The Gold Standard
Premium quality carbon credits

THE GOLD STANDARD:
Project Design Document for Gold Standard Voluntary Offset projects

(GS-VER-PDD)

For more information, please contact The Gold Standard:

http://www.cdmgoldstandard.org
info@cdmgoldstandard.org

phone +41 61 283 09 16
fax +41 61 271 10 10

April 2006

This document was developed by: ECOFYS

The Gold Standard for VERs has received financial support from:

reeep renewable energy & energy efficiency partnership

WWF climatecare myclimate The Climate Protection Partnership David Suzuki Foundation SOLUTIONS ARE IN OUR NATURE

Explanatory information on how to complete the PDD and how to obtain Gold Standard registration can be found in the project developer's manual available on the Gold Standard website.

This template of the PDD is applicable for micro-, small- and large-scale projects. Note that the shaded boxes present information on the Gold Standard VER project development procedures. Project developers should delete these shaded boxes when preparing their PDD.

VOLUNTARY OFFSET PROJECTS

PROJECT DESIGN DOCUMENT FORM (GS-VER-PDD)
Version 01 - in effect as of: January 2006)

CONTENTS

A. General description of project activity

B. Application of a baseline methodology

C. Duration of the project activity / Crediting period

D. Application of a monitoring methodology and plan

E. Estimation of GHG emissions by sources

F. Environmental impacts

G. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity
Annex 2: Baseline information
Annex 3: Monitoring plan
Annex 4: Appendices
4.1 Minutes from Stakeholder Consultations
4.2 Product Cost and Income Statement
4.3 Further Information on Quality Assurance
Annex 5: Supporting Documents
5.1 Kitchen Surveys for Ugastoves
5.2 KT 2006 Stats Char Ugastove
5.3 KT07 Stats Instit Ugastoves
5.4 KT07 Stats Wood-Dom Ugastove

SECTION A. General description of project activity

A.1 Title of the project activity

Title: Efficient Cooking with Ugastoves
Version: 090324
Date: 24 March 2009

A.2. Description of the project activity

One of the major causes of deforestation in Uganda is the use of wood fuels[1] for domestic and institutional cooking. More than 95% of Ugandans rely on solid fuels for cooking, typically charcoal or wood for urban dwellers, and wood for rural households. A series of focus groups held in 2005 in three Kampala divisions concluded that the most common domestic cooking device in urban areas was the traditional metal charcoal stove, followed by the three-stone wood fire which is in use by an urban minority. Institutional cooking was found to be mostly firewood based.

The project reduces green-house emissions by disseminating fuel-efficient stoves. The project is based on pilot work in 2005 by the Urban Community Development Association of Kampala, Uganda (Ugastove). A stove manufacturing business with the name Ugastove was founded on the basis of this pilot work in 2007. Three types of stoves are marketed by Ugastove:

a. improved fuel-efficient charcoal stoves for domestic and restaurant use
b. improved fuel-efficient residential wood stoves
c. improved fuel-efficient institutional wood stoves

The improved charcoal stove reduces fuel consumption by introduction of an insulated combustion chamber which increases combustion efficiency and retains heat. The wood stoves use the well-proven rocket technology, which consists of an insulated elbow-jointed combustion chamber that increases combustion efficiency and retains heat while also raising the cooking pot to the hottest point above the flame. The institutional rocket stoves further increase heat transfer by having the cooking pot rest within a skirt.

Tests were conducted in 2006 to measure the fuel savings introduced by the improved stoves, with the following results:

- the improved charcoal stove reduced charcoal consumption in sampled households by 36% on average, in some cases saving more than 50% of the fuel used previously
- the wood rocket stove promoted by the project saved 58% of the fuel on average in the sampled households
- the improved institutional wood stoves reduced fuel-use by 45% on average in the sampled schools

While these stoves will significantly reduce greenhouse gas emissions, they simultaneously provide co-benefits to users and families in the form of relief from high fuel costs and reduced exposure to health-damaging airborne pollutants.

To date, Ugastove has concentrated its marketing efforts in Kampala, with some limited extension to the other urban areas of Uganda. The dissemination of improved charcoal stoves is targeted to urban areas where charcoal use is most pervasive. The improved institutional wood stoves are targeted to urban and peri-urban areas to replace traditional wood fires in institutions such as schools which pay high fuel costs. The wood stoves are not yet marketed widely and are intended for rural areas.

[1] The term wood-fuel is used to mean all fuel derived from woody biomass, including charcoal, while “firewood” or “wood” is used to mean the woody biomass in its original unprocessed composition.

From January through August 2005, UCODEA (later to become Ugastove) sold less than 3,000 stoves. During these months plans were made to secure carbon finance in order that sales could be increased dramatically through a major marketing and promotion effort, combined with technical development and quality assurance to disseminate reliable improved-efficiency models at affordable prices. From September 2005 through 2006 and 2007, using carbon finance advances and monies expected to be recouped from carbon finance, the expansion was implemented; marketing and operational capacity were improved, the company Ugastoves was registered, quality assurance systems were devised, and the technical designs of the stoves were improved to achieve the high levels of efficiency listed above.

Technical assistance was provided in 2005-7 by the Center for Entrepreneurship in International Health and Development (CEIHD)[2]. Further support on project design and carbon finance was obtained from ClimateCare[3] in 2006-7 for the period from September 2005 to date. Financial support for indoor air pollution mitigation work was obtained for the period 2005-2006 from the Partnership for Clean Indoor Air.

Table A.2 shows the expected volume of sales of high efficiency stoves throughout the project period, including the 3 years pre-registration[4]. The table calculates “operational stove years” by assuming an even rate of installation through the year. Operational stove-years are an important concept, since GHG emission reductions are dependent not on the sale of an improved stove for use in a kitchen operating an inefficient stove, but rather they are dependent on the number of months or years the improved stove is in daily use. An improved stove working for six months qualifies as 0.5 operational stove-years.

Table A2 assumes that the charcoal stoves have a 3-year working life while the institutional stoves have a working life of ten years or more. These assumptions not made by the monitoring protocol, which requires that actual usage drop off rates are measured during project operation.

Currently inefficient and polluting cooking regimes are deeply established in the culture. The project aims to break this mould and move large populations away from conditions under which GHG emissions are unacceptably high, and health effects are unacceptably inhumane, for the women and children spending long hours each day in conventional kitchens.

The carbon finance provides a basis for maintaining a professional commercial relationship between the user and the disseminators, while also introducing an affordable price, a quality guarantee and a warranty system. The quality assurance strategy is a major benefit of carbon finance. It has the potential to introduce a new set of quality expectations amongst consumers and so shift the critical mass of prevailing practice away from inefficient cooking with its extreme environmental and health penalties, to a new mass prevailing practice involving significantly reduced GHG emissions and healthier kitchens.

---

[2] CEIHD is based in Berkeley, California, in the USA.

[3] ClimateCare is part of JPMorgan Environmental Markets and is based in Oxford, UK, with offices in Nairobi Kenya, Santiago Chile, Mumbai India, Ankara Turkey, and several other countries.

[4] The project started in 2006 and installations made during that year are included in the count of emission reductions which starts two years before date of registration in 2009.

Table A.2.a Charcoal

Project Year	Sales	Expiries	Number of users by year end	Projected operational stove years
Installs	3,000	0	3,000	1,500
Year -2	10,000	0	13,000	8,000
Year -1	10,000	0	23,000	18,000
year 1	30,000	-3,000	50,000	36,500
Year 2	30,000	-10,000	70,000	60,000
Year 3	30,000	-10,000	90,000	80,000
year 4	30,000	-30,000	90,000	90,000
Year 5	30,000	-30,000	90,000	90,000
	173,000			**384,000**

Table A.2.b Residential Rocket Wood-Stoves

Project Year	Sales	Expiries	Number of users by year end	Projected operational stove years
Installs	0	0	0	0
Year -2	0	0	0	0
Year -1	0	0	0	0
year 1	400	0	400	200
Year 2	600	0	1,000	700
Year 3	1,200	0	2,200	1,600
year 4	2,000	-400	3,800	3,000
Year 5	2,500	-600	5,700	4,750
	6,700			**10,250**

Table A.2.c Institutional Wood-Stoves

Project Year	Sales	Expiries	Number of users by year end	Projected operational stove years
Installs	15	0	15	8
Year -2	30	0	45	30
Year -1	40	0	85	65
year 1	50	0	135	110
Year 2	50	0	185	160
Year 3	50	0	235	210
year 4	50	0	285	260
Year 5	50	0	335	310
	335			**1,153**

The sustainability matrix presented below assesses the project in terms of environmental and sustainable development impact. The indicators are scored on the following basis:

1. Water quality and quantity: The project has no negative effect on both water quality and quantity in the country. It can be argued though that indirectly due to biomass conservation, the project could, in principle result, in increased forest cover in the water catchment areas, among others, resulting in increased water quantity.

2. Air quality: Mothers and children will be exposed to fewer hazardous air pollutants through reduced emissions of carbon monoxide and fine particulate matter. Air pollution from cooking with solid fuel is a key risk factor for childhood pneumonia as well as many other respiratory, cardiovascular, and ocular diseases. (Refer to Pennise, D., Haigler, E., Ndemere, J., Charron, D., "Indoor Air Pollution Monitoring Summary for Urban Community Development Association's Wood Stove Project", CEIHD 2007, and "Assessing the Spread of Improved Charcoal Stoves in Urban Areas, Tanzania" by Tanzania Traditional Energy Development and Environment Organization-TaTEDO; http://sgp.undp.org/download/SGP_Tanzania1.pdf).

3. Other pollutants: the project does not have a positive or negative effect with regard to other pollutants

4. Soil condition: the project has no effect.

5. Biodiversity will be improved through the stove program reducing pressure on remaining forest reserves. Uganda is home to more than 5,000 plant species, 345 species of mammals, and 1,015 types of birds[5]. Once the project achieves the expected 90,000 Ugastove users towards the 6th and 7th years, the annual conservation effect is therefore calculated as 1.8 saved tonnes/Ugastove user multiplied by 90,000 users, or 0.16 million tonnes of wood, representing 3,000 hectares saved each year. This is a significant mitigation in the context of current deforestation causing loss of habitat and biodiversity in the order of 100,000 hectares per year, as it demonstrates a practical step forward which can be followed with increasing dissemination of improved stoves contributing to increasing preservation of biodiversity.

6. Employment quality: The improved stoves give rise to employment opportunities in manufacturing, distributing, retailing, and maintaining the stoves, as well as in relation to business development and management, and in relation to technological skill. The jobs involved are almost all skilled or semi-skilled, ranging from artisanal skill in ceramics, tin-smithing, to business management and marketing. Accordingly the quality is high, providing a cadre of people able to contribute positively to their society and able to earn incomes securely.

7. Livelihood of the poor: The circumstances of poor families will be improved by a reduction in expenditures on fuel due to the more efficient stoves. A typical Ugastove retails for about 6 Euros[6]

[5] http://news.mongabay.com/2006/0125-uganda.html "Uganda's annual deforestation rate has climbed 21 percent since the end of the 1990s. The country lost an average of 86,400 hectares of forest—or 2.1 percent of its forest cover—per year between 2000 and 2005. On a generational time scale, Uganda lost 26.3 percent of its forest cover (1.3 million hectares) between 1990 and 2005. Like Burundi, land-clearing in Uganda results mostly from subsistence farming and cutting for fuel-wood. This forest loss is directly threatening some of the highest concentrations of biodiversity in Africa: Uganda is home to more than 5,000 plant species, 345 species of mammals, and types of 1,015 birds".

[6] Based on Ugastove sales records. Ugastoves wholesale at Shs 12,000 and retail at about Shs 15,000, although retailer margins vary.

and saves a family over 300 Kg of charcoal per year. At the current price of between 0.16 Euros/kg[7] and 0.19 Euros/kg[8] the financial savings for charcoal users in Kampala is approximately 50 Euros and more likely greater in most cases. In 2006, per capita income was approximately 220 Euros[9] implying a significant livelihood benefit in this fuel saving. In the case of wood-burning stoves, the reduction in wood consumption in rural areas implies relief from drudgery and more opportunity for productive activity, arising from less time spent collecting fuel. As a further benefit, stoves are found by users to be more convenient, shortening the cooking time. Further evidence of the livelihood benefit can be found in "*Cookstoves for the Developing World*" [10]; and "*Impacts of efficient stoves and cooking fuel substitution in family expenditures of urban households in Dar es Salaam, Tanzania*" [11].

8. Access to energy services. The improved stoves require less fuel, which in many areas can be a very scarce resource or expensive to buy.

9. Human and institutional capacity is raised through the business development component of the project. The challenge of moving into areas such as large-scale promotion and advertising matched by quality control and branding initiatives, together with the introduction of improved production and accounting systems, is already having a positive effect. The organizational chart for Ugastoves presented in Annex 3 of this document, demonstrates a significant advance in business capacity. This annex together with Annex 4.3, describes the establishment of developed management systems which are designed to ensure that the company can grow successfully. Key features are quality-assurance on production and sales records, as described in Section D.3; further, Market Development is a monitored variable, together with Human and Institutional capacity (Section D.1.1) and thus will be described on a quarterly basis in monitoring reports through the lifetime of the project.

10. Employment (numbers): Ugastoves has 53 employees (13 admin, 3 marketing, 36 production) most of their positions have been created since the project start in the course of 2006 and 2007. A growth in numbers of at least 10% is expected as production grows over the next three years. There are 100 registered retailers currently and this number is expected to double over the next three years. Contact details fro Ugastoves are provided in Annex 1 of this document.

11. Balance of payments: the project has no effect.

12. Technological self-reliance. The introduction of locally manufactured technology with optimized energy efficiency helps to build technological self-reliance. The project has introduced specialist skills in ceramics, involving careful mixing of the ingredients of the stove insulation liners and the associated kiln construction and kiln operation skills.

No negative indicators arise from the project activities and an overall score is achieved as follows:

Sustainable Development Matrix **Score (-2 to 2)**

[7] Sustainability Watch (http://www.suswatch.org/uganda/index.php?option=com_content&task=view&id=40&Itemid=1) and Economic Evaluation of Improved Household Cookstoves in Uganda; www.fuelnetwork.org/component/option,com_docman/task,doc_download/gid,146/Itemid,57

[8] Standard price of charcoal reported by Ugastove in July 2008

[9] World Bank Annual Report, 2007

[10] http://socrates.berkeley.edu/~kammen/cookstoves.html

[11] http://www.iei-la.org/documents/E.%20D.%20PAPER%20No.%202.59.01-05.pdf.

