**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 03 - in effect as of: 28 July 2006**

**CONTENTS**



**Annexes**

**Revision history of this document**

| **Version Number** | **Date** | **Description and reason of revision** |
|---|---|---|
| 01 | 21 January 2003 | Initial adoption |
| 02 | 8 July 2005 | The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.<br>As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>. |
| 03 | 22 December 2006 | The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM. |

## SECTION A. General description of small-scale project activity

### A.1 Title of the small-scale project activity:

Title: Meru Improved Cook Stoves
Version: 1.0
Completion date: 27/05/2011

Version history:
1.0 Pre-validation

### A.2. Description of the small-scale project activity:

Background to and purpose of project

In Kenya 70% of the national energy supply is met through use of biomass fuels, with 90% of this demand coming from the domestic sector.[1] Traditional cooking involves the use of a 3-stone fire, which amongst other shortfalls is only able to produce 10% thermal efficiency.[2] Combined with a population growth rate of 2.7%[3] it is not surprising to find that between 1990 and 2005 Kenya lost forest coverage at a rate of 0.3-0.5%/year, with protected forest making up only 1.6% of land coverage by 2005.[1,3] This situation is not sustainable and Kenya's ability to meet future energy needs under a business-as-usual scenario is questionable, as highlighted by the Kenyan Ministry of Energy in a 2002 report.[4] The burning of significant quantities of non-renewable biomass also gives rise to large quantities of greenhouse gasses, contributing to anthropogenic climate change.

Added to environmental pressures is the poor quality of life experienced by the rural poor, using traditional wood stoves which generate a large amount of smoke within the home due to poor combustion efficiencies. A WHO report concluded *'Indoor air pollution is a major environmental and public health hazard for many of the world's poorest, most vulnerable people.'* Biomass smoke has been linked to a range of health problems such as acute respiratory infections (ARI) in children, chronic obstructive lung diseases (such as chronic bronchitis and asthma), lung cancer and pregnancy-related outcomes. It is estimated that 4-5% of global deaths occur as a result of exposure to smoke particulates.[5]

The 'Meru Improved Cook Stove project' will address these issues by distribution of domestic wood-burning improved cook stoves in households within the project area. Recipients will receive stoves in exchange for $CO_2$e rights, thanks to the carbon revenues expected and be directed in correct use of the stove by local community groups engaging with the project developers. Pilot studies have shown the

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[1] "Kenya: Integrated assessment of the Energy Policy", UNEP, 2006 : http://www.unep.ch/etb/areas/pdf/Kenya%20ReportFINAL.pdf

[2] UNFCCC Methodology AMS-II-G http://cdm.unfccc.int/UserManagement/FileStorage/AUBHMWJVKFSY9D1380NOI5ET26ZQLG

[3] "State of the world's forests 2009", FAO, 2009 : http://www.fao.org/docrep/011/i0350e/i0350e00.HTM

[4] "Study on Kenya's energy demand, supply and policy strategy for households, small scale industries and service establishments", Republic of Kenya Ministry of Energy, 2002.

[5] "The health effects of indoor air pollution exposure in developing countries", WHO, 2002 : http://whqlibdoc.who.int/hq/2002/WHO_SDE_OEH_02.05.pdf

stoves to reduce fuel consumption significantly[6]. This will result in an improved living environment for recipients and reduced pressure on local forests, with a reduction of wood being burnt annually as a result of the project. By reducing fuel consumption, $CO_2$ emissions from combustion of non-renewable biomass will be correspondingly reduced.

As the stoves will be distributed without monetary charge, the project can expect to achieve high levels of market saturation in an area, allowing as many households as possible to benefit from the improved stove. The way in which a cook uses the stove is also a key influencing factor in the fuel savings made.[7] It is expected therefore that by making such improved stoves commonplace within a community, and hence building strong local understanding of the technology, higher levels of fuel savings will be achieved.

Technology to be employed

Pilot studies have shown the large majority of households within the project area to be cooking for domestic purposes only, on three-stone fires using wood fuel. There is one main representative household cluster. For these reasons the project will initially employ a single model of wood-burning stove, which will be distributed for domestic use only. More advanced and efficient models of stove are currently under development and may be included in the project if available at the appropriate time. If this should occur the appropriate clustering would be organised.

The improved stoves (known as the Carbon Zero Kenya or CZK stove) are a fixed construction of an inner ceramic liner surrounded by extruded clay components and mortar, using a 'rocket' style design. This consists of a horizontal (combined) fuel and air intake, terminating in a firebox with a vertical outlet on which the cooking pot rests. Relative to the three stone fire, this type of stove allows higher combustion temperatures to be reached and improved fuel/air mixing, hence higher levels of combustion are achieved. This reduces the amount of smoke produced. There is no chimney as such, draft is created by the temperature difference between the low inlet and the outlet, and the hot combustion gasses pass out of the top directly onto the cooking pot in order to achieve high levels of thermal transfer. Despite the combustion gasses remaining in the house, the improved combustion efficiencies mean that smoke levels are dramatically reduced.

[6] Refer to file 'PDD supplementary calculations v.02' for details.

[7] Page 10 "Solid fuel household cook stoves: characterisation of performance and emissions", Biomass and bioenergy 33 (2009) 294-305. http://www.pciaonline.org/files/Stoves_Paper_Final_Color_2.26.09.pdf

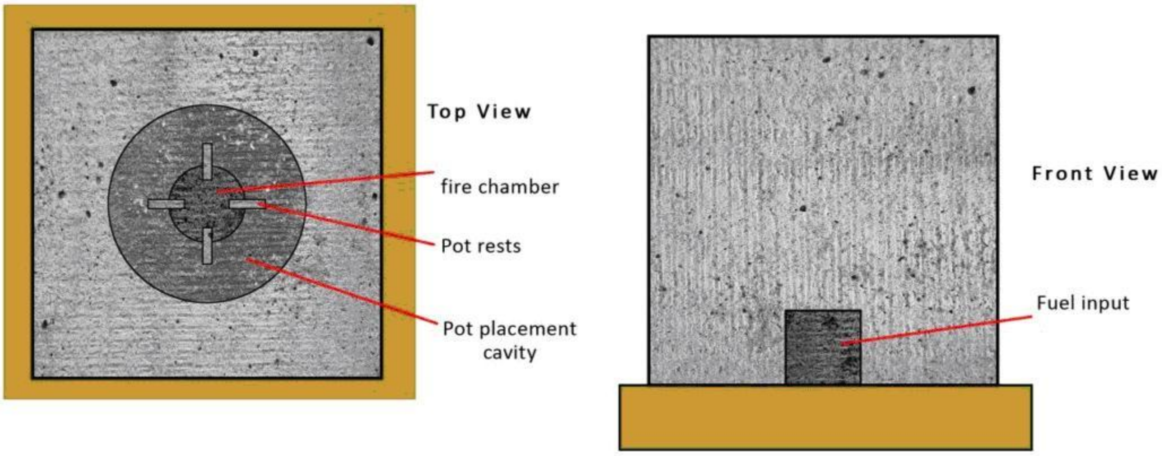


*Image 1. Diagram of CZK stove*

The stove consists of an inner firebox being a standardised fired-ceramic liner, made locally where possible; a grey cast iron plate that is specifically shaped for optimum efficiency; an open front ease of viewing whilst operating the fire; a secondary air intake to assist with the fire starting, maximising air flow during combustion and keeping the wood on a brick loading platform; and the outer skin of fired bricks. It is a high performance, ergonomically designed cook stove that was designed with both the builder and the user in mind.

Research into the environmental impact of producing construction materials suggests that the greenhouse gas emissions generated as a result of this would be insignificant in relation to the reductions made over the lifespan of the stoves. Further details are discussed under leakage.

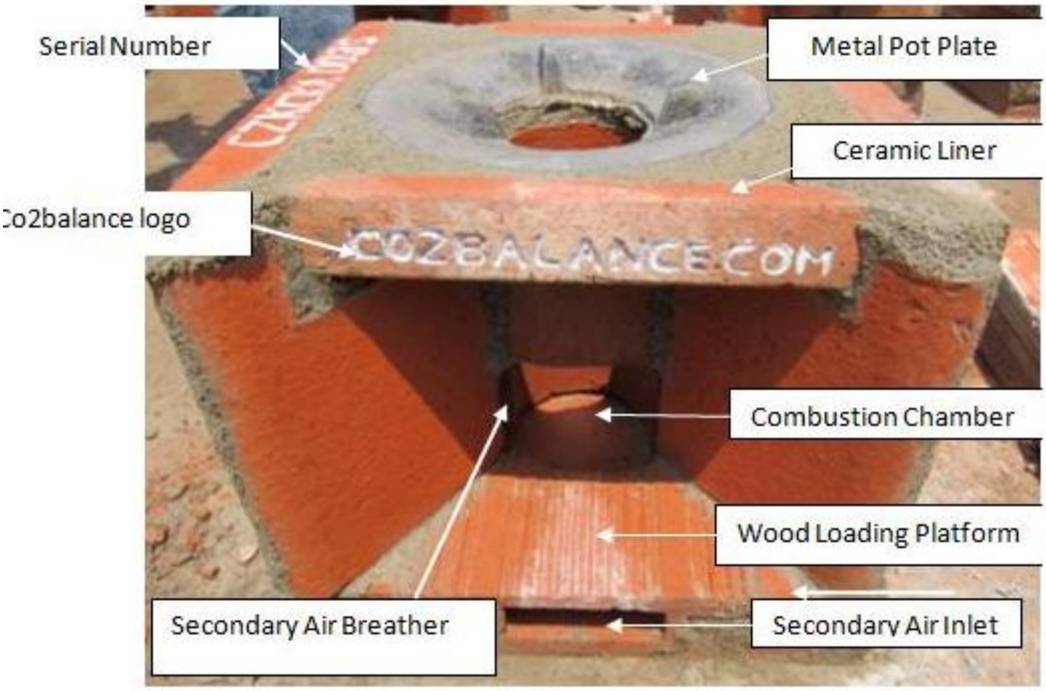


*Image 2. Photo of a CZK stove*

**The Carbon Zero Kenya Cook-Stove (CZK)**

The pilot project and development work have been funded by co2balance UK Ltd, as will the implementation of the project; VER sales will constitute the only revenue stream. Carbon Zero Kenya Ltd will implement this project with the assistance of local stove contractors. Long term monitoring and stove maintenance will be managed similarly.

**1st) LSC was held:** 30th November 2010

**2nd) LSC report is submitted to the Gold Standard Registry 05th January 2011** (construction can now commence under regular project cycle application)

**3rd) Pilot construction undertaken**

During the elapsed time between the local stakeholder consultation and the start of pilot stove construction other scopes of the project were advanced as for example reinforcement of community engagement, building the electronic database to track stoves individually, further internal training on project implementation, etc. Country logistics allowed start construction of the pilot stoves a few months later when the necessary resources were put in place to ensure an adequate implementation.

Construction of the rest of stoves (to meet the maximum allowable emissions reductions for a small scale activity) is planned for early 2011.

| Date | Stoves constructed in period | Total stoves operational |
|---|---|---|
| March 2011 | 146 | 146 |

| Date | Stoves constructed in period |
|---|---|
| March 2011 | 146 |
| April 2011 | 0 |
| May 2011 | 250 |
| June 2011 | 400 |
| July 2011 | 400 |
| August 2011 | 0 |
| September 2011 | 4,000 |
| October 2011 | 0 |
| November 2011 | 3,750 |
| December 2011 | 3,485 |
| January 2012 | 3,750 |
| February 2012 | 3750 |
| March 2012 | - |

As shown above, the first stage was the stakeholder consultation. Following this the construction of the pilot stoves commenced, hence the application for registration is under the regular cycle and not the retro-active cycle. Stove construction then will continue on a regular basis till all the project stoves are constructed. It is anticipated that the full amount of stoves will be complete within the shortest possible time.

