MONITORING REPORT FORM (F-CDM-MR)
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 4
Completion date of the monitoring report	January 22nd 2013
Registration date of the project activity	1/10/2010
Monitoring period number and duration of this monitoring period	Monitoring period number 2 October 2, 2010 to October 1 2011 (inclusive of both dates).
Project participant(s)	Hestian Innovation Ltd.
Host Party(ies)	Malawi
Sectoral scope(s) and applied methodology(ies)	Energy Efficiency in thermal applications of non-renewable biomass Methodology: Gold Standard Technologies and Practices to Displace Decentralised Thermal Energy Consumption
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	59,078 VERs for year 3 (24/11/2010 – 23/11/2011) as per registered PDD Version 6
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	72,972 VERS for year 2/10/2010 to 1/10/2011 (inclusive of both dates).

PART I. Description of project activity

A.1. **Purpose and general description of project activity**

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

This Monitoring Report applies to five technologies, namely: (1) Portable Ceramic Stoves; (2) Fixed Esperanza Stoves; (3) Rocket Barns; (4) Institutional Cook Stoves and (5) Urban Cook Stoves.

				
(1) Portable ceramic stove	(2) Fixed *esperanza* stove	(3) Rocket Barn	(4) Institutional Cook Stove	(5) Urban Cook Stove

The project activity involves progressive installation of four types of improved cook stoves and improved tobacco curing 'rocket barns'. Kitchen Tests and Kitchen Surveys have been conducted for all of the fuel-efficient devices.

Urban Cook Stoves (UCS) and Institutional Cook Stoves (ICS) have been included in the project activity based on feedback received during local stakeholder consultation. Kitchen Surveys and Kitchen Tests have been completed for UCS and ICS clusters and are presented in this report.

This Monitoring Report covers:

(1) Portable Ceramic Stoves (PCS);

(2) Fixed Esperanza Stoves (FES);

(3) Rocket Barns (RB);

(4) Institutional Cook Stoves (ICS); and

(5) Urban Cook Stoves (UCS).

Benefits of this project 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 farmers 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.

A.2. **Location of project activity**

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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)**
The host country is Malawi. Malawi is not a project	**Hestian Innovation Ltd.**	**Yes**

participant. The project is voluntary and is therefore not hosted or invested in by a party of the Kyoto Protocol.		

A.4. **Reference of applied methodology**

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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 November 24 2008 to November 23 2015 (both days included).

PART II. Implementation of project activity

A.1. **Description of implemented registered project activity**

The project activity has disseminated Portable Ceramic Stoves (PCS), Fixed Esperanza Stoves (FES), Rocket Barns (RB), Institutional Cook Stoves (ICS) and Urban Cook Stoves (UCS) as detailed in the box below with a calculated GHG offset of 72,972 tons generated during the monitoring period.

Devices sold generating emission reductions:				
	24/11/2008 to 01/10/2009	2/10/2009 to 01/10/2010	02/10/2010 to 01/10/2011	Total
PCS	1767	5308	5839	12914
FES	0	1,524	862	2,386
RB	153	588	211	952
ICS	0	1	30	31
UCS	0	51	204	255

Note: documented replacement and additional PCS stoves, totaling 112 and 643 respectively, are neither included in the table above nor are considered for ER calculations.

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

Date	**Activity**	**Purpose**
2nd of October, 2010 – 1st of October 2011	Sales recording	Establish sales database to track number of devices sold and determine clusters for kitchen / barn surveys
Ongoing	Non-Renewable Biomass – monitoring for official credible publicly available value	Determine percentage of non- renewable biomass
(see box below)	Baseline Kitchen Performance Tests Baseline Kitchen Surveys for ICS and UCS clusters	Determine baseline firewood savings and clusters
1-6 December 2010 (PCS)	Kitchen Surveys (PCS)	Determine if clusters are still

1-8 June 2011 (PCS)		representative
6-13 December 2010 (FES) 11-14 July 2011 (FES)	Kitchen Surveys (FES)	Determine if clusters are still representative
30th of March to 4th of April 2011	Usage Survey and Aging Stove Tests (PCS)	To establish drop-off rates in stove usage and to measure fuel performance & other relevant factors in aging stoves.
18th February to 28th May 2011 (Usage survey) 4th February to 8th April 2011 (aging RB test)	Usage Survey and Aging Barn Tests (RB)	To establish drop-off rates in barn usage and to measure fuel performance & other relevant factors in aging barns.
20-26 September 2011 (RB)	Barn Surveys (RB)	Determine if clusters are still representative.

Baseline Kitchen Performance Tests & Baseline Kitchen Surveys	
Monitoring activity:	**Baseline and Follow-up:**
ICS Survey & Test	7th of September 2010 to 10th of October 2011
UCS Survey & Test	31st of August – 3rd of September 2010 & 11th - 15th of October 2009 (initial baseline and follow-up), & 20-23rd of September, 27- 30th of September 2011 to 11th - 14th of October 2011 (supplementary baseline and follow-up)

Note: in relation to First Verification Report (3.10) ***FAR 3*** was raised relating to newly incorporated Institutional Cook Stoves and Urban Cook Stoves (not included in the first Monitoring Report or the initial retroactive Verification). For these devices, additional periodic kitchen tests and kitchen surveys have been conducted prior to the first periodic verification of these devices.

The GS observed *(GS Verification Review - FAR 1*) from KS reports submitted with request for issuance that a significant proportion of households surveyed, use a mix of fuelwood and biomass residues. According to kitchen survey reports submitted at the time of registration, the predominant percentage of households were using only fuelwood i.e., 95.2% and 98% households for FES and PCS respectively (KS - PCS and FES- October 2009). According to the recent kitchen surveys only 39% (KS-FES-July 2010) and 48% (KS- PCS- September 2010) households use only fuelwood. If biomass residues are mixed in large proportion with fuelwood then it will indicate that the fuel mix is significantly different in newly added households. Hence, the GS required that during future requests for issuances it should be discussed in the monitoring report and verified by DOE whether new households added to clusters defined in registered PDD, meet the specifications of these clusters particularly 'wood as predominant fuel for cooking'. If kitchen surveys show different fuel mix where wood is not the predominant fuel then a new cluster shall be formed and new baseline shall be established and validated.

New customers overwhelmingly meet the specifications of PCS ad FES clusters particularly 'wood as predominant fuel for cooking' as almost all rural households cook and heat water with firewood. This can be corroborated in the National Energy Policy (2003) and Welfare Monitoring Survey (2009) of the National Statistics Office.[1] The variation between the baseline surveys and posterior routine kitchen surveys is related to how the respondent to the survey is probed or asked a question by the enumerator. While many households **occasionally** use biomass residues, principally from agricultural activities, the **main** fuel is firewood, with very few exceptions. For future surveys enumerators are to be trained on how to consistently probe questions related to the **main** or principal source of fuel.

[1] Page 70, http://www.nso.malawi.net/index.php?option=com_content&view=article&id=48:welfare-monitoring-survey-wms-2009&catid=5

A.2. **Post registration changes**

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

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N/A

A.2.2. Corrections

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N/A

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

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Please see revised monitoring plan.

Default values for the non-renewable biomass fraction (fNRB) for LDCs and SIDs as per the CDM SSC WG thirty-fifth meeting report Annex 20 pages 4 and 8 stipulate that Malawi has a fNRB of 81%. This factor is to replace the fNRB in the PDD of approximately 73.82% as a more credible value that has become publicly available for the Republic of Malawi.