Asterixes denote monitored indicators

Local/Regional/global environment		
	Water quality and quantity	
	Air quality*	1
	Other pollutants	
	Soil condition	
	Biodiversity	1
Sub-total		*2*
Social sustainability and development		
	Employment*	1
	Livelihood of the poor*	1
	Access to energy services*	1
	Human and institutional capacity*	1
Sub-total		*4*
Economic and technological development		
	Employment (numbers)	1
	Balance of Payments (sustainability)	
	Technological self-reliance*	1
Sub-total		*2*
TOTAL		8

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
The project is voluntary: no Kyoto party participates	JP Morgan Ventures Energy Corporation	The project is voluntary: no Kyoto party participates
Ditto	Centre for Entrepreneurship in International Health and Development (CEIHD)	Ditto
Ditto	Ugastoves Limited	Ditto

The project is being implemented in Uganda but as a voluntary carbon project. As such, a formal host country approval is not required. However, the Ugandan DNA has been officially informed of the project and was a participant in the Main Stakeholder Consultation meeting on the project, where the Uganda Government's approval of the project was recorded in the minutes.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The project promotes sales of improved wood-fuel stoves primarily in Kampala, the capital of Uganda, with expanding sales throughout the country. Wood-fuels marketed in Kampala are sourced from forest areas hundreds of kilometres from the town, and as these sources become depleted, it can be reasonably expected that more distant areas of the country will be used.

A.4.1.1. Host Party(ies):

The project is voluntary and therefore is not hosted or invested in by a Party to the Kyoto Protocol.

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

All regions of Uganda, Africa

A.4.1.3. City/Town/Community etc:

All regions and towns

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

Ugastove is the local implementing organization and will conduct the project from its offices in the Makindye District of Kampala, with assistance from CEIHD (based in Berkeley, California, USA).

Contact Person(s):	Kawere Muhammad Ugastoves@gmail.com
Address:	Plot 574, Kayemba Road Nkere Zone Kibuye I Parish Makindye Division Kampala, Central Region P.O. BOX 15191 Uganda
Phone:	256-41-578 251, 256-752-640 073, 256-772-314 882

A.4.2. Size of the project:

Large-scale (the CO2e savings greater than 60,000 tonnes/year on average)

A.4.3. Category(ies) of project activity:

A.2. Domestic Energy Efficiency

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The project reduces the amount of green house gases (GHGs) emitted through production and use of charcoal and firewood as cooking fuels, by introducing widespread use of efficient charcoal and wood stoves (including those used by institutions such as schools) which replace existing inefficient stoves.

Carbon finance was identified as the only feasible method of up-scaling Ugastove during discussions in the years 2004, 2005, and January 2006.

The UNFCC "Tool for demonstration and assessment of additionality" (Version 05) has been used in the following 4 steps to establish additionality of the project activity.:

Step 1: Identification of alternatives to the project activity consistent with mandatory laws and regulations

Since there are no laws or mandatory requirement for the use of efficient biomass cookstoves in Uganda, , Ugastoves is proposing to implement the project activity over and above the national and sectoral requirements. The GHG emission reductions achieved by the project are therefore additional to those directed by the Uganda government policies and regulations.

Sub Step 1a: Define alternatives to the project activity

The following scenarios have been identified as realistic and credible alternatives to the project activity with outputs and services with comparable quality:

- Scenario 1: The proposed project activity undertaken without using carbon finance
- Scenario 2: Energy delivered at household level through liquid fossil fuels such as LPG
- Scenario 3: Energy delivered at household level through electricity
- Scenario 4: Continuation with the current situation

Scenario 1: Proposed project activity undertaken without using carbon finance

This scenario represents the proposed project activity, with all the project activity benefits, but without carbon financing. Scenario 1 will not only result in significant biomass fuel savings but will also reduce the CO_2 emissions from cooking activities in the same manner as the proposed project. Scenario 1 is also in compliance with all applicable legal and regulatory frameworks just like the proposed project

The project proponents had been making a small number of stoves in Kampala before the project commenced. Studies showed that the business model was not sustainable[12]. It was shown that the project

[12] "Modelling a Framework for Sustainable Development in the Ugandan Household Energy Market" A Proposal Dana Charron, submitted to The Shell Foundation December 2004 from Venture Strategies in International Health and Development. This included the finding that: "*..... artisans have started improved stove businesses in Uganda but few have been successful over the long term and no improved woodstove has penetrated the national household energy market. While the barriers to*

proponents needed external finance in order to scale up operations, make physical improvements at the factory, develop institutional capacity, develop quality assurance, improve awareness in the community, run marketing campaigns and provide credit to purchasers.

Ugastoves also needs to be professionally run and large scale to be sustainable.

This alternative would face the same barriers as the project activity under consideration (The barriers are detailed under "Barrier Analysis" below). Hence without the CDM revenue which would actually supplement the financial burdens associated with increased requirement for making physical improvements at the factory, developing institutional capacity, developing a quality assurance system, improving awareness in the community, running marketing campaigns and providing credit to purchasers, this alternative would not be a feasible option for Ugastoves.

For the reasons above, and given the limited financial resources of Ugastoves, this alternative is not realistic and is not taken as a credible baseline.

Scenario 2: Energy delivered at household level through liquid fossil fuels such as LPG

This scenario would involve the community in Uganda currently using biomass switching to LPG for cooking. While this scenario is legal and meets all the statutory requirements, it would face significant barriers. The required amount of LPG would not be available in Uganda given that all the fossil fuels are imported through Kenya as crude oil and is processed at the Kenya Petroleum Oil Refineries whose capacity is barely meeting Kenya's own requirements. Also given the price of LPG (which continues to rise with crude oil prices), the related appliances, including cylinders, most of the biomass fuel users in Uganda would not afford it, even if it was available. The annual cost of delivering the same amount of energy from LPG could be up to five times the cost of delivering it from an improved charcoal stove. According to HEDON House Hold Energy Network report (http://www.hedon.info/goto.php/UgandaCountrySynthesis), LPG is used by less than 2% of urban households, and very little by the poor who are the major biomass fuel users targeted by the proposed project.

For the reasons above, this alternative is not realistic and cannot taken as a credible baseline.

Scenario 3: Energy delivered at household level through electricity

There is no evidence that people in this socio economic bracket are moving towards cooking with electricity. Firstly it is expensive (0.021 Euro per kWh for general residential use), secondly the distribution network is limited (the rate of connection is only 5% of homes for the whole country[13], and only 2% of rural homes), thirdly the capital cost of a cooker is too high (appliance costs vary from around 20 Euros for a simple hotplate up to several hundred Euros for a good quality oven and rings), and fourthly the supplies are highly unreliable due to load shedding by the national utility. Most important has been the constant increase in fossil fuel prices which have drawn them the majority of the Ugandan community to biomass fuels and further away from electricity which is marginally generated from fossil fuels in Uganda.

---

entry are low, artisan producers find it much harder to achieve the conditions necessary for growth: the ability to produce a consistent supply of high quality product that meets customer expectations at an affordable price. Margins on household stoves are so low that they do not come close to providing the capital necessary to expand not only production, but also marketing and distribution. This has made it impossible for most to finance the transition from a local operation to mass production and commercial distribution". Informal studies, home visits, and retailer site visits by the author and colleagues verified that this lack of viability for improved stove businesses continued to be true in 2005 with respect to UCODEA (later to become Ugastoves).

[13] A rate of 4% is reported in 2003 (pace.energyprojects.net/links/UGANDA_PPPs_PACE.ppt) thus we conservatively adjust to 5%

Scenario 3 is in compliance with all applicable legal and regulatory frameworks but, due to the reasons above, it is not realistic and cannot be taken as a credible baseline.

Scenario 4: Continuation with the current situation

In the absence of the project activity, Ugastove would be forced to operate without revenues from carbon finance. This would force a sharp increase in prices and a large reduction in volume (see the estimated Ugastove income statement in Appendix 4.2). In addition, current investments in marketing, quality assurance, and production assets would be impossible. Due to the large debt Ugastove has accrued, the company would most likely go bankrupt and cease production.

Alternative 4 is in compliance with all applicable legal and regulatory requirements and may be the baseline alternative.

Since this alternative is the status quo and does not face the barriers identified for Scenarios 1, 2 and 3 (as per Step 3: Barrier Analysis of the "Tool for the demonstration and assessment of additionality"; vers 05) below, it is considered as the most probable baseline scenarios in the absence of additional capital financing. From the above analysis, it is concluded that the continuation of the current situation is the most likely alternative to the project activity.

Sub Step 1b: Consistency with mandatory laws and regulations

The Project Activity and the alternatives outlined in Sub Step 1a above are all in compliance with and do not contravene national legislation.

Step 2: Investment Analysis

Not Used

Step 3: Barrier Analysis

In this section, it is determined that the proposed project activity faces barriers that prevent the implementation of this type of project activity, which are not faced by Scenario 4 above (Continuation with the current situation). The barriers are identified and analysed below.

Sub step 3a: Barrier Identification

Investment Barriers

- Studies carried out in the initial stages of the Project Activity showed that in order to sell widely, the charcoal stoves were being sold below cost and were essentially subsidized by unpaid staff salaries[14], and the accrual of debts to suppliers, and to owners who have invested in capital in the form of land for production, and vehicles . Carbon finance would help to cover costs while not raising prices. In order to develop a market, money had to be invested in:
    - a) the fabric of the factory
    - b) skills of junior and senior management
    - c) skills of artisans
    - d) marketing

[14] Ugastoves has a history of not paying staff salaries in time, a trend which is attributed to its cashflow and product costing.

e) awareness creation
f) credit facilities
g) working capital
h) quality assurance system
i) preserving a wholesale stove subsidy

If the true costs of the above were included in the retail price of the stove, it would become unaffordable[15]. The carbon finance is effectively subsidising the cost of the stove to make it affordable by funding these business development and market creation costs.

- The funds to carry out these market creation activities could not be borrowed from standard financial institutions as the perceived risk would be too high for their lending criteria. Therefore carbon finance is the only credible market based option for the development of this Project Activity
- Customer credit requirement: As customers tend to be cash poor stoves are often sold on a "take now – pay later" basis. They do not have capital available to purchase the stove but can pay once they have saved on charcoal. This approach means that the project proponent ties up valuable working capital that could be put to better use elsewhere.

Technological Barriers

- **Equipment:** Significant research went into designing a stove that could
  1) be manufactured in Kampala
  2) be technologically appropriate for the milieu and
  3) be suitable for the cooking practices in user households.

  Such stoves and such manufacturing equipment was not available in Kampala prior to the Project Activity.

- **Skilled Labour:** Significant time has been spent in training artisans to make the metal and clay parts of the stoves and to assemble them. As these stoves are new in Kampala, this skill base had to be created and maintained. A key issue in many countries has been whether or not improved stove manufacturing skills have been nurtured beyond initial training by establishment over time of a reliable market. A 2000 DFID report notes that stove markets in Kenya and Ethiopia have grown much more rapidly due to extensive technical and business development assistance. Uganda by contrast has not seen widespread uptake of stoves because artisans trained to produce better stoves, have then been left to fend for themselves and have not been able to develop sustainable markets. The project provides the necessary maintenance and growth of the artisanal skill base.

- **Skilled Professionals:** Time had to be spent in improving professional capacity at Ugastoves, in personnel and data management techniques, accounting, marketing and other skills required in making a successful program.

- **Technology risk:** Users have to be convinced that the new stoves will make them financial savings whilst being suitable to use for cooking traditional foods.

Barriers due to Prevailing Practice

Habitual use of traditional stoves imposes a very strong influence on the baseline scenario, resulting in continuation of use of traditional inefficient charcoal stoves. Inertia requires a significant amount of

---

[15] According to "The Distribution of Welfare in Uganda; http://www.ossrea.net/eassrr/jun00/okwi/okwi.htm), Uganda's mean per capita expenditure was UG Shs 70,776.8 (Euros 28.3) per year in 2000, which shows that at a price of Euros 5 per stove, the stove alone would constitute 17.7% of the annual personal expenditure.

sensitisation, marketing, demonstration and personal anecdote to overcome. The carbon finance will fund these activities which are required to shift the common practice from inefficient traditional stoves to improved ones under the Project Activity.

Sub Step 3b: Barrier Analysis

From step 1 above, it was shown that the only realistic and credible alternative to the project is Scenario 4 which represents the continuation of the current situation. It was established that the other two scenarios are not realistic and credible because they face additional barriers not faced by the proposed project activity. These additional barriers are associated with the costs of switching to and continuing to use either LPG (Scenario 2) or electricity (Scenario 3).

Scenario 4, representing the continuation of the *status quo* does not face any of the above barriers. People have been cooking on such unimproved stoves for many generations and they are the common practice. They are cheap and affordable to the target communities.

Step 4: Common Practice Analysis

Sub Step 4a: Analyze other activities similar to the proposed project activity

Initiatives have been taken by the Government of Uganda to increase the uptake of improved charcoal cook stove in Uganda through stimulation of a commercial market. On balance, these have not been successful.

In a 2007 paper entitled "*Gender and Compliance with Technological innovation for the Improved Charcoal Stove in Uganda" by AFREPEN* **(**http://www.afrepren.org/Pubs/articles/wrec/artcl5.htm)**,** the position was stated as follows:

"In the late 1980's, the Household Energy Planning Programme attempted to identify suitable charcoal stoves, laboratory tested them and qualified them for mass production and dissemination. The aim of the project was to improve economic consumption of charcoal and improve peoples' lives. The project was however limited by inadequate programmes and poor policy commitment."

The first Ugandan National Stoves Workshop took place in March - April 1987 (http://www.hedon.info/HouseholdEnergyActivitiesInUganda). It was convened by the newly formed Ministry of Energy and brought together some 60 individuals, primarily from Ugandan organisations but also from certain Kenyan and European agencies concerned with the problems of wood energy.

The workshop proposed the establishment of a National Wood Energy Conservation Committee, consisting of representatives of government and non-government agencies. An ambitious, comprehensive programme of activities was proposed, with implementation to begin immediately in order to achieve the greatest possible impact. The report of the workshop is presented in "Doing More with Less: Sustainable Development of the Wood Energy Sector in Uganda" (Karekezi, Marwick, Sizoomu and Turyareeba, RWEPA, 1991).