Sustainability

As well as reducing greenhouse gas emissions this project will contribute to sustainability and millennium development goals in a number of ways including:

- Reducing householders exposure to health damaging biomass smoke
- Reducing pressure on local woodland and hence biodiversity
- Improved livelihood of the poor
- Increased rate of technology transfer

A detailed discussion of the impact of the project on sustainable development can be found in the accompanying Gold Standard Passport.

## A.3. Project participants:

| Name of Party involved (*) ((host) indicates a host Party) | Private entity project participants | Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No) |
|---|---|---|
| Kenya (host) | N/A | No |
| United Kingdom | co2balance UK | No |

The project is voluntary and as such official endorsement from the Parties is not required, the Kenyan DNA (NEMA) is however, aware of the project as this is the host country. NEMA were invited to the local stakeholder's meeting and also engaged to confirm the EIA non-requirement status of the project. Confirmation of the non-EIA requirement is available at validation.

## A.4. Technical description of the small-scale project activity:

### A.4.1. Location of the small-scale project activity:

#### A.4.1.1. Host Party(ies):

Republic of Kenya

#### A.4.1.2. Region/State/Province etc.:

The activities will take place within the Eastern Province of Kenya.

#### A.4.1.3. City/Town/Community etc:

The project activities will take place within the Kenyan country as follows:

**Province:** Eastern Province

**District:** Meru South District

**Divisions:** Chuka, Magumoni, Igambang'ombe, Mt Kenya forest (Total of 33,259 HHS)

**Location/Sub-location breakdown as below:**

| **Chuka Division** | | |
|---|---|---|
| | | Estimated number of households |
| **Location** | **Kiang'ondu** | **4695** |
| Sub locations | Kiang'ondu | 1024 |
| | Mucwa | 755 |
| | Township | 2916 |
| **Location** | **Mugwe** | **2649** |
| Sub locations | Mugirirwa | 1369 |
| | Kirege | 1280 |
| **Location** | **Karingani** | **4820** |
| Sub locations | Mariani | 1374 |
| | Karongoni | 1207 |
| | Ndagani | 1225 |
| | Njaini | 239 |
| | Rukindu | 775 |
| **Location** | **Kithangani** | **1116** |
| Sub locations | Kithangani | 319 |
| | Weru | 292 |
| | Marembo | 327 |
| | Rianthiga | 178 |
| **Location** | **Gitareni** | **2277** |
| Sub locations | Gitareni | 884 |
| | Kiamucii | 803 |
| | Kaarani | 590 |
| **Location** | **Muiru** | **1312** |
| Sub locations | Muiru | 771 |
| | Nkuthika | 541 |
| Total HHS | | 16,869 |

| Magumoni Division | | |
|---|---|---|
| | | Estimated number of households |
| **Location** | **Thuita** | **1688** |
| Sub location | Thuita | 885 |
| | Kathatwa | 803 |
| **Location** | **Rubate** | **1077** |
| Sub location | Kanthiri | 415 |
| | Rubate | 662 |
| **Location** | **Magumoni** | **1501** |
| Sub location | Nthambo | 962 |
| | Njuri | 539 |
| **Location** | **Mwonge** | **1619** |
| Sub location | Mwonge | 700 |
| | Kangoro/Karamani | 546 |
| | Kagumo | 373 |
| **Location** | **Kabuboni** | **1195** |
| Sub location | Kanyakini | 482 |
| | Kabuboni | 713 |
| **Location** | **Mukuuni** | **2171** |
| Sub location | Kinoru | 648 |
| | Karamani | 1068 |
| | Mukuuni | 455 |
| Total HHS | | 9,251 |

| Igambang'ombe Division | | |
|---|---|---|
| | | Estimated number of households |
| **Location** | **Kajuki** | **1928** |
| Sub location | Kajuki | 666 |
| | Kamutiria | 677 |
| | Makanyanga | 585 |
| **Location** | **Kamwimbi** | **1305** |
| Sub location | Kiaritha | 734 |
| | Kamwimbi | 571 |
| **Location** | **Mutino** | **2115** |
| Sub location | Kamonka | 530 |
| | Mutino | 775 |
| | Kathanje | 810 |
| **Location** | **Kamaindi** | **786** |
| Sub location | Igambang'ombe | 343 |
| | Kamaindi | 443 |
| **Location** | **Itugururu** | **1005** |
| Sub location | Igamatundu | 548 |
| | Mbogoni | 457 |
| Total HHS | | 7,139 |

**A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :**

**GPS locator**
**Latitude : 0°21'42.42"S**
**Longitude : 37°44'31.26"E**

For the purposes of this project the boundaries have been defined as the political boundary to include all sub-locations as illustrated below.


The stoves will be individually tracked using GPS co-ordinates to ensure they fall within the project boundary. Furthermore, each stove is marked with a unique identification number that will be uploaded and kept on the electronic database; this includes household occupants and GPS co-ordinates. That will allow the individual tracking of each stove to avoid double counting and boundary issues.

**A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:**

The project falls under the Energy Efficiency – Domestic type and category according to the GSV2.1 toolkit.

The project technology of the generic 'rocket stove' type is well proven to be environmentally safe and sound in relation to the baseline 'three-stone' technology. [8] The rocket stove technology will be distributed to a number of households within the project area and households trained in efficient use of the stoves to ensure successful transfer of this technology type to the area in question.

**A.4.3 Estimated amount of emission reductions over the chosen crediting period:**

| Year | ER - Estimation of annual emissions reductions in tonnes $CO_2e$ |
|---|---|
| 2010 | 0 |
| 2011 | 21,267 |
| 2012 | 71,611 |
| 2013 | 71,611 |
| 2014 | 71,611 |
| 2015 | 71,611 |
| 2016 | 71,611 |
| 2017 | 71,611 |
| **Total estimated reductions (tonnes $CO_2e$)** | 450,933 |
| **Total number of crediting years** | 7 |
| **Annual average of the estimated reductions over the crediting period** | 64,419 |

**A.4.4. Public funding of the small-scale project activity:**

There is no public or ODA funding for this project activity, all revenue for the project will be derived from the sales of VERs. Please see annex 2 in the passport for a copy of ODA letter as proof of this.

**A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large**

[8] MacCarty, N., Ogle, D., Still, D., Bond, T. & Roden, C., (2008). '*A laboratory comparison of the global warming impact of five major types of biomass cooking stoves*', *Energy for Sustainable Development* 12 (2), pp. 5-14. Accessed from http://www.aprovecho.org/lab/pubs/rl/perf-stud/category/20

**scale project activity:**

In accordance with the guidelines recorded in EB54, Annex 13, paragraph 7, the proposed small-scale project activity is exempted from undergoing a de-bundling check.

Refer to Excel file 'PDD Supplementary Data Meru' for calculations.

## SECTION B. Application of a baseline and monitoring methodology

### B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The small-scale project activity falls within the 'Energy Efficiency – Domestic' category and will utilise the Gold Standard 'Methodology for improved cook-stoves and kitchen regimes V.02'. This is the most up to date version of the methodology at the time of submission.

Additionality is demonstrated using the UNFCCC Tool for the demonstration and assessment of additionality (Version 05.2) which shows that the project would not be possible without VER revenues.

### B.2 Justification of the choice of the project category:

The applicability criteria of the chosen methodology will be addressed in turn to show that this methodology is applicable to the proposed project activity. Sections in italics represent the criteria specified by the methodology, Section I, pg. 2.

1. The *'methodology is applicable to programs or activities introducing improved cook-stoves or water treatment technology (e.g. water filters) and practices to households and institutions that result in improved kitchen regimes within a distinct geographical area.'*

The project activity is introducing improved cook-stoves to households within the geographical region defined in section A.4. The activity will be replacing inefficient open wood fires with wood-stoves of a higher thermal and combustion efficiency, and training householders in their use, will result in improved kitchen regimes[9] in the form of reduced fuel use, corresponding GHG emission reductions, and lowered levels of indoor air pollution.

2. *'The project activity is implemented by a project coordinator who acts as project participant.'*

The project activity is being implemented by co2balance UK Ltd, who also act as project participant.

3. *'The individual households and institutions will not act as project participants.'*

The individual household stove recipients will not act as project participants and will all sign a carbon rights transfer form confirming that the rights to GHG emission reductions are transferred to the PP as payment for the improved cook stove.

[9] According to Section I, page 2 of the methodology: '*The term "regime" is used to encompass a range of practices which determine green-house gas emissions arising from energy use in the kitchen.'*

4. *'The methodology addresses the switch from cook-stoves and kitchen regimes used in institutions or domestic homes having significant green-house gas emission to those having considerably less or zero emissions.'*

The pilot project for the proposed project activity has shown that the activity will replace 3-stone wood stoves that have significant GHG emissions with improved stoves having over 50% less GHG emissions. Refer to PDD section B.6.3 for details.

5. *'Kitchen regimes with significant green-house gas emissions may involve the use of more than one fuel type and more than one stove type, and the switch to low emission regimes may involve a shift in the apportionment of fuel types and/or adoption of new fuels and cook-stoves and/or water treatment technology.'*

The Kitchen Surveys carried out indicate that wood is the main fuel used in the area, although other fuels are used in household kitchen regimes. The 'switch to low emission regimes' will involve adoption of new cook stoves and may or may not involve a shift in apportionment of fuel types.

6. *'The shift may occur in a phased manner, a program or project comprising a progressive increase over the project years in adoption of an improved fuel mix, improved stoves and/or water treatment technology.'*

It is intended that the improved cook stoves will be progressively introduced to the kitchens over the first crediting year of the project activity.

7. *'Low-emission cook-stoves and regimes replace relatively high-emissions baseline scenarios.'*

Again, the pilot project for the proposed project activity has shown that the activity will replace 3-stone wood stoves that have significant GHG emissions with improved stoves having over 50% less GHG emissions. Refer to PDD section B.6.3 for details.

8. *'The project boundary can be clearly identified, and the stoves counted in the project are not included in another voluntary market or CDM project (i.e. no double-counting takes place)'*

The project boundary has been clearly demarcated using political divisions recognised in Kenya. The stoves counted are individually marked with a project specific identification code that is referenced in all records relating to the stove, stored in the project proponents' database. This ensures that the stoves are not accidentally counted in other project activities.

9. *'The project is located in a single country'*

The project is located in Kenya and no other country.

10. *The improved cook-stoves do not number more than ten per kitchen and have a continuous useful energy outputs of less than 50kW (defined as total energy delivered usefully from start to end of operation divided by time of operation)*

A single stove only will be introduced into each kitchen counted by the proposed project activity. Using the results of the baseline study, the continuous useful energy output has been estimated at 1.72kW.[10]

[10] Please refer to the file 'PDD supplementary data Meru'.

11. *'Examples of project technologies are improved biomass stoves...'*

The project technology in this case will be an improved biomass stove.

12. *'Examples of Baseline technologies are biomass stoves…'*

The baseline technology in this case will be an improved biomass stove.

The project will be classified as small-scale in accordance with the Gold Standard rules, which follow the definition laid out by the CDM EB. Small scale energy efficiency projects are defined as producing average annual energy savings of <60GWh$_e$ or <180GWh$_{th}$ per annum. Applying that thermal limit will result in a limitation of wood saved by the project. Likewise, such a maximum amount of wood saved by the project will determine the maximum amount of stoves to implement (dependent on the amount of wood saved per stove) to achieve the maximum emission reductions claimed for the project scale. Please refer to file 'PDD supplementary data Meru v0.1' for details of these calculations.

## B.3. Description of the project boundary:

The project boundary is determined as specified in the methodology.

a. The project boundary is defined as the domestic kitchens in which each stove is installed, recorded.
b. The target area as defined in section A.4.1.4.
c. The Fuel Collection Area has been defined based on the information gathered by the Kitchen Surveys. The results analysis[11] showed that the majority of households collect their fuel from the local area walking /with donkey cart and the rest buy it locally.