Use of the ex-post approach applied to suppressed demand for cooking services (GS methodology *"technologies and practices to displace decentralised thermal energy consumption"* (version 3). instead of PDD ER approach (the interpretation of the methodology is included as an annex to this monitoring report). In accounting for the emissions reductions, the report takes into account the suppressed demand for cooking energy services as provided for in GS methodology *"technologies and practices to displace decentralised thermal energy consumption"* (version 3). This is a deviation from the PDD and is described below.

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

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On 31/10/12 the GSF approved PP's request to change the scale of the project from Large Scale to Small Scale.

A.2.5. Changes to start date of crediting period

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N/A

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

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N/A

PART III. Description of monitoring system

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Monitoring equipment:

The following instrument is used to weigh the amount of wood used by households / farms before and after acquiring an improved device promoted by the project:

Equipment	Manufacturer	Type	Accuracy
Weighing scales (spring dial hoist scale)	Generic - Globe Universal (available in hardware stores in Malawi)	100 kg capacity	Precision of 0.5 kg
Hanging scales with tare function	Voltcraft HS-30	30 kg capacity	Accurate to 20g
Wood humidity	Voltcraft	Moisture measuring range 6%	±1% (in moisture range

measuring device	FM-300	to 99.9%	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

Table 1 Monitoring Equipment used.

The calibration of the monitoring equipment for project emission parameters is checked by enumerators as per the equipments' 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- *(in response to first verification report (3.3.2)* ***FAR 4)***.[2].

Involvement of Third Parties:

Monitoring is being performed by Hestian Rural Innovation Development.

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. At this time, to the best of our knowledge there are no other registered greenhouse gas emission reduction projects in Malawi involving stoves or barns, and thus today no risk of double counting exists. However, the project developers continue to monitor whether any other projects exist. In such cases, the project developer will cross reference our total sales database and end user database with any other projects to ensure that there is no overlap. 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 kitchen surveys are first captured in paper form then compiled in a Microsoft Excel spreadsheet. Records will be kept for two years after the project activity is completed. Monitoring data is analyzed using Microsoft Excel and SPSS (Software Package for Social Sciences).

Special event log:

No special events have occurred since the last verification report.

Quality assurance and quality control measures

Documented procedures and management plan:

Roles and responsibilities:

The Project Coordinator assists the project implementing and monitoring body HRID and the specific project managers to maintain and make available accurate records. The Project Coordinator collates a composite electronic Total Sales record and HRID keeps back-up paper records. HRID's existing accounting and records system accurately tracks sales, inventories and supply and purchases. HRID maintains a full sales database in Excel of all 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.

[2] The digital hanging scales, the wood humidity measuring device and the 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.

HRID have implemented a limited warranty system for the rocket barn, the esperanza stoves and institutional cook stoves.

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 quarterly monitoring activities. Hard copies of ER contracts and warranty are filed as additional backup and for verification purposes.

Direct sales to end-users information is collected by HRID's agents, who are issued with contract forms in advance and submit the forms to the relevant project manager. 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 in collaboration with the project coordinator, who are best capable of collecting this data because they know the technology and the end-users best.

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 are organised by external 3rd party consultant(s) and / or HRID staff, and new enumerators are trained prior to conducting surveys and tests. Survey and test results are filed in paper at HRID 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.

The Project Coordinator monitors that improved cook-stoves or barns do not number more than ten per kitchen / farm. To date no kitchen or farm has more than ten devices, hence the capacity limitation of the applied GS methodology has been met *(see First Verification Report (3.10)* ***FAR 2****)*.

Trainings:

HRID and external consultants recruited enumerators during the baseline study and trained them to conduct surveys and tests. Kitchen Surveys (KS), Barn Surveys (BS), Kitchen Performance Tests (KPTs), Barn Performance Tests (BPTs), Usage Surveys and Aging Stove / Barn Tests are performed by trained enumerators and supervised by relevant project manager. These enumerators perform monitoring activities and report directly to the respective project manager. The Project Coordinator collates the information provided by the respective project managers.

HRID and its agents actively train new supervisors, ceramic artisans, specialised builders, metal workers and technicians to be employed by the project. To date, they have trained 1,054 new artisans in the skills needed to manufacture and market efficient stoves and barns. Training new workers takes 1-6 months, depending on the individual and the skills they are aiming to achieve.

HRID prefers 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.

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

Involvement of Third Parties:

Clioma Ltd. - sub-contracted to conduct KTs, KSs, BTs and BSs.

Dr. Wilson Jere and Amulike Msukwa from Bunda College, University of Malawi have provided the Project with assistance in statistical analysis of ICS and UCS tests, the usage surveys for PCS and FES 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.

HRID and its agents 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) HRID and its 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 / barn management and (iii) to improve firewood management Producers and builders 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. HRID and its agents also 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 and barns 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 before and after firing the stoves in a fuel-efficient kiln is performed by trainees of field facilitators that certify the quality of each ceramic stove produced and ascertain the validity of records of the producer groups. The production batch is recorded in the ceramic stove's serial number so that the performance of each batch is monitored.
- For the FES and RB, the end-user certifies by signature that the device has been built to specification to authorise payment. The RB includes a one-year warranty and health check and the FES includes a 2-month warranty on the ceramic pot-rest. For ICS there is a 2-year warranty.

(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 be 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 are given an incentive in the form of "purchase 2 stoves and receive a free tree seedling"
b. Stove promoters of PCS are encouraged to promote at a village level the adoption of 2 stoves.
c. FES builders have been trained on how to build a double-esperanza stove (see annex 2)

The adoption of a second improved cook stove has had the following results to date:

- Number of PCS users with an additional stove – 576 (4.2% of users).[3]
- Number of FES users with an additional stove – approximately 7 out of 100 (7%) of FES end-users in the usage survey in May 2012 had 2 FES in their household.[4]

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 as noted in GS Issuance Review FAR 2.

PART IV. Data and parameters

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

(Copy this table for each piece of data and parameter.)

Data/Parameter	$P_{B, PCS, 0}$
Unit	Kg / household-day
Description	Quantity of fuel that is consumed in the baseline scenario for PCS
Source of data	Baseline FT for PCS
Value(s) applied	7.02 kgs / household day (equivalent to 2.561 tons / household year)
Purpose of data	This was the initial fixed baseline data for PCS users before baseline data was assessed in terms of suppressed demand.
Additional comment	With the inclusion of baseline data being assessed for suppressed demand this parameter is no longer used for the calculation of emission reductions for households using PCS. The value of 5.237 t / household year is now being used for suppressed demand calculations.

Data/Parameter	$P_{B, FES, 0}$
Unit	Kg / household-day
Description	Quantity of fuel that is consumed in the baseline scenario for FES
Source of data	Baseline FT for FES
Value(s) applied	9.21 kgs / household day (equivalent to 3.361 tons / household year)
Purpose of data	This was the initial fixed baseline data for FES users before baseline data was assessed in terms of suppressed demand.
Additional comment	With the inclusion of baseline data being assessed for suppressed demand this parameter is no longer used for the calculation of emission reductions for

[3] 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 600+ 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.

[4] For FES, households that have adopted a double stove in one kitchen are recorded as one sale.

	households using FES. The value of 5.237 t / household year is now being used for suppressed demand calculations.