In practice few if any of the proposed activities have been taken up; one of the workshop participants speaks of there having been "no funding, no facilities, no follow-up." This is clearly a case where a high level of commitment was achieved and expectations were raised among numerous agencies, only to be left unfulfilled.

According to the "*The Energy Policy for Uganda*" developed by the Republic of Uganda Ministry of Energy and Mineral Development, (http://www.energyandminerals.go.ug/EnergyPolicy.pdf), woodfuel, which represents the bulk of domestic fuel in Uganda, is burnt in inefficient traditional stoves. Improved stoves and kilns and substitution fuels (LPG, kerosene) for cooking are not extensively spread due to their cost, lack of awareness and other different socio-economic barriers The use of improved cookstoves is therefore confirmed by government reporting not to be widespread in Uganda. However, there have been some improved cookstoves initiatives in the East African region that can shed some light on the common practice with the region. The key experiences for Tanzania and Kenya are discussed below.

Improved Cookstoves In Tanzania

Improved stoves were initially introduced in Tanzania to combat deforestation and, later it was suggested that improved stoves would enhance the quality of life of the users by improving the kitchen environment. |See "Improved Cookstoves in Tanzania "; http://www.hedon.info/goto.php/TanzanianStoves.

The open and competitive atmosphere that prevails in Tanzania has created a good environment for creativity and led to the development of a wide range of innovative improved stove designs. The most common improved stoves, which have been tested by the Institute of Production Innovation (IPI) at the University of Dar es Salaam to compare the efficiencies of the different stoves in the country, are:

- Morogoro charcoal/wood stoves
- Jiko la Dodoma
- Jiko Bora
- Coal stoves

Morogoro Charcoal/Wood Stoves

Research and development in wood-burning mud and ceramic stoves started in the early 1980s in Morogoro, at the Faculty of Agriculture, Forestry and Veterinary Science of the University of Dares Salaam (now the Sokoine University of Agriculture). It was at this place that a Louga stove (originally developed in Senegal) was modified to suit local Tanzanian socio-cultural conditions. This work was sponsored by IDRC but did not go beyond the stage of laboratory testing due to the unpopularity of the Louga stove.

In 1985, the Morogoro Fuelwood Stove Project (MFSP) was launched with support from NORAD. Two separate portable ceramic stoves were developed, the improved Morogoro charcoal stove as well as the Morogoro firewood stove. The emphasis was on production, training and the promotion of the two stoves and awareness-creation of the socio-economic and environmental advantages of conserving firewood.

The Morogoro all-ceramic charcoal stoves use up to 45% less fuel than the traditional metal charcoal stoves. This project faced a serious setback when it was learnt that 60% of the all-ceramic stoves cracked when they were first used. Two years of work on clay mixtures, forming and firing did not cure the cracking problem and so the design was changed to incorporate a grate. This reduced the cracking rate to about 25%.

To date, some 2,500 stoves have been sold, although not all are still in use[16]. Experiences gained by the MFSP indicate that people in the region are generally not motivated to pay for or even use a stove if they can get firewood relatively easily and free of charge. Thus the diffusion of these stoves has been fairly slow. Apart from working on the ceramic cookstoves, MFSP is training people to produce metal stoves, namely Mapumba cookstoves. The Mapumba stove is an efficient improved metal stove which utilizes biomass wastes such as sawdust, rice husks and cowdung.

Jiko la Dodoma

Another type of improved charcoal stove is the double-walled metal UNICEF-designed stove from Kenya where it is known as the Umeme jiko. In Tanzania, the stove was christened the Jiko la Dodoma. In

[16] In 2007 alone, Ugastoves sold over 15,000 stoves and is projecting to increase to at least 30,000 per year.

comparison with the traditional charcoal stove (jiko), the Dodoma stove features three design improvements which contribute to increased energy efficiency:

- enclosure of the combustion chamber and partial enclosure of the cooking pot by raising the wall of the stove;
- better insulation of combustion chamber and pot through double wall;
- regulation of air inflow through a sliding door.

This stove has a heat transfer efficiency of 36% compared to 15-20% for the traditional stove. The material required to produce the Dodoma stove is four to five times the amount necessary for producing a traditional stove. Likewise, the labour input required is five times greater and the work needs a skilled artisan. The stove is both bulky and heavy and small pots tend to slide while food is being stirred. In spite of these drawbacks, the Dodoma stove has registered significant sales in Dodoma, Arusha, Tanga, Iringa and Dar es Salaam. However, the distribution of the stove has not been successfully commercialised as it has proved to be expensive to most target households.

Jiko Bora

With the assistance of the World Bank, the Ministry of Energy and Minerals' Renewable Energy Development Project Unit (REDPU) has launched a project aimed at developing and disseminating more efficient technologies for wood conversion and utilization. One of the components of this project is the Dar es Salaam Improved Charcoal Stove Pilot Project whose objective is to design, develop and disseminate an improved energy-saving cookstove.

The project has adopted the metal ceramic design of the Kenya ceramic jiko (KCJ) which has been modified to suit the prevailing production technology in Tanzania. The end result was the charcoal burning Jiko Bora.

The project started by buying 200 KCJs from Kenya and giving them to people in and around Dar es Salaam. People were allowed to use the stoves for about one month and if they liked them, they paid for them. But if they found the stoves unsuitable, they were free to return them so they could be given to other households to try. After one month, none of the households returned the stoves; instead they asked for more stoves for their neighbours.

Secondly, artisans were trained to make this type of stove. About 300 stoves were made in Tanzania and laboratory-tested at the Institute of Production Innovation. Two types of standard laboratory tests were conducted: the water boiling and the controlled cooking tests. After the laboratory tests, a field test was conducted and the performance of the stoves was found to be acceptable.

The future market for the charcoal burning ceramic Jiko Bora looks good, with sales projected at over 60,000 per year in Dar es Salaam region alone and well over half a million annually country-wide.

However, the sales and production of the Jiko Bora had not expanded as much as TaTEDO had hoped. In 1997, demand for the Jiko Bora was estimated at 12,000 per month. However, only about 4,000 stoves were actually being produced each month despite the financial and technical support provided to the program by TaTEDO, the Tanzanian Government and a number of development agencies. Therefore, TaTEDO conducted a study in 1998 with funding from SGP to understand the reasons for this lack of production and market expansion. (http://sgp.undp.org/download/SGPTanzania1.pdf). The study identified financial, technical, and institutional barriers, among others, as key factors affecting the success of the project.

Community Charcoal/Woodstoves

For public institutions that use wood as fuel, different sizes of improved woodstoves with chimneys have been developed by CAMARTEC (Centre for Agricultural Mechanisation and Rural Technology). The main purpose of these stoves is to reduce the running expenditure through reduced woodfuel consumption. This stove is designed for use in institutions such as schools and hospitals. Since May 1989, woodstoves of 100 litre and 200 litre sizes have been produced with their locally manufactured stainless cooking pots. According to CAMARTEC, fuel savings of this stove range from 70 to 85%. The community woodstove can use mineral coal and can also bake bread. The improved community charcoal and woodstoves are commonly known as the Duma stoves. Two models of Duma charcoal stoves of 30 and 50 litres capacities have been produced. These institutional charcoal stoves are made of steel sheet metal and lorry rims. The stove has its inside lined with bricks and plastered. There are portable and non-portable models. In Arusha, the stoves are made at the CAMARTEC workshop and about 20 to 30 are sold each year. In total, 100 stoves have been sold so far.

The future development of stove programmer in Tanzania looks bright, but eventual success will depend on a wide range of factors, two of which are central requirements for any successful attempt to realize the wide-scale dissemination of improved stoves in the country are:

- continued support for greater participation of small-scale informal sector entrepreneurs and private sector manufacturers;
- institutional development.

It is therefore concluded that most of the stove producers in Tanzania who wish to expand their production are faced with financial problems. But the metal/ceramic stove technology has shown signs of high replicability by the entrepreneurs and good acceptance by users in Tanzania. It has also been confirmed in Tanzania that wood energy conservation through the introduction of innovative stove products is a significant industry providing opportunities for new jobs and income generation in a novel sector.

It is remarkable that many small and medium-scale Tanzanian entrepreneurs have shown willingness to invest their own financial resources in the production and marketing of improved stoves, especially the Jiko Bora. However, most of the commercial ventures have failed and assistance in the form of loans channelled to informal sector entrepreneurs and private sector manufacturers has been lacking. Such funds would ensure that the dynamism of the small and medium-scale entrepreneurs is brought to bear on the dissemination of improved cookstoves in the country, the design and development work having been financed by the Tanzanian Government and various development agencies.

In the area of institutional development, there is no well-established, specialized stove agency (such as KENGO of Kenya) in Tanzania. All key institutions working on improved stoves are involved in other development activities. Improved stoves are just a small part of their development activities.

Specialization is a very important ingredient in introducing a product to the sophisticated urban household market where competition from other producers of traditional biomass and high grade fuel stoves is fierce (Karekezi and Walubengo, 1990). The need for specialization therefore depends on the type of technology and the intended beneficiaries. In the case of improved stoves which benefit the urban population, there is need for specialization. This can be achieved by strengthening the newly formed Tanzania Traditional Energy Development Organization so it is able to monitor the impact of training, stove designs and publicity on the intended beneficiaries.

The stove development described above shows a strong move towards the use of charcoal and possibly coal to replace wood as the preferred domestic fuel in urban areas. However, there has been no widespread adoption of the technology in Tanzania mainly due to the barriers identified under barrier analysis above.

Improved Cookstoves In Kenya

Kenya Ceramic Jiko

The Kenya Ceramic Jiko, a portable charcoal stove which, can reduce fuel consumption by 30-50%, saving the consumer money, reducing toxic gas and particulate matter, and resulting in better overall heath for the user, is the most successfully distributed energy efficient stove in the region. The stove is now used in over 50% of all urban homes and 16% of rural homes in Kenya and there have been attempts by neighbouring African countries to adapt it but with limited success.
The stove was developed by international aid and governmental agencies, local women's organizations, and craftspeople in 1982. The stove was manufactured by Rural Technology Enterprises

The stove has been promoted by local and international agencies. There are now more than 200 businesses, artisans, and micro-enterprise or informal sector manufacturers producing over 13,000 stoves each month. There are over 700,000 such stoves in use in Kenya (Walubengo, 1995).

A formal private sector company, Jerri International, served as the initial manufacturer of the stove. This arrangement was subject to debate, and KCJ production then evolved into two, often related, informal sector activities: production of the metal cladding by artisans who were generally already producing traditional metal stoves in Kenya; and production of the ceramic liner, which is produced in a number of regional or rural clay and pottery workshops and factories.

Since 1982 the Kenya Energy and Environment Organization (KENGO) has organized promotion and outreach efforts to encourage the use of the stove. A number of foundations, including CARE, UNICEF, and the Bellerive Foundation have all played roles in the evolution of the stove and the stove dissemination process, as has the U. S. (US AID) and German (GTZ) aid and development organizations. The Foundation for Woodstove Dissemination has worked both within Kenya and internationally as the coordinator of a network of stove researchers, promoters, and dissemination specialists.

As outlined above, the stove evolved through the efforts of a number of public and private sector organizations with interests in aid, development, health, and environmental conservation, and has evolved over time. The process of research, development, demonstration and then commercialization that led first to the stove and then to other stove models in Kenya was seeded by international and local development funds. After explicit consideration a decision was made not to directly subsidize commercial stove production and dissemination. Initially stoves were expensive (~ US$ 15/stove), sales were slow, and the quality was variable. Continued research and refinement, and expanded numbers and types of manufacturers and vendors increased competition, and spurred innovations in materials used and in production methods. The wholesale and retail network for stoves is now extensive. The stoves can be purchased in a variety of sizes. Prices for the stove models have decreased to roughly US$ 1 - 3 depending on stove size, design and quality (Kammen, 1995a; Walubengo, 1995). This decrease is consistent with the 'learning curve' theory of price reductions through innovations that result from experience gained in the manufacturing, distribution, marketing and sales process. It has therefore been difficult for other countries, like Uganda, who have not taken this path to introduce large scale adoption of the stoves.

Reductions in fuel use associated with the stoves and other improved stoves have been examined in a number of countries. In Kenya, charcoal use among a sample of families using the stove fell from 0.67 to 0.39 kg/charcoal/day. This totals over 600 kg of charcoal/year for an average family, and a savings of over $US 60/year. A study in Rwanda prior to the war found charcoal use fell from 0.51 kg/person/day to 0.33 with the use of improved stoves. Personal incomes in Kenya and Rwanda average $300 - 400/year (Karekezi and Ranja, 1997).

The stove project faced a number of important barriers, including: the view held by some researchers and dissemination groups (Kammen, 1995b) that there could be a bias against changing the cooking style at all; the need to promote the stove as fuel saving despite higher initial costs; and the need to conduct training and support services for a seemingly 'simple' household technology. A success and a drawback of the stove program is the network of often informal sector manufacturers and vendors. On the one hand, the direct and

grass-roots commercialization fully integrates the stove into the local economy. On the other hand, quality and price variations in the stoves produced in such diverse settings can be great, including a number of clearly sub-standard models. Stoves manufactured poorly rarely stay in the market for long, but opinion of the stoves, and individual bad experiences can colour the future interest of potential users.
The stove process has focused attention on the trade-offs between development 'project' and commercial sector management of a technology, and highlights the potential to involve the informal sector. At the same time, it has become clear that there is an important role for cooperative projects where government, NGO, or other organizations provide training, outreach services, publicity, and other logistical support for the local commercial industry.
(Refer “Research, Development and Commercialization of the Kenya Ceramic Jiko and other Improved Biomass Stoves in Africa”; http://www.solutions-site.org/cat2_sol60.htm).

The key success factors for the Kenya Ceramic Jiko were as follows:

- Support for research both within developing nations and for research collaborations between developing nations led to significant innovations in the technology and in the entire production and commercialization process.
- Extended, stable, program support was invaluable while short-lived, episodic funding can lead to waste and inefficiency and the need for re-learning and duplication of effort. There are significant technical, social, cultural and economic questions that must be addressed even for technologies that may appear to be simple (Kammen and Dove, 1997) and that were addressed in the project. At the same time, long-term support was most effective with safeguards against complacency and dependency instituted from the outset.
- Support for stove programs needed not take the form of direct subsidies. Partnerships between institutional groups, including NGOs and international organizations, involved in R&D, promotion, and training were decoupled from commercial production and sales as long as the mechanisms for feedback, cooperation and public to private sector spillover were explicitly addressed.