Greenhouse gasses that can be included in the project and baseline are as tabulated below.

| | Source | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| **Baseline** | Cooking, production of fuel, and transport of fuel | $CO_2$ | Yes | Important source of emissions |
| | | $CH_4$ | Yes | Important source of emissions |
| | | $N_2O$ | Yes | Can be significant in some fuels |

| | Source | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| **Project** | Cooking, production | $CO_2$ | Yes | Important source of emissions |

[11] For full details see file 'NRB study' report uploaded to the GS registry and provided to the DoE.

| | | | | |
|---|---|---|---|---|
| | of fuel, and transport of fuel | $CH_4$ | Yes | Important source of emissions |
| | | $N_2O$ | Yes | Can be significant in some fuels |

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

The project baseline has been developed in line with the chosen methodology, and the Energy Efficiency – Domestic type and category according to the GSV2.1 toolkit.

**1. Determine customer groups "or clusters"**

Step 1.1: Establish a pilot distribution record (PDR).

A small number (146) of pilot stoves were built in the project area in March 2011 for the purposes of carrying out surveys and tests required for baseline development. A pilot distribution record (PDR) containing the names and addresses/locations of the stove beneficiaries was created and stored in the project developer's database.

Step 1.2: Provisionally assess fuel types, fuel mix, and kitchen regimes.

Provisional assessments made by local staff established that almost exclusively domestic cooking in the project areas is carried out using firewood fuel gathered from local forests or purchased from firewood sellers.

In accordance with the methodology these have been divided into the following categories:

a) Renewable and Non-renewable Woody Biomass, which includes all wood-fuels.

   **Wood fuel was used as main cooking fuel in 96% (Baseline) and 98% (Project) of cases in each scenario. Charcoal was the main secondary fuel – before the CZ stove 43% used charcoal as secondary fuel while 50% used no secondary fuel. After the CZ stove 58% used no secondary fuel with 40% using charcoal.**

b) Renewable energy fuels, sourced or methods with zero green-house gas emissions (RE), such as some agricultural residues/coppiced wood, biogas, solar cookers, heat retention cookers (excluding sustainably produced woody biomass which is covered in category (a) above)

   **None identified**

c) Alternative fuels (AF) emitting green-house gases during production or combustion (such as fossil fuels, dung, some crop residues) defined as fuels which do not fall into the above two categories

   **Some minor usaged of paraffin/kerosene or LPG stoves were reported as secondary fuel uses both before and after the installation of CZ stove.**

The results of the Kitchen Surveys showed that 47% of households in the baseline situation utilised fuel for warmth, this dropped slightly to 14% in the project scenario.

Step 1.3: Analyze renewability fraction of wood-fuels.
An assessment was made by C4 Eco Solutions (Pty) Ltd of the renewability fraction of wood fuel in the Meru region (refer to 'NRB Study' separate report).

Step 1.4: Divide pilot distribution record (PDR) into major groups or clusters.
No major cluster distinctions were identified at this stage and hence the PDR was not split.

Step 1.5: Carry out a qualitative survey (Kitchen Survey – KS)
Kitchen Surveys were carried out early April as directed by the independent consultant HED and as described in the baseline report.[12] All pilot stove recipients were surveyed for completeness.

The results of the surveys were assessed by HED and identified one cluster for this project (Refer to the file 'Baseline Report-Meru' uploaded to the GS registry):

Subsequently, a minimum of 45 households were randomly selected from the KS group by HED according to the conclusions from the KS results. This would produce a conservative assessment of fuel savings made.

Step 1.6: Refine demarcation of clusters and populate Project Database
As the project database is simply the distribution record re-organised for the calculation of emission reductions and at this stage only one cluster has been identified, the two records were at this stage identical. The 'project database' is a separate section of the PPs database however, and allows for the addition of clusters, and recalculation of emission reductions based on the results of monitoring activities.

**2. Calculate baseline emissions**

Step 2.1: Estimate expected variation and improvement in emission reductions
An appropriate statistical analysis was carried out by HED and is documented in the baseline report.

Step 2.2: Specify the units of emission reduction or fuel consumption
The units of emission reduction selected were $tCO_2e$/stove/year.

Step 2.3: Make quantitative measurements (Kitchen Performance Tests)
Kitchen Performance Tests were carried out late April 2011 as specified and documented in the baseline report, using the HHs selected from the previous survey (KS). The previous section has presented the sampling criteria for the KPTs. In summary:

- Households should have an AME value between the $05^{th}$ and $95^{th}$ percentiles of the KS Pilot Groups figures.
- Should include 1-2 households that use their fuel for business purposes most frequently.
- The sample should include approx 30% of households which use their stove for heating

[12] Refer to the file 'Baseline Report-Meru-Final V01' uploaded to the GS registry.

- ‘Non-users’ of the CZ Stove should remain in the sample.
- Approx 30% of the KPT sample should be households that use charcoal to make up a quarter or more of their fuel consumption post CZ Stove.
- Willingness to take part.
- Should be made up of 54% exclusive CZ users, 40% primary users, 2% secondary users and 4% not using the CZ stove.

Step 2.4: Calculate baseline

A 4-day paired KPT (3 full days or 72 hours monitored, requiring 4 days of visits) was considered to be a good option. Households were asked to cook as normal during the KPT in order to account for any retained use of a baseline stove.[13] The baseline and project emissions calculations are documented in PDD section B.6.3. and the fuel savings identified by the KPT shown below.

| | kg/HH/day |
|---|---|
| **Firewood Consumption 3-stone stove** | **12.10** |
| **Saving Adj for lower bound of 90% confidence** | **5.71** |

| | t/HH/year |
|---|---|
| **Firewood Consumption 3-stone stove** | **4.42** |
| **Saving Adj for lower bound of 90% confidence** | **2.08** |

**Leakage**

As specified in the chosen methodology the following sources of leakage have been assessed for this project.

[13] In accordance with the methodology, the use of baseline stoves along with the improved stoves is allowed as long as it can be demonstrated that a mechanism is put in place by the PP to provide an incentive for the surrendering of the old stoves by beneficiaries. There is an issue in applying this concept to a project a) replacing baseline stoves with no intrinsic form or value i.e. three stones, and b) where the project technology is exchanged for carbon rights only (no monetary exchange). Based on the incentive for the beneficiary being intrinsic to the technology, which reduces fuel costs or time spent collecting fuel, the PP will monitor use of stoves as part of the quarterly monitoring Kitchen Survey (MKS), including reasons for no use or retained use of baseline technology. If significant retained use of baseline technology is determined, the PP will re-visit the incentive situation and make modifications accordingly.

*a) Some users of the efficient stoves respond to the fuel savings associated with higher efficiency stoves by increasing consumption of fuels with GHG emission characteristics by retaining some use of inefficient stoves, to the extent that project emissions are higher than those calculated from the assumption that cooking energy is constant. This is sometimes referred to as the 'rebound' effect.*

This is accounted for by the design of the KPT and KS, as they include relevant questions to assess residual use of retained baseline technology, refer to the footnote on this page also.

*b) The project activity stimulates increased use of a high emission fuel either for cooking or for other purposes outside the project boundary (as would be the case for example if efficient cooking stimulated an increase in NRB consumption - possibly because the NRB fuel becomes cheaper due to the project activity).*

Householders targeted by the project do buy wood as well as collect it for free from the surroundings. As the fuel in question is not part of an economic market outside the project boundary, reduction in pressure on the NRB is unlikely to result in increased use of the fuel outside of the project area. In any case the NRB fraction will be periodically monitored as requested by the methodology and used to inform of any changes in the future.

*c) By virtue of promotion and marketing of a new model and type of stove with high efficiency, the project stimulates substitution of a cooking fuel or stove type with relatively high emissions by households who commonly using a cooking fuel or stove type with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.*

All stove recipients cook on 3 stone fires, in which case the only scenario producing this leakage would be a recipient reducing use of renewable fuels such as crop residues. This will be captured through monitoring KS and KPTs.

*d) The project population compensates for loss of the space heating effect of inefficient cook-stoves by adopting some other form of heating or by retaining some use of inefficient stoves.*

This is possible in some areas covered by the project, any compensation will however be covered in the results of the KPT (which encompasses all wood-fuel use) and the KS (which will pick up on any use of other fuels for space heating) and so this need not be separately assessed.

*e) The traditional stoves displaced are re-used outside the boundary in a manner suggesting more usage than would have occurred in the absence of the project.*

In all cases the traditional stoves replaced are three rocks; these have no market value and are not a product as such. There is nothing limiting the use of three stone cooking across the country (technology is lowest, price is zero), which is why this cooking method is so widespread. This leakage source can therefore be discounted.

*f) Significant emissions from transportation or construction involved in the project activity, including emissions associated with production/transport of the efficient stoves themselves, or production/transport of project fuels (for example briquette manufacture and supply may be energy-intensive).*

An assessment of project construction emissions has been made and is detailed in 'PDD supplementary data Meru'. All components and liners used are fired clay. The raw material (clay) is extracted and manufactured into bricks and the liner in the same factory in Mombasa, 700 km away from the project area. Both bricks and liners, are transported by truck (10 tonne to 48 tonne truck types) into the project area where stocked up in a central storage till a pick up truck delivers them to the communities. Emissions from production and transportation are assessed in 'PDD supplementary data Meru'; the potential impact of construction materials used is detailed also. Any emissions associated with delivery of fuel (likely zero) will only decrease with the implementation of the project which will reduce fuel consumption.

*g) The non-renewable biomass saved under the project activity is used by non-project households/users who previously used renewable energy sources.*

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

*h) The non-renewable biomass saved under the project activity is used to justify the baseline of other project activities.*

To the best knowledge of the project proponent there are at present no similar projects registered under the GS or CDM within the project area, this source of leakage is therefore avoided. The proponent is developing similar projects within the host country however these are all being carefully developed through an electronic database available along the project period in order to avoid any conflicting issues.

In summary, risks a), c) & d) are subsumed by the KPT, risk b) is subsumed by the NRB analysis, risk e) & g) are discounted, risk f) is subsumed in annex 3, and finally, risk h) is subsumed by the electronic database.

Thus the total leakage factor applied is **0.0177 $tCO_2$/stove for the first year of the project only**. Thus, further leakage in future years after the first one is not expected.

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:**

There has not been a previous announcement that the project activity would go ahead without the Gold Standard. The project activity is financed upfront for future Gold Standard VERs as the only source of funding and so the project activity could not go ahead without VER revenues.

Additionality is demonstrated using the UNFCCC Tool for the demonstration and assessment of additionality (Version 05.2) which shows that the project would not be possible without VER revenues.

**Step 1: Identification of alternatives to the project activity consistent with current laws and regulations**.

***Sub-step 1a: define alternatives to the project activity:***

**Alternative 1:** Stoves are designed, marketed, built and distributed by a stove builder without registering as a Gold Standard VER project.

*Under this alternative scenario the project would proceed as laid out in this document. This would provide the same energy output, result in the biomass savings, improved livelihoods and other contributions to sustainable development identified. There may be some retained use of baseline stove for occasional heating purposes as identified in the baseline study.*

**Alternative 2:** Continuation of the current situation – use of traditional cooking with 3-stone fireplaces.

*Without the intervention of the project and use of carbon finance it is unlikely that the status quo will change.*

**Outcome of sub-step 1a:** Two realistic and credible alternatives to the project activity have been identified.

***Sub-step 1b: Consistency with mandatory laws and regulatory***

In Kenya there is no law or regulation that applies to the efficiency of cooking stoves or that requires the use of efficient stoves, and none is expected to be introduced during the project hence all cook stove distribution is a voluntary action. Hence the alternatives identified in Sub-step 1a above are in compliance with the mandatory laws and regulations in Kenya.

**Outcome of sub-step 1b:** Two realistic and credible alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region and EB decisions on national and/or sectoral policies and regulations have been identified.

