft FM-300	Moisture measuring range 6% to 99.9%	±1% (in moisture range 6% ~ 40%).
Digital hand thermometer	Voltcraft K 101 thermometer	Measuring range -200°C to +1370°C (reversible °C/°F)	-200°C to +200°C accuracy of 0.3% of the display, +1 °C
Digital high precision scale	My Weigh KD-8000	8 kg capacity digital weighing scale	Accuracy of 1g

Digital hanging scale	Voltcraft HS-30	30kg capacity digital hanging scale	Accurate to 20g

Table 2: Equipment used for Water Boiling Tests (PCS) and Kitchen Tests (ICS)

The calibration of the monitoring equipment for project emission parameters is checked by enumerators as per the equipment's operating instructions, prior to conducting tests. The hand thermometer, for example, is calibrated in the factory. For precise measurements the hand thermometer can be set to the respective temperature sensor. The temperature sensor is held in a container of icy water (0°C). The hand thermometer's display is checked after approximately one minute. If it does not read 0°C it can be correctly set by turning the offset calibration screw[3].

Involvement of Third Parties:

Continuous monitoring is being performed by Area 55 Consulting, a company that replaced Hestian Rural Innovation Development as Project Implementer effective July 1, 2012, and external consultants such as Clioma Ltd.

Data concerning double counting:

The project continues to monitor any risks of double counting in this project, specifically determining whether any of the stoves sold as part of this project are counted in any other emission reduction projects. As at August 1, 2013, Alchemy Carbon Ltd. has a registered CDM project in Malawi to promote an improved stove developed by co2balance UK Ltd. which is different to the GS613 project stoves. As far as the PP is aware, stoves have not yet been distributed under this project.
Other registered CDM PoAs aim to promote improved mud/brick stoves, metal stove with ceramic chamber and ACE Phillip's stove (project implementer Total Land Care). The only other project promoting same ceramic stove as this project is by the Southern Africa Regional Carbon Facility (SRCF). Project targets to date have not coincided between the projects so there is no risk of double counting at present.

The project developers continue to monitor whether any other projects exist within the project boundary. In such cases, the project developer will make every effort to cross reference our total sales database and end user database with any other projects to ensure that there is no overlap. In cases where there are several projects owned by the project developer, the project developer will "fill" projects chronologically with as many devices as necessary to reach the project size limit. In addition, the project continues to use all legal documentation outlined in the PDD to ensure legal ownership over offsets, a step that further avoids double counting.

Data processing and archiving (incl. software used):

Sales records and results of monitoring surveys are first captured in paper form then compiled in a Microsoft Excel spreadsheet or Microsoft Access database. Records will be kept for two years after the project activity is completed. Monitoring data is analysed using Microsoft Excel and SPSS (Software Package for Social Sciences).

Special event log:

No special events have occurred since the last verification report.

3 The digital hanging scales, the wood humidity measuring device and digital hand thermometer that the project use are manufactured by Voltcraft©. Lindenweg 15, D-92242 Hirschau/Duitsland Tel. +49 180/586 582 7 (www.voltcraft.de). The 8 kg capacity high precision scales is used for conducting water boiling tests and is manufactured by My Weigh (www.myweigh.com), with a 1g of accuracy, had a professional factory calibration test on 20/01/2012 and does not normally new recalibration during its 30 year warranty. Self-calibration instructions are included in KD-8000 manual.

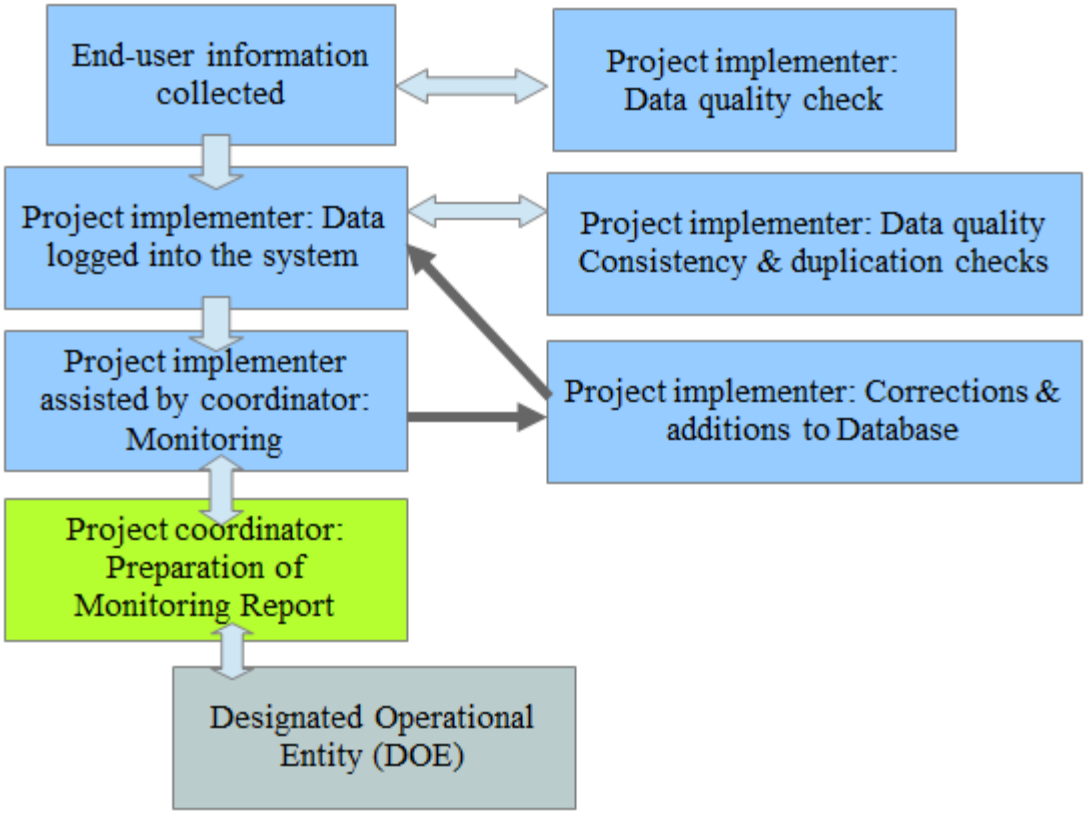
Quality assurance and quality control measures

Quality control tools were developed for the Chitetezo Mbaula and are used in stove trainings. During training, producers are instructed not to 'fire' stoves which are not of the correct specifications. Further to this, retailers individually inspect the stoves before purchasing from the producer and substandard stoves are not purchased, which acts as a further internal quality control. In event of problems with the larger technology (the institutional cook stove), the warranty system explained under 'Roles and Responsibilities' applies.

Documented procedures and management plan:

A simplified monitoring plan has been developed by the project coordinator, which aims to build capacity of project managers and their field staff in line with monitoring tasks outline roles and responsibilities documented below.

Roles and responsibilities:



The Project Coordinator assists the project implementing and monitoring bodies (project implementers), such as Area 55 Consulting and Concern Universal (CU), and the specific project managers to maintain and make available accurate records. The Project Coordinator collates a composite electronic Total Sales Record and project implementers keep back-up paper records. The existing accounting and records system accurately tracks sales, inventories and supply and purchases. Project implementers maintain a full electronic sales database of all household sales that take place, listed according to the sales mechanism, date, device, type etc. Sales databases are cross-checked with production records and other data to ensure consistency and accuracy.