Data/Parameter	$P_{B, UCS, 0}$
Unit	Kg / household-day
Description	Quantity of fuel that is consumed in the baseline scenario for UCS
Source of data	Baseline FT for UCS
Value(s) applied	7.91 kgs / household day (equivalent to 2.888 tons / household year)
Purpose of data	This was the initial fixed baseline data for UCS users before baseline data was assessed in terms of suppressed demand.
Additional comment	With the inclusion of baseline data being assessed for suppressed demand this parameter is not used for the calculation of emission reductions for households using UCS. The value of 5.237 t / household year is now being used for suppressed demand calculations.

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	0.360 kgs / 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 Childrens' 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	$P_{B, RB, 0}$
Unit	Kg / kg output
Description	Quantity of fuel that is consumed in the baseline scenario for RB in 2008
Source of data	Baseline FT for RB
Value(s) applied	11.96 kgs / kg output (equivalent to 15.722 tons / barn year, given average output per Rocket Barn is estimated to be 1,315 kgs per season as per the registered PDD V3.0.)
Purpose of data	This is the fixed baseline data for RB users. RB baseline has not been assessed to date for suppressed demand.
Additional comment	

Data/Parameter	$EF_{b, CO2}$ and $EF_{p, CO2}$
Unit	tCO_2 / t_wood
Description	CO_2 emission factor arising form 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 form 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	0.4554 tCO2/t wood (=(1.224 tCO2/TJ * 0.0156 TJ/ t * 21) + (0.01125 tCO2/TJ * 0.0156 TJ/ t * 310))
Purpose of data	Default IPCC values for CH4 and N20 emissions for wood / wood waste are applied. The following GWP100 are applied: 21 for CH4, 310 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	Effb,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	$Eff_{b,PCS}$
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.

A.2. **Data and parameters monitored**
(Copy this table for each piece of data and parameter.)

Data/Parameter	fNRB
Unit	81%
Description	Non-renewability status of woody biomass fuel for the project in monitoring period 2.
Source of data	CDM – SSC WG Thirty fifth meeting report, Annex 20, page 4 (February 2012).
Monitoring Frequency	Fixed by baseline study for a given crediting period, updated if necessary
QA/QC procedures	Transparent data analysis and reporting
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	$P_{P, PCS, 2009}$
Unit	4.29 Kg / household-day (equivalent to 1.566 tons / household year)
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. Four visits per monitored household in day 0, day 1, day 2 and day 3 to capture data over a 72-hour period. Monitoring equipment: Voltcraft FM-100 Moisture meter (Capacity to measure moisture content up to 44%; Accuracy of 1%). Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg)
Monitoring frequency	Updated every 2 years, or more frequently
QA/QC procedures	Pre-testing conducted to train enumerators; paired tests to minimise external factors, larger sample (n=252) used to minimise bias.
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.

Data/Parameter	$P_{P, PCS, 2011}$
Unit	4.97 Kg / household-day (equivalent to 1.813 tons / household year)
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. Four visits per monitored household in day 0, day 1, day 2 and day 3 to capture data over a 72-hour period. Monitoring equipment: Voltcraft FM-100 Moisture meter (Capacity to measure moisture content up to 44%; Accuracy of 1%). Voltcraft HS-30 (30 kg capacity, Accurate to 20g)
Monitoring frequency	Updated every 2 years, or more frequently
QA/QC procedures	Pre-testing conducted to train enumerators; larger sample (n=103) used to minimise bias.
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.

Data/Parameter	$P_{P, FES, 2009}$
Unit	4.79 Kg / household-day (equivalent to 1.747 tons / household year)
Description	Quantity of fuel that is consumed in the project scenario for FES in year 0 (when project PCS were first disseminated)
Source of data	Measured during Project PFT for FES in October 2010. Four visits per monitored household in day 0, day 1, day 2 and day 3 to capture data over a 72-hour period. Monitoring equipment: Voltcraft FM-100 Moisture meter (Capacity to measure moisture content up to 44%; Accuracy of 1%). Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg)
Monitoring frequency	Updated every 2 years, or more frequently
QA/QC procedures	Pre-testing conducted to train enumerators; paired tests to minimise external factors, larger sample (n=71) used to minimise bias.
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.

Data/Parameter	$P_{P, UCS, 2011}$
Unit	3.22 Kg / household-day (equivalent to 1.174 tons / household year)
Description	Quantity of fuel that is consumed in the project scenario for UCS in year 0 (when project UCS were first disseminated)
Source of data	Measured during Project PFT for UCS in October 2011. Four visits per monitored household in day 0, day 1, day 2 and day 3 to capture data over a 72-hour period. Monitoring equipment: Voltcraft FM-100 Moisture meter (Capacity to measure moisture content up to 44%; Accuracy of 1%). Voltcraft HS-30 (30 kg capacity, Accurate to 20g)
Monitoring frequency	Updated every 2 years, or more frequently
QA/QC procedures	Pre-testing conducted to train enumerators; paired tests to minimise external factors, larger sample (n=90) used to minimise bias.
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.

Data/Parameter	$P_{P, RB, 2009}$
Unit	4.26 Kg / kg output (equivalent to 5.603 tons / barn-year)
Description	Quantity of fuel that is consumed in the project scenario for RB in year 0 (when project RBs were first disseminated)
Source of data	Measured during Project PFT for RB in February – April 2009. Four visits per monitored household in day 0, day 1, day 2 and day 3 to capture data over a 72-hour period. Monitoring equipment: Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg) Measuring tape
Monitoring frequency	Updated every 2 years, or more frequently
QA/QC procedures	Pre-testing conducted to train enumerators; paired tests to minimise external factors, large sample (n=128) used to minimise bias.
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.

Data/Parameter	$P_{P, RB, 2011}$
Unit	2.797 Kg / kg output (equivalent to 3.679 tons / barn-year)
Description	Quantity of fuel that is consumed in the project scenario for RB 2 years after the first Project PFT (2 years after project RBs were first disseminated)
Source of data	Measured during Project PFT for RB in February – April 2011. At least 2 recording visits per monitored barn, before after and possibly during the cure, which normally lasts for 4-5 days for a Rocket Barn. Monitoring equipment: Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg) Measuring tape
QA/QC procedures	Pre-testing conducted to train enumerators; large sample (n=109) used to minimise bias.
Additional comment	As end-users improve their use of the new technology wood savings increase.

Data/Parameter	$P_{P, ICS, 2011}$
Unit	0.085 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)
Source of data	Measured during Project PFT for ICS in September 2010 – October 2011. Wood is weighed at the start and the end of each day for three consecutive feeding days. Monitoring equipment: Generic spring-dial hoist scales (100 kg capacity, precision of 0.5 kg)
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.
Additional comment	