**Step 2: Investment Analysis**

***Sub-step 2a: Determine appropriate analysis method***

As the proposed project activity generates no financial or economic benefits other than the VER revenues, the simple cost analysis (option I) will be applied, as suggested by the additionality tool.

***Sub-step 2b: Option I. Apply simple cost analysis***

The costs associated with the proposed activity and alternatives identified in Step 1 are documented here which will demonstrate that at least one alternative is less costly than the proposed activity.

**Proposed activity**

Despite the development of various improved stoves within Kenya over the last 30 years[14], there has been very low penetration of the technology in rural wood-burning households (referenced in barrier analysis). The rocket-stove cost price is €25 (breakdown cost is shown below:

[14] http://www.hedon.info/BP35_WomenAndEnergyProject-Kenya

| Material | Qty | Unit | Unit Cost (€) | Total (€) |
|---|---|---|---|---|
| Metal pot plate | 1 | nr | € 3.61 | € 3.61 |
| Ceramic Liner | 1 | nr | € 1.62 | € 1.62 |
| Walls | 3 | nr | € 1.90 | € 5.70 |
| Side caps | 2 | nr | - | € 0.82 |
| Logo shelf | 1 | nr | € 0.76 | € 0.76 |
| Base | 1 | nr | € 2.76 | € 2.76 |
| Sand | 1 | kg | - | € 0.25 |
| Vermiculite | 1 | kg | € 0.24 | € 0.24 |
| Main Transportation | - | stove | € 3.77 | € 3.77 |
| Assembly | 1 | stove | € 5.43 | € 5.43 |
| **Total (€)** | - | - | - | **€ 25** |

In line with the estimated distribution potential of 19,931 improved cook stoves in the defined project area this would require funding of €498,275. In this scenario a proposed total of 450,800 VERS will be issued to the proponent over the first 7 years of the project (after GS deductions). Retailing the VERs at €8 each (indicative estimated price) would provide a surplus of €3.0m, sufficient to cover the additional burden of putting the project through the Gold Standard as well as making the project an investment opportunity for financiers.

**Alternative 1**
Under this alternative scenario the project would be implemented as per the proposed activity and thus would incur the same build costs of €498,275. However, without registration through the Gold Standard or other carbon financing mechanism this would have to be funded in another manner, either by sales or charitable donations.

A brief assessment of the ability of householders to fund their own stove has been made: According to the International Fund for Agricultural Development (IFAD) 53% of Kenya's rural population live below the poverty line.[15] The average income in Kenya is KES4,000 – KES4,250 per month[16,17] (~€40), and for the rural poor 83% of the household budget is spent on food[1].

A Ministry of Energy study found the cost of firewood to stand between 77KSh/tonne and 1,200KSh/tonne. Also, at the national level, many householders are able to purchase a monthly permit to remove firewood at a cost of KES39/month[4] or for free from the local area. Thus the four options were analysed individually: if buying fuel at low price estimate, if buying fuel at high price estimate, if own collection of fuel paying permit and if own collection of fuel not paying permit.

Calculations have been made to assess the ability of households in the target area to purchase a rocket stove at the cost price of €25 (breakdown cost available in the supplementary excel sheet info file) based

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[15] http://www.ruralpovertyportal.org/web/guest/country/home/tags/kenya
http://www.fao.org/fileadmin/templates/ess/documents/food_security_statistics/country_profiles/eng/Kenya_E.pdf

[16] http://www.ruralpovertyportal.org/web/guest/country/statistics/tags/kenya

[17] http://www.unicef.org/infobycountry/kenya_statistics.html

on the data tabulated below for the three possible situations stated above plus the free collection option, which would be the best scenario economically.

| | |
|---|---|
| Average income (KES/month) | 4,250 |
| Average income (KES/year) | 51,000 |
| Proportion of income spent on food (%) | 83% |
| Fuel price 1 = low estimation (KES/tonne) | 77 |
| Fuel price 2 = high estimation (KES/tonne) | 1,200 |
| Permit cost (KES/month) | 39 |
| Permit cost (KES/year) | 468 |
| Cost of CZ stove (KES) | 3,044 |

*Table showing initial data used to assess the study below.*

Therefore, for the three possible scenarios stated above plus the free collection option, which would be the best scenario economically, the different fuel costs to calculate the average household income remaining after meeting the basic needs of fuel and food were projected. The cost of a rocket stove as a proportion of this remaining income was then calculated and is shown in the table below. Each scenario was assessed independently:

| *Fuel use (t/hh/year)* | *2.90* |
|---|---|
| If buys fuel: low estim | 23% |
| If buys fuel: high estim | 37% |
| If collects: paying permit | 24% |
| If collects: free collection | 22% |

*Table showing cost of rocket stove as % of annual HH income after purchasing food and fuel.*

The results show that, based in the fuel use determined in the baseline study, even in the most conservative scenarios householders wishing to purchase a stove would have to save at least 22% of their remaining income for a year (calculations available in the supplementary excel info file). This does not take into account any of the other costs of living such as clothing and schooling, it seems most likely then that the majority of householders would not be able to independently purchase a rocket stove.

Alternatively the project could rely on charitable donations, however this would only be possible for a small scale and sporadically when donor funding is available.

This alternative is likely to be more costly than the proposed activity.

**Alternative 2**

There are no costs associated with the continuation of cooking on a 3 stone fire, thus this alternative is clearly less costly than the proposed activity.

**It is concluded that the proposed activity is more costly than at least one alternative (Alternative 2), so the assessment can proceed to Step 4 (Common practice analysis). The proponent has opted to apply Step 3: Barrier Analysis also.**

**Step 3: Barrier Analysis**

***Sub-step 3a: Identify barriers that would prevent the implementation of the proposed GS VER project activity:***

**(a) Investment barriers**

*Government funding*
This is discussed in step 4 below.

*Private funding*
Significant up-front investment has been required to research, test and develop an appropriate stove for the rural Kenyan situation. A study by the World Bank found that 53% of small business in Kenya identified access to finance as a major business constraint, ranking this as the second largest obstacle, 83% of small businesses rely on internal funding/returns for investment.[18] Given this, it is unlikely that a source of funding could be found for a start-up business as proposed.

The proposed project activity is being developed by co2balance UK Ltd. a private business established in 2003 in the carbon offset industry. Carbon Zero Kenya Ltd, a separate organisation, will manage the implementation of the project activity.

Co2balance UK Ltd has a number of offices and permanent employees, established with funding obtained from retail sales of carbon, shareholders and private investors. The business model (and all investment made) is based around the existence of carbon revenues as a source of income, without which projects would be cash negative as the stoves are exchanged for a householders legal ownership of the $CO_2$e emissions reductions. This level of investment made would unlikely be made in a single Kenyan SME with the same business model.

As for obtaining private investment in such a business, studies, reports, and surveys show that the political and economic environment in Kenya is not ideal for foreign investment. Kenya currently has a credit rating of 'B', which is five levels below investment grade.[19] The credit rating was downgraded after the post-election violence in 2007/2008.

The poor credit rating embodies aspects of political instability and wide-spread corruption. In 2009, The World Bank Institute published governance ratings for Kenya. The report covers such aspects as political stability, corruption, rule of law, and government effectiveness from 1996 to 2008. The rating is displayed as a percentile and interpreted as the percentage of countries that rank below the one in question. Concerning "Political Stability and Absence of Violence" in Kenya in 2008, the report stated, with 90 per cent confidence, that 80 per cent of countries are

[18] http://www.enterprisesurveys.org/CustomQuery/Country.aspx?economyid=101&year=2007&characteristic=size

[19] Kenya's Credit Rating Outlook Raised to 'Stable' by S&P 2008, March 10th). *Bloomberg*, Retrieved from www.bloomberg.com/apps/news?pid=20601116&sid=aGLaHAcFh8sQ&refer=africa

more stable and less violent then Kenya. Additionally, 70 per cent of countries were shown to perform better than Kenya in "Control of Corruption" in 2008 with 90 per cent confidence.[20]

Finally, a study by the World Bank found that 53% of small business in Kenya identified access to finance as a major business constraint, ranking this as the second largest obstacle, 83% of small businesses rely on internal funding/returns for investment.[21] The up-front costs required to develop market efficient cook stoves are significant, and until a reduction in costs could be proven, there would be no market. Given this financial case, for such a business it is unlikely that a source of funding could be found.

In summary, there is no or insufficient private capital due to the actual or perceived risk of conducting business in the host country, Kenya.

**(b) Technological barriers *Inter alia***

Although the *generic* 'rocket stove' technology is not new, significant funding has been required to overcome the numerous technological barriers to implementation of the specific technology. Investment is required in: researching, developing and testing the design; financing construction materials; transportation of materials; education programme, amongst other things. Although there is existing ceramic manufacturing capacity within the country, financing is required for specific components that have been developed for the project. The specific technology to be utilised would not have been developed without the anticipated carbon finance. Maintenance of product quality is also an important factor to consider, especially in light of the successful Kenya Ceramic Jiko (KCJ) which is independently produced and marketed for charcoal consuming urban dwellers. It has been found that although widely disseminated, the product efficiency and durability has dwindled due to a lack of enforced standards and cost-cutting measures to remain in the market.[22]

Despite the presence of improved cook stoves in Kenya for 30 years[14], the use of improved wood stoves in rural Kenya is not widespread (estimated at 4% penetration[23]), with householders typically using inefficient three stone fires due to a number of technological and financial barriers.[24,1] Clearly marketing and education is required to encourage the uptake and continued use of improved stoves, this is a challenge in the rural communities of the proposed activities.

Skilled labour: In addition there is a lack of an adequately trained local workforce capable of constructing and maintaining stoves at present, specific training in construction is required for the technology to be utilised. There is no clear development of a market that would drive such capacity to be built due to the financial barriers stated above.

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[20] Governance Matters 2009: Country Data Report for Kenya, 1998-2008 (2009, June). *World Bank Institute*. http://info.worldbank.org/governance/wgi/pdf/c116.pdf

[21] http://www.enterprisesurveys.org/CustomQuery/Country.aspx?economyid=101&year=2007&characteristic=size

[22] Pg. 56"Study on Kenya's energy demand, supply and policy strategy for households, small scale industries and service establishments", Republic of Kenya Ministry of Energy, Sept 2002.

[23] Pg. 55"Study on Kenya's energy demand, supply and policy strategy for households, small scale industries and service establishments", Republic of Kenya Ministry of Energy, Sept 2002.

[24] http://www.hedon.info/RocketMudStovesInKenya

**(c) Barriers due to prevailing practice *inter alia***

Habitual use of traditional stoves imposes a very strong influence on the baseline scenario, resulting in continuation of use of traditional three stone fires. There have been some efforts to introduce improved cook-stoves in Kenya however success has been limited mainly to urban-dwelling charcoal users.

Although significant efforts have been made to produce an improved stove that is similar in use to three stone cooking, there remain some differences in the way a user must approach cooking. Without community-based staff to provide education and guidance on stove use it is unlikely that widespread adoption would occur.

**Outcome of sub-step 3a:**

| Barrier | Prevents scenario 1? | Prevents scenario 2? |
|---|---|---|
| Investment – private funding | Yes – not available | No |
| Technological - development | Yes – funding required | No |
| Technological - QA | Yes – consistent funding required | No |
| Technological - training | Yes – funding required | No |
| Prevailing practice - education | Yes – funding required | No |

Clear barriers such as poor access to finance, low attractiveness of Kenya for external investment, lack of high quality technology, and low education about the improved technology offered have been identified that may prevent the implementation of alternative scenario 1.

***Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)***

None of the identified barriers discussed above prevent alternative 2, continuation of cooking on three stone fires, from occurring.