Area 55, who is the only project implementer currently promoting institutional stoves, implements a 2 year limited warranty system for the institutional cook stoves. There is no formal overarching warranty system in place for household cookstoves, from any of the project implementers.

Replacement within areas less than 10km away from promoter and production group may be done if stove breaks within first few weeks of use at the discretion of the stove promoter and production group[4]. Further than this it is too difficult to assess for simple ceramic stove if stove broke during transport or recklessness or fault of user.

End user information is collected through direct sales to end-users by retailers or agents of the project and is contained in warranty and/or emission reduction contract. This information is collated into an electronic database from which project monitoring can be conducted. The database and Excel records are backed up and sent to the project coordinator for checking prior to using them as the basis for monitoring activities. Hard copies of ER contracts and warranty are filed as additional backup and for verification purposes. During monitoring period 4, one of the main project implementers Area 55 Consulting began scanning these paper records to prevent any losses in case of emergencies such as fire/theft.

Direct sales to end-users information is collected by implementers' agents who are issued with contract forms in advance and submit the forms to the relevant project managers. The customers in the sales record for which phone numbers or addresses are available are used for survey sampling to support the periodic monitoring activities.

Monitoring tasks, such as monitoring surveys, assessment of leakage and other such tasks are managed by the project managers who are best capable of collecting this data because they know the technology and the end-users best, with the support of the project coordinator.

It is important to note that monitoring surveys are not used directly in ER calculations, but instead serve to inform whether new clusters are required (which could in turn effect ER calculations) and monitor certain Gold Standard sustainability indicators. Surveys and tests are organised by project implementer staff with guidance from the project coordinator, and enumerators are trained prior to conducting surveys and tests. Survey and test results are filed in paper at Area 55's office and are analysed using Excel to compile reports. The integrity of data is constantly cross-checked with other variables to ensure consistency and avoid mistakes.

Trainings:

Kitchen Surveys (KS), Kitchen Performance Tests (KPTs), Usage Surveys and Monitoring Surveys are performed by trained enumerators and supervised by relevant project managers and the project coordinator as necessary. These enumerators perform monitoring activities and report directly to the respective project managers. The Project Coordinator collates the information provided by the respective project managers.

Project implementers also take the lead in training of new producers and promoters. Project implementers prefer to use local enumerators and artisans in different parts of the country because it decreases transport costs and employs local people, which is a benefit to the community and helps strengthen the project's local presence. Households seem to be more comfortable and trustful of local people performing the surveys / tests.

Project implementers and their agents also train end-users on proper use of the stove, as outlined in section below on troubleshooting.

Involvement of Third Parties:

4 The approach is an informal agreement between producers, promoters and customers. The complementary replacement stove promotes customer loyalty and helps to market the stoves locally.

Clioma Ltd. provides technical assistance to the project in areas of quality control and project monitoring.

Dr. Wilson Jere and Amulike Msukwa from Bunda College, University of Malawi periodically provide the Project with assistance in statistical analysis of the usage and monitoring surveys for all technologies and the adjusted adult meals for ICS.

Internal audits and control measures:

The volume of devices sold is the basis to determining the emissions reductions. Respective project managers manage their sales records, project database and information on sustainable development indicators, and forward them to the project coordinator.

Project implementers are subjected to financial audits under Malawi law.

Troubleshooting procedures:

Troubleshooting procedures (as commonly understood) do not apply to this project.

The following measures improve the lifetimes of the technologies and help to maintain efficiency:

(1) Project implementers and their agents provide user-training to each and every end-user on how: (i) to operate the devices (i.e. user training), (ii) to improve kitchen management and (iii) to improve firewood management. Producers are trained on production techniques and design specifications.

(2) Stove users are encouraged to avoid leaving portable stoves out in the rain and protect fixed stoves from the elements. By protecting stoves, their life-span can be extended.

(3) End-users are trained on how to improve firewood management by drying and splitting, firewood before use, by not overloading the furnace or fire chamber with too much fuel and by extinguishing un-used firewood in sand so that it can be used later.

(4) Kitchen management is promoted to reduce exposure to smoke by encouraging improved kitchen ventilation and to improve cooking practices by using a lid while cooking, by soaking beans overnight, by using the hot stove after cooking to heat water for bathing etc.

(5) As part of Surveys, home visits are made as required by the methodology. During these visits, proper use of the stove and firewood and kitchen management is discussed. Project implementers and their agents also periodically follow up with users through its extensive sales network. These visits serve to reinforce proper use principles outlined above.

(6) The project's decentralized production of stoves facilitates after-sales services from producer / contractor to end-user. Some of the troubleshooting and quality assurance measures that are in place include:

- For the PCS, quality control occurs both before and after firing the stoves in a fuel-efficient kiln. The production batch is recorded in the ceramic stove's serial number so that the performance of each batch is monitored. Producers are trained to not fire stoves that are not of correct specifications and for marketing, only stoves which are market ready and purchased from production group so producers know poor quality stoves will not be purchased.
- The ICS includes a two year warranty and health checks including minor maintenance as necessary, which is facilitated by income generated through carbon financing. The project implementer has complied with requests for repairs and maintenance in line with warranties and there are no problems with the warranty system to date.

(7) The project promotes the adoption of a second stove per household to discourage occasional use of the old stove (i.e. the 3-stone fire) and to facilitate ease of replacement should one of the stoves become damaged or worn out. A second stove is of particular benefit to households with many people as there seems to be a positive relationship between the number of people in household and fuel consumption.

a. PCS adopters are encouraged to purchase 2 stoves at the same time and
b. Stove promoters of PCS are encouraged to promote at a village level the adoption of 2 stoves.

The adoption of a second improved cook stove has had the following results to date: 13% of PCS users with an additional stove (based on November 2013 survey, see table below):[5]

# of Stoves per Household	# of Survey Respondents	% of Survey Respondents
1	125	87
2	13	9
3	5	3
4	1	1

Number of institutions with more than one ICS – 68 (67% of total), see table below:

# of Stoves per Institution	# of Total Institutions	% of Total Institutions
1	33	33%
2	27	27%
3	16	16%
4	13	13%
5	7	7%
6	1	1%
7	1	1%
8	2	2%
9	1	1%

The Project will continue to tests approaches on how to encourage the adoption of a second stove per household to discourage occasional use of the old stove (i.e. the 3-stone fire) and report on these approaches.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data/Parameter	$P_{B, PCS, 0}$
Unit	Kg / household-day
Description	Quantity of fuel that is consumed in the baseline scenario for PCS

5 For PCS, many of the production groups offer warranties where households receive an extra stove for free if their stove has cracked or been damaged within a certain time period. Such stoves are often not recorded in the Total Sales Record. Many of the 300+ stove producers produce stoves for their own use or for their families and neighbours as a gift, loan or repayment, which are often not recorded in the Total Sales Record. It is estimated that dissemination and use of PCS, and associated ERs, are significantly conservative.