Sub Step 4b: Discuss any similar options that are occurring
International development agencies, for example GTZ, have run improved wood-burning stove projects in peri-urban and rural Uganda. These are not directly comparable to the proposed project, as they do not include transformation of the urban charcoal-burning market. One such project consists of distribution of Rocket Lorena stoves (http://www.gtz.de/en/presse/23841.htm) which have been distributed in rural Uganda and is supported by both German and Dutch Government, working with the Ugandan government. To date the project has received German government funding in the tune of € 5,450,000 (http://www.gtz.de/de/dokumente/en-factsheet-uganda-2007.pdf). According to a GTZ report “ Economic evaluation of the improved household cooking stove dissemination programme in Uganda” (http://www.gc21.de/ibt/de/site/cdw/cdw-hessen/ibt/inhalt/docs/hera/4.%20Projektevaluation%20Uganda%20Projekt.pdf), 8,224 improved charcoal cooking stoves were in use by the end of 2006. The program continues on the basis of substantial financial support from the German, Dutch and Uganda Governments.

This experience to date indicates conditions whereby barriers to market development are severe and have failed to be surmounted through various efforts. This situation demonstrates that Carbon Financing is a feasible funding option for the project.

Conclusion

The distinctions set out here between other activities and the Project Activity are so great that the project is additional.

A.4.4.1. Estimated amount of emission reductions over the crediting period:

Table A.4.4.1 (a)

Project Year	Annual estimation of Emission Reductions in tonnes CO2e
-2	12,201
-1	27,364
1	55,223
2	90,987
3	122,903
4	142,184
5	148,445
Total Emission Reductions (tonnes of CO2e)	**599,307**
Total Number of crediting years	7
Annual average over the crediting period of estimated reductions	**85,615**

SECTION B. Application of a baseline methodology

B.1. Title and reference of the approved baseline methodology applied to the project activity:

The project follows the methodology approved in January 2008 by the Gold Standard Foundation entitled "Improved Cook-Stoves and Kitchen Regimes". This methodology covers both the baseline and monitoring requirements for such a project.

The methodology applied also draws upon the Tool for the Demonstration and Assessment of Additionality; Version 05

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology quantifies green house gas emissions from non-renewing biomass, and therefore applies to the project as there is clear evidence that the use of woody biomass and charcoal as cooking fuel is not balanced by the re-growth in the supply area.

The methodology is suitable for a project with a large supply area where very likely other projects may seek to quantify the non-renewing portion of the biomass consumption they save. By assessing non-renewability status in a fractional manner, the methodology assures that all projects in the same area are capped equally and there is no risk of double counting.

The methodology requires that surveys and quantitative measurements are carried out in the kitchens of the stove users. Since the fuel consumption reductions arising from the project will be sensitive to locally determined factors the application of a methodology requiring measurements in samples of households, as opposed to one dependent on lab testing of stove efficiency, is appropriate.

B.2. Description of how the methodology is applied in the context of the project activity:

In the context of this project, the basic assumptions of the methodology are that the green-house gas reductions arising from adoption of the Ugastoves can be determined conservatively as follows:

- Emission factors for charcoal and wood combustion are the same in the case of baseline stoves and project stoves, and the most recent IPCC default values for these stove-fuel combinations are appropriate[17]
- The green-house gas emissions arising from charcoal production are an important component of the baseline assessment and these are associated with credible and published emission factors derived from measurements made of similar techniques in similar localities[18]
- The emission reductions resulting from sales of Ugastoves are conservatively assessed by a combination of two approaches[19]:
  - applying a rigorous statistical analysis to the results of fuel-consumption sampling (Kitchen Tests) in households using a specific model of the Ugastove under a particular set of conditions,
  - making appropriate adjustments for application of these results to sales of other models used in alternative conditions, following the observations and analysis of a survey of 100 varied customers (the Kitchen Survey)

The methodology prescribes a sequence whereby a Kitchen Survey is carried in order that its results can be used to define customer groups (clusters) together with the characteristics required of subsequent Kitchen Tests (KTs) so that the customer groups may be represented by the tests. In the particular case of this project, this sequence was reversed with respect to sales of charcoal Ugastoves, for two reasons:

- the fuel consumption of a set of homes had already been measured in a Kitchen Test (KT) in 2006 prior to survey work (Kitchen Survey KS) undertaken in 2007.
- when the 2007 KS survey was concluded, the analysis of its results showed that the 2006 KT was valid for application, given stringent statistical analysis and appropriate adjustments, to the full range of Ugastoves models and conditions of use.

The KS recommended that the project calculates emission reductions for charcoal Ugastoves according to the following clusters:

a) Sales of charcoal stoves of sizes 2 to 5
b) Sales of charcoal stoves of size 1

Cluster (c) comprises institutional stoves burning wood. A survey was conducted together with a kitchen test in 2007 sampling 9 schools burning wood and using the Ugastove.

Cluster (d) comprises wood-burning domestic stoves. A provisional KT in 2006 was conducted in Kampala alongside the KT which evaluated fuel savings of the charcoal Ugastoves.

The Baseline Study and KS investigated the following risks of leakage:

---

[17] The Methodology allows in Step 2.4 (section II part 4.2) for use of IPCC default values

[18] The Methodology allows for emission reductions from production of fuels (section II, Part 1). The published emission factors in use here are found in Table 6A of "Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise,Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27 2001". This table calculates the averages of measured emissions of greenhouse gases from earth mound kilns. Although these measurements were taken in Kenya several years ago field surveys in Uganda have revealed that the same techniques for charcoal production are used currently and no change can realistically be expected (despite considerable efforts to change this state of affairs) during the course of this project.

[19] Statistical analysis is required by Step 2.3 (Section II, part 4.2) of the methodology and adjustments are allowed in the final paragraph of Step 1.5 (Section II, part 4.1)

a) Some users of the efficient stoves might respond to the fuel savings associated with higher-efficiency stoves by increasing consumption of fuels with GHG emission characteristics, 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.
b) The project activity might stimulate 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).
c) By virtue of promotion and marketing of a new model and type of stove with high efficiency, the project might stimulate 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.
d) The project population might compensate 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
e) The traditional stoves displaced might be re-used outside the boundary in a manner suggesting more usage than would have occurred in the absence of the project.
f) Significant emissions from transportation or construction involved in the project activity might occur, including emissions associated with production/transport of the efficient stoves themselves, or production/transport of project fuels

The quantitative results of the Kitchen Test subsumes the potential sources of leakage a, b, d, and e. Because the KT represents fuel savings in actual households, the results already incorporate the effects of these potential leakages.

In the case of (c), it was clear that both the much lower disposable income levels in rural areas and the continuing practice of self-collection prevent a transition from wood users to charcoal. In any case observations and interviews indicated that a switch from a traditional wood stove to an improved charcoal stove would result in reduced GHG emissions, such that there is no risk of leakage in this scenario. On the other hand the indications also were that an efficient charcoal stove has slightly worse GHG emissions than an efficient wood stove. Since this is a very unlikely scenario in view of the investment made by rural people in a new wood stove on the basis of charcoal being unavailable, it can be neglected.

Leakage source c is addressed through the Kitchen Survey which is a continuous monitoring requirement and a leakage factor will therefore be applied in the future if significant fuel switching from wood to charcoal is observed.

Indeed all potential sources of leakage discussed above will be followed throughout the project period. Fuel-switching will be continuously monitored in the monitoring KS's for both rural and urban sales, and the leakage factor re-evaluated accordingly.

Leakage source f, transport, is a consideration not addressed by the baseline and monitoring KTs or KS, but contributes to surplus emission reductions (from reduced charcoal shipments to Kampala) as much, if not more, than it contributes to leakage.

Thus, no leakage factor is applied.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered VER project activity:

In the case of conventional charcoal stove users, the baseline study shows the average consumption of families sampled using the traditional stove was 1.13 tonnes per year, in conditions where they are cooking only with charcoal. Families in the sample moving to the improved charcoal stove (size 2) and using it for the same purpose and thermal load (cooking meals of the same type, number and sizes) were found to reduce their consumption to 0.72 tonnes per year on average. The adoption of the improved stove therefore resulted in a saving of 0.41 tonnes of charcoal on average each year by each user. This figure reduces to 0.30 to take account of the statistical error margin arising from the variation in the sample and adoption of the lower bound of a 90% confidence interval[20].

A fuel saving of 0.30 tonnes/year corresponds to a greenhouse gas emissions reduction of 1.76 tonnes of CO_2e per year per family, given the biomass source for charcoal is 91% non-renewable. In order to adjust for real-world conditions observed by survey, such as use of secondary fuels, the GHG reduction figure adopted for project calculations is 1.46 tonnes of CO_2e per year per family using a medium size stove, and 1.32 for a family using a size 1 stove[21].

In the case of institutional fire-wood stoves, the baseline study shows that average fuel demand per meal amongst a set of sampled institutions was 0.19 kg. Through adoption of the Ugastove, consumption per meal reduced to 0.10 kg on average, giving a fuel saving of 0.09 kg of fire-wood per meal on average in the sampled schools. Extending this result to apply to all schools, a figure of 0.072 kg/meal is conservatively derived from statistical analysis. This translates to a green house gas emission reduction of 45% for the sampled schools or 36% for all schools adopting the Ugastove.

For domestic wood users, the mode of GHG reduction is the same. The initial indications from a small sample taken in Kampala in 2006 are a saving 3.4 kg of wood per day, or 2.56 tCO_2/stove-year. Although these initial tests did confirm that a saving of this order was indeed being made, further tests will be needed to evaluate this saving more precisely in actual conditions of use of the Ugastove in rural areas.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary is defined as the kitchens used by the project population (Ugastove purchasers); this is distinct to the Reachable Fuel Collection Area, which is the geographical area of Uganda where fuel-woods can reasonably be expected to be collected throughout the period of the project.

---

[20] The statistical analysis of the Kitchen Test sample determined that with 90% confidence savings would not fall below 0.82 kg/day for all stoves sold, corresponding to a minimum saving of 0.30 tonnes of charcoal per year per stove operational for a year.

[21] The Kitchen Survey observed that some improved stove users continued to use their old inefficient stove alongside the new one; also that some users cooked with LPG as well as with charcoal. An analysis was made of the effect of these conditions on overall fuel consumption savings with the conclusion that the results of a KT where the sample did not include such conditions, should be a downward adjustment of 0.83. In the case of Size 1 stoves, a further downward adjustment of 0.9 was factored in. Ugastove is assessing the feasibility of a system that rewards retailers for scrapping inefficient stoves, since the practice of retained use of inefficient stoves has the effect of reducing the company's carbon finance revenue (the monitoring KPTs capture fuel use by all stoves used in each kitchen). In practice the effect is found to be small, as many typical unimproved charcoal stoves in Uganda have a short life often of only several months. The adjustment mentioned above is considered highly conservative by local observers and subject to investigation through monitoring KPTs. Once a family has a Ugastove, observations and interviews have indicated that generally the old stove is not replaced when it becomes inoperable.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The baseline study was completed 03/03/08 and was carried out in several stages:

1. A sample of 68 domestic cooks were issued with size 2 charcoal Ugastoves in June-August 2006 and their charcoal consumption weighed for three days while cooking without the Ugastove, then for three days while cooking with the Ugastove, without use of secondary fuels or stoves[22]. Concurrently a Kitchen Test for a sample of 13 wood-burning stoves was carried out. The results of the above two tests were reported by Evan Haigler of CEIHD, Joseph Arineitwe Ndemere, Dr David Pennise, and Dr Dana Charron in February 2007. The raw data from the two above tests were analyzed by Dr Tim Heaton of Oxford University Statistics Department, in January 2008, to determine emission reductions.
2. The non-renewability fraction of fuel-wood in Uganda, was analyzed by Dr Adam Harvey of ClimateCare and Evan Haigler of CEIHD in 2008.
3. A survey and KT was commissioned by CEIHD which investigated the fuel consumptions of 11 schools using the wood-burning Ugastove in comparison with a set of schools which did not have Ugastoves; this was undertaken in mid 2007 and completed by 20 August. The raw data from these tests were analyzed by Dr Tim Heaton of Oxford University Statistics Department, in January 2008, to determine emission reductions.
4. In November 2007 a Kitchen Survey was commissioned by CEIHD and undertaken by Kellen Namusisi and Joseph Arineitwe Ndemere, comprising interviews with the primary cooks in 84 houses. This was extended with a further 20 home interviews in January 2008 under commission from ClimateCare. The second phase was also carried out by Kellen Namusisi who worked with ClimateCare to prepare a Kitchen Survey report completed 3 March 2008.

The parties mentioned may be contacted through the project participants listed in Annex 1. The results of the Baseline Study are summarized in Section E together with a parameters table and are introduced here as follows:

[22] The three days were in each case chosen carefully to avoid Sundays, which was identified as a day when most families would cook more than on other days of the week. The KT result was therefore conservative in this regard. The dates of the KT were chosen to avoid the festive seasons of Easter and Christmas, again making sure that the results were conservative.

The KS recommended that the project calculates emission reductions for charcoal Ugastoves according to the following clusters:

a) Sales of charcoal stoves of sizes 2 to 5
b) Sales of charcoal stoves of size 1

With respect to both cluster (a) and cluster (b) the KS suggested that a single Kitchen Test focused on charcoal-only users of stove size 2 is appropriate if the following adjustments[23] are made to its outcome:

a) Sales of charcoal stoves of sizes 2 to 5: Adjust downwards the fuel saving figure derived from the KT by a factor of 0.83. This factor takes into account the conditions observed by the KS (secondary fuel use, retained use of old stove alongside new). In addition, since the sales of stove sizes 3-5 represent higher savings than measured in the KT, the application of a KT with this profile is conservative.
b) Sales of charcoal stoves of size 1: Adjust downwards the fuel saving figure derived from the KT by a factor of 0.75. This factor takes into account the conditions observed by the KS (secondary fuel use, retained use of old stove alongside new), and in addition accommodates the relative fuel consumption of small stoves compared to no 2 size stoves, within a conservative margin.