***"If both Sub-steps 3a – 3b are satisfied, proceed to Step 4 (Common practice analysis)".***

**Step4: Common practice analysis**

***Sub-step 4a: Analyze other activities similar to the proposed project activity:***

Improved cook stoves started to appear in Kenya in 1981 following the UN 'Conference on New and Renewable Sources of Energy'

**Upesi Stoves**

The Upesi project started in 1995, it was supported by Intermediate Technology Development Group (ITDG) the aim was to commercialise the Upesi stove in Western Kenya. This stove had been developed in collaboration with GTZ 9 years previously: Potters were trained in the production of the liner and it was distributed by Ministry of Agriculture employees, price (~120KES) and distribution were subsidised by GTZ in order to make distribution viable in rural areas. After 8 years the support was withdrawn and so the project did not continue on any significant scale[25]

The stove is a simple fired clay liner (see image) which can be either used on its own or built into the ground to improve efficiency and durability. Original testing[*] showed up to 43% wood savings and an expected life of around 4 years.

**Upesi liner[25]**

After 5 years the Upesi project had trained a number of people in marketing as well as production of the liner, it was estimated that 16,000 had been distributed.

The Rural Stoves West Kenya (RSWK) project (building the mandeleo/upesi/jiko Kisasa stoves[26]), was a project working with the Ministry of Agriculture through the Home Economics Officers, the interest being that through the reduced pressure on non-renewable biomass - rate of deforestation was reduced which was of interest to the Ministry of Agriculture. When funding (1990 - 1995) from the Ministry of Agriculture dropped off, the level of production decreased as the subsidies, in the form of free transport for the stoves and controlled prices were removed and the poorer purchasers were unable to afford higher prices.

[25] http://www.hedon.info/BP56_TheUpesiRuralStovesProject
[26] Rural Stoves West Kenya: http://practicalaction.org/?id=t4sl_casestudy_stoves

**Built-in Upesi/Mandeleo stove**[27]

Similar observations have been made regarding the Kuni Mbili, promoted by KENGO, the wood fuel version of the KCJ which is subsidised and often sold at cost or less than cost[28]. This is currently considered acceptable as the stove is still in demonstration, but when subsidies are removed the success of the Kuni Mbili commercialisation is in question. There are only 20,000 of these stoves in operation in Kenya at present.[28]

**Kuni Mbili**[29]

The Kenyan Ceramic Jiko was first pioneered two decades ago and has broken into the urban market, however over this time stove quality has deteriorated as price competition has led producers to cut costs

[27] Taken from http://www.pisces.or.ke/pubs/pdfs/PISCES_Kenya_Report_2010.pdf
[28] Kuni Mbili
http://www.hedon.info/BP30_CookingStovesForCommercialSustainableProductionAndDisseminationInAfrica?bl=y
[29] Taken from http://www.bioenergylists.org/stovesdoc/Ezzati/Home%20Page%20of%20Majid%20Ezzati.htm

in response to competition[30]. Improved Kenyan stoves tested in the 1980s consumed 30-50% less charcoal than conventional ones, today this is 24%. Consumers are not necessarily aware of drop in efficiency but a notice the decline in appearance and robustness.

The Private Sector Development in Agriculture (PDSA) stove project was carried out by GTZ on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). The objective of this project was to distribute ~180,000 ICS by 12/2008 within rural and urban households in a number of districts of Kenya, including Kisumu. The project focussed on commercialising a number of stove technologies, dometic ICS were; the existing Jiko Kisasa (formally mandeleo/upesi) liner, Jiko Kisasa built in & a new model, the rocket mud stoves.

**Two pot rocket stove[31]**

It is reported[37] that by Dec 2007, 24 individuals were involved in the production of fixed Jiko Kisasa stoves and 220 trained in constructing rocket stoves.

***Sub-step 4b: Discuss any similar Options that are occurring:***

A recent assessment of the PDSA project[32] showed that no poor households had the more expensive rocket stove (similar quality to the proposed activities technology) and that low income households such as those targeted by the proposed activity had only 16% of ICS despite making up half the population. It was also found that the lowest number of households utilising ICS was in the area where the proposed activity will be developed.[33] Surveying showed that the main reasons for people not owning an ICS (in

[30] DFID http://povertystoves.energyprojects.net/

[31] Taken from http://www.gtz.de/de/dokumente/en-kenya-results-assessment-stoves-2009.pdf

[32] Pg 35 http://www.gtz.de/de/dokumente/en-kenya-results-assessment-stoves-2009.pdf

[33] Pg 36 http://www.gtz.de/de/dokumente/en-kenya-results-assessment-stoves-2009.pdf

order of responses) were cost, no interest & don't know where to buy them[34]. Clearly the proposed activity addresses these issues.

Although a number of improved cook stove dissemination activities have been observed in Kenya, all have been subsidised by external funding and have not lead to widespread common use of improved cook stoves in rural Kenya use of improved wood stoves in rural Kenya is estimated at 4% penetration[35]. The repeated efforts at commercialisation suggest that they have not been successful despite subsidising stoves. The distinction between these and the proposed activity is that stoves are given in exchange only for legal entitlement to the $CO_2$e rights, and in the poorest rural communities, thus reaching those unlikely even to buy a subsidised stove. On top of this the stove quality will be higher due to the use of centralised production of the key components (pot rests and ceramic liner) and more stringent QA procedures that can be put in place with a project building many stoves in a short period and a small geographical area. In this sense it is anticipated that product quality differentiates the proposed project from others.

It is therefore concluded that the project is additional.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

The project proponent has elected to use a fixed baseline, inline with the chosen methodology. Due to capacity limitation the construction of the stoves will take place throughout the first crediting year of the project, as indicated in section C.1.1. All project stoves will have been constructed by the end of the first crediting year. Each stove build date is individually recorded in the proponent's database and emission reductions calculated on an individual basis. A 1 week lead time is accounted for between construction and operation of the stove, this leads to a conservative assessment of the emission reductions made and accurate calculation of emission reductions under a progressive distribution scenario. Likewise, the distribution record will be accordingly built into the database to justify the application of the fixed-baseline approach.

The exact equations given in the methodology were not used however the method and calculated results are not altered. This is approved by the methodology (page 19, penultimate paragraph); "*It is legitimate to derive emission reduction values on a per Unit basis directly from the KT tests, and modify the mode of calculation of project emission reductions (and of baseline and project emissions) accordingly, in cases where this results in the most transparent and clear mode of calculation, and where this is consistent with the calculations above*".

Changes made are demonstrated below.

Original calculations from methodology:

[34] Pg 52 http://www.gtz.de/de/dokumente/en-kenya-results-assessment-stoves-2009.pdf

[35] Pg. 55"Study on Kenya's energy demand, supply and policy strategy for households, small scale industries and service establishments", Republic of Kenya Ministry of Energy, Sept 2002.

$$ER_y = \sum BE_{i,y} - \sum PE_{i,y} - \sum LE_{i,y}$$ …………Eqn ER.1a

Where:

$ER_y$ = Emissions reductions in total project population in year y ($tCO_2e/yr$)
$BE_{i,y}$ = Baseline emissions of cluster i in year y ($tCO_2e/yr$)
$PE_{i,y}$ = Project emissions of cluster i in year y ($tCO_2e/yr$)
$LE_{i,y}$ = Leakage of cluster i in year y ($tCO_2e/yr$)

Within each cluster emissions are calculated thus:

$$BE_{i,y} = N_{i,y} \times BE_y$$ …………Eqn ER.1b

$$PE_{i,y} = N_{i,y} \times PE_y$$ …………Eqn ER.1c

Where:

$N_{i,y}$ = the number of Units in cluster i

$$BE_y = X_{nrb,bl,y} \times B_{bl,y} \times EF_{bl,bio,CO2} + \sum (AF_{bl,i,y} \times EF_{af,CO2,i})$$

+∑(Non-CO2 emissions during cooking)
+∑(GHG emissions during production of the fuels) …………Eqn B.1a

Where:

$BE_y$ = baseline emissions in year y (in tonnes $CO_2e$ per year) specific to cluster and Unit chosen

$X_{nrb,bl,y}$ = the non-renewable fraction of the woody biomass harvested in the project collection area in year y in the baseline scenario

$B_{bl,y}$ = the mass of woody biomass consumed during cooking in the baseline in year y (tonnes/year)

$EF_{bl,bio,co2}$ = the $CO_2$ emission factor for use of the biomass fuel in the baseline scenario in tonnes $CO_2$ per tonne fuel

$AF_{bl,i,y}$ = The mass of alternative fuel i in the baseline in year y in accordance with trends projected throughout the project period, in tonnes. This mass can be set to zero in cases where the KT is appropriately designed to subsume alternative fuels (approach 3).

$EF_{af,co2,i}$ = The $CO_2$ emission factor for use of the alternative fuel i in the baseline in tonnes of $CO_2$ per tonne fuel.

Non-$CO_2$ emissions during cooking

$$= \sum (B_{bl,y} \times EF_{bl,bio,non-co2,i}) + \sum (AF_{bl,i,y} \times EF_{af,i,non-co2\_gas\_i})$$ …………Eqn B.1b

GHG emissions during production of the fuels

$$= X_{nrb} \times B_{bl,y} \times EF_{bio,prod,co2}$$

$$+\sum(AF_{bl,i,y} \times EF_{af,prod,co2,i})$$
$$+\sum(B_{bl,y} \times EF_{bio,prod,non-co2\_gas\_i})$$
$$+\sum(AF_{bl,i,y} \times EF_{af,i,prod,non-co2\_gas\_i}) \text{ ...........Eqn B.1c}$$

Where:

$EF_{bl,bio,non-co2,i}$ = Emission factor for GHG gas i in the baseline scenario in units of tonnes gas per tonne wood-fuel

$EF_{af,non-co2\ gas\ i}$ = Non-$CO_2$ emission factor during cooking for alternative fuel i for GHG gas i in tonnes gas per tonnes fuel

$EF_{bio,prod,co2}$ = $CO_2$ emission factor for wood-fuel during production in tonnes gas per tonnes fuel

$EF_{af,prod,co2,i}$ = $CO_2$ emission factor for fuel I during production in tonnes gas per tonnes fuel

$EF_{bio,prod,non-co2\ gas\ i}$ = Non-$CO_2$ emission factor for wood-fuel during production in tonnes gas per tonne fuel

$EF_{af,prod,non-co2\ gas\ i}$ = Non-$CO_2$ emission factor for alternative fuel i for GHG gas i during production in tonnes gas per tonnes fuel

$$PE_y = X_{nrb,pj,y} \times B_{pj,y} \times EF_{pj,bio,CO2} + \sum(AF_{pj,i,y} \times EF_{af,CO2,i})$$
+∑(Non-$CO_2$ emissions during cooking)
+∑(GHG emissions during production of the fuels) …………Eqn P.1a

Where:

$BE_y$ = project emissions in year y (in tonnes $CO_2$e per year) specific to cluster and Unit chosen

$X_{nrb,pj,y}$ = the non-renewable fraction of the woody biomass harvested in the project collection area in year y in the project scenario

$B_{pj,y}$ = the mass of woody biomass consumed during cooking in the project each year (tonnes/year)

$AF_{pj,i,y}$ = The mass of alternative fuel i in the project in year y in accordance with trends projected throughout the project period, in tonnes. This mass can be set to zero in cases where the KT is appropriately designed to subsume alternative fuels (approach 3).

Non-$CO_2$ emissions during cooking

$$= \sum(B_{pj,y} \times EF_{pj,bio,non-co2,i}) + \sum(AF_{pj,i,y} \times EF_{af,i,non-co2\_gas\_i})$$ …………Eqn P.1b

GHG emissions during production of the fuels

$$= X_{nrb} \times B_{pj,y} \times EF_{bio,prod,co2}$$
$$+ \sum(AF_{pj,i,y} \times EF_{af,prod,co2,i})$$
$$+ \sum(B_{pj,y} \times EF_{bio,prod,non-co2\_gas\_i})$$
$$+ \sum(AF_{pj,i,y} \times EF_{af,i,prod,non-co2\_gas\_i})$$ …………Eqn B.1c

Calculations used in this project:

The KPT was appropriately designed following the third form to calculate the baseline (refer to page 12 of the methodology). So, the KPT measures fuel consumption of the primary fuel only, while the households involved are carrying on a degree of typical fuel and stove-type mixing and/or typical use of RE forms during the KPT itself. Therefore, any secondary fuel is treated as zero in both the baseline and the project scenarios. Therefore, all alternative fuels, $AF_{bl,i,y}$ and $AF_{pj,i,y}$ were set to zero.