Data/Parameter	$U_{P, PCS}$
Unit	$U_{P, PCS, 0-1}$ = 94.8% (after 6 months) $U_{P, PCS, 1-2}$ = 85.6% (after 18 months) $U_{P, PCS, 2-3}$ = 76.3% (after 30 months)
Description	Cumulative usage rate for technologies in project scenario PCS. Usage of stoves over time to determine project fuel consumption for PCS users.
Source of data	Usage survey for PCS in May 2012. Percentage of stoves in use with 90 % confidence intervals. A normal linear regression model was fitted to the data to determine the trend.
Monitoring frequency	Annual or more frequently, in all cases on time for any request for Issuance. One Usage Survey per monitored household.
QA/QC procedures	Pre-testing conducted to train enumerators; large sample (n=151) used to minimise bias.
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	$U_{P, FES}$
Unit	$U_{P, FES, 0-1}$ = 86.9% (after 6 months) $U_{P, FES, 1-2}$ = 70.3% (after 18 months) $U_{P, FES, 2-3}$ = 53.7% (after 30 months)
Description	Cumulative usage rate for technologies in project scenario FES. Usage of stoves over time to determine project fuel consumption for FES users.
Source of data	Usage survey for PCS in May 2012. Percentage of stoves in use with 90 % confidence intervals. A normal linear regression model was fitted to the data to determine the trend.
Monitoring frequency	Annual or more frequently, in all cases on time for any request for Issuance. One Usage Survey per monitored household.
QA/QC procedures	Pre-testing conducted to train enumerators; sufficiently large sample (n=100) used to minimise bias.
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	$U_{P, UCS}$
Unit	$U_{P, UCS, 0-1}$ = 85% (after 6 months) $U_{P, UCS, 1-2}$ = 70% (after 18 months)
Description	Cumulative usage rate for technologies in project scenario UCS. Usage of stoves over time to determine project fuel consumption for UCS users.
Source of data	Conservative estimation; less than FES or PCS
Monitoring frequency	Annual or more frequently, in all cases on time for any request for issuance. One Usage Survey per monitored household.
QA/QC procedures	
Additional comment	The UCS fuel consumption data is presented for the first time in MR2. In Annex 5 in the methodology applied by the project "Technologies and Practices to Displace Decentralized Thermal Energy Consumption - 11/04/2011", under project preparation and monitoring schedule usage and monitoring surveys are to be conducted annually after first verification. The data for UCS is being verified for the first time in MR2 and usage and monitoring survey for UCS will be presented in MR3.

Data/Parameter	**UP, ICS**
Unit	$U_{P,\ ICS,\ 0\text{-}1}$ = 90% (after 6 months) $U_{P,\ ICS,\ 1\text{-}2}$ = 80% (after 18 months)
Description	Cumulative usage rate for technologies in project scenario ICS. Usage of stoves over time to determine project fuel consumption for ICS users.
Source of data	Conservative estimation
Monitoring frequency	Annual or more frequently, in all cases on time for any request for issuance. One Usage Survey per monitored institution.
QA/QC procedures	
Additional comment	The ICS fuel consumption data is presented for the first time in MR2. In Annex 5 in the methodology applied by the project "Technologies and Practices to Displace Decentralized Thermal Energy Consumption - 11/04/2011", under project preparation and monitoring schedule usage and monitoring surveys are to be conducted annually after first verification. The data for ICS is being verified for the first time in MR2 and usage and monitoring survey for ICS will be presented in MR3.

Data/Parameter	**$U_{P,\ RB}$**
Unit	$U_{P,\ RB,\ 0\text{-}1}$ = 94% (after 1 season) $U_{P,\ RB,\ 1\text{-}2}$ = 97% (after 2 seasons) $U_{P,\ RB,\ 2\text{-}3}$ = 81% (after 3 seasons)
Description	Cumulative usage rate for technologies in project scenario RB. Usage of barns over time to determine project fuel consumption for RB users.
Source of data	Usage survey for RB in May 2012. Percentage of barns in use.
Monitoring frequency	Annual or more frequently, in all cases on time for any request for issuance. One Usage Survey per monitored farm.
QA/QC procedures	Pre-testing conducted to train enumerators; sufficiently large sample (n=127) used to minimise bias.
Additional comment	

Data/Parameter	**$N_{PCS,\ y}$**
Unit	$N_{PCS,\ 24/11/2008\ –\ 01/10/2009}$ = 128,503 technology days $N_{PCS,\ 02/10/2009\ –\ 01/10/2010}$ = 1,379,339 technology days $N_{PCS,\ 02/10/2010\ –\ 01/10/2011}$ = 3,659,854 technology days
Description	Technology days in the project database for the project scenario PCS through year. Used to calculate VERs.
Source of data	Total sales record. Calculated from day after technology is disseminated for specific monitoring periods (all dates inclusive).
Monitoring frequency	Continuous
QA/QC procedures	Transparent data analysis and recording
Additional comment	

Data/Parameter	$N_{FES, y}$
Unit	$N_{FES, 24/11/2008 – 01/10/2009}$ = 0 technology days $N_{FES, 02/10/2009 – 01/10/2010}$ = 398,080 technology days $N_{FES, 02/10/2010 – 01/10/2011}$ = 707,571 technology days
Description	Technology days in the project database for the project scenario FES through year. Used to calculate VERs.
Source of data	Total sales record. Calculated from day after technology is disseminated for specific monitoring periods (all dates inclusive).
Monitoring frequency	Continuous
QA/QC procedures	Transparent data analysis and recording
Additional comment	

Data/Parameter	$N_{UCS, y}$
Unit	$N_{UCS, 24/11/2008 – 01/10/2009}$ = 0 technology days $N_{UCS, 02/10/2009 – 01/10/2010}$ = 5,731 technology days $N_{UCS, 02/10/2010 – 01/10/2011}$ = 48,970 technology days
Description	Technology days in the project database for the project scenario PCS through year. Used to calculate VERs.
Source of data	Total sales record. Calculated from day after technology is disseminated for specific monitoring periods (all dates inclusive).
Monitoring frequency	Continuous
QA/QC procedures	Transparent data analysis and recording
Additional comment	

Data/Parameter	$N_{RB, y}$
Unit	$N_{RB, 24/11/2008 – 01/10/2009}$ = 153 technology seasons $N_{RB, 02/10/2009 – 01/10/2010}$ = 741 technology seasons $N_{RB, 02/10/2010 – 01/10/2011}$ = 952 technology seasons
Description	Technology seasons in the project database for the project scenario RB through year. Used to calculate VERs.
Source of data	Total sales record. Calculated for each full season of RB for specific monitoring periods.
Monitoring frequency	Continuous
QA/QC procedures	Transparent data analysis and recording
Additional comment	

Data/Parameter	$N_{ICS, y}$
Unit	$N_{ICS, 24/11/2008 – 01/10/2009}$ = 0 technology days $N_{ICS, 02/10/2009 – 01/10/2010}$ = 197 technology days $N_{ICS, 02/10/2010 – 01/10/2011}$ = 12,371 technology days
Description	Technology days in the project database for the project scenario ICS through year. Used to calculate VERs.
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.
Monitoring frequency	Continuous
QA/QC procedures	Transparent data analysis and recording
Additional comment	

Data/Parameter	$Eff_{P,PCS}$
Unit	$Eff_{P,PCS,0-1}$ = 26% $Eff_{P,PCS,1-2}$ = 21% $Eff_{P,PCS,2-3}$ = 22%
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. As project domestic stove demonstrates efficiency <31%, this is to factored into suppressed demand calculations.
Source of data	Water boiling tests in May 2012 using Water Boiling Test protocol 4.1.2 (http://www.pciaonline.org/files/WBT4.1.2_0_0.pdf) Monitoring equipment: Volctraft K-101, K-102 Digital Thermometers (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.
Monitoring frequency	Every 2 years
QA/QC procedures	Training and pre-testing of protocol. Use of accurate equipment that was recently calibrated in factory.
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	$Eff_{P,FES}$
Unit	$Eff_{P,FES,0-1}$ = 25% $Eff_{P,FES,1-2}$ = 17% $Eff_{P,FES,2-3}$ = 18%
Description	Efficiency of aging project FESs. To assess how the efficiency of project FES compare to that of a baseline conservative estimation of 31% efficiency for PCS. As project domestic stove demonstrates efficiency <31% this is factored into suppressed demand calculations.
Source of data	Water boiling tests in May 2012 using Water Boiling Test protocol 4.1.2 (http://www.pciaonline.org/files/WBT4.1.2_0_0.pdf) Monitoring equipment: Volctraft K-101, K-102 Digital Thermometers (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.
Monitoring frequency	Every 2 years
QA/QC procedures	Training and pre-testing of protocol. Use of accurate equipment that was recently calibrated in factory.
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: $ER / hh / day = (U_{P,FES,Y} * (P_{b,y} * (1 – (Eff_{b,y} / Eff_{P,FES,Y}))) / 365$