Source of data	Baseline FT for PCS
Value(s) applied	14.35 kg / household day (equivalent to 5.237 t / household year
Purpose of data	Calculation of baseline emissions for PCS users.
Additional comment	With the inclusion of baseline data being assessed for suppressed demand the initial fixed baseline data for PCS users (7.02 kg / household day, equivalent to 2.561 tons / household year) was assessed in terms of suppressed demand. The initial baseline survey and test were conducted in April / May before the cold season when households may use more wood for space heating, and just after the rainy season when perhaps more wood is used to compensate for higher moisture content.

Data/Parameter	$P_{B, ICS, 0}$
Unit	Kg / adult-adjusted meal
Description	Quantity of fuel that is consumed in the baseline scenario for ICS
Source of data	Baseline FT for ICS
Value(s) applied	0.3604 kg / adult-adjusted meal
Purpose of data	This is the initial fixed baseline data for ICS users.
Additional comment	Baseline data for ICS has not yet been assessed for suppressed demand.

Data/Parameter	Person - meal
Unit	% of person meal or adult-adjusted meal
Description	Appropriate weighting for (i) Workforce (male and female), (ii) children's meal (primary school), (iii) 6 year olds and under (pre-primary school) (iv) light meals (e.g. tea).
Source of data	Baseline FT for ICS; Conversion factors used to estimate Adult Equivalent (AE) are sourced from Government of Malawi, *Impact and output indicators for agriculture, food security, nutrition and natural resources projects/ programmes in Malawi*, July 2008.
Value(s) applied	Workforce (male and female) meal = 0.90 person meal Children's meals (primary school) = 0.75 person meal 6 year olds and under (pre-primary school) = 0.60 person meal Teas = 0.50 person meal
Purpose of data	This parameter is used to normalise workforce made up of women and men, primary school meals, orphanage meals and light meals (e.g. tea).
Additional comment	

Data/Parameter	$P_{P, PCS, 2009}$
Unit	Kg / household-day
Description	Quantity of fuel that is consumed in the project scenario for PCS in year 0 (when project PCS were first disseminated).
Source of data	Measured during Project PFT for PCS in April - May 2009.
Value(s) applied	4.29 Kg / household-day (equivalent to 1.566 tons / household year)
Purpose of data	Used in Suppressed Demand Calculations for PCS and conservatively applied for UCS and FES.
Additional comment	Extrapolated savings likely to be conservative as end-users were not yet accustomed to the new technology and are likely to become more efficient with practice. It is appropriate to conduct a PFT in April – May as this is the same season as when the baseline was conducted.

Data/Parameter	$P_{P, PCS, 2011}$
Unit	Kg / household-day
Description	Quantity of fuel that is consumed in the project scenario for PCS in year 2 (2 years after project PCS were first disseminated)
Source of data	Measured during Project PFT for PCS in March - April 2011.
Value(s) applied	4.97 Kg / household-day (equivalent to 1.813 tons / household year)
Purpose of data	Used in Suppressed Demand Calculations for PCS
Additional comment	The average of $P_{P, PCS, 2009}$ and $P_{P, PCS, 2011}$ are used to estimate the monitored consumption of fuels, which is used to calculate an ex-post evaluation of ERs considering suppressed demand. It is appropriate to conduct a PFT in March – April as this is the same time when the baseline and initial follow-up surveys and tests were conducted.

Data/Parameter	$EF_{b, CO2}$ and $EF_{p, CO2}$
Unit	tCO_2 / t_wood
Description	CO_2 emission factor arising from use of fuels in baseline and project scenarios
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Tables 1.2/1.4
Value(s) applied	1.7472 tCO2/t wood (=112.0 tCO2/TJ * 0.0156 TJ/ t)

Purpose of data	Default IPCC values for wood / wood waste are applied for emission factors required to calculate CO_2 emission reductions
Additional comment	EF in baseline and project have the same value as the project reduces use of the same fuel.

Data/Parameter	$EF_{b, nonCO2}$ and $EF_{p, nonCO2}$
Unit	tCO_2 / t_wood
Description	Non-CO_2 emission factor arising from use of fuels in baseline and project scenarios
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 2.9 in Volume 2: Energy
Value(s) applied	Up to December 31, 2012: 0.4554 tCO2/t wood (=(1.224 tCO2/TJ * 0.0156 TJ/ t * 21) + (0.01125 tCO2/TJ * 0.0156 TJ/ t * 310)) Effective January 1, 2013: 0.5296 tCO2/t wood (=(1.224 tCO2/TJ * 0.0156 TJ/ t * 25) + (0.01125 tCO2/TJ * 0.0156 TJ/ t * 298))
Purpose of data	Default IPCC values for CH4 and N20 emissions for wood / wood waste are applied. The following GWP100 are applied up to December 31, 2012: 21 for CH4, 310 for N20; and effective January 1, 2013: 25 for CH4, 298 for N20.
Additional comment	Both defaults are within a range and the mean of the range is taken as the default. Technical references are from studies in developing country contexts and are more up-to-date than other default values. EF in baseline and project have the same value as the project reduces use of the same fuel.

Data/Parameter	$Eff_{b,y}$
Unit	%
Description	Efficiency of the various baseline technologies i
Source of data	GS methodology default
Value(s) applied	10%
Purpose of data	This is a conservative value that can be confirmed for three stone fires or other baseline stoves using simple boiling tests.
Additional comment	This parameter is included for *suppressed demand* calculations.

Data/Parameter	$Eff_{p,PCS}$

Unit	%
Description	Efficiency of portable ceramic stove (PCS)
Source of data	Testing the Chitetezo Mbaula. Biomass Research Centre of the Centre for Research in Energy and Energy Conservation (CREEC), Makerere University – College of Engineering, Design, Art and Technology, Kampala, Uganda, August 2012.
Value(s) applied	31%
Purpose of data	Thermal efficiency of PCS that can be compared with efficiency of aging project PCS using simple water boiling tests.
Additional comment	This parameter is included for *suppressed demand* calculations.

D.2. Data and parameters monitored

Data/Parameter	fNRB
Unit	Percent
Description	Non-renewability status of woody biomass fuel for the project in monitoring period 2.
Measured/Calculated/ Default	Default
Source of data	CDM – SSC WG Thirty fifth meeting report, Annex 20, page 4 (February 2012).
Value(s) of monitored parameter	81%
Monitoring equipment	
Measuring/Reading/ Recording Frequency	Fixed by baseline study for a given crediting period, updated if necessary
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Calculation of baseline emissions.
Additional comment	73.82% was the value used in registered PDD Version 3 from Baseline Study conducted by PP (section B.2.2 in PDD); At registration and verification (FAR1) PP asked to be replace fNRB by *"a more actual official credible value as soon as a value is publicly available for the republic of Malawi".*81% is the value used in registered PDD Version 6, page 25 with confirmation of acceptance by Malawi's DNA, the Environmental Affairs Department, on 15 June 2012 as the default value of non-renewable biomass (fNRB) for the Republic of Malawi.