Furthermore, for the reasons set out in B.6.2 $EF_{bio,prod,co2}$ and $EF_{bio,prod,non-co2\ gas\ i}$ were also set to zero.

This leaves the following equations:

$$BE_y = X_{nrb,bl,y} \times B_{bl,y} \times EF_{bl,bio,CO2} + \sum (B_{bl,y} \times EF_{bl,bio,non-co2,i})$$

$$PE_y = X_{nrb,pj,y} \times B_{pj,y} \times EF_{pj,bio,CO2} + \sum (B_{pj,y} \times EF_{pj,bio,non-co2,i})$$

Since:

$$ER_y = \sum BE_{i,y} - \sum PE_{i,y} - \sum L_{i,y}$$

As there is only one cluster this reduces to:

$$ER_y = \left(\left(BE_y - PE_y\right) \times N_y\right) - \left(LE_y \times N_y\right)$$

Hence:

$$ER_y = \left(\left( X_{nrb,bl,y} \times B_{bl,y} \times EF_{bl,bio,CO2} + \sum (B_{bl,y} \times EF_{bl,bio,non-co2,i}\right) - \left( X_{nrb,pj,y} \times B_{pj,y} \times EF_{pj,bio,CO2} + \sum (B_{pj,y} \times EF_{pj,bio,non-co2,i})\right) \times N_y \right) - \left(LE_y \times N_y\right)$$

Since in all cases:

$$X_{nrb,bl,y} = X_{nrb,pj,y}$$

And

$$EF_{bl,bio,CO2} = EF_{pj,bio,CO2}$$

And

$$EF_{bl,bio,non-co2,i} = EF_{pj,bio,non-co2,i}$$

The equation can be rearranged thus:

$$
\begin{aligned}
ER_y = ( & \left(B_{bl,y} - B_{pj,y}\right) \times X_{nrb,y} \times EF_{bio,CO2} \\
& + \sum \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,non-co2,i} \times N_y ) \\
& - \left(LE_y \times N_y\right)
\end{aligned}
$$

As this project is accounting for methane ($CH_4$) and Nitrous Oxide ($N_2O$) as well as Carbon Dioxide ($CO_2$), the equation is then:

$$
\begin{aligned}
ER_y = ( & \left(B_{bl,y} - B_{pj,y}\right) \times X_{nrb,y} \times EF_{bio,CO2} \\
& + \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,CH4} \\
& + \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,N2O} ) \times N_y ) \\
& - \left(LE_y \times N_y\right)
\end{aligned}
$$

As stoves are being constructed progressively, the equations used in the proponent’s database will account for this as follows:

For each stove the following calculation is made:

$$
\begin{aligned}
ER_{stove,y} = (( & \left(B_{bl,y} - B_{pj,y}\right) \times X_{nrb,y} \times EF_{bio,CO2} \\
& + \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,CH4} \\
& + \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,N2O} )) \\
& \div 365 ) \\
& \times \text{days operational}
\end{aligned}
$$

This is then summed for each vintage, and the leakage subtracted based on the number built during that vintage.

**B.6.2. Data and parameters that are available at validation:**

The project proponent has elected to use a fixed baseline, in line with the chosen methodology, and hence the following parameters will be available at validation but not monitored.

| **Data / Parameter:** | $EF_{bl.bio,co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_biomass |
| Description: | $CO_2$ emission factor arising from use of wood-fuel in baseline scenario |
| Source of data used: | Calculated from IPCC defaults |
| Value applied: | 1.7472 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Deemed valid by methodology. |
| Any comment: | Details of calculations available to validator. |

| **Data / Parameter:** | $EF_{pj.bio,co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_biomass |
| Description: | $CO_2$ emission factor arising from use of wood-fuel in project scenario |
| Source of data used: | Calculated from IPCC defaults |
| Value applied: | 1.7472 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Deemed valid by methodology. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{af,co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_fuel |
| Description: | $CO_2$ emission factor arising from use of alternative fuel |
| Source of data used: | N/A |
| Value applied: | N/A |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The Kitchen Survey identified that no alternative fuels were used by project beneficiaries. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{bl.bio,non-co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_biomass |
| Description: | Non-$CO_2$ emission factor arising from use of wood-fuel in baseline scenario |
| Source of data used: | Calculated from IPCC defaults – refer to ‘PDD supplementary data Meru’. |
| Value applied: | 0.0292 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Deemed valid by methodology. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{pj.bio,non-co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_biomass |
| Description: | Non-$CO_2$ emission factor arising from use of wood-fuel in project scenario |
| Source of data used: | Calculated from IPCC defaults – refer to ‘PDD supplementary data Meru v.0.1’. |
| Value applied: | 0.0292 |
| Justification of the choice of data or | Deemed valid by methodology. |

| | |
|---|---|
| description of measurement methods and procedures actually applied : | |
| Any comment: | Refer ‘PDD supplementary data Meru’ for further details. |

| **Data / Parameter:** | $EF_{af, non-co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_fuel |
| Description: | Non-$CO_2$ emission factor arising from use of alternative fuel |
| Source of data used: | N/A |
| Value applied: | N/A |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The Kitchen Surveys identified that no alternative fuels were used by project beneficiaries. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{bio,prod,co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_fuel |
| Description: | $CO_2$ emission factor arising from production of wood-fuel |
| Source of data used: | IPCC defaults or project-relevant measurement reports |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | As revealed in the baseline Kitchen Surveys (annex 3) fuel is harvested and transported manually (walking and/or donkey cart) by each individual household and so does not generate any production related $CO_2$ emissions. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{af,prod,co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_fuel |
| Description: | Non-$CO_2$ emission factor arising from production of alternative fuel |
| Source of data used: | N/A |
| Value applied: | N/A |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The Baseline Kitchen Surveys identified that no alternative fuels were used by project beneficiaries. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{bio,prod,non-co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_biomass |
| Description: | Non-$CO_2$ emission factor arising from production of wood-fuel |
| Source of data used: | IPCC defaults or project-relevant measurement reports |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | As revealed in the baseline Kitchen Surveys (annex 3) fuel is harvested and transported manually (walking and/or by donkey cart) by each individual household and so does not result in any transport related production $CO_2$ emissions. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{af,prod,non-co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_fuel |
| Description: | Non-$CO_2$ emission factor arising from production of alternative fuel |
| Source of data used: | N/A |
| Value applied: | N/A |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The baseline Kitchen Surveys identified that no alternative fuels were used by project beneficiaries. |
| Any comment: | - |

| **Data / Parameter:** | $X_{nrb,bl,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Non-renewability status of woody biomass fuel in year in baseline scenario |
| Source of data used: | Report compiled by Anthony Mills (PhD) and Diane Southey (MSc)<br>C4 EcoSolutions (Pty) Ltd., Cape Town, South Africa |
| Value applied: | 0.95 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Assessment carried out by third party according to GS methodology for Improved Cook-Stoves and Kitchen Regimes v.02. |
| Any comment: | - |

| **Data / Parameter:** | $X_{re,bl,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Woody biomass combustion avoided due to renewable energy fuels form in baseline year (i.e. solar cookers, agricultural residues, etc) |
| Source of data used: | Baseline Kitchen Survey |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | No renewable fuel use by project beneficiaries was identified by the baseline kitchen surveys, monitoring kitchen surveys will be used to identify any change in this situation. |
| Any comment: | - |

| **Data / Parameter:** | $X_{af,bl,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Woody biomass combustion avoided due to alternative fuels in baseline |
| Source of data used: | Baseline Kitchen Surveys |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | No renewable fuel use by project beneficiaries was identified by the baseline kitchen surveys, monitoring kitchen surveys will be used to identify any change in this situation. |
| Any comment: | - |

| **Data / Parameter:** | $EF_{af,prod,non-co2}$ |
|---|---|
| Data unit: | $tCO_2$/t_fuel |
| Description: | Non-$CO_2$ emission factor arising from production of alternative fuel |
| Source of data used: | N/A |
| Value applied: | N/A |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The baseline Kitchen Surveys identified that no alternative fuels were used by project beneficiaries. |
| Any comment: | - |

| **Data / Parameter:** | $AF_{bl,i,y}$ |
|---|---|
| Data unit: | t_fuel/unit-year |
| Description: | The mass of alternative fuel i combusted in the baseline year |
| Source of data used: | Baseline Kitchen Surveys |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | No renewable fuel use by project beneficiaries was identified by the baseline kitchen surveys, monitoring kitchen surveys will be used to identify any change in this situation. |
| Any comment: | - |

**B.6.3 Ex-ante calculation of emission reductions:**

All the calculations performed in this section are further developed and available in the supplementary excel info sheet sent with this document.

As described in section B.6.1. the following equation has been used to calculate emissions.

$$\begin{aligned} ER_y = ( & \left(B_{bl,y} - B_{pj,y}\right) \times X_{nrb,y} \times EF_{bio,CO2} \\ & + \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,CH4} \\ & + \left(B_{bl,y} - B_{pj,y}\right) \times EF_{bio,N2O}) \times N_y ) \\ & - \left(LE_y \times N_y\right) \end{aligned}$$

As discussed in section B.4 and the attached report, the results of the KPT were analysed to provide the average fuel saving per stove per year to the lower bound of 90% confidence interval. This was then used to calculate the ex-ante emissions reductions per stove-year.

| | **kg/HH/day** |
|---|---|
| **Firewood Consumption 3-stone stove** | **12.1** |
| **Saving Adj for lower bound of 90% confidence** | **5.71** |

Therefore,

| | **t/HH/year** |
|---|---|
| **Firewood Consumption 3-stone stove** | **4.42** |
| **Saving Adj for lower bound of 90% confidence** | **2.08** |

Leakage has been assessed as one-off source identified that will be written off in the first crediting year following a stoves construction, following this zero leakage is anticipated.

Hence:

$$LE_1 = 0.0177 \times 19{,}931$$
$$LE_1 = 353$$

$$LE_2 = 0.0177 \times 0$$
$$LE_2 = 0$$

$$LE_{3,4\ldots n} = 0$$

The anticipated number of stoves to be constructed is:

$$N_1 = 19{,}931$$
$$N_2 = 0$$

$$ER_n = (2.08 \text{ x } 0.97 \text{ x } 1.7472 + 2.08 \text{ x } 0.00982 + 2.08 \text{ x } 0.01934) \text{ x } N_y - (LE_y - N_y)$$

$$ER_n = 3.593 \text{x } N_y - (LE_y - N_y)$$

See supplementary excel file for details.