Data/Parameter	$Eff_{P,UCS}$
Unit	$Eff_{P,UCS,0-1}$ = 23% $Eff_{P,UCS,1-2}$ = 25%
Description	Efficiency of aging project FESs. To assess how the efficiency of project UCS compare to that of a baseline conservative estimation of 31% efficiency for PCS. As project domestic stove demonstrates efficiency <18.1%, this is factored into suppressed demand calculations.
Source of data	Water boiling tests in May 2012 using Water Boiling Test protocol 4.1.2 (http://www.pciaonline.org/files/WBT4.1.2_0_0.pdf) Monitoring equipment: Volctraft K-101, K-102 Digital Thermometers (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.
Monitoring frequency	Every 2 years
QA/QC procedures	Training and pre-testing of protocol. Use of accurate equipment that was recently calibrated in factory.
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 = ($U_{P,UCS,Y}$ * ($P_{b,y}$ * (1 – ($Eff_{b,y}$ / $Eff_{P,UCS,Y}$))) / 365

Data/Parameter	Bpj,y
Unit	1.6895 Tonnes of dry biomass = ((1.566 + 1.813 tonnes biomass)/2)
Description	Monitored consumption of fuels over time. Tonnes of dry biomass used in the project for technology and fuel combination pj in year y
Source of data	(i) Baseline Field Test (BFT) for PCS, and (ii) Project Field Test for PCS users 2 years after purchasing PCS 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
Monitoring frequency	Fixed updated baseline; B_{PY} or P_{PY} (project update) revised every 2 years.
QA/QC procedures	Trained enumerators, sufficiently large sample.
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	$LE_{p,MR2}$
Unit	0 tCO2e per year
Description	Leakage in project scenario during year 2/10/2010 – 1/10/2011
Source of data	Baseline and monitoring surveys
Monitoring frequency	Every 2 years
QA/QC procedures	Transparent data analysis and reporting
Additional comment	Leakage is assessed every 2 years. First leakage assessment was included in MR1,and will be again assessed for MR3. A value of zero has been assigned for MR2. Aggregate leakage can be assessed for multiple project scenarios, if appropriate.

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: Vast majority of survey respondents stated that there is less smoke from devices promoted by the project In the Kitchen Survey for FES conducted in July 2011, 100% of respondents claim that the PCS produces less smoke. Quantitative: Air quality tests carried out in 2009 reveal an average reduction of 41% in PM concentrations for PCS users and 55% in PM concentrations for FES users. Further tests are due to be carried out in 2011-12 with some of the Project's stove customers.	Air Quality Excel, FES KS results excel, PCS KS results excel, RB BS 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 8,848 households that have accessed PCS are located in the Upper Shire region in keeping with priorities of NAPA.	FES KS results excel, PCS KS results excel, RB BS results excel.
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.	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. 15,555 households using improved Cook Stoves, 21 institutions using improved Institutional cook stoves and 952 Rocket Barns being used contribute positively to reducing pressure on natural resources.	FES KS results excel, PCS KS results excel, RB BS results excel ICS KS in 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	HRID General Policies and Procedures Manual, Chapter 4.
Livelihood of the poor	Survey	Financial impact (Note: savings estimated are only economic estimation of wood savings and not real monetary saving for	MK (Malawi Kwacha) saved per year	From the devices disseminated by the project to date: Savings of wood is valued at MK 153 million p.a. Savings of labour in terms of both cooking / curing time savings and fuel collection savings is valued at MK 70.5 million p.a.	Livelihood of poor excel, FES KS results excel, PCS KS results excel, RB BS results excel.

		households since the wood is mostly collected and not purchased).		Improved income from RB is valued at MK 66 million p.a., which is likely to have a multiplier effect in rural areas where RBs are located.	
Access to affordable and clean energy services	Survey	Access to clean technologies	Number of stoves and rocket barns sold.	Up to 15,555 households (approx 12,914 + 2,386 + 255) have accessed affordable and appropriate PCS, FES and UCS. 21 institutions are using 31 improved institutional stoves. 952 Rocket Barns being used in Malawi smallholder flue-cure sector.	Sales Records (from November 24 2008 to October 1 2011) and FES KS results excel, PCS KS results excel, RB BS results excel ICS KS in excel.
Human and Institutional capacity	Survey	Numbers	Trainees, employees with new skills	616 (82% female) trained on ceramic stove production; 403 (59% female) trained on marketing, awareness raising and stove promotion; 32 trades people trained on RB, ICS and UCS construction techniques; and 22 people work at a coordination level trained on various skills such as business, database management, geographic information systems, surveys and Kitchen / Barn performance tests.	Employment and skills development excel.
Quantitative employment and income generation	Survey	Numbers – job creation	Jobs / year	The project is generating income for 1,076 people (99% in rural areas, 70% women).	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.	Project provided seed capital to 2 former employees to set up as sub-contractors.	Evidence of Charles Construction and Phukaphuka. 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.	Sales Records (from November 24 2008 to October 1 2011) and FES KS results excel, PCS KS results excel, RB BS results excel ICS KS in excel.

A.3. **Implementation of sampling plan**

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Usage and monitoring surveys for both FES and RB applied a simple random sample from their respective total sales records. PCS applied a geographic cluster random sample.

For UCS and ICS, the baseline and project scenarios are being assessed in this monitoring report and as of yet usage surveys have not been carried out. For emission reduction calculations, conservative provisional usage rates have been used for UCS and ICS.

For the usage survey for RBs, as there is only one season per year, the actual results are used for usage rates. For FES and 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. For this reason assistance was sought from qualified statisticians to conduct a regression analysis 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 and in most cases over-sampling has been the norm.

Water boiling tests have been conducted for aging stoves. For PCS, stoves of various ages were randomly selected form one village and the users were asked to give up their old stoves in return for a new stove. Similarly for UCS, stoves of various ages were randomly selected from one part of Lilongwe City. For FES one demonstration stove was tested and also a further stove was tested in one village.

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

A new implementation schedule has been drawn up and presented in the revised monitoring plan, which plans for GS 613 to conform with *"Technologies and Practices to Displace Decentralised Thermal Energy Consumption (11/04/2011)."*

PART V. 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 n (Date November 2, 2012).

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

For all five (5) technologies 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.
$EF_{b,\,wood,\,CO2}$ = $EF_{p,\,wood,\,CO2}$ = 1.7472 tCO2/t wood
$EF_{b,\,wood,\,nonCO2}$ = $EF_{p,\,wood,\,nonCO2}$ = 0.4554 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:
= ((1.7472 * 0.81) + 0.4554) tCO2/t wood
= **1.871 tCO2/t wood**

GS 613 promotes three household cookstoves (i.e. PCS, FES and UCS). PCS is the Project's stove with the highest sales to date and its Project dissemination began before the project's other domestic stoves (i.e. FES and UCS) so more historic information is available for PCS.