The final result of the KS, KT and the adjustments recommended, were as follows:

a) Sales of charcoal stoves of sizes 2 to 5: emission reduction of 1.46 tCO_2e per operational stove year (lower bound of 90% confidence interval and adjusted as described above).
b) Sales of charcoal stoves of size 1: emission reduction of 1.32 tCO_2e per operational stove year (lower bound of 90% confidence interval and adjusted as described above).

Sales of size 1 and sizes 2-5 are expected to remain approximately equal through the project period, and therefore the average of the two emission reduction figures above is applied to a single sales projection for all charcoal stoves.

Cluster (c) comprises institutional stoves burning wood. A survey was conducted together with a kitchen test in 2007 sampling 9 schools burning wood and using the Ugastove. A statistical analysis of the results found at 90% confidence level that the average saving of the institutional stoves were 0.072 kg of wood per adjusted person-meal, where the adjustment in this case normalises primary children's meals and light meals. This value is conservative given a significant percentage of institutional stoves are used by the military and restaurants, which invariably cook larger portions per person-meal compared to primary schools with young children. For the purposes of projecting future emission reduction savings this figure is multiplied by the average number of adjusted person-meals per day observed in the sample of school investigated, together with the number of days of school attendance typical for Kampala.

Cluster (d) comprises wood-burning domestic stoves. A provisional KT in 2007 in Kampala indicated an emission saving of 2.56 tCO_2e/stove-year. This is considered an indicative figure only due to limitations in the sampling size and the necessity to carry out the KT in specific rural areas as and when the marketing operations of Ugastove develop in those areas.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

[23] This type of adjustment is prescribed by the Methodology on page 9 in the final paragraph of Step 1.5 (Section II, part 4.1)

C.1.1. Starting date of the project activity:
1st Jan 2006

C.1.2. Expected operational lifetime of the project activity:
7 years 0 months

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

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:
Two years before Date of Registration (or 1st April 2007 if so chosen by project participants and later than Date of Registration)

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: N/A

C.2.2.2. Length: N/A

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

The monitoring protocol is included within the methodology "Improved Cook-Stoves and Kitchen Regimes", approved by the Gold Standard Foundation.

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The monitoring methodology has been developed in the context of this project activity.

D.2. 1. OPTION 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID #	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	*Stove Sales*	*Sales Records*	*Number of stoves by type and size*	*M*	*Daily*	*All sales*	*Electronic and paper*	
2	*Project Fuel Consumption*	*KTs*	*Mass fuel per year*	*M*	*Biannually*	*Sample*	*Electronic and paper*	*Fuel consumption of improved stove*
3	*Clustering definitions*	*Monitoring KS*	*As specified above*	*E*	*Quarterly*	*Sample*	*Biannual monitoring reports*	*To ensure representative KTs*
4	*Usage factor*	*Usage KT or KS*	*% operational*	*M, E*	*Biannually*	*Sample*	*Electronic and paper*	
5	*Age Factor*	*Stove-age KT*	*Mass fuel per year*	*M*	*Biannually*	*Sample*	*Electronic and paper*	
6	*New Stove performance*	*New Stove KT*	*Mass fuel per year*	*M*	*Biannually*	*Sample*	*Electronic and paper*	*Fuel consumption of new improved stove*
7	*Market development*	*Company records and Quarterly Report*	*Sales trends and expenditure on sensitisation and promotion*	*E*	*Quarterly*	*Major promotional activities*	*Electronic and paper*	*Sales trends and their correlation to promotions*

D.2.1.2. Data to be collected in order to monitor project performance on the most sensitive sustainable development indicators:

Sustainable Development Indicator	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)
Air quality	*Survey*	*Air pollutants (CO, particulates)*	*Survey observations*	*Estimated through home interviews and observations as to inside/outside cooking*
Lively-hood of the poor	*Survey*	*Financial impact*	*Ug Sh*	*Estimated through home interviews during quarterly Kitchen Survey visits to randomly selected Ugastove buyers*
Employment	*Survey*	*Numbers*	*Employees*	*Direct employees and retailers of Ugastoves are measured and spin-off employment (competitors) is estimated*
Access to Energy Services	*Survey*	*Fuel cost, consumption, ease of collection*	*Tonnes/year, prices, walking distances*	*Estimated through kitchen tests and surveys*
Human and institutional capacity	*Survey*	*Skill levels*		*Estimated through records of Ugastove and spin-off achievements in business, marketing, and technology areas*
Technological self-reliance	*Survey*	*Achievement*		*Estimated though observation and record of Ugastove and spin-off technical innovations and developments*

D.2.1.3. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO2 equ.)

Please see Section E

D.2.1.4. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
8	*Non-Renewable Biomass fraction*	*NRB assessment study in Annex 2 and follow-up Monitoring NRB studies*	*Xnrb: % non-renewable biomass*	*M, C, E*	*Biannually*	*Sufficient depth and conservative approach*	*National Data are electronic. Survey results are paper and electronic*	*Following approach of baseline assessment*
9	*Baseline Fuel Consumption*	*Baseline and Monitoring KS and KT*	*Mass fuel per year*	*M*	*Biannually*	*Sample*	*Electronic and paper*	

The recording frequency for the parameters 1 to 9 in the tables above reflect the maximum intervals; in practice the project operator and assignated third parties may take measurements more frequently and update emission reduction calculations appropriately on the basis of the revised data.

D.2.1.5. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO2 equ.)

Please see Section E

D. 2.2. OPTION 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:
N/A

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):
N/A

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data varia ble	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Com ment
Al leakage risks		*KS*		*e*	*quarterly*		*Electronic and paper*	

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Qualitative assessment through quarterly Kitchen survey home visits throughout the project period

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Annex 2.3

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

The project operator will employ a 3rd party expert with independent status and suitable credentials to ensure quality control in several of the monitoring activities. This consultant will be responsible for the periodic KS's, Usage Surveys, leakage investigation, and spot-checks (including field observations of retailer activity) to confirm the validity of Sales Records and to confirm the absence of double-counting in any form. He or she will ensure that the Detailed Customer Database and the Project Database are up to date and that the latter is representative of the most recent definitions of clusters. He or she will cross-check the Sales Record with the sales records of retailers, and with production records (materials purchases, staff numbers), and with Ugastoves's internal accounting records. The 3rd party expert's reports on the methods used for such cross-checks and their findings will be included in quarterly monitoring reports available to the verifier. The project operator is responsible to fill this role to standard in any instances where a 3rd party is unavailable or has been unable to do so. More detail is provided in Annex 4.4.

Data *(All from Table 2.2.1)*	Data Variable	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	*Stove Sales*	*Low*	*Third party review (cross-checks as defined)*
2	*Project Fuel Consumption*	*Low*	*Third party review*
3	*Clustering definitions*	*Low*	*Conducted by third party*
4	*Usage factor*	*Low*	*Conducted by third party*
5	*Age Factor*	*Low*	*Conducted by third party*
6	*New Stove performance*	*Low*	*Conducted by third party*
7	*Market Development*	*Low*	*Conducted by third party*
8	*Non-Renewable Biomass fraction*	*Low*	*Conducted by third party*
9	*Baseline Fuel Consumption*	*Low*	*Conducted with third party assistance*

Sustainable Development Indicators:

Data Variable	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Air quality	*Low*	*Conducted with third party assistance*
Lively-hood of the poor	*Low*	*Conducted with third party assistance*
Employment	*Low*	*Conducted with third party assistance*
Access to Energy Services	*Low*	*Conducted with third party assistance*
Human and institutional capacity	*Low*	*Conducted with third party assistance*
Technological self-reliance	*Low*	*Conducted with third party assistance*

D.4. Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The Project Operator and will schedule and implement the monitoring activities described and tabulated above, and summarize results in the form of quarterly monitoring reports (QMR's), due for submission within one month of end of each quarter. These QMR's will annex the prior reports of the 3rd party expert which will be due for submission within two weeks of the end of each quarter.

D.5 Name of person/entity determining the monitoring methodology:

The monitoring methodology is as prescribed in the methodology "Improved Cook-stoves and Kitchen Regimes" under the Gold Standard Foundation prepared by ClimateCare with contributions from CEIHD.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The equations used to calculate the project emissions associated are presented in the Methodology (with reference to Section 7 of Part II) and are resolved as follows for the charcoal Ugastoves:

Eproject(per stove-year) = Adj(KS) x EF(nrb) x F(mean fuel consumption KT new stoves)

Where Eproject(per stove-year) is the CO2e emission associated with a single stove operating for one year, EF(nrb) is the sum of the charcoal emissions factors presented in table E.1 (taking into account Xnrb), and F(mean fuel consumption KT new stoves) is the average fuel consumption of the new stoves sampled by the Kitchen Test.

In the case of Size 1 Adj(KS) is the 0.75 downward adjustment recommended by the KS analysis, while in the case of Sizes 2 to 5 Adj(KS) is the 0.83 downward adjustment recommended by the KS analysis.

Cluster	Stove type	Adj(KS)	Project Emissions			
			Average Fuel consumed in sample		Efnrb	Emissions
			Non-adj	Adj		w/o leakage
			t/yr	t/yr	tco2e/t	tCO2e/st-yr
a	Charcoal Sizes 2-5	0.83	0.715	0.593	5.89	3.49
b	Charcoal Size 1	0.75	0.715	0.536	5.89	3.16

In the case of wood-burning institutional stoves, no KS adjustment is made as the Kitchen Survey carried out for all customers (61 schools) did not indicate any requirement for adjustment. The KT for the schools sample measured fuel consumption per meal (adjusting or normalizing the number of meals according to sizes of meals). The number of adjusted meals per day per school was measured and the average taken for the sample.

Cluster	Stove type	Average adj meals per day per school	School days per year	Av adj meals/year per school	Project Emissions		
					Av fuel consumed per adj meal	Efnrb	Emissions w/o leakage
c	Wood	meals/day	days	meals/yr	kg	tco2e/t	tco2e/st-yr
	Institutional	896	270	241,920	0.102	2.04	50.46

In the case of domestic wood stoves, no KS adjustment is made as a Kitchen Survey was not done in respect of rural wood users. Further, the sample size of the KT was small. Accordingly no emission reductions will be submitted for verification until a domestic wood KS is done followed by a larger KT sample. The current calculations for domestic wood emissions are treated as purely indicative pending this work.

Cluster	Stove type	Project Emissions		
		Average fuel in sample	Efnrb	Emissions w/o leakage
		t/yr	tco2e/t	tCO2e/st-yr
d	Wood domestic	1.726	2.04	3.53

Table E.1: GHG intensities of charcoal and wood in Uganda

Fractional Non-Renewability	Xnrb,y	0.91	fraction	Wood Fuel Renewability Analysis Annex 2 PDD Ugastoves
EF Charcoal Production; CO2	EFch,prod,co2	1.802E-03	tCO2/kg_ch	Ref2: Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil, David M. Pennise, Kirk R. Smith, Environmental Health Sciences, University of California, Berkeley, California. Journal of Geophysical Research Vol 106 October 27 2001.
EF Charcoal Production; CH4	EFch,prod,CH4	9.370E-04	tCO2e/kg_ch	Ref2 & GWP from IPCC SAR 1996
EF Charcoal Production; N20	EFch,prod,N20	4.700E-05	tCO2e/kg_ch	Ref2 & GWP from IPCC SAR 1996
EF Charcoal Consumption; CO2	EFch,use,co2	3.304E-03	tCO2/kg_ch	IPCC 2006 GL.
EF Charcoal Consumption; CH4	EFch,use,CH4	2.050E-04	tCO2e/kg_ch	IPCC 2006 GL. GWP: IPCC SAR 1996.
EF Charcoal Consumption; N20	EFch,use,N20	5.000E-05	tCO2e/kg_ch	IPCC 2006 GL. GWP: IPCC SAR 1996.
EF Charcoal Combined; CO2	$EF_{ch,CO2}$	5.106E-03	tCO2/kg_ch	Calculated from above
EF Charcoal Combined; CH4&N20	$EF_{ch,non\text{-}CO2}$	1.239E-03	tCO2e/kg_ch	Calculated from above
EF Charcoal CO2e (NRB)	EFch,CO2e	5.885E-03	tCO2e/kg_ch	Calculated from above
EF Wood Consumption; CO2	EFwd,co2	1.747E-03	tCO2e/kg_wd	IPCC 2006 GL.
EF Wood Consumption; CH4	EFwd,CH4	4.010E-04	tCO2e/kg_wd	IPCC 2006 GL. GWP: IPCC SAR 1996.
EF Wood Consumption; N20	EFch,N20	5.400E-05	tCO2e/kg_wd	IPCC 2006 GL. GWP: IPCC SAR 1996.
EF Wood Combined; CH4&N20	$EF_{wd,\ non\text{-}CO2}$	4.550E-04	tCO2e/kg_wd	Calculated from above
EF Wood CO2e (NRB)		2.045	tCO2e/t_wd	Calculated from above

E.2. Estimated leakage:

This is estimated to be zero for all clusters as detailed in section B.2.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Cluster	Stove type	Project Emissions	
		Leakage	E with leakage
		tCO2e/st-yr	tCO2e/st-yr
a	Charcoal Sizes 2-5	0.00	3.49
b	Charcoal Size 1	0.00	3.16

Cluster	Stove type	Project Emissions	
		Leakage	E with leakage
		tCO2e/st-yr	tCO2e/st-yr
c	Wood Institutional	0.00	50.46

Cluster	Stove type	Project Emissions	
		Leakage	E with leakage
		tCO2e/st-yr	tCO2e/st-yr
d	Wood domestic	0.00	3.53

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline;

The equations used to calculate the baseline emissions associated are presented in the Methodology (with reference to Section 7 of Part II) and are resolved as follows for the charcoal Ugastoves:

Ebaseline(per stove-year) = Adj(KS) x EF(nrb) x F(mean fuel consumption KT traditional stoves)

Where Ebaseline(per stove-year) is the CO2e emission associated with a single stove operating for one year, EF(nrb) is the sum of the charcoal emissions factors presented in table E.1(taking into account Xnrb), and F(mean fuel consumption KT traditional stoves) is the average fuel consumption of the old stoves sampled by the Kitchen Test.

In the case of Size 1 Adj(KS) is the 0.75 downward adjustment recommended by the KS analysis, while in the case of Sizes 2 to 5 Adj(KS) is the 0.83 downward adjustment recommended by the KS analysis.