Data/Parameter	**$P_{P, ICS, 2013}$**
Unit	Kg / adjusted adult meal
Description	Quantity of fuel that is consumed in the project scenario for ICS in year 0 (when project ICSs were first disseminated)
Measured/Calculated/ Default	Measured
Source of data	Average of Project PFT for ICS in 2011 and Project PFT for ICS in September 2013 – October 2013.
Value(s) of monitored parameter	0.0538 Kg / adjusted adult meal
Monitoring equipment	Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg)
Measuring/Reading/ Recording frequency	Updated every 2 years, or more frequently
Calculation method (if applicable)	Wood is weighed at the start and the end of each day for three consecutive feeding days. 2011 KPT value = 0.0854 kg / adjusted adult meal 2013 KPT value = 0.0223 kg / adjusted adult meal Average = (0.0854 + 0.023)/2 = 0.0538 kg / adjusted adult meal
QA/QC procedures	Pre-testing conducted to train enumerators; paired tests to minimise external factors, large sample (n=93 (3 days info from 31 institutions)) used to minimise bias. To normalise different types of meals into person-meals or adult equivalent meals, adjustment factors are presented in person meal parameter presented in data and parameters fixed ex-ante above.
Purpose of data	Calculation of project emissions
Additional comment	

Data/Parameter	$Eff_{P,ICS}$
Unit	tonnes wood / 10,000 meals
Description	Efficiency of aging project ICS
Measured/Calculated/ Default	Calculated
Source of data	Average of Project PFT for ICS in 2011 and Project PFT for ICS in September 2013 – October 2013
Value(s) of monitored parameter	$Eff_{P,ICS,0-1}$ = 0.538 tonnes wood / 10,000 meals $Eff_{P,ICS,1-2}$ = 0.538 tonnes wood / 10,000 meals

	$Eff_{P,ICS,2-3}$ = 0.538 tonnes wood / 10,000 meals $Eff_{P,ICS,3-4}$ = 0.538 tonnes wood / 10,000 meals
Monitoring equipment	Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg)
Measuring/Reading/ Recording frequency	Every 2 years
Calculation method (if applicable)	Wood is weighed at the start and the end of each day for three consecutive feeding days. 2011 KPT value = 0.0854 kg / adjusted adult meal 2013 KPT value = 0.0223 kg / adjusted adult meal Average = (0.0854 + 0.022)/2 = 0.0538 kg / adjusted adult meal
QA/QC procedures	Pre-testing conducted to train enumerators; paired tests to minimise external factors, large sample (n=93 (3 days info from 31 institutions)) used to minimise bias. To normalise different types of meals into person-meals or adult equivalent meals, adjustment factors are presented in person meal parameter presented in data and parameters fixed ex-ante above.
Purpose of data	Calculation of project emissions
Additional comment	

Data/Parameter	**$U_{P, PCS}$**
Unit	Percent
Description	Single Weighted Usage Parameter for PCS age 0-4 in year 5 of the project. Based on cumulative usage rate for technologies in project scenario PCS. Usage of stoves over time to determine project fuel consumption for PCS users.
Measured/Calculated/ Default	Calculated
Source of data	Usage surveys for PCS in November 2013.
Value(s) of monitored parameter	70.32%
Monitoring equipment	
Measuring/Reading/ Recording frequency	Annual or more frequently, in all cases on time for any request for Issuance. One Usage Survey per monitored household.
Calculation method (if applicable)	Usage rates for PCS of each age group taken as percentage of stoves in use with 90 % confidence intervals. A normal linear regression model was fitted to the data to determine the trend. $U_{P, PCS, 0-1}$ = 85.7% (after 6 months) $U_{P, PCS, 1-2}$ = 76.9% (after 18 months)

	$U_{P, PCS, 2-3}$ = 68.2% (after 30 months) $U_{P, PCS, 3-4}$ = 59.4% (after 42 months) Single weighted usage parameter is the sum of products of usage rates and % of total technology days for PCS of each age group: = (% of technology days age 0-1 * 85.7%) + (% of technology days age 1-2 * 76.9%) + (% of technology days age 2-3 * 68.2%) + (% of technology days age 3-4 * 59.4%)
QA/QC procedures	Pre-testing conducted to train enumerators; large sample (n=144) used to minimise bias.
Purpose of data	Calculation of emission reductions
Additional comment	The data was tested for dependency and both the autocorrelation and partial autocorrelation were not significant. Therefore, time series models (autoregressive and moving average models) could not be fit to the data.

Data/Parameter	**UP_{ICS}**
Unit	Percent
Description	Single Weighted Usage Parameter for ICS ages 0-4 in year 5 of the project. Based on cumulative usage rate for technologies in project scenario ICS. Usage of stoves over time to determine project fuel consumption for ICS users.
Measured/Calculated/ Default	Calculated
Source of data	Usage and monitoring surveys September – October 2013
Value(s) of monitored parameter	89.4%
Monitoring equipment	
Measuring/Reading/ Recording frequency	Annual or more frequently, in all cases on time for any request for issuance. One Usage Survey per monitored institution.
Calculation method (if applicable)	Percentage of stoves in use $U_{P, ICS, 0-1}$ = 100% (after 6 months) $U_{P, ICS, 1-2}$ = 89% (after 18 months) $U_{P, ICS, 2-3}$ = 75% (after 30 months) $U_{P, ICS, 3-4}$ = 100% (after 42 months) – Note that this is because there is only one stove in this age group and it is still in use. Single weighted usage parameter is the sum of products of usage rates and % of total technology days for ICS of each age group:

	= (% of technology days age 0-1 * 100%) + (% of technology days age 1-2 * 89%) + (% of technology days age 2-3 * 75%) + (% of technology days age 3-4 * 100%)
QA/QC procedures	
Purpose of data	Calculation of emission reductions
Additional comment	

Data/Parameter	$\mathbf{N_{PCS, y}}$
Unit	Technology days
Description	Technology days in the project database for the project scenario PCS through year. Used to calculate emission reductions.
Measured/Calculated/ Default	Calculated
Source of data	Total sales record. Calculated from day after technology is disseminated for specific monitoring periods (all dates inclusive).
Value(s) of monitored parameter	$N_{PCS, 02/10/2012 – 01/10/2013}$ = 7,979,987 technology days
Monitoring equipment	
Measuring/Reading/ Recording frequency	Continuous
Calculation method (if applicable)	Technology days = number of devices * number of days in use for current monitoring period
QA/QC procedures	Transparent data analysis and recording
Purpose of data	Calculation of emission reductions
Additional comment	

Data/Parameter	$\mathbf{N_{ICS, y}}$
Unit	Technology days
Description	Technology days in the project database for the project scenario ICS through year. Used to calculate emission reductions.
Measured/Calculated/ Default	Calculated

Source of data	Total sales record. Meals are estimated in adult adjusted meals. Number of adult adjusted meals per feeding day and number of feeding days per year estimated to give number of adult adjusted meals per year and divided by 365 gives equivalent amount of ICS meals per day. Then number of ICS days calculated from day of commission for specific monitoring periods.
Value(s) of monitored parameter	$N_{ICS,\ 02/10/2012-\ 01/10/2013}$ = 352,202 technology days
Monitoring equipment	
Measuring/Reading/ Recording frequency	Continuous
Calculation method (if applicable)	Technology days = number of devices * number of days in use for current monitoring period
QA/QC procedures	Transparent data analysis and recording
Purpose of data	Calculation of emission reductions
Additional comment	