	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	CREEC, 2012	Based on performance of used stoves of different ages.			B pj, 2011	B pj, 2009	$P_{b,0,SD}$
					$Eff_{b,y}$	$Eff_{p,y,0}$	$Eff_{p,y,0-1}$	$Eff_{p,y,1-2}$	$Eff_{p,y,2-3}$			
PCS	**2.561**	1.566	**0.995**	**39%**	10%	31%	26%	21%	22%	1.813	**1.6895**	5.237
FES	3.361	1.747	1.614	48%			25%	17%	18%			
UCS	2.888	1.174	1.714	59%			21%	37%	N/A			

Table 2 Comparison of domestic stoves

Table 2 above clearly shows that of the three domestic stoves promoted by GS 613, PCS has the lowest baseline consumption, the lowest absolute project savings and the lowest percentage project savings.

To simplify monitoring and improve GS613's effectiveness, the PP proposes that FES and UCS conservatively adopt the same values as PCS for (i) project consumption for PCS (i.e. lower than baseline consumption for both FES and UCS) and (ii) suppressed demand adjusted baseline consumption of 5.237 Tons_wood / HH p.a. which is equivalent to baseline domestic stove emissions of **9.797 CO2e / HH p.a.**

Baselines emissions for RBs are the product of 15.73 tons_wood / year by the combined emission factor of 1.871 emissions / ton_wood = **29.42 CO2e / RB p.a.**

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 as presented in Annex 1 Normalisation of Person Meals of the Report on Statistical Analysis of Fuel consumption on Wood-burning Institutional Cook Stoves (ICS) Tests, May 20, 2012. Baseline consumption of one adult meal was 374gs of wood / adjusted adult meal, which is equivalent to **6.743 CO2e / 10,000 adjusted adult meals p.a.**

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

Conservative Project Emissions Reductions (tCO2e)

Carbon flows			Monitoring period			
			MR1	MR2		
Offset vintage		Devices sold*	24/11/08 – 1/10/10	2/10/10 - 1/10/11	Total	
24/11/08 - 1/10/09	PCS	1,767	3,679	7,205	10,884	16,379
	FES					
	UCS					
	ICS*					
	RB	153	2,702	2,793	5,495	
02/10/09 - 1/10/10	PCS	5,308	3,518	23,318	26,836	58,747
	FES	1,524	2,461	4,322	6,783	
	UCS	51		210	210	
	ICS	1		5	5	
	RB	588	13,084	11,830	24,914	
2/10/10 - 1/10/11	PCS	5,839		16,872	16,872	23,289
	FES	862		2,118	2,118	
	UCS	204		391	391	
	ICS	96		151	151	
	RB	211		3,757	3,757	
			25,444	**72,972**	98,416	

*ICS is measured in 10,000 meals served

Baseline Emissions (tCO2e)

Carbon flows			Monitoring period			
			MR1	MR2		
Offset vintage		Devices sold*	24/11/08 – 1/10/10	2/10/10 - 1/10/11	Total	
24/11/08 - 1/10/09	PCS	1,767	5,431	10,636	16,067	24,602
	FES	0	0	0	0	
	UCS	0	0	0	0	
	ICS*	0	0	0	0	
	RB	153	4,197	4,339	8,536	
02/10/09 - 1/10/10	PCS	5,308	5,193	34,421	39,615	88,641
	FES	1,524	3,633	6,380	10,013	
	UCS	51	0	310	310	
	ICS	1	0	7	7	
	RB	588	20,323	18,374	38,697	
2/10/10 -	PCS	5,839	0	24,907	24,907	34,644

1/10/11	FES	862	-	3,126	3,126	
	UCS	204	0	578	578	
	ICS	96	0	198	198	
	RB	211	-	5,835	5,835	
					147,888	

*ICS is measured in 10,000 meals served

A.2. **Calculation of project emissions or actual net GHG removals by sinks**

Project Emissions (tCO2e)
Carbon flows

			Monitoring period			
			MR1	MR2		
Offset vintage		Devices sold*	24/11/08 – 1/10/10	2/10/10 - 1/10/11	Total	
24/11/08 - 1/10/09	PCS	1,767	1,752	3,431	5,183	8,223
	FES	0	0	0	0	
	UCS	0	0	0	0	
	ICS*	0	0	0	0	
	RB	153	1,495	1,545	3,040	
02/10/09 - 1/10/10	PCS	5,308	1,675	11,104	12,779	29,894
	FES	1,524	1,172	2,058	3,230	
	UCS	51	0	100	100	
	ICS	1	0	2	2	
	RB	588	7,239	6,545	13,783	
2/10/10 - 1/10/11	PCS	5,839	0	8,035	8,035	11,355
	FES	862	-	1,008	1,008	
	UCS	204	0	186	186	
	ICS	96	0	47	47	
	RB	211	-	2,078	2,078	
					49,472	

*ICS is measured in 10,000 meals served

A.3. **Calculation of leakage**

GS613 was monitored for leakage in MR1 and is not scheduled to report on leakages until MR3.

No significant sources of leakage have been identified at this point in the project, but future offset calculations will be adjusted accordingly if sources of leakage are later identified. The following possible sources of leakage will continue to be monitored in future Kitchen Surveys (KS), Barn Surveys (BS), Kitchen Performance Tests (KPT) and Barn Performance Tests (BPT):

- 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 or barns 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.

- The traditional or conventional stoves and barns replaced by the improved stoves and barns 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). There is no evidence of old barns being used in a manner of increased consumption.

- Manufacture, distribution, or use of the improved stoves gives rise to new emissions associated with transport or manufacturing. An analysis presented in the baseline Barn Survey demonstrates that this effect for rocket barns is more than compensated for by reduction in transport emissions due to decreases in woodfuel use. Similarly, wood that is used in the firing of ceramics (e.g. portable ceramic stove) is negligible (e.g. 2 kgs / stove compared to the annual savings (e.g. >1 tonne / stove / year).

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.

A.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})	Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
24/11/08 – 01/10/2011	147,888	49,472	0	98,416
Less ERs already claimed in Mon Rep 1 and issued				-25,444
Total (ERs to be claimed in Mon Rep 2)				72,972

Note the Project is undergoing a simple scale reduction and is within the Small Scale threshold of 77,646.50 CO2 eq . p.a. (see calculation below):

Using 81% NRB for Malawi the tonnes CO2eq / tonne wood increases to 1.871

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

= 0.00043GWh/tonne wood

So 180GWh/year = 41,500 tonnes of wood or,

41,500 tonnes wood/year * 1.871 tonnes CO2/tonne wood

= 77,646.5 tonnes CO2/year

Total VERs to be claimed in MR2 is 72,972 which is equivalent to 39,000.6 tonnes of wood, which is below the small scale threshold of 41,500 tonnes of wood.

A.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_2e)	59,078 VERs for year 3 (24/11/2010 – 23/11/2011) as per registered PDD Version 3	72,972 VERS for year 2/10/2010 to 1/10/2011 (inclusive of both dates).

A.6. **Remarks on difference from estimated value in registered PDD**
>>

GS613 has managed to reach the upper limits of small scale methodology quicker than expected.

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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

Approach to the inclusion of Suppressed Demand (SD) in the calculation of emissions reductions attributable to efficient biomass cook stoves in Malawi

For Hestian Innovation for the evaluation and selection of an appropriate approach to dealing with SD in their project (GS613).