Cluster	Stove type	Adj(KS)	Baseline Emissions			
			Average Fuel consumed in sample		Efnrb	Emissions
			Non-adj	Adj fuel		
			t/yr	t/yr	tco2e/t	tCO2e/st-yr
a	Charcoal Sizes 2-5	0.83	1.128	0.936	5.89	5.51
b	Charcoal Size 1	0.75	1.128	0.846	5.89	4.98

In the case of wood-burning institutional stoves, no KS adjustment is made as the Kitchen Survey carried out for all customers (61 schools) did not indicate any requirement for adjustment. The KT for the schools sample measured fuel consumption per meal (adjusting or normalizing the number of meals according to sizes of meals). The number of adjusted meals per day per school was measured and the average taken for the sample.

Cluster	Stove type	Average adj meals per day per school	School days per year	Av adj meals/year per school	Baseline Emissions		
					Av fuel consumed per adj meal	Efnrb	Emissions
c	Wood	meals/day	days	meals/yr	kg	tco2e/t	tco2e/st-yr
	Institutional	896	270	241,920	0.199	2.04	98.44

In the case of domestic wood stoves, no KS adjustment is made as a Kitchen Survey was not done in respect of rural wood users. Further, the sample size of the KT was small. Accordingly no emission reductions will be submitted for verification until a domestic wood KS is done followed by a larger KT sample. The current calculations for domestic wood emissions are treated as purely indicative pending this work.

Cluster	Stove type	Baseline Emissions		
		Average fuel in sample	Efnrb	Emissions
		t/yr	tCO2e/t	tco2e/st-yr
d	Wood domestic	3.723	2.04	7.61

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The difference between the values shown above for project and baselines emissions are the average emission reductions for the sample of stoves tested in the respective Kitchen Tests. The formula is:

ER(per stove-year) = Eproject(per stove-year) - Ebaseline(per stove-year)

Table E.5 sets out the values of the average emission reductions for each sample in the respective Kitchen Tests, and also sets out the mean fuel savings and emission reductions at the lower bound of a 90% confidence interval, as required by the methodology.

Table E.5. Emission reductions per stove-year for sample and adjusted for all sales

Cluster	Stove type	Emission reductions	Fuel savings		Emission reductions
		Average from sample	Lower bound of 90% C.I.		Lower bound of 90% C.I.
		tCO2e/st-yr			tCO2e/st-yr
a	Charcoal Sizes 2-5	2.02	0.25	t/yr	1.46
b	Charcoal Size 1	1.82	0.22	t/yr	1.32
0	Institutional	47.98	0.072	kg/adjusted meal	35.62
d	Wood domestic	4.08	1.252	t/yr	2.56

E.6. Table providing values obtained when applying formulae above:

Table E.6 sets out the values of emission reductions obtained when applying the formulas and statistical analysis described above, taking into account the projected sales volumes through the project period. In this table clusters a and b are combined taking an average of the two specific emission reduction values presented in Table E.5, since initial sales records demonstrate approximately equal volumes of sales for charcoal Ugastoves size 1 and sizes 2 to 5.

Table E.6

Year	**Projected Sales**			**Operational Stove-Years** (assumed 3-year life)			**Annual estimation of ERs (tCO2e)**			
	Charcoal	Domestic Wood	Institutional Wood	Charcoal	Domestic Wood	Institutional Wood	Charcoal	Domestic Wood	Institutional Wood	**Totals**
Installs	3,000	0	15	1,500	0	8	NA	0	0	**0**
Year -2	10,000	0	30	8,000	0	30	11,133	0	1,068	**12,201**
Year -1	10,000	0	40	18,000	0	65	25,049	0	2,315	**27,364**
1	30,000	400	50	36,500	200	110	50,793	512	3,918	**55,223**
2	30,000	600	50	60,000	700	160	83,496	1,792	5,699	**90,987**
3	30,000	1,200	50	80,000	1,600	210	111,328	4,096	7,479	**122,903**
4	30,000	2,000	50	90,000	3,000	260	125,244	7,680	9,260	**142,184**
5	30,000	2,500	50	90,000	4,750	310	125,244	12,160	11,041	**148,445**
Totals	**173,000**	**6,700**	**335**	**384,000**	**10,250**	**1,153**	**532,287**	**26,239**	**40,781**	**599,307**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

No adverse environmental impacts will take place as a result of the project activity. Questions in this regard were answered to the satisfaction of authorities attending the stake-holder consultations in March 2007 and January 2008. Project approval of the PDD has been granted by the Designated National Authority, before which a full Environmental Impact Assessment was deemed unnecessary by the National Environmental Management Authority (NEMA) of Uganda.

F.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:

N/A

SECTION G. Stakeholders' comments

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

Two stakeholder consultations have been carried out. An initial meeting took place in on 16 March 2007, and a Main Stakeholder Consultation meeting took place on 14 January 2008, both in Kampala.

The meetings were attended by representatives from government, environmental and civil society organizations, academia and the private sector. There were 30 participants in the first meeting, and 27 in the main meeting.

In general, the assembled stakeholders expressed support for the project, and expressed appreciation that the project would deliver co-benefits beyond greenhouse gas reduction, as follows:

- Improvement in indoor air quality, leading to reduced risk of ill-health in women and children;
- Defence against environmental degradation by virtue of lessened demand for wood-fuels
- Poverty alleviation arising from reduced fuel consumption and costs.

G.2. Summary of the comments received:

The primary recommendations made by the stakeholders were:

1. That the carbon funding is linked to poverty alleviation and millennium development goals (through ensuring that the stoves are priced to be affordable to as many households as possible)
2. That the project expands its marketing and distribution efforts to give families outside of Kampala access to the stoves;
3. That the quality and durability of the stove will be maintained so that it continues to deliver the promised co-benefits;
4. That this project platform is used to improve upstream fuel wood harvesting and charcoal production practices.
5. That the carbon rights of individual purchasers of the stoves be respected and the position in this regard clarified
6. That the fuel savings and green-house gas emission saving tests conducted by the project are fully rigorous so that the results can be used as precedents for further work in Uganda

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

The project has accommodated the recommendations in the following ways::

1. *That the carbon funding is linked to poverty alleviation and millennium development goals (through ensuring that the stoves are priced to be affordable to as many households as possible).* In July 2007 Ugastoves introduced a smaller stove (Size 1) which is less expensive than the size previously sold for standard domestic use (now referred to as the medium size or Size 2). This has increased sales made efficient cooking more affordable to the wider population. Other strategies under consideration are payment plans or micro-credit, and special subsidies targeted at particular areas or at particularly vulnerable or needy population groups, to be realized as sufficient carbon financing revenues are collected. Further, the business development strategy for Ugastoves includes investigation of methods of reducing production costs and stoves prices, including consideration of methods of extending current levels of control of retail prices.

2. *That the project expands its marketing and distribution efforts to give families outside of Kampala access to the stoves.* In the short term distribution is starting now in areas outside Kampala as and when opportunities present themselves. In the longer term, Ugastoves is planning to franchise their manufacturing and distribution systems to other regions of Uganda.

3. *That the quality and durability of the stove will be maintained so that it continues to deliver the promised co-benefits.* Firstly, Ugastoves retailers now issue a warranty card which allows customers to claim a free pan-rest replacement. This is results in longer stove life-times, and has the advantage of facilitating follow-up monitoring services which will be used to detect quality issues and correct them in good time. Secondly, it is intended to monitor not only GHG reductions but also IAP impacts of the stoves, through the course of the project, so that the co-benefits will be visible. Furthermore, the non-renewability fraction of the wood-fuels will continue to be monitored. And finally, part of the business development strategy is to build define the Ugastove brand so that quality control and branding together can build a durable product with a large market appeal.

4. *That this project platform is used to improve upstream fuel wood harvesting and charcoal production practices.* The project has already stimulated the preparation of projects to increase the efficiency of charcoal production and to establish field trials of sustainable charcoal production systems. Through further networking and through the non-renewable biomass monitoring activities of this project, it is expected that further stimulus will be given to these initiatives. It should be recognised nevertheless that this very important task is outside the scope of the project.

5. *That the carbon rights of individual purchasers of the stoves be respected and the position in this regard clarified.* The current expansion of Ugastoves sales, the pricing of the stove, and its quality assurance initiatives (such as the free pan-rest), are already dependent on carbon finance. Consequently, in July 2007 the decision was taken that in order to respect customer carbon rights it was important to inform customers of this. Since then, customers of an Ugastove have routinely received a warranty card on which is printed the message that the carbon finance associated with use of the stove has been used. This statement expresses that any end user claim to ERs is waived in preference to Ugastove in return for partial payment for the stove (since the stove price is subsidized by carbon finance). The statement is augmented by the following measure: leaflets in local language are being placed inside the combustion chamber of each stove sold, with an explanation of carbon finance and an explanation of the waiving of ER rights via subsidized pricing.

6. *That the fuel savings and green-house gas emission saving tests conducted by the project are fully rigorous so that the results can be used as precedents for further work in Uganda.* The project proponents are very aware of the importance of this request and have responded by ensuring that survey work and the analysis applied to fuel consumption tests is fully professional, so that the results are conservative and can safely be used by Ugandans as precedents. The methodology for monitoring requires that further surveys and tests are carried out at intervals throughout the project period (including not only fuel consumption but also non-renewability of the biomass), so that it will be possible for all parties to revisit the fuel-saving and emission-reduction figures in coming years.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	JP Morgan Ventures Energy Corporation ("JPMorganClimateCare")
Street/P.O.Box:	112 Magdalen Road
City:	Oxford
Postfix/ZIP:	OX4 1RQ
Country:	UK
Telephone:	+44 1865 207000
E-Mail:	environmental.markets@jpmorgan.com cc: adam.harvey@jpmorganclimatecare.com
URL:	www.jpmorganclimatecare.com
Salutation:	Dr
Last Name:	Harvey
First Name:	Adam
Mobile:	+44 791 739 1156
Direct tel:	+44 1865 207019

Organization:	Centre for Entrepreneurship in International Health and Development (CEIHD)
Street/P.O.Box:	46 Shattuck Square #25
City:	Berkeley,
State/Region:	California
Postfix/ZIP:	CA 94704
Country:	United States
Telephone:	1.510.843.1795
E-Mail:	ehaigler@ceihd.org
URL:	www.ceihd.org
Salutation:	Mr.
Last Name:	Haigler
First Name:	Evan
Mobile:	+1 949 274 0139
Direct tel:	+1 949 274 0139

Organization:	Ugastoves Ltd
Street/P.O.Box:	Plot 574, Kayemba Road Nkere Zone Kibuye I Parish Makindye Division
City:	Kampala
State/Region:	Central Region
Postfix/ZIP:	P.O. BOX 15191
Country:	Uganda
Telephone:	256-41-578 251, 256-752-640 073, 256-772-314 882
E-Mail:	ugastoves@gmail.com
Salutation:	Mr
Last Name:	Muhammad
First Name:	Kawere

Annex 2

BASELINE INFORMATION

Baseline Information regarding fuel consumption measurements is provided in section B.5 above; baseline information regarding non-renewability assessment is provided here.

Non Renewable Biomass Baseline

1. Introduction

The assessment made here does not define NRB for the complete project period. The parameter is an important one in assessing the green-house gas emissions accruing from wood-fuels, and its value may change over the period of the project. Since new stoves are progressively installed throughout the project period the baseline evolves. Indeed, it is hoped that the project and others like it (together with parallel initiatives such as tree-integrated agriculture and forestation programs) will reduce the NRB status of the country in forthcoming years and with it the NRB status of wood-fuels. The methodology requires that the assessment is made at least every two years through the project; this implies a new assessment will be made at latest in 2010, and that stoves installed subsequently will have their evolved baseline and project NRB values freshly set.

The methodology for NRB assessment is itself under review in 2008 and 2009 as many parties around the world work to derive a practical approach commensurate with approved methods of addressing GHG emissions in other sectors. Therefore the improved assessment for NRB for this project will very possibly be informed by new methodology.

It is useful to keep in mind the breadth of legitimate approaches to NRB. For example, carbon saving projects currently approved by DOEs include those that take the approach that all wood-fuel saved is 100% NRB, so long as this amount (or aggregate of all amounts saved by parallel initiatives) does not itself tip the balance from net depletion to sustainability of woody biomass. This approach is possibly more legitimate than the approach followed here.

Another important point is that NRB assessment following the approach prescribed here requires that an official figure is ordained by a DNA or equivalent government body for each country – this is necessary to encompass multiple carbon projects and multiple parallel initiatives to achieve woody biomass sustainability. Again it may be less satisfactory than the 100%-until-renewability limit approach.

As a further similar example, it is legitimate to argue that world net deforestation by itself implies that all wood-fuel CO2 can be accounted as GHG[24] emissions, regardless of a local ratio of harvest to growth, in the same way that CO2 emissions from fossil burning are not calculated net of forest growth.

[24] Allowing that once world forest net depletion is zero, GHG is only claimed in excess of the world biomass growth rate by application of a single world fraction to all NRB-baseline emission reduction projects

2. Summary and sensitivity analysis

A sensitivity analysis approach has been taken here, in order to ensure a conservative assessment of NRB status. This involves using both quantitative and qualitative approaches to implementation of the methodology, and taking more than one reading of the sources available for a quantitative approach, in all cases remaining faithful to the prescriptions of the methodology. The results of each approach is compared here in the summary table; as a conservative measure, the lowest value for NRB is applied to the emission reduction projection of the PDD.

The table shows the results of four separate approaches to analysis each in line with the requirements of the methodology and each adopting conservative values and assumptions.

	Approach	**NRB**
3.1	Evidence-of-sustainability	100%
3.2	Quantitative analysis of national biomass renewability based on 2005 data from FAO	91%
3.3	Quantitative analysis of national biomass renewability adjusted for 2008	92%

3. Implications of the methodology

The methodology followed here for assessing a non-renewable biomass fraction for Uganda is given in the document “*GS-VER Methodology for Improved cook-stoves and Kitchen regimes”.*

This defines the non-renewable biomass fraction (NRBF) as the total harvest (H) of woody biomass (from an area where biomass can reasonably be collected) net of the mean annual increment (MAI) in that area, divided by the total harvest (H), thus:

NRBF = (H – MAI) / H ,   or   NRBF = 1 – MAI/H

Alternatively NRBF can be expressed as the inverse of the regeneration fraction of woody biomass as follows:

NRBF = 1 – BRF

where BRF is the Biomass Regeneration Fraction, or the ratio of CO_2 re-absorbed to total CO_2 released, in wood-fuel collection areas. This method of expressing NRBF is introduced as a convenience, simply because BRF is a less complicated and more intuitive concept.

