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

*Improved Household Charcoal Stoves in Mali*

(GS-VER-PDD)

Developed by E+Carbon
according to the "Indicative Programme, Baseline, and Monitoring Methodology for Improved Cook-Stoves and Kitchen Regimes Version 1."

Version 3.1 – Registration

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This document was developed by: ECOFYS

The Gold Standard for VERs has received financial support from:
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**VOLUNTARY OFFSET PROJECTS**

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

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Annexes

## SECTION A. General description of project activity

### A.1 Title of the project activity

Title: Improved Household Charcoal Stoves in Mali
Version: 3.1
Date: 5 September, 2009

PDD Version history:
Version 1.0 – pre-validation
Version 2.0 – validation, uploaded to GSP
Versions 2.1-2.6 – subsequent validation revisions
Version 3.0-3.1 - registration

### A.2. Description of the project activity

**FORESTS AND THE FORESTRY SECTOR**

*Mali is a Sahelian country with more than half its area covered by the Sahara Desert, about one-third seriously endangered by desertification and only about 15 percent favourable to plant production. Forests occupy about 10.8 percent of the land area (13.2 million hectares). Problems of degradation of wooded areas are especially acute in Mali, where combating desertification is a national priority, as are the search for food self-sufficiency and combating poverty.*

*The main forest problems are the spread of cropping on cleared land, heavy pressure from grazing, bush fires and overexploitation of fuel wood resources … These problems are compounded by persistent drought and an annual population growth of more than 2.2 percent.*

*Forest resources and land are of strategic importance for the population's well-being and for the country's prospects of development. Apart from the importance of fuel wood and timber, non-wood forest products - fruit, nuts, baobab leaves, raffia, fodder for livestock, bush meat, medicinal plants, honey and edible oils - should also be noted."*

*–United Nations Food and Agriculture Organization*[1]

Fuel wood and charcoal (together referred to as wood fuel) meet between 80[2] and 90% of Mali's fuel requirements[3]. Although wood continues to dominate national energy consumption, charcoal use in both rural and urban areas is

[1] http://www.fao.org/forestry/site/18308/en/mli/

[2] Schema Directeur d'Approvisionnement (SDA) en bois energie de