The consultancy was for the inclusion of the SD in the verification of emissions reductions for cook stoves and other efficient thermal energy services between October 2010 and October 2011. The inclusion is being considered exclusively for the cook stove interventions in this verification. The introduction of CDM Suppressed Demand Standard (July 2011) and exploration of the treatment of approaches to SD by the Gold Standard Foundation (GS) allows for proposals that may interpret how to include SD in carbon accounting.

The following is a proposal on how the GS613 Malawi project can be verified using a deviation from the original PDD which was developed using the first version of the GS methodology which later included an annex on how to account for SD. This annex is included as an annex to this document and its interpretation is the substance of this document.

The first draft of the verification report follows the PDD and does not include SD. Two approaches to the inclusion of SD are considered, these include:

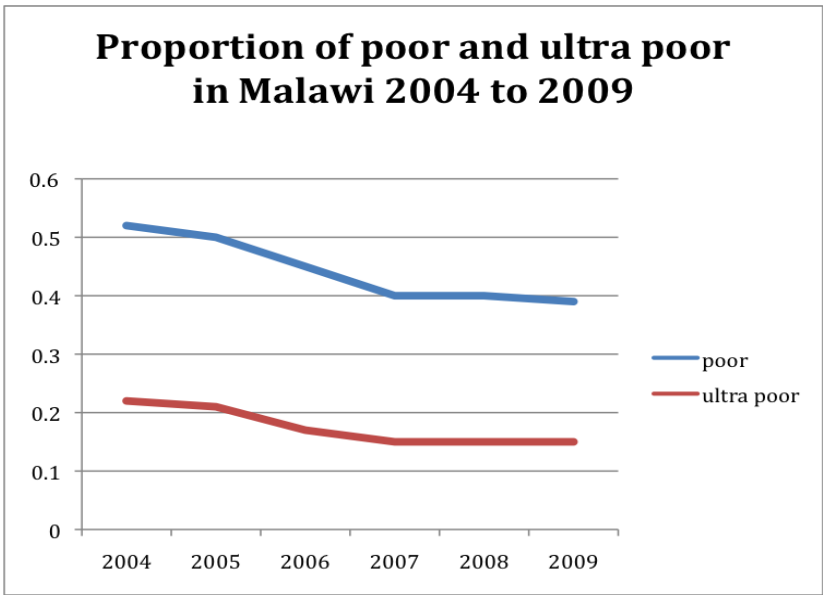
1. The interpretation of SD by using a Minimum (MSL) or Sufficient Service Level (SSL); or
2. The inclusion of SD using an ex-post approach based on the useful service level reached by the project.

The monitored annual tonnages of wood per household per year are as follows:

1. Pre project consumption (April 2009) 2.561 tonnes
2. Initial post project follow-up (April 2009) 1.566 tonnes
3. 2-year post project follow-up (April 2011) 1.813 tonnes

Approach 1: MSL or SSL

The MSL is included in the CDM SD Standard and is not controversial in its application to the indigent whose livelihoods are not improving. However, statistics show that in Malawi (the 8th poorest country in the world) livelihoods are improving albeit from a low base. Statistics (ref. Welfare Monitoring Report 2009, National Statistics Office) show decreases in the “poor” and “very poor”. See figure below.



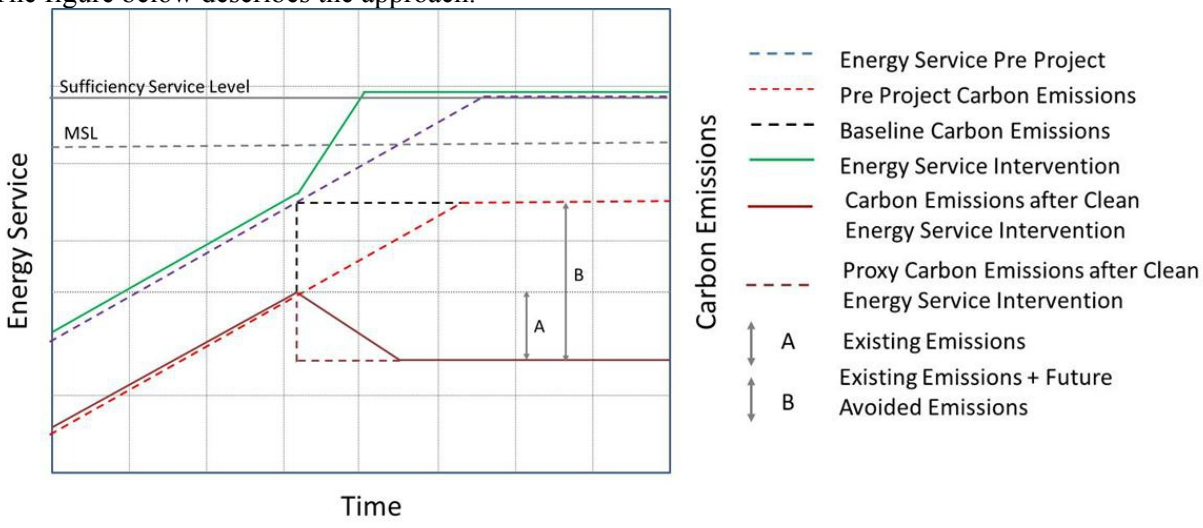
With poverty decreasing or conversely livelihoods increasing, the use of sufficiency level may be applied, but the question would be how to locate this level in the absence of an international or national set level for sufficiency? Proxies could include a basket of commodities describing the minimum quantities of goods and services required for life in urban areas of the country.

If the SSL approach were to be used the level of service could be applied from the commencement of the project to each efficient cook stove. Application of this approach would dramatically reduce monitoring from estimation of the consumption of fuels in a statistically relevant sample to monitoring whether the cook stoves are being used or not within a statistically relevant sample.

The calculation of emissions reductions (ER) would be the emissions from the baseline (BL) less those from the project (P) calculated using the efficiencies of the technologies and fuels utilized in the baseline and project multiplied by the emissions factors of the fuels at the SSL less any leakage (L). SSL in this case would be "useful" Megajoules of energy. Emissions factors (EF) of the baseline and project fuel are required in the calculations.

ER = SSL/efficiency of BL tech*EF BL fuels – SSL/efficiency of P* EF P fuels - L

The figure below describes the approach.



A Malawi institution called the Centre for Social Concern publishes a monthly "Basic Needs Basket" of various household requirements[5]. The basket applies to four urban areas and the most recent figures were for July 2011. As yet there is not a rural basic needs basket. But if the urban quantity of charcoal is utilized as a MSL proxy for rural areas, the monthly 100kgs of charcoal[6] could be equated to a quantity of biomass. The calculation would be as follows:

= 1200kgs charcoal/year * 29.5MJ/kg charcoal/15.6MJ/kg wood = 2269kgs bone dry wood/year
or, at 12% average moisture content[7]
= 2269kgs/0.88 = 2579kgs wood/year

The approach while simple (once MSLs or SSLs) are determined it is yet to be fully agreed to by the GS, and as such constitutes some risk, and may be appropriate to subsequent verifications once the GS has agreed.