The regeneration rate is the mass of wood growing per year above ground. The harvest rate is the mass of wood extracted per year. If we abbreviate the former to G for “Growth” (rather than MAI, for simplicity, though it is the same thing as mean annual increment) and the latter to “H” for harvest we can say:

BRF = G / H
(equivalent to 1 - NRBF = 1 - (H-G)/H)

To apply the concept, it is useful to picture the collection area for wood-fuel around a village or town. This is the area or distance around the settlement beyond which it is not easy or economically feasible, either commercially or by the fuel-user themself, to travel to collect and transport back wood-fuel. This is not necessarily a radial area, but a set of “arms”; that is, a series of corridors describing an area either side of usable paths, valleys, and roads where the terrain allows access for wood–fuel collection.

If we were to find that all the wood fuel in this area had already been collected, or that the land had been converted to agriculture, urbanization, or to pasture, or that it was simply degraded to the extent of useful growth not occurring, or some combination of these effects, then the Growth in the collection area would be zero, and the analysis of BRF would reach this limit:

G = 0 therefore BRF = 0 / H = 0

If on the other hand we were to find that all woody biomass stock collection was carefully monitored, and that all mass removed was monitored and policed to ensure that the inventory of stock did not lessen, then Growth would equal (or exceed) Harvest and we would achieve the other limit of BRF:

BRF = G / H = 1

The intermediate case is of course the case where the annual growth is a portion of the harvest but has a mass which is less than that of the harvest.

The question arises as to the nature of the intermediate case. It is not an equilibrium situation, as are the two cases above, since the biomass living stock is reduced which in turn reduces the growth[25]. In practice this case is usually associated with increasing population, poverty, and increasing demand for fuel-wood, such that two effects occur simultaneously:

- Continuous expansion of the boundaries of the collection area, beyond reasonable limits (by implication the methodology is defining reasonably accessible areas as areas where people can collect fuel-wood within limits of human safety, maintenance of minimum standards of livelihood, and economic feasibility)
- Because expansion of the collection area boundaries is constrained by the difficulty and cost of going further afield, there is in practice an exponential depletion of stock within the collection area rapidly culminating in the BRF=0 case we saw above

Therefore under conditions of a collection area whose boundary is fixed by criteria of reasonableness (ie livelihood and safety-preserving), NRB can be seen as always 100% if significant stock depletion (or local deforestation) is taking place and an unacceptable level of poverty is associated with expansion of the boundary. Uganda is a good example of this scenario as described below.

The methodology as it stands prescribes such fixed collection areas and therefore prescribes 100% NRBF (or 0% Biomass regeneration fraction BRF) to situations of local deforestation and poverty.

[25] Excepting the special case where over-grown areas are thinned to stimulate growth.

At the same time, the methodology prescribes 0% NRBF (100% BRF) to areas where fully sustainable wood harvesting and production is practised.

It follows then, that should there be evidence of local deforestation and poverty in all areas of a country except areas where sustainable management is practised, the effective country-wide BRF value, as given by the methodology, would be (following Option (b) of the methodology which permits aggregation of all wood-fuel collection areas) as follows:

BRF = Within the overall collection area: (areas of fully sustainable biomass harvesting and production) divided by (total wood harvesting and production areas), or

BRF = Within the overall collection area: (mass of wood harvested in a way which is balanced with growth and there is clear evidence for this) divided by (total mass of fuel-wood extracted)

with the value for NRBF being 1 – BRF.

Following this reading of the methodology, the first approach to NRB analysis for Uganda should be to see if the conditions described here do comply with this implication.

3. 1. Evidence-of-sustainability approach

In rural areas approximately 46% of Uganda's population live below the poverty line (FOSA 2001) and are using wood as a cooking fuel. People working in the charcoal industry are generally poor, working long hours in difficult conditions away from home. Deforestation has not been reversed in recent years and indeed is estimated at 4% per year[26] which taken together with rural poverty implies that outside fully managed areas where there is evidence of sustainable cut, annual growth or increment can be considered zero within reasonably accessible collection areas[27]. This conclusion is compounded by the observation that most of the land where charcoal is made is converted to agriculture, also implying that the collection areas do not generate new woody biomass growth significantly.

Countering this trend are the efforts being made to establish community-based forest resources management (CBFRM)[28]. At the current time no clear evidence exists of CBFRM providing sustainable fuel-wood resources to some communities.

Given this analysis, the following expression is valid as implied by the prescribed methodology:

[26] FOSA 2001: 1.5 million hectares of forest are degraded and now protected to allow recovery. The remaining 3.5 million hectares of forested area are subject to rapid deforestation at a rate estimated to be 4% per year with timber extraction exceeding the allowable cut by about 4 times

[27] Mueller 2003 reports on a study of a sample of homes in Masindi district: "some communities … also nowadays experience firewood-shortage and hence are no longer able to satisfy their needs from their surrounding environment. They presently have to pay 2,300 UShs per bundle which is indisputably too much to be met by poorer families. 77.5% of the respondent households experience months of short food especially during the rainy seasons. …. 87% of the respondent households are dissatisfied with the occurring financial conditions of their family which moreover comprises the circumstance that 40% of the households are not able to satisfy basic needs with the available monetary resources".

[28] Kaboggoza, 2000, FAO Workshop on Tropical Secondary Forest Management in Africa.

BRF = Within reasonable accessible collection areas, areas of fully sustainable biomass harvesting and production / total wood harvesting and production areas

= 0; therefore, NRBF or Xnrb = 100%

3.2. NRB assessment using 2005 quantitative data

(a) Establish supply area, annual increment, and harvest

The quantitative approach for calculating X_{nrb} (non-renewability fraction) requires defining the supply area, mean annual increment, and annual harvest for the Project Area.

In the case of the wood-fuels marketed in urban Kampala, whether charcoal or fire-wood, there is clear evidence of transportation over large distances, implying that the collection areas are widespread and the country as a whole should be seen as the supply area. Domestic wood and charcoal stoves marketed by Ugastove are sold in areas near Kampala where wood-as-wood fuel is hand-collected or purchased and charcoal is purchased. Wood resources are scarce in these peri-urban and urban areas and it is thus the conclusions reached with regard to the whole country as a supply area, will be conservative with respect to the non-renewability status of firewood and charcoal used in Ugastoves.

Uganda's total growing stock in 2005, was 164,000,000 m3[29].Careful attention was given in a recent study[30] to the question of biomass productivity or mean annual increment. The conclusion was that a reasonable approach was to apply a generic growth rate of 2.5% of standing stock to cover all prevalent biomass types[31] .

This implies that the mean annual increment in Uganda can be set at 2.5% of 164 million m3, or 4.1 million m3/year.

The annual harvest (H) of wood countrywide in 2005 was 46,449,000 m3 [32], of which an astonishing 91%, or 42,410,000 m3, was destined as wood-fuel.

(b) Quantify non-renewable biomass

Given the above, the non-renewability fraction is calculated as:

$X_{nrb} = 1 – (MAI/H)$

---

[29] FRA 2005

[30] Drigo, Wisdom East Africa, FAO, 2005

[31] This applies to all types except plantation forest, the increment of which can be better estimated as 10% of mid-rotation stock. In the case of Uganda, plantation forest currently comprises only 0.2% of overall stock (FOSA) and so need not be included in these calculations

[32] FRA 2005

Uganda's total growing stock, as defined and calculated by the FAO in 2005 (FRA 2005), is 164 million m3. Multiplying this by a generic mean annual increment rate for wood of 2.5% gives us the total mean annual increment (MAI)= 4.1 million m3/year.

The annual harvest (H) of wood countrywide in 2005 was 46,449,000 m3.

X_{nrb}= 1 - (MAI/H) = 1 - (4,100,000 /46,449,000) = 0.91 (91%)

This fraction Xnrb is applied to both the baseline and project scenarios, for the following reasons:

- the project monitoring plan requires progressive updating of the NRB value (at least every two years) through the project period, thus the effect of this project together with other similar projects and conservation or afforestation activities, as well as converse influences such as rising population, will be reflected appropriately
- while in principle the baseline NRB may have a higher value than the project NRB for each stove replacement due to the conservation effect of the efficient stove, the attribution of values does not operate at this level of resolution, since the replacements are being made continuously through the project period and the baseline and project values are therefore in practice both shifting (the accumulated effect of previous installations changes the baseline for further installations)
- the shifts in NRB value caused by the project itself within the intervals between periodic NRB re-assessments do not make a significant change (in comparison to resolution of NRB assessment data) between baseline and project values due to the very large shortfall between harvest and increment quantities[33], although the project is part of and a stimulus to wholesale market transformation toward efficient stoves and sustainable woodland management.
- therefore, while the conservation effect of the project by itself will mitigate the effect of rising population (driving NRB value upward) it is unlikely to outweigh it[34]. Hopefully other project activities will augment its effect and the combined effect will be to lower NRB. This reduction will become apparent within two years when NRB is re-assessed under the monitoring plan and will be taken into account.

(c) Maintain conservativeness

The figures presented so far for harvest are under-estimated for several reasons. The first is that the country-wide approach taken here does not reflect accessible or reasonable collection distances for wood-fuel users, as required by the methodology; taking this into account, non-renewability is very likely to be more severe.

---

[33] The average number of stoves operational throughout one year of the period is approximately 50,000. Each stove operational for one year will be saving approximately 300kg of charcoal per year, corresponding to a reduction in woody biomass consumption of 1.8 tonnes per year (at 6 tonnes of wood to one tonne of charcoal). The saving in wood consumption due the project each two year interval will therefore be approximately 180,000 tonnes on average or approximately half a percent of the current annual harvest of 35 million tonnes/year. The NRB value remains 0.91 even if it is assumed that MAI increases by the same percentage as the harvest decreases. Once the project achieves the expected 90,000 Ugastove users towards the 6th and 7th years, the conservation effect is calculated as 1.8 tonnes/Ugastove user multiplied by 90,000, or 0.16 million tonnes of wood per year.

[34] The rising demand for wood-fuel due to population increase is estimated at over 3% per year (FOSA 2001) largely due to increasing urbanization causing an increase in charcoal consumption at 6% per year (FOSA 2001).

Secondly, wood removal (the "harvest" in calculations made above) is often under-estimated and under-reported[35]; thus, the value of Xnrb is likely to be higher in reality than estimated above.

Further, the figures used are over three years out-of-date (although they are the best available). Demand for wood has been growing rapidly in previous years and will continue to grow through the project period. Urban growth is very pronounced, reflected in charcoal demand increasing at 6% per year (FOSA 2001), and rising demand for construction timber. General population growth is 2.9%/yr (FOSA 2001), while increase in wood-fuels demand overall (rural and urban) is estimated to be over 3% per year (FOSA 2001).

The effect of deforestation due to clearance for agriculture also has the effect of reducing the increment, since the standing stock is shrinking (also due to the consumption of non-renewing wood).

The equation NRB = 1- (MAI/H) must therefore be seen in terms of an increasing value of H and a decreasing value of MAI, giving an increasing shortfall or a worsening non-renewable biomass condition.

3.3 NRB assessment projecting quantitative data for 2008

The following analysis uses the same quantitative methodology as section 3.2, above, but projects increased fuel demand and forest scarcity in 2008. It therefore gives a less conservative, but perhaps more realistic, estimate of current non renewability in 2008.

(a) Establish supply area, annual increment, and harvest

The entire country is again used in this calculation as the supply area.

Between 2000 and 2005 the growing stock in Uganda was reduced by 2.3% from 167,800,000 m3 to 164,00,000 m3. Conservatively assuming a linear trend, this suggests a 0.46% annual reduction, resulting in a projected 2008 growing stock of 161,800,000 m3.

This implies that the 2008 mean annual increment in Uganda can be set at 2.5% of 161,800,000 million m3, or 4.0 million m3/year.

Assuming a 4% annual increase in woodfuel demand (as discussed in section 3.2, above) between 2005 and 2008,it is projected that the annual harvest (H) of wood countrywide has increased from 46,449,000 m3 in 2005 to 52,249,000 m3 in 2008.

(b) Quantify non-renewable biomass

Given the above, the non-renewability fraction is calculated as:

$X_{nrb} = 1 – (MAI/H)$

Uganda's 2008 projected total growing stock is 161.8 million m3. Multiplying this by a generic mean annual increment rate for wood of 2.5% gives us the total mean annual increment (MAI)= 4.0 million m3/year.

---

[35] FRA 2005: "Countries usually do not report illegal removals and informal fuelwood gathering,and thus the figures for removals might be much higher than those reported".

The projected annual harvest (H) of wood countrywide in 2008 is 52,249,000 m3.

X_{nrb}= 1 - (MAI/H) = 1 - (4,000,000 /52,249,000) = 0.92 (92%)

NRBF or X_{nrb} = 0.92

3.4 Sense-check comparison with other Sub-Saharan countries

In order to provide a sense-check of the non-renewability fraction calculated for Uganda in this report, the table below illustrates a calculation of non-renewability for several countries in Sub-Saharan Africa, using the same methodology and the same source (FRA 2005) for data on production and harvest.

The table shows that NRB varies widely in Sub-Saharan Africa. Each of the NRB fractions below is related to a particular geographic, social and economic context so that the fraction varies according to the size of existent forest, population, harvesting practices, and the country's position on the "energy ladder". Out of the five countries surveyed in Sub-Saharan Africa as part of this sense check, Niger has the highest $X_{nrb.}$

Country	Growing stock (m3) (forest +wooded land)	MAI (m3) (growing stock x 2.5% growth rate)	Annual Wood Harvest (m^3)	X_{nrb}
Uganda	164,000,000	4,100,000	46,449,000	0.91
Rwanda	100,000,000	2,500,000	10,429,000	0.76
Kenya	281,000,000	7025000	26,658,000	0.74
Tanzania	1,312,000,000	32800000	28,033,000	-0.17
Niger	25,000,000	625,000	12,470,000	0.95

4. References

1. *Energy-Poverty in Masindi District* Anke Maria Mueller, University of Oldenburg 2003 Ministry of Energy and Mineral Development (MEMD) under the GTZ Energy Advisory Project
2. *The Uganda Forest Policy* 2001, Ministry of Water, Lands, and Environment
3. FOSA 2001: *Forestry Outlook Studies in Africa* FOSA 2001: Uganda, Ministry of Water, Lands, and Environment, Charlotte Kanabahita
4. *Wood-fuel Integrated Supply/Demand Overview Mapping (WISDOM) Methodology – East Africa*: Spatial wood-fuel production and consumption analysis of selected African countries FAO – Forestry Department – Wood Energy, Rudi Drigo, 2005
5. Kaboggoza, 2000, FAO Workshop on Tropical Secondary Forest Management in Africa.
6. FRA 2005: Food and Agriculture Organization's Global Forest Resources Assessment 2005

Annex 3

MONITORING PLAN

The project will follow a Monitoring Plan as set out in the methodology "Improved Cook-stoves and Kitchen Regimes". Of particular importance is the requirement that a Monitoring Kitchen Survey is undertaken of 25 Ugastove customers each three months, and that the data collected is held in a Detailed Customer Database. This data will function as a guide to sustainable development indicators, and as a guide to evolving baseline conditions and to factors such as usage drop-off and age performance of Ugastoves.