### B.6.4 Summary of the ex-ante estimation of emission reductions:

| Year | PE - Estimation of project activity emissions ($tCO_2e$) | BE - Estimation of baseline emissions ($tCO_2e$) | LE - Estimation of leakage ($tCO_2e$) | ER - Estimation of overall emission reductions ($tCO_2e$) | |
|---|---|---|---|---|---|
| 2010 | - | - | 0 | N/A | *Outside crediting period* |
| 2011 | - | - | 218 | 21,134 | *2011/12 leakage applied here* |
| 2012 | - | - | 133 | 71,611 | |
| 2013 | - | - | 0 | 71,611 | |
| 2014 | - | - | 0 | 71,611 | |
| 2015 | - | - | 0 | 71,611 | |
| 2016 | - | - | 0 | 71,611 | |
| 2017 | - | - | 0 | 71,611 | |
| **Total** | - | - | **351** | **450,800** | |

| ($tCO_2e$) | | | | |
|---|---|---|---|---|

**Note 1:** *Baseline and project emissions were not adjusted to lower bound of 90% confidence interval, this was only applied to the mean difference (savings). For this reason and to avoid confusion the PE & BE columns have been left blank and only overall ER projected here.*
**Note 2:***The leakage generated by the construction of pilot stoves in 2011 and 2012 has been registered and subtracted from the overall emission reductions for the first crediting year (2011)*

## B.7 Application of a monitoring methodology and description of the monitoring plan:

### B.7.1 Data and parameters monitored:

*(Copy this table for each data and parameter)*

| **Data / Parameter:** | $X_{nrb,pj,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Non-renewability of woody biomass fuel in year y in project scenario |
| Source of data used: | Report compiled by Anthony Mills (PhD) and Diane Southey (MSc)<br>C4 EcoSolutions (Pty) Ltd., Cape Town, South Africa |
| Value of data: | 0.97 |
| Description of measurement methods and procedures to be applied: | As deemed valid in the methodology v2. |
| QA/QC procedures to be applied: | Study commissioned to specialist in-house team and/or an independent third party. |
| Any comment: | Subject to biennial monitoring |

| **Data / Parameter:** | $X_{re,pj,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Woody biomass combustion avoided due to renewable energy form in year y in project |
| Source of data to be used: | Monitoring Kitchen Survey |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | No renewable fuel use by project beneficiaries was identified by the initial kitchen surveys, monitoring kitchen surveys will be used to identify any change in this situation. |
| QA/QC procedures to be applied: | Kitchen Surveying will be overseen by specialist in-house team and/or an independent third party. |
| Any comment: | Monitoring surveys will be carried out quarterly, as per the methodology. |

| **Data / Parameter:** | $X_{af,pj,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Woody biomass combustion avoided due to alternative fuels in year y in project |
| Source of data to be used: | Monitoring Kitchen Surveys |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | No renewable fuel use by project beneficiaries was identified by the initial kitchen surveys, monitoring kitchen surveys will be used to identify any change in this situation. |
| QA/QC procedures to be applied: | Kitchen Surveying will be overseen by specialist in-house team and/or an independent third party. |
| Any comment: | Monitoring surveys will be carried out quarterly, as per the methodology. |

| **Data / Parameter:** | Leakage |
|---|---|
| Data unit: | t_$CO_2$e per year |
| Description: | Potential GHG emissions outside project boundary caused by project activity |
| Source of data to be used: | Study |
| Value of data | $L_1$=351, $L_2$=0, $L_{3,4,\ldots n}$=0 |
| Description of measurement methods and procedures to be applied: | Kitchen Surveys supported by desk-based research |
| QA/QC procedures to be applied: | Kitchen surveys are used |
| Any comment: | Value stated is to be applied in year one only, no further leakage is anticipated, however this will be reviewed biennially. |

| **Data / Parameter:** | $(B_{bl,y} – B_{pj,y})$ |
|---|---|
| Data unit: | t_biomass/stove/year |
| Description: | (Mass of woody biomass combusted in the baseline in year y – Mass of woody biomass combusted in the project in year y) |
| Source of data to be used: | Kitchen Performance Tests |
| Value of data | 2.08 |
| Description of measurement methods and procedures to be applied: | Kitchen Surveys and Kitchen Performance tests as described in section B.4 |
| QA/QC procedures to be applied: | Specialist in-house team and/or an independent third party commissioned to produce a report. |
| Any comment: | Carried out biennially |

| **Data / Parameter:** | $AF_{pj,i,y}$ |
|---|---|
| Data unit: | t_fuel/unit-year |
| Description: | Mass of alternative fuel i combusted in the project in year y |
| Source of data to be used: | Monitoring Kitchen Surveys |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | No renewable fuel use by project beneficiaries was identified by the initial kitchen surveys, monitoring kitchen surveys will be used to identify any change in this situation. |
| QA/QC procedures to be applied: | Kitchen Surveying will be overseen by specialist in-house team and/or an independent third party. |
| Any comment: | Monitoring surveys will be carried out quarterly, as per the methodology. |

| **Data / Parameter:** | Usage in year y |
|---|---|
| Data unit: | Fraction |
| Description: | Percentage of stoves of age x remaining in use in year y |
| Source of data to be used: | Our own survey |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | Usage surveys carried out biennially. |
| QA/QC procedures to be applied: | Specialist in-house team and/or an independent third party commissioned to produce a study report. |
| Any comment: | - |

| **Data / Parameter:** | Age |
|---|---|
| Data unit: | Fraction |
| Description: | Adjustment to values of $B_{pj,,y}$ and $AF_{pj,i,y}$ for stoves of age x |
| Source of data to be used: | Aging stove KPT |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | Aging stove KPT will be carried out as per specialist in-house team and/or expert third party direction. |
| QA/QC procedures to be applied: | Specialist in-house team and/or an independent third party commissioned to produce a study report. |
| Any comment: | Carried out biennially |

| **Data / Parameter:** | New Stove |
|---|---|
| Data unit: | Fraction |
| Description: | Adjustment to values of ($B_{bl,y}$ – $B_{pj,,y}$) and $AF_{pj,i,y}$ for new stove models |
| Source of data to be used: | New stove KPT |
| Value of data | - |
| Description of measurement methods and procedures to be applied: | New stove KPT will be carried out with specialist in-house team and/or expert third party direction. |
| QA/QC procedures to be applied: | Specialist in-house team and/or an independent third party commissioned to produce a study report. |
| Any comment: | At launch of new model and not less than biennially |

**B.7.2 Description of the monitoring plan:**

The project proponents will supervise and assist stove contractors in generating the appropriate records during the construction phase of the project.

The monitoring tasks continually undertaken are:

1. Maintenance of pilot & Total Distribution Record (TDR)
Accurate distribution records will be kept and stored both electronically and in paper format. The stove builders will create paper records (of type shown below) for each stove built; these will then be transferred to a computer system belonging to the project proponents and the original documentation stored in the local office (Kenya).

- Stove serial number
- Stove Model
- Project region
- Builder's name
- Name of builder's trainer
- Stove building date
- Resident's name
- Resident address (where possible)
- Resident phone number (where possible)
- Mode of use (domestic in all cases)
- Type of fuel used
- Pilot stove (Y/N)
- GPS Coordinates
- Carbon rights handover signed (Y/N)

2. Maintenance of a Detailed Customer Database (DCD)

A detailed customer database will be kept, containing the results of all Kitchen Surveys (KS's) and Kitchen Performance Tests (KPT's). Initially the baseline KS & KPT data will be entered; following this the results of monitoring KS's & monitoring KPT's will be added.
Monitoring KS's will be carried out for 25 randomly selected beneficiaries from the TDR, per cluster, every quarter according to the methodology rules. As the stoves will be constructed over a short period and no further stoves built, households will be selected from the TDR for the previous quarter during the construction period and from the whole TDR for later monitoring KS's as will not be new project beneficiaries added to the database anymore after the construction period.

The monitoring KS's will provide information regarding the ongoing relevance of KPT results (cluster changes, usage drop-off & aging stove performance drop-off) and sustainable development indicators. KPT's will be carried out every two years to assess performance of aging stoves and to ensure emissions reductions claims made in monitoring reports remain accurate. KS's will be carried out face to face, with a max 50% by telephone.

**Data collected during a KS contains the following type of data:**

- General information - Name, address, telephone number etc
- Household socio-demographic information
- Cooking behaviour, fuel type & mix
- Sources of fuel, prices or labour input (person-hours, distances)

3. Updating of Project Database
A project database will be created, which divides the project beneficiaries into groups according to the most recently defined clusters, derived from the TDR. The conclusions drawn from KS's and KPT's will also be recorded here relating to cluster changes and changes in emissions reductions (if any). Emission reductions calculations will be documented here also.

4. Calculation of emissions reductions
Emissions reductions will be calculated (according to new cluster adjustments if necessary) using the results of the Monitoring KS's and KPT's, **using updated values for biomass savings (**$B_{bl,y} – B_{pj,y}$**), NRB, leakage, usage, age, new stove models.**

Periodic monitoring tasks
- NRB fraction assessed by literature review every two years
- Leakage estimates (identified in the PDD and possible new sources) will be surveyed every two years
- Drop-off in usages rates by beneficiaries in the first year will be surveyed every two years, random sampling as in the KS
- An aging stove KPT to assess performance of ageing stoves will be carried out every two years to assess any changes in performance of the project stoves
- A baseline monitoring KPT will be carried out every two years IF: The KS reveals that baseline parameters measured by the KPT's may have changed significantly.
- New stove KPT will be carried out for new models if launched.

- Assessment of wider social and economic impact and contribution to local sustainable development of the project will be made every two years. This will be assessed through a study supported a desktop research, field work in the local area and all the information/documentation produced during the monitoring period as described above.

<u>Quality assurance</u>

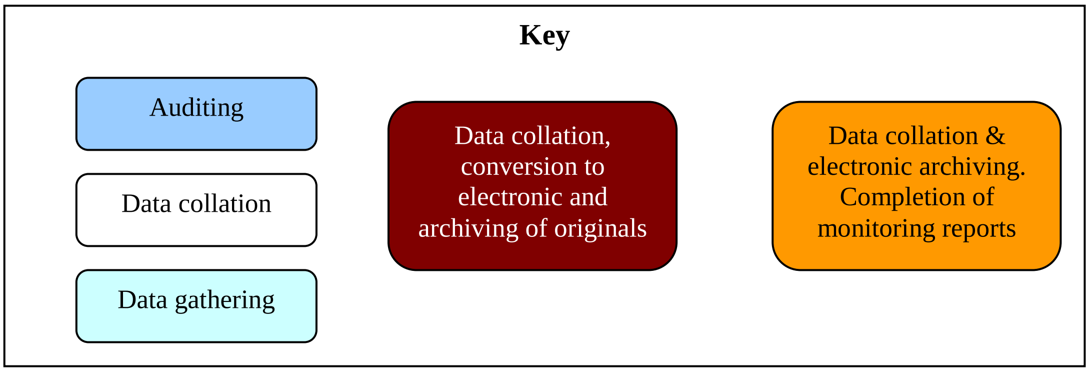
- Throughout the duration of the project a specialist in-house team and/or an independent third party consultant will be engaged to reinforce data gathering and monitoring tasks.

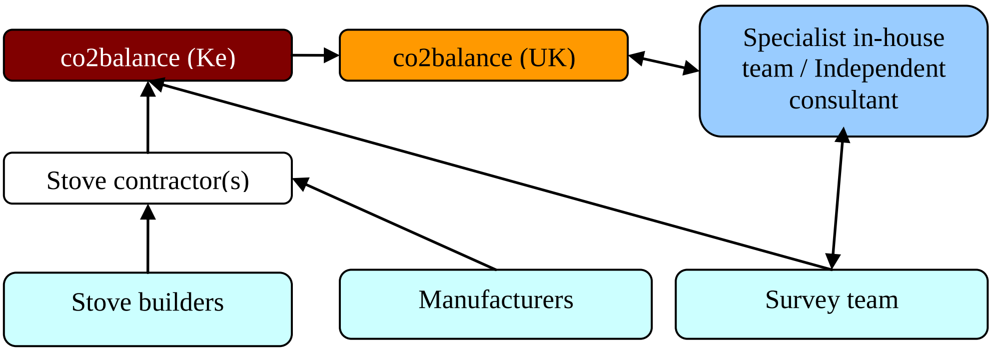
<u>Measurement equipment (scales)</u>

- Sets of digital hanging scales accurate to at least 50g will be used, ideally with Kenya Bureau of standards certification. Where equipment is acquired outside of Kenya it will be taken to the Kenya Bureau of Standards for calibration and certification.
- Scales will then be checked annually by KBS and either re-certified or discarded and replaced if no longer accurate.
- A unique marking will be placed on each scale and records of certification/failure maintained to ensure only certified scales are in use.
- All staff using scales will be adequately trained in accurate use of the equipment.