Approach 2: Ex-post evaluation of emissions reductions
Very simply the approach would be to calculate the amount of fuel required to provide the project level of service (PLS) using the baseline technologies, fuels and behavioural measures less emissions from the project and any identified leakage. The GS allows for this approach in version 3 of the methodology where it is stated that:

> *In many developing countries the level of energy service is not sufficient to meet human development needs due to lack of financial means and/or access to modern energy infrastructure or resources. This concept is known as suppressed demand and is described in Annex 2. The methodology allows for a baseline scenario to be assessed in terms of suppressed demand, if evidence is provided that the project technology users, or a "cluster" of such users within the project population, are otherwise deprived of a reasonable level of human development (or humanely acceptable benchmark) in comparison to their peers and provided that there is likelihood of avoided future emissions as for example if the standard of living is increasing for some of the project population or their peers outside of the project boundary.* ***In such case, the level of thermal energy consumption in the baseline scenario will not correspond to the pre-project situation but to a satisfied demand level, which will be equal to or lower than the project level of satisfied demand****. (ref: GS Methodology "technologies and practices to displace decentralised thermal energy consumption", page 8.)*

The PLS is calculated for the least efficient of the three domestic stoves in the project, the portable ceramic stoves (PCS) others include the fixed esperanza stoves and urban cook stoves. The application of the approach to all stoves in the project using figures from the PCS is therefore conservative.

The PLS per cook stove is the amount of useful energy service calculated from the monitored consumption of fuels (PF) multiplied by the efficiency of the project stoves.

The emissions reduction calculation is as follows:

ER = (PF * (efficiency of P technology/efficiency of BL technology) * EF BL fuels) – (PF * EF P fuels) – leakage

[5] The Centre for Social Concern (CfSC) carries out research into the cost of living for people in Malawi. This is done every month through gathering information for the "Basic Needs Basket" (BNB) in Blantyre, Lilongwe, Mzuzu and Zomba. (ref: http://www.cfscmalawi.org/bnb_pub.html)

[6] While most Malawians use wood for cooking, Charcoal is used extensively in urban areas. Electricity, which is included in the BNB, is used in some urban homes for cooking, but electricity has been excluded for this calculation on the basis of conservatism.

[7] Moisture content reference to monitoring and protocol, Shell Foundation Household Energy and Health Programme protocols (Bailis & Smith, 2004).

Based on monitored data this calculation could be as follows (assuming BL of P fuels have the same EF). Note NRB = 0.81. Efficiency of 3 stone fires default 10%. Efficiency of efficient cook stoves is 31% using water boiling tests as performed in 2012 by the regional testing centre, Centre for Research in Energy and Energy Conservation, Makerere University could be used. EF biomass for GS613 is 1.871 tonnes CO2/tonne biomass, as in validated PDD[8] with more actual and credible NRB factor of 81%.

ER = (((1.566 + 1.813 tonnes biomass)/2)* (0.31 / 0.1) * 1.871 tonnes CO2/ton biomass) – (1.566 +1.813 tonnes biomass)/2 * 1.871 tonnes CO2/ton biomass – leakage

ER = 6.637 tonnes CO2/annum (using 31% efficiency for the project technology)

This ex-post approach is currently a more comfortable interpretation of the SD approach in the GS methodology than the MSL or SSL approach, which still has to be endorsed implicitly by the GS. The major issue here is to verify the efficiencies of the technologies and to ensure that there is no wastage/take-back/rebound under the project. The IPCC values also apply to dry biomass.

The baseline level of biomass calculated using an ex-post approach is as follows:

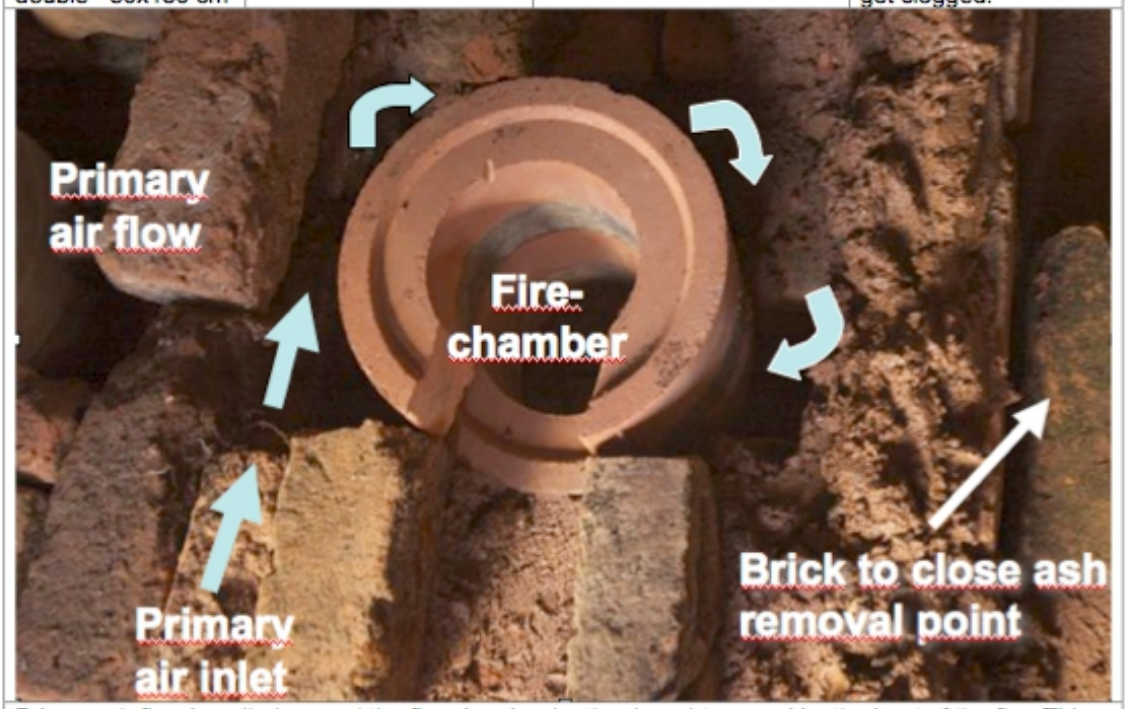
BL wood use[9] = (1.566 + 1.813 tonnes biomass)/2 * 0.31 /0.1
= 5.237 tonnes wood per stove per year

[8] EF of biomass for both the project and baseline is equal to the EF of CO2 emissions by the non renewable biomass (NRB) factor plus the EF of non-CO2 emission; = (1.747*0.81)+(0.455) = 1.871.

[9] Biomass usage comes from direct monitoring of a statistically relevant sample of stoves using the Kitchen Performance Test described in the methodology.

Annex 2

Double pot Esperanza Stove:

<table>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Foundations for single pot esperan-za =80x80 cm, double =80x150 cm</td><td>Double pot can fit within narrow existing kitchen.</td><td>Single line of bricks to separate stoves.</td><td>Metal and ceramic grate. NOTE holes in grate are too small and get clogged.</td></tr>
<tr><td colspan="4"> 
</td></tr>
<tr><td colspan="4">Primary air flow is pulled around the fire-chamber by the draught caused by the heat of the fire. This air heats up through the radiated heat from the fire-chamber and takes it back into the fire. In this way, the air reaching the combustion zone is preheated, leading to cleaner combustion and increased efficiency. (NOTE: for this process to be effective a brick needs to close the ash removal point to prevent cold air directly entering the firechamber).</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Demonstration of air being pulled through</td><td>Pot-rests. NOTE primary air inlets on opposite side to ash removal point.</td><td>Stoves accommodate different pot size.</td><td>Constructed stove – ready for smearing.</td></tr>
</table>