Data/Parameter	$Eff_{P,PCS}$
Unit	%
Description	Efficiency of aging project PCSs. To assess how the efficiency of project PCS compare to that of a baseline conservative estimation of 31% efficiency for PCS.
Measured/Calculated/ Default	Measured
Source of data	Water boiling tests in May 2012 and January – March 2013 using Water Boiling Test protocol 4.1.2. (http://www.pciaonline.org/files/WBT4.1.2_0_0.pdf) Test results statistically analysed to establish efficiency of aged PCS for GS 613.
Value(s) of monitored parameter	$Eff_{P,PCS,0-1}$ = 25.61% $Eff_{P,PCS,1-2}$ = 25.15% $Eff_{P,PCS,2-3}$ = 24.69% $Eff_{P,PCS,3-4}$ = 24.23%
Monitoring equipment	Volctraft K-101 Digital Thermometer (Measurement Range -200 C to +200 C; Accuracy ± (0.3% of the display, + 1 C); KD-8000 Scale (Accuracy ± 1g); and Voltcraft FM-300 Wood Humidity Measuring Device.
Measuring/Reading/ Recording frequency	Every 2 years

Calculation method (if applicable)	
QA/QC procedures	Training and pre-testing of protocol. Use of accurate equipment that was recently calibrated in factory.
Purpose of data	Calculation of emission reductions
Additional comment	This parameter is included for *suppressed demand* calculations as per GS613 PDD Version 6 Annex 5. The efficiency for each age is used in calculation of ER calculations expressed in "tonnes CO2 / HH / day" columns in the "ER Calcs" Excel database for each technology being credited. Calculations are as follows: ER / hh / day = ($U_{P,PCS,Y}$ * ($P_{b,y}$ * (1 – ($Eff_{b,y}$ / $Eff_{P,PCS,Y}$))) / 365

Data/Parameter	Bpj,y
Unit	Tonnes of dry biomass
Description	Monitored consumption of fuels over time. Tonnes of dry biomass used in the project for technology and fuel combination pj in year y
Measured/Calculated/ Default	Calculated
Source of data	(i) Baseline Field Test (BFT) for PCS, and (ii) Project Field Test for PCS users 2 years after purchasing PCS; April 2009 and April 2011 Monitoring equipment: Voltcraft FM-300 Wood Humidity Measuring Device; Voltcraft digital hanging scales to weigh biomass; Biomass consumption and moisture content are monitored and measured using protocols prescribed in the methodology
Value(s) of monitored parameter	1.6895 Tonnes of dry biomass = ((1.566 + 1.813 tonnes biomass)/2)
Monitoring equipment	Voltcraft FM-300 Wood Humidity Measuring Device; Voltcraft digital hanging scales to weigh biomass;
Measuring/Reading/ Recording frequency	Fixed updated baseline; B_{PY}
Calculation method (if applicable	
QA/QC procedures	Trained enumerators, sufficiently large sample.
Purpose of data	Calculations for suppressed demand
Additional comment	This parameter is included for *suppressed demand* calculations. Baseline wood use = Bpj,y * ($Eff_{p,y}$ / $Eff_{b,y}$) Baseline emissions ($Eff_{b,y}$) = Baseline wood use * Emission factor of

	baseline and project fuel $Eff_{b,y}$ ultimately used in ER calculations as follows : ER / hh / day = ($U_{P,Y}$ * ($P_{b,y}$ * (1 – ($Eff_{b,y}$ / $Eff_{P,Y}$))) / 365 To be updated for MR4.

Data/Parameter	$LE_{p,MR4}$
Unit	%
Description	Leakage in project scenario during year 02/10/2012 – 01/10/2013
Measured/Calculated/ Default	Calculated
Source of data	PCS Usage and Monitoring surveys – November 2013 ICS Usage and Monitoring Surveys 2013
Value(s) of monitored parameter	PCS – 5% ICS – 10%
Monitoring equipment	
Measuring/Reading/ Recording frequency	Every 2 years
Calculation method (if applicable)	Leakage was taken as 5% of gross PCS emission reductions to account for user households which also retain use of their baseline stoves, and 10% of gross ICS emission reductions to account for retained use of baseline stoves.
QA/QC procedures	Transparent data analysis and reporting
Purpose of data	Calculation of emission reductions
Additional comment	Leakage assessed is reported every 2 years and thus far has been reported as a zero value. Aggregate leakage is assessed for multiple project scenarios through ongoing monitoring surveys for each of the project technologies, dates of which are reported above. To date the only source of leakage which has been identified is the continued use of the baseline stove together with the project stove in some households. No households claim to use the stoves for any purpose other than cooking and heating water (no space heating). Please see Part IV.4 for further discussion on leakage.

Monitoring Results for Gold Standard Sustainability Indicators as per GS613 Passport Version 4 (Gold Standard Requirement)

Indicator	Data type	Data variable	Data unit	Value	Source
Air quality	Survey and/or PM concentrations	Air pollutants (CO, particulates)	Survey observations and /or indoor air pollution	Qualitative: 100% of survey respondents stated that there is less smoke from devices promoted by the project In the Kitchen Survey for PCS conducted in November 2013. 95% of ICS surveyed users also claim that there is less smoke in the kitchen with this project stove Quantitative: Air quality tests carried out in 2009 reveal an average reduction of 41% in PM concentrations for PCS users.	PCS KS results excel. ICS KS results excel.
Water quality and quantity	Survey	Soil erosion / river siltation -mitigated due to reduction in tree-felling.	Proper use of devices Sales data	All end-users are using improved devices properly and are generating wood fuel savings. Shire river produces most of Malawi's hydro electricity and has been identified by Malawi's National Adaptation Programme of Action (NAPA) as a region where reforestation should be prioritised. Approximately 26,730 households that have accessed PCS are located in the Upper Shire region in keeping with priorities of NAPA. It is assumed that wood savings translate into reduced tree felling or a reduction in the increase of tree felling associated with current trends in deforestation and increased pressure on natural resources.	PCS KS results excel. Note – positive impact of ICS use not included
Soil condition	Survey	Soil quality at a community level - Soil condition enhanced due to reduced soil erosion.	Clay collection for use as an input into stove production.	Sources of clay for all PCS production centres monitored. Reduced wood harvests and associated reduction in deforestation, which is the norm, are likely not to deteriorate soil quality.	Clay monitoring excel.
Biodiversity	Surveys	Alteration and destruction of natural habitat mitigation	Proper use of stoves	Reduced pressure on natural resources can improve the integrity of natural habitat for flora and fauna. 26,730 households using improved Cook Stoves and 101 institutions using improved Institutional cook stoves contribute positively to reducing pressure on natural resources.	PCS KS results excel, ICS KS excel.
Quality of employment	Policies	Provision of health insurance for Project Staff	Project staff with health insurance.	All staff employed directly by the project are covered with health insurance	Area 55 General Policies and Procedures
Livelihood of the poor	Survey	Financial impact (Note: savings	MK (Malawi Kwacha) saved per	From the devices disseminated by the project to date:	Livelihood of poor excel, PCS KS results