All data recorded will be stored by the project proponents for a minimum of two years after the end of the crediting period or the last issuance of VERs, whichever occurs later.

The diagram below shows the organisational responsibilities for the monitoring plan, arrows show the flow of monitoring information.



**B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)**

The application of the methodology to the project activity to report the baseline was completed on the 20/05/2011.

The application was carried out by co2balance UK Ltd. (the project proponent), with support from HED.

(Project proponent)
co2balance UK Ltd.
1 Discovery House
Cook Way
Bindon Rd.
Taunton TA2 6BJ
+44 (0) 1823 332233
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Jonathan Rouse
HED Consulting
+44 (0) 207 193 4314
j.r.rouse@gmail.com

## SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

**C.1.1. Starting date of the project activity:**

The initial investment commitment for project construction was made in January 2011 for the construction of 146 stoves. The schedule of this construction (as per section B.4) was 146 pilot stoves March 2011 and then the rest of stoves (non-pilot stoves) will be built throughout 2011/early 2012. Evidence has been provided to the DoE for this commitment as shown in the constructor agreement, the starting date of the project activity is therefore January 2011 as it is the investment commitment date.

In accordance with the Gold Standard Requirements[36], section V, requirements V.a.2.1 & V.a.2.4, the starting date of the crediting period has been set to 01/03/2011 as the rest of stoves (non-pilot stoves) are to be constructed soon after this.

**C.1.2. Expected operational lifetime of the project activity:**

The initial operational lifespan of the improved stoves is expected to be 7 years 0 months, following this a review will be carried out to assess the feasibility of refurbishment in order to achieve another 7 years 0 months of operational life.

**C.2 Choice of the crediting period and related information:**

The project will use a 7 year renewable crediting period.

[36] Version 2.1 effective June 2009

**C.2.1. Renewable crediting period**

**C.2.1.1. Starting date of the first crediting period:**

01/03/2011

**C.2.1.2. Length of the first crediting period:**

7 years 0 months

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

Not Applicable.

**C.2.2.2. Length:**

Not Applicable.

## SECTION D. Environmental impacts

>>

**D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:**

The Designated National Authority of the host party has provided confirmation that the project does not require an Environmental Impact Assessment to be carried out. Please see letter provided together with this document.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

Not Applicable.

## SECTION E. Stakeholders' comments

>>

### E.1. Brief description how comments by local stakeholders have been invited and compiled:

The co-operation and understanding of local stakeholders is a key to the success for the project activity, with this in mind a face to face stakeholder meeting was at the.

Local stakeholders were identified by local women's groups and church groups who invited stakeholders by word of mouth, relevant NGOs and the Gold Standard were invited by email and a public invitation was placed in The Daily Nation Newspaper. All stakeholders receiving a personal invitation were provided with a brief summary of the project as well.

When inviting organisations and individuals to attend the stakeholder meeting, best efforts were made to expand the selection in order to avoid missing out any organisations or individuals that could have a key interest in the activity. A small group of diverse participants were chosen by their location, need, how affected they were by the traditional cooking methods and its consequences, their capacity to help participate and their motivation to make the project work. The main priority was to make certain that it was not only the visible, voluble and easy to access that were invited.

The meeting took place on the 30th November 2010 at the Mesacco Building in Chuka Town. It was attended by co2balance staff, local and international NGOs and individuals: The stakeholder meeting was attended by 62 people, (36%) and men (64%) present.

Stakeholders were encouraged to actively participate in the meeting, aiding in creating a sustainable development matrix and discussing how the sustainable development indicators identified could be monitored. At the end of the meeting all stakeholders were invited to fill out a feedback form.

### E.2. Summary of the comments received:

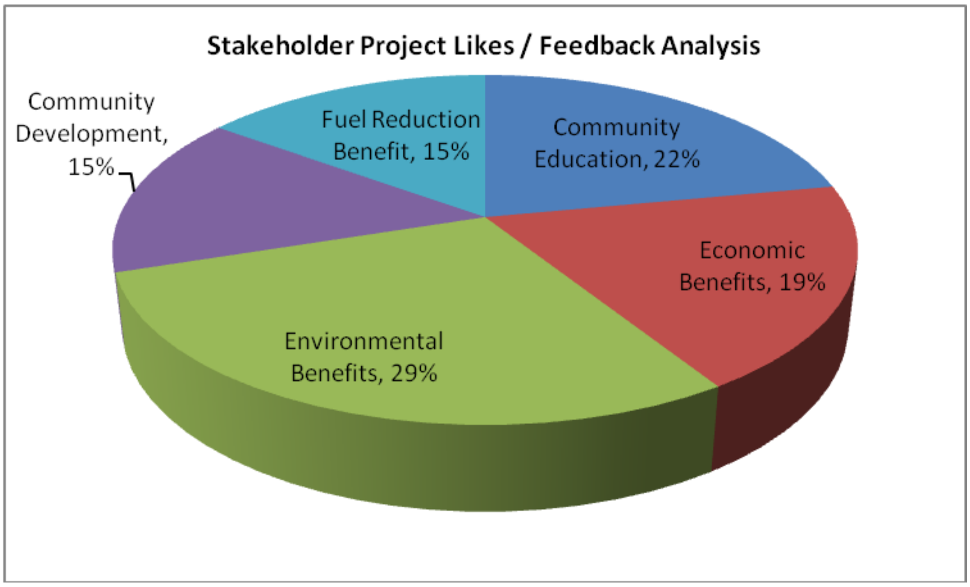
Shown below is a selection of comments representative of those received at the end of the meeting.

| **Name** | **Jasper Msake (Feedback form 3)** |
|---|---|
| What is your impression of the meeting? | Learn a new thing and improve economy in community |
| What do you like about the project? | I would like the project to attain its goals so people can save the energy |
| What do you not like about the project? | What I don't like is that the project should not fail it should prosper |
| Signature | See LSCR. |

| **Name** | **Judith Karaai (Feedback Form 5)** |
|---|---|
| What is your impression of the meeting? | My information is to say thank you for your good work I am now teaching my group and others |
| What do you like about the project? | To make work easy and save time |
| What do you not like about the project? | Everything about the project is good |
| Signature | See LSCR |

| **Name** | **Fredrick Gitari (Feedback Form 6)** |
|---|---|
| What is your impression of the meeting? | I'm impressed by the knowledge that co2balance gives time to the people of the community. Im also impressed that the project gives community better health |
| What do you like about the project? | I would like the project to be 'enlarged' to the community it will also uplift the standard of the community it will give less time in preparing meals |
| What do you not like about the project? | The project is up to date |
| Signature | See LSCR. |

| **Name** | **James Robert (Feedback Form 7)** |
|---|---|
| What is your impression of the meeting? | To learn and know about co2balance |
| What do you like about the project? | To improve our environment for better standard of life and to protect our forests |
| What do you not like about the project? | Nothing |
| Signature | See LSCR. |




The overall consensus was that the meeting was successful and informative. Participants felt that they were made fully aware of the project and its objectives, and that their questions were answered.

Below are some comments extracted from the feedback forms that relate directly to the graph / indicators:

**Environmental benefits**:
Feedback form 2: "It protects the environment through prevention of mass tree felling and the environment is everything"

Feedback form 9: "The project will help the community save the environment by allowing the trees to grow, save time normally spent collecting firewood; the health and cleanliness of the kitchen."

**Fuel Reduction Benefit**:
Feedback form 4: "The project will help people to use little firewood and also will help to conserve environment and destroying our trees and forests within our district"

Feedback form 24: "This jiko [stove] will save us from using so much wood."

**Community Education:**
Feedback form 15: "Education on awareness of new co2balance cooking method."

**Economic Benefits**:
Feedback form 20: The project will enhance the community access more savings from energy expenditure."

Feedback form 23: "It will save people time and money."

**Community Development Benefits**:
Feedback form 29: "It's good. To improve the living standards of the community."

Fee back form 30: "It's a good initiative to improve the living standards of the community."

The only dislikes about the project related to 2 points

- The duration and start time of the meeting. Due to late arrivals of Local officials the start time was not kept. We had to begin an hour later as we could not start without key community figures. This was observed by participants and commented on in some of the feedback forms. When the meeting was opened we apologised for the late start. 4 of the participants felt that the meeting should have gone on for a little longer. We spoke to the District Officer about this, and were told that we should not be concerned. We had covered all the relevant topics, and that we had done what we had intended to do. He said that often within these communities, some people prefer longer meetings as they feel that if the meetings are longer they will be provided with meals.
- The second dislike of the project was that co2balance was unable to provide schools and local NGO's with institutional stoves.
- Both of these are not True Dislikes of the project.

**E.3. Report on how due account was taken of any comments received:**

No stakeholder comments needed to be taken into account leading to no modifications of any aspects of the project

**<u>Annex 1</u>**

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | co2balance |
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| Represented by: | Matt Thomas |
| Title: | Mr |
| Salutation: | |
| Last Name: | Thomas |
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| | |
|---|---|
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**Annex 2**

INFORMATION REGARDING PUBLIC FUNDING

Please refer to the Passport document to see proof letter.

## Annex 3

### BASELINE INFORMATION

**See supplementary files for the NRB study.**

**See supplementary files for baseline report.**

**Leakage**

**Source f: Transportation and construction of stoves**

An estimate of the $CO_2$ emissions generated in the construction of the stoves has been assessed for leakage purposes, the results found this form of leakage to be minimal. For the sake of remaining conservative however, this assessment has been included in the calculation of emissions reductions achieved.

Emissions from material production:

The materials used to construct each stove[37] are detailed below, along with $CO_2$ emission factors[38] identified in the available literature for the embodied carbon of materials.

| Components | Quantity | Weight | Units | EF | $kgCO_2e$ |
|---|---|---|---|---|---|
| Metal Pot Plate | 1 | 2 | kg | 2.03 | 4.06 |
| Ceramic Liner | 1 | 4 | kg | 0.7 | 2.8 |
| Back Walls | 1 | 3 | kg | 0.24 | 0.72 |
| Side Walls | 2 | 11 | kg | 0.24 | 2.64 |
| Side Caps | 2 | 1.76 | kg | 0.24 | 0.4224 |
| Logo Shelf | 1 | 1 | kg | 0.24 | 0.24 |
| Base | 1 | 7.7 | kg | 0.24 | 1.848 |
| Cement | N/A | 3 | kg | 0.74 | 2.22 |
| Sand | N/A | 10 | kg | 0.0051 | 0.051 |
| **Total** | | **43.46** | **kg** | | **15.0014** |

Emissions associated with material production were therefore estimated to be 15 $kgCO_2$/stove.

Emissions from material transportation:

Bricks and liners clay is extracted from Mombasa and manufactured in the same site. This is approximately 700km from the project area and materials are transported to site via (10 tonne to 48 tonne) truck to storage point. Then a pickup truck delivers them to the local communities doing up to 50 more kilometres to the furthest point in the project boundary. The emissions generated by this transport have also been accounted for:

| Mode | Pickup truck | Heavy Duty Truck (Components) |
|---|---|---|
| Journey distance (km) | 30 | 702 |
| Materials transported per stove (tonnes) | 0.0610 | 0.0532 |
| EF ($kgCO_2$/tkm) | 0.0380 | 0.07157 |
| Transport emissions ($kgCO_2$/stove) | 0.0695 | 2.6729 |
| **Total $kgCO_2$/stove** | | **2.7424** |

[37] As defined by the stove construction manual provided to contractors by the project proponent.

[38] Data sources as in excel calculation sheet provided, leakage section.

Emissions associated with transportation were therefore estimated to be 2.742 kg$CO_2$/stove.

Total leakage emissions (construction and transportation):

The total leakage associated with transportation and construction has been assessed to be **0.0177t$CO_2$/stove** , for the whole life span of the stove.

**<u>Annex 4</u>**

**MONITORING INFORMATION**

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**See Passport document.**