The Monitoring Plan includes bi-annual Kitchen Surveys (KS) and Kitchen Performance Tests (KPTs), which will include investigation of the performance of ageing Ugastoves, so that such adjustments can be made to the emission reduction values used in monitoring reports. Also, usage will be investigated, and appropriate adjustments made to emissions reductions claims based on measured usage drop-off rates.

Verification will take place annually, and the Verification report will follow the methodology in the above respects. Updated assessments of sustainable development indicators will be included as a component of the monitoring report submitted for Verification.

The following chart shows the respective roles of CEIHD, CIRCODU (the Center for Integrated Research and Community Development Uganda), and Ugastoves in monitoring. The subsequent charts also provide detail of the organization of project implementation. Annex 4.3 (Further Information on Quality Assurance) describes management, monitoring, and implementation procedures. With respect to training of monitoring personnel, CIRCODU has been, and will continue to be, trained and briefed by CEIHD to undertake key monitoring tasks and in turn will provide training alongside CEIHD experts, to the Ugastove staff in record keeping relevant to monitoring.

The Ugastove sales record is collected by the Financial Manager based on sales receipts submitted by the sales team. The accountant enters this information into a Quickbooks accounting system. On a monthly basis, the Operations Manager aggregates the information, checks it for accuracy and sends it to CEIHD.

In order to create a system that cross checks the accuracy of the stove sales record, the Ugastove Operations Manager aggregates production and inventory records from the Production Manager and submits them to CEIHD for comparison.

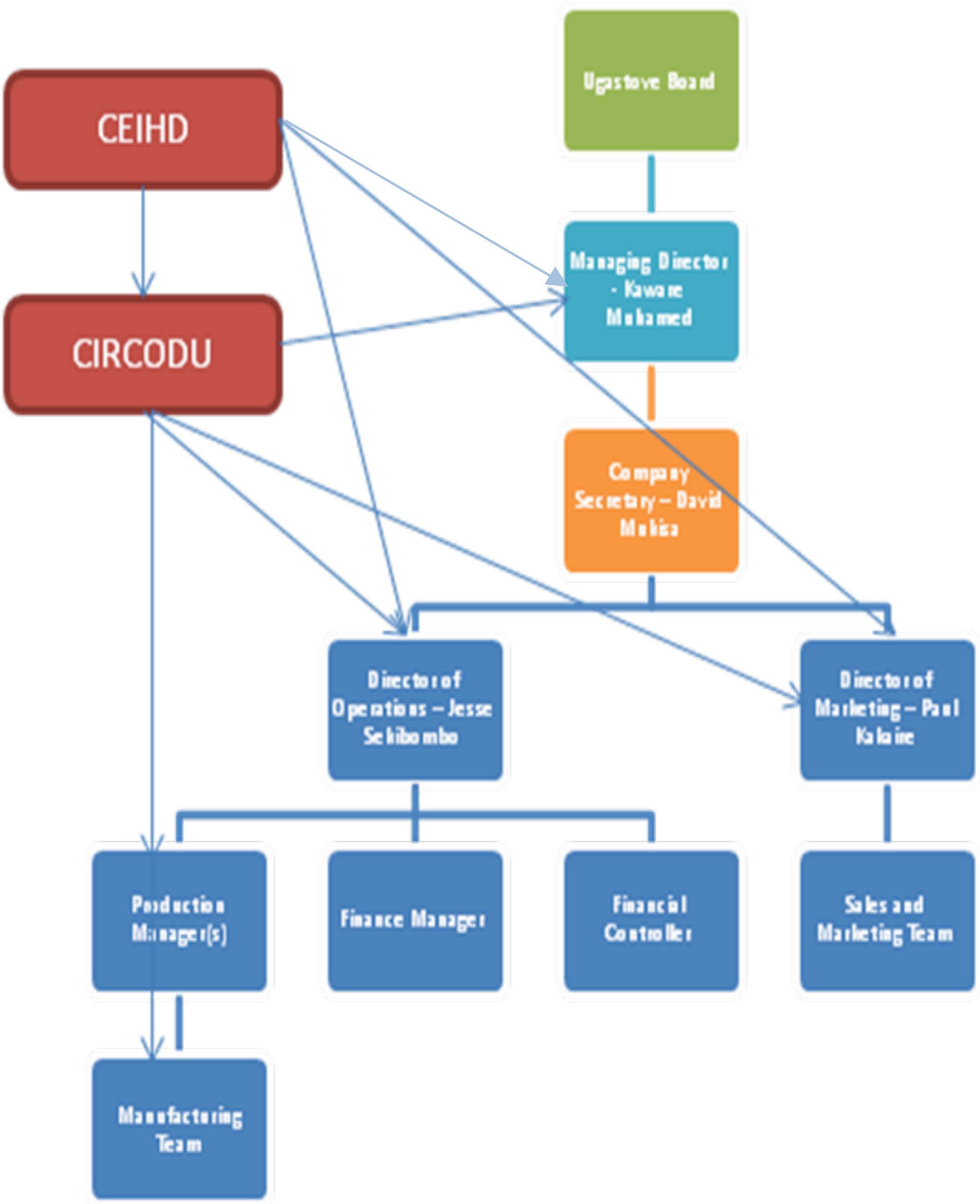
CIRCODU will provide periodic (4 per year) spot checks at Ugastove to ensure that production, sales, and inventory records match purchases of raw materials. These records will also be cross-checked with artisan labour records (ensuring the number of stoves produced matches the amount of labour for which artisans were paid).

In addition, CIRCODU monitors stove performance and usage. CIRCODU will perform a usage survey every two years to capture the stove usage rates of participants in the initial KPT. On a quarterly basis, CIRCODU will also perform 25 Kitchen Surveys (KS).

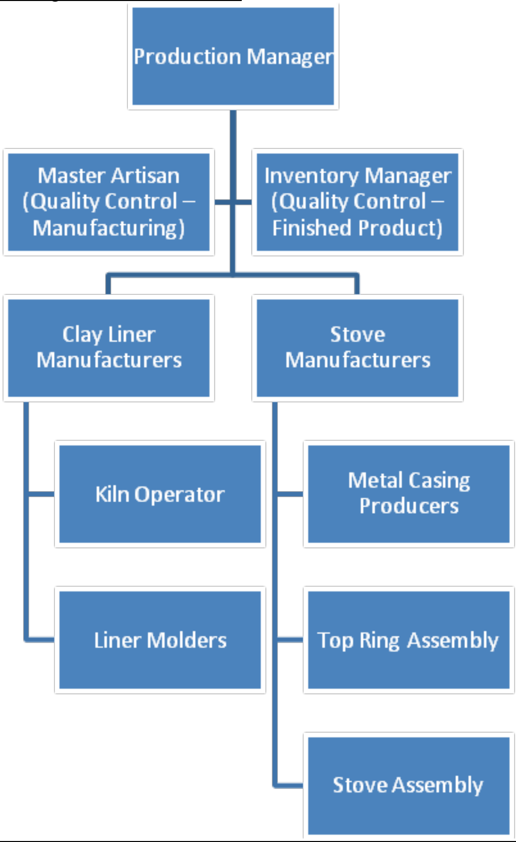
CEIHD will use data from the Usage Surveys and Kitchen Surveys to conduct a drop-off analysis according to the Methodology.

CEIHD will conduct a biannual Non-Renewable Biomass assessment to include any new information on the sustainability of wood harvest in Uganda. As more research is completed, CEIHD will also seek to increase the resolution of the NRB to focus specifically on areas of charcoal harvest in Uganda.

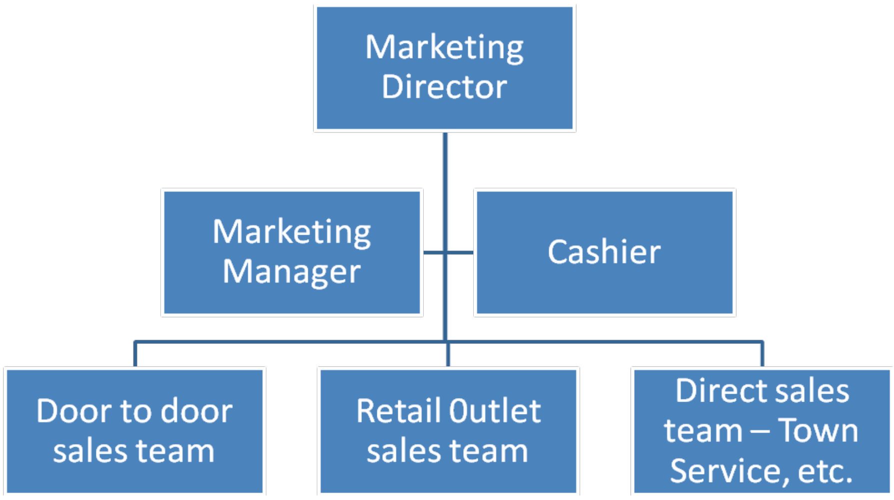
Organogram 1: Ugastove Organizational Chart and Monitoring Relationships
Note: CIRCODU (the Centre for Integrated Research and Community Development Uganda) is a 3rd party monitoring group



Oganogram 2: Manufacturing Team Organizational Chart



Organogram 3: Sales Team Organizational Chart – Reorganized and funded exclusively by carbon finance.



Annex 4 Appendices

Appendix 4.1 Minutes of Stakeholder Consultation – see associated document

Appendix 4.2 Product Cost and Income Statement

The table below shows that a shortfall exists between monthly product cost and income. The company is accruing debt at a rate of about $10,000,000 Shillings per month (not including carbon payments). Because no banks will loan, the debt is accruing to employees who aren't being paid, and to the national social security administration. The debt accumulation rate confirms the operating loss estimate of this income statement.

Income (Non Carbon) Small Stoves		
Daily Stove Production		50
Monthly		1300
Average Sale price		12000
Monthly Income	15,600,000	
% Collected		90%
Total	**14,040,000**	
Income (excl carbon finance) Institutional Stoves		
Monthly		3
Average Sale price		1000000
Monthly Income	3,000,000	
% Collected		90%
Total	**2,700,000**	
Total Monthly Income	**16,740,000**	
Expenses (Variable) Small Stoves		
Variable Labor Cost		2000
Raw Materials Cost		7000
Total Variable Costs Per Stove		9000
Total Variable Costs	**11,700,000**	
Expenses (Variable) Institutional Stoves		
Institutional Margin Estimate		20%
Variable Costs of Institutional Stoves	**2,400,000**	
Total Variable Expenses	**14,100,000**	
Expenses (Fixed)		

Salary	$	6,000,000
Allowances	$	2,000,000
Electricity	$	100,000
Brochures	$	100,000
Security	$	436,600
Marketing and Sales Costs (treated as overhead)	$	4,000,000
Transportation and Delivery	$	800,000
NSSF	$	600,000
Total	**$**	**14,036,600**
Total Monthly Expenses	**$**	**28,136,600**
Operating Gain (Loss)		**(11,396,600)**

Appendix 4.3 Further Information on Quality Assurance

The controls to ensure there are no double counting of the stoves under this project start at the production stage. When production is planned, the required raw materials are determined and procured. After production, the production records are prepared and passed over to the Production Manager (see the organograms presented in Annex 2 in context of the Monitoring plan) who has the responsibility of reconciling the actual production against material purchased. Any discrepancies are resolved and the actual number of stoves produced by size is recorded.

Based on the orders received from the retailers (which must be in writing), deliveries of stoves are made against delivery notes and invoices which are also recorded and records are maintained. On a weekly basis, the stoves deliveries/sales are reconciled with the production and it is the responsibility of the Sales and marketing Manager to ensure that the weekly sales figures are reconciled with the production.

On a weekly basis, the Sales Executives collect the actual sales made by the retailers, the stock balances of each type of stove at the retailers and reconcile them with the deliveries made to the particular retailer. Records of stoves sold directly by Ugastoves are also maintained and reconciled by Ugastoves in a similar manner.

All the procurement records are maintained in hard copies while the production and sales records are maintained electronically in a computerised system. For data security, the Production Manager backs up the weekly data on a CD which is stored in a remote location. The weekly CD made at the end of the month becomes the monthly back up and the earlier weekly CDs are reused.

On a quarterly basis, the third party expert (expected to be the Centre for Integrated Research and Community Development Uganda or CIRCODU) in charge of quality control validates and verifies the process for gathering the data and the accuracy of the data, and confirms that the records are accurate. A report is produced after the quarterly records validation and verification process by the third party expert. The report is circulated to CEIHD, JPMorgan ClimateCare and Ugastoves Production Manager and the Sales and Marketing Manager.

The Accountant is responsible for inputting the data into the computer system. The Account is also responsible for analysis of the data in the system. The Production Manager and the Sales and Marketing Manager are each responsible for ensuring the accuracy and correctness of the data from their respective areas of work.

Since the stoves are counted and reconciled from the production to the sales stages, there is no risk of double counting as this will be detected and rectified at the various reconciliation steps in the process.

Also since there is only one coordinator, Ugastoves, double counting is not likely. A warranty card system, with control serial numbering, has also been introduced. Once fully operational, the warranty card numbering system will provide a second control against double-counting.

The organisation structure for the implementation of the project is attached to this PDD.

Presently, there is no cook stove project activity that is claiming any carbon credits. However, should such a project be implemented in future, the contracting with retailers will be revised so as to ensure separation of the Ugastoves sales from any other stove sales records that they could be keeping.