		estimated are only economic estimation of wood savings and not real monetary saving for households since the wood is mostly collected and not purchased).	year	Savings of wood is valued at MK 270 million p.a. Savings of labour in terms of cooking time savings and fuel collection savings is valued at MK 180 million p.a.	excel.
Access to affordable and clean energy services	Monitoring of sales	Access to clean technologies	Number of stoves and rocket barns sold.	Up to 26,730 households have accessed affordable and appropriate PCS. 101 institutions are using 260 improved institutional stoves.	PCS Sales Records (from November 24 2008 to September 9,2012), ICS Sales Records (from November 24, 2008 to October 1, 2013)
Human and Institutional capacity	Survey	Numbers	Trainees, employees with new skills	450 people trained in various new skills – stove production, promotion, sales, environmental education, business, database management, geographic information systems, data collection and project monitoring. 67% of all direct employment are female.	Employment and skills development excel.
Quantitative employment and income generation	Survey	Numbers – job creation	Jobs / year	The project is generating income for 450 people (94% in rural areas, 6% in urban)	Employment and skills development excel.
Balance of payments & investment	Clay monitoring info and example invoices from new companies	Increased investment in dissemination of improved devices	New businesses. New production groups.	The PP makes direct foreign investment for project implementation.	New groups documented in clay monitoring excel.
Technology transfer & technological self-reliance	Total sales records	Dissemination record	Number of stoves and rocket barns sold.	As in access to clean technologies above.	PCS Sales Records (from November 24 2008 to September 8,2012), ICS Sales Records (from November 24, 2008 to October 1, 2013)

D.3. Implementation of sampling plan

For MP4 both usage and monitoring surveys and kitchen performance tests were required for the ICS. Since the KPT requires the enumerator to visit the same institutions each day for 4 consecutive days, emphasis was placed on reaching institutions [and stoves] in relatively close proximity to one another. A random sample was not conducted; rather, great effort was made to reach as many institutions and stoves as possible within the districts with the greatest concentration of stoves. In total, institutions and stoves from 5 districts representative of Central and Southern region were surveyed and tested. For the PCS, over 90% of the stoves sold are in a concentrated area within 3 – 4 TAs (Traditional Authorities) that consist of more than 800 villages in 3 of the 30 districts of Malawi. As per FAR Q1 of MR3, a simple random sample was used for usage and monitoring surveys and to assess average stove lifespan. The simple random sample was first applied to the GVHs (a purely random sample from the total sales record would present enormous financial and logistical challenges) to obtain between three and five GVHs with the highest numbers of stoves per age group, and then to all stoves from those GVHs in the total sales record to obtain a minimum of 40 households for survey. (Previous sampling was based on discussions with field officers and as allowed by the Methodology[6]: five geographic jurisdictions locally called Group Village Headman (GVH) each containing on average 10 villages, were selected as being representative of 800-plus villages and users of technologies of each age were random sampled from this cluster. This approach was justified as the villages share very similar socioeconomic, cultural, climatic, geographic and altitudinal characteristics. This approach also facilitated efficient and effective monitoring in terms of time, effort and financial costs.)

For PCS domestic stoves demand is seasonal and dissemination is not evenly distributed throughout the year, which complicated calculating usage at time intervals of 6 months, 18 months and 30 months. The results of the usage surveys in MP4 were similar to those in MP3; therefore, the PP continues to use the stove lifespan as per regression analysis in MP3 conducted by qualified statisticians to calculate usage at the various time intervals to ensure conservativeness in all calculations of fuel savings and emission reductions.

In all cases the minimum sample sizes have been met, where possible, and in some cases there has been over-sampling for PCS. Minimum sample sizes were been met in 3 of 4 cases for the ICS due to slow uptake in the first 3 years of the project.

Water boiling tests have been conducted for aging PCS. Stoves of various ages were randomly selected from one village and the users were asked to give up their old stoves in return for a new stove. Water boiling tests will be continually conducted using a similar approach for aging stoves.

In terms of the desired precision for wood savings estimations, the “90 : 30” rule has been satisfied for all technologies.

A new implementation schedule was presented in the revised monitoring plan of MR3, which plans for GS 613 to conform with *“Technologies and Practices to Displace Decentralised Thermal Energy Consumption (11/04/2011).”*

SECTION E. Calculation of emission reductions or GHG removals by sinks

Emission reduction calculation follows Gold Standard methodology *Technologies and Practices to Displace Decentralised Thermal Energy Consumption (11/04/2011)*; calculation steps are detailed in GS613 PDD V6 (Date November 2, 2012).

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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For the two technologies currently promoted by GS 613, the baseline fuel (i.e. woody biomass) and the project fuel (i.e. woody biomass) are the same, the baseline and project emission factors are the same.

From October 2, 2012 – December 31, 2012:

$EF_{b, wood, CO2}$ = $EF_{p, wood, CO2}$ = 1.747 tCO2/t wood
$EF_{b, wood, nonCO2}$ = $EF_{p, wood, nonCO2}$ = 0.455 tCO2/t wood
$fNRB_{i,p}$ = $fNRB_{i,b}$ = 0.81

In the baseline and project scenarios the combined CO2 and non-CO2 emission factor for wood is:
= ((1.747 * 0.81) + 0.455) tCO2/t wood
= **1.870 tCO2/t wood**

From January 1, 2013 – October 1, 2013:

$EF_{b, wood, CO2}$ = $EF_{p, wood, CO2}$ = 1.747 tCO2/t wood
$EF_{b, wood, nonCO2}$ = $EF_{p, wood, nonCO2}$ = 0.529 tCO2/t wood
$fNRB_{i,p}$ = $fNRB_{i,b}$ = 0.81

In the baseline and project scenarios the combined CO2 and non-CO2 emission factor for wood is:
= ((1.747 * 0.81) + 0.529) tCO2/t wood
= **1.944 tCO2/t wood**

	Before considering SD				Adjusted Baseline considering Suppressed Demand				
HH stove	Tons_wood / HH p.a.			Savings	Fuel efficiency		Tons_wood / HH p.a.		
	$P_{b,0}$	$P_{p,0}$	$P_{b,0}$-$P_{p,0}$	%	Default value $Eff_{b,v}$	CREEC, 2012 $Eff_{p,v,0}$	B pj, $_{2011}$	B pj, $_{2009}$	$P_{b,0,SD}$
PCS	**2.561**	1.566	**0.995**	**39%**	10%	31%	1.813	**1.6895**	5.237

Table 3: Comparison of domestic stoves in tonnes_wood / HH p.a.

Table 3: Comparison of domestic stoves in tonnes_wood / HH p.a.**Table 3** above clearly shows that of the PCS domestic stove promoted by GS 613 has a low project consumption and high percentage project savings relative to the baseline.

The project applies the suppressed demand approach, with the suppressed demand adjusted baseline consumption of 5.237 tonnes_wood / HH p.a. which is equivalent to baseline domestic stove emissions of 9.793 tCO2eq / HH p.a. up to December 31, 2012; and 10.180 tCO2eq / HH p.a. beginning January 1, 2013, as per calculations below:

Suppressed demand adjusted baseline consumption x Emission Factor of Baseline and Project Fuels

From October 2, 2012 – December 31, 2012:
5.237 tonnes_wood/HH/year x 1.870 tonnes_CO2e/tonne_biomass = 9.793 tCO2eq/HH/year

From January 1, 2013 – October 1, 2013:
5.237 tonnes_wood/HH/year x 1.944 tonnes_CO2e/tonne_biomass = 10.180 tCO2eq/HH/year

For institutional cook stoves, baseline and project emissions are based on adjusted adult meals, where children's meals and light meals (e.g. teas) are normalised to be on the same metric as adult meals. Baseline consumption of wood for one adult meal was 60.2 g_wood / adjusted adult meal, which is

equivalent to 6.739 tCO2eq / 10,000 adjusted adult meals. up to December 31, 2012, and 7.006 tCO2eq / 10,000 adjusted adult meals beginning January 1, 2013, as per calculations below:

From October 2, 2012 – December 31, 2012:
3.604 tonnes_wood/10,000 meals x 1.870 tonnes_CO2e/tonne_biomass = 6.739 tCO2eq/HH/year

From January 1, 2013 – October 1, 2013:
3.604 tonnes_wood/10,000 meals x 1.944 tonnes_CO2e/tonne_biomass = 7.006 tCO2eq/HH/year

Baseline emissions in absence of project activity shown below:

Baseline Emissions (tCO2e)
Carbon flows

			Monitoring period						
			MR1	MR2	MR3	MR4			
Offset vintage	Device	Devices sold	24/11/2008 - 1/10/2010	2/10/2010 - 1/10/2011	2/10/2011 - 1/10/2012	2/10/2012 - 31/12/2012	1/1/2013 - 1/10/2013	Total	
24/11/2008 - 1/10/2009	PCS	1,767	5,431	10,636	10,033	2,630	4,726	33,456	46,415
	RB	153	4,197	4,339	4,424	0	0	12,960	
2/10/2009 - 1/10/2010	PCS	5,308	5,193	34,421	31,104	7,901	24,548	103,168	169,218
	FES	1,524	3,633	6,380	0	0	0	10,013	
	UCS	51		310	0	0	0	310	
	ICS	1		7	9	2	5	23	
	RB	588	20,323	18,374	17,008	0	0	55,704	
2/10/2010 - 1/10/2011	PCS	5,839		24,907	35,194	8,806	27,563	96,469	115,010
	FES	862		3,126	1,797	0	0	4,923	
	UCS	204		578	0	0	0	578	
	ICS	102		198	756	154	482	1,589	
	RB	211		5,835	5,616	0	0	11,451	
2/10/2011 - 1/10/2012	PCS	7,228			9,873	11,036	34,544	55,454	59,779
	ICS	697				1,047	3,278	4,325	
2/10/2012 - 31/12/2012	PCS	0				0	0	0	341
	ICS	57				341	0	341	
1/1/2013 - 1/10/2013	PCS	6,588				0	14,919	14,919	14,919
	ICS	399					673	0	
			38,777	109,111	115,812	**31,917**	**110,738**		405,682

E.2 Calculation of project emissions or actual net GHG removals by sink

Project emissions are calculated for PCS as per Annex 5 of the GS 613 PDD V 6:

Project Fuel Consumption * Emission Factor of Project Fuel
Ending December 31, 2012 = 1.690 tonnes_wood / hh year * 1.870 = 3.15
Beginning January 1, 2013 = 1.690 tonnes_wood / hh / year * 1.944 = 3.28

For ICS, project emissions are calculated per 10,000 meals in a similar way:

Project Fuel Consumption (per 10,000 meals) * Emission Factor of Project Fuel
Ending December 31, 2012 = 0.538[7] tonnes_wood / 10,000 meals * 1.870 = 1.007 tCO2e / 10,000 meals
Beginning January 1, 2013 = 0.538 tonnes_wood / 10,000 meals * 1.944 = 1.047 tCO2e / 10,000 meals

The ERs achieved during the monitoring period are the sum of calculations for each technology (less leakage) using the formula below:

[7] 0.602 tonnes wood per 10,000 meals is the average of 2011 project KPT result 0.854 tonnes wood used per 10,000 meals and the 2013 project KPT result 0.350 tonnes wood used per 10,000 meals, in keeping with conservative approach of project.

VERs = $N_{PCS\ 2/10/2012 – 1/10/2013}$ * ER / hh / day

Where

ER / hh / day = ($U_{PCS\ 0\text{-}4}$ * ($P_{b,y}$ * (1 – ($Eff_{b,y}$ / $Eff_{P,PCS,Y}$)))) / 365

And

$U_{PCS\ 0\text{-}4}$ represents the single weighted usage for the technology ages 0-4
$P_{b,y}$ represents the baseline emissions
$Eff_{b,y}$ represents the efficiency of the baseline technology
$Eff_{P,PCS,Y}$ represents the efficiency of the project technology

Project emissions and emission reductions due to project activity are shown below:

Project Emissions (tCO2e)
Carbon flows

			Monitoring period						
			MR1	MR2	MR3	MR4			
Offset vintage	Device	Devices sold	24/11/2008 - 1/10/2010	2/10/2010 - 1/10/2011	2/10/2011 - 1/10/2012	2/10/2012 - 31/12/2012	1/1/2013 - 1/10/2013	Total	
24/11/2008 - 1/10/2009	PCS	1,767	1,752	3,431	3,236	849	1,525	10,792	15,408
	RB	153	1,495	1,545	1,576	0	0	4,616	
2/10/2009 - 1/10/2010	PCS	5,308	1,675	11,104	10,034	2,549	7,919	33,281	56,457
	FES	1,524	1,172	2,058	0	0	0	3,230	
	UCS	51		100	0	0	0	100	
	ICS	1		2	2	0	1	5	
	RB	588	7,239	6,545	6,058	0	0	19,841	
2/10/2010 - 1/10/2011	PCS	5,839		8,035	11,353	2,841	8,892	31,120	37,294
	FES	862		1,008	580	0	0	1,588	
	UCS	204		186	0	0	0	186	
	ICS	102		47	179	23	72	321	
	RB	211		2,078	2,000	0	0	4,079	
2/10/2011 - 1/10/2012	PCS	7,228			3,185	3,560	11,144	17,890	18,536
	ICS	697				157	490	647	
2/10/2012 - 31/12/2012	PCS	0				0	0	0	51
	ICS	57				51	0	51	
1/1/2013 - 1/10/2013	PCS	6,588				0	4,813	4,813	4,813
	ICS	399					101	0	
			13,333	36,139	38,202	**10,030**	**34,957**		132,560

E.3 Calculation of leakage

GS613 was previously monitored for leakage in MR1 where no significant sources of leakage were identified. In MP4, PCS usage and monitoring surveys were revised as per FAR P4 of MR3 to more adequately address leakage. To this end, the PP included space heating as an option expressly given to respondents along with cooking and heating water, as a main use for the PCS. As per the PCS Usage and Monitoring Survey report (November 2013), all respondents claimed to use their stoves for cooking and heating water, and none responded to using the PCS for space heating.

Another potential source of leakage which was addressed was the continued use of baseline stoves. To this end, 35.8% of respondents (42 of 117 PCS users) claim to seldom use their baseline stove (this was defined as once a week on average). This would represent 1.7% leakage, based on the calculation below:

Baseline stove usage (seldom) = 1/21 (based on standard average of 3 meals per day)

Leakage = % of households seldom using baseline stove * Baseline stove usage

= 35.8% * 1/21 = 1.7%

1.7% of survey respondents (2 of 117 PCS users) claim to use their baseline stoves often (defined as at least once every 2 days). This would represent an additional 0.28% leakage, based on the calculation below:

Baseline stove usage (often) = 3.5/21 = 16.6%

Leakage = % of households using baseline stove often * Baseline stove usage

= 1.7% * 16.6% = 0.28%

Total leakage as per PCS usage and monitoring surveys (November 2013) = 1.7% + 0.28% = 1.98%

The PP has opted to apply 5% leakage to the overall ERs for PCS households so that its estimations of emission reductions remain conservative.

For ICS, the annual survey revealed that 25% of institutions using the ICS were also using baseline stoves. If we assume that each institution used 1 baseline stove for every 3 ICS stoves, representing 25% of total usage, leakage is calculated at 6.25%. The PP has conservatively applied a 10% leakage factor.

The following possible sources of leakage continue to be monitored in annual Monitoring and Usage Surveys, and Project Field Performance Tests:

- Increased use of non-renewing biomass as a result of savings in woodfuel use. Evidence from the baseline kitchen surveys and tests demonstrate (i) increasing scarcity of wood and (ii) increasing price of woodfuel. Avoided consumption should also be considered in a context where basic energy needs are not being met in baseline scenarios.
- Users of efficient stoves replace lower emissions technology than the improved stove. For example, switching from inefficient fuelwood to efficient charcoal can yield an increase in overall emissions in some cases. There is also evidence from the baseline Kitchen Surveys and Tests for the portable ceramic stove in Balaka that some of the few rural households that were using charcoal during the baseline shifted to use of wood fuel with lower net GHG emissions. GS 613 does not promote the use of charcoal or appliances that use charcoal; and its fuel-efficient wood-burning devices aim to discourage the use of charcoal, which is currently harvested unsustainably and produced inefficiently in Malawi.
- Improved stove users compensate for loss of the space heating effect of inefficient cook-stoves by adopting some other form of heating, such as open fires, or by retaining some use of inefficient stoves. Space heating effect is already duly captured in the KPTs (over a 72-hour period). The baseline was not conducted in cold period or in high altitude areas thus avoiding bias in the pre-project consumption. KPTs were conducted in the same season as the baseline which is appropriate.
- The traditional or conventional stoves replaced by the improved stoves are re-used by the same families or other families in a manner suggesting increased consumption of woodfuel beyond the baseline demand level. GS 613 predominantly replaces 3-stone fires which are used by over nine out ten rural households in Malawi (Energy Policy 2003).
- Manufacture, distribution, or use of the improved stoves gives rise to new emissions associated with transport or manufacturing. Wood that is used in the firing of ceramics (e.g. portable ceramic stove) is negligible (e.g. 2 kg / stove compared to the annual savings (e.g. >1 tonne / stove / year).

Future offset calculations will be adjusted accordingly if sources of leakage are later identified. It should be considered that the basic energy needs are not being met in the baseline scenarios and savings are used to bridge this gap and are unlikely to be wasted or lost through leakages.

E.4 Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_{2e})	5% Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
02/10/2012 – 31/12/2012	31,917.40	10,029.53	3,834.76	18,053.11
01/01/2013 – 01/10/2013	110,738.20	34,956.63	13,338.67	62,442.90
Total	142,655.60	44,986.16	17,173.43	80,496.01

The Project underwent a simple scale reduction and is now within the Small Scale threshold of 80,581 CO2 eq . p.a. (see calculation below):

Using 81% NRB for Malawi the tonnes CO2eq / tonne wood is calculated as:
1.871 using old GWP for N2O and CH4, effective up to December 31, 2012 (applied to the first 91 days (25%) of the 365-day crediting period) and
1.944 using new GWP for N20 and CH4, effective as at January 1, 2013 (applied to the latter 274 days (75%) of the 365-day crediting period)

Weighted average of EF for baseline and project fuels
= (1.870 * 25%) + (1.944 * 75%) = 1.925

15.6GJ/tonne wood * 1000MJ/GJ/3.6MJ/kWh/100,000kWh/GWh
= 0.0043GWh/tonne wood

So 180GWh/year = 41,860 tonnes of wood or,

41,860 tonnes wood/year * 1.925 tonnes CO2/tonne wood

= 80,581 tonnes CO2/year

Total VERs to be claimed in MR4 is 80,496 which is equivalent to 41,816 tonnes wood/year below the small scale threshold of 41,860 tonnes of wood.

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO_2eq)	77,500 VERs for year 5(24/11/2011 – 23/11/2012) as per registered PDD Version 6	80,496 tCO2e for year 2/10/2012 to 1/10/2013 (inclusive of both dates).

E.6. Remarks on difference from estimated value in registered PDD

GS613 has reached the upper limits of small scale methodology quicker as projected in the revised PDD GS613 V6. Revision of IPCC GWP values has also resulted in increased small scale limit.

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History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Form **Business Function**: Issuance		

Annex 1. Sampling and Monitoring Schedule for GS613 (to be updated annually):

Parameters	**GS 613 V.6**	**Last done**	**Next Due?**
NRB	Fixed; updated if necessary	Proposed default of 81% accepted by Malawi's DNA on 15 June 2012	Updated if necessary (no update period specified)
Fuel consumption in baseline (PBY) or $B_{BL,Y}$ to verify; baseline FT update	Updated every 2 years, except in cases where a fixed baseline is adopted	Fixed baseline is adopted and accepted	Fixed baseline is adopted and accepted
$B_{P,Y}$ or P_{PY}, project FT update	Every 2 years for ICS; PCS not monitored as per SD approach	2011 (PCS), 2013 (ICS)	2015 (ICS)
Usage (drop off rate) UPY (project scenario)	Annual or more frequently	2013 (PCS, ICS)	2014 (PCS, ICS)
Performance test/project fuel test (WBTs for domestic wood stoves)	Every 2 years	2013 (ICS), 2013 (PCS)	2015 (ICS), 2015 (PCS)
New stove performance	No new stove		
Stove sales	Continuous	Continuous	Continuous
Monitoring surveys	Every year	2013 (PCS, ICS)	2014 (PCS, ICS)
GSF required SD indicators			
Air Quality	Annual	2013 monitoring surveys (PCS, ICS)	In time for MR 5
Water qual & quan	Annual	2013 monitoring surveys (PCS, ICS)	In time for MR 5
Biodiversity	Annual	2013 monitoring surveys (PCS, ICS)	In time for MR 5
Soil condition	Annual	2013	In time for MR 5
Quality of employment	Annual	2013	In time for MR 5
Livelihood of the poor	Annual	2013	In time for MR 5
Access to clean energy	Annual	2013	In time for MR 5
Human & instit. Cap	Annual	2013	In time for MR 5
Quant employm't & IGAs	Annual	2013	In time for MR 5
BoP & investments	Annual	2013	In time for MR 5
Tech transfer	Annual	2013	In time for MR 5
Leakage assessment		2013 (PCS)	2015 (PCS)
Update parameters	Every 2 years	2013 for MR3V5	2015 for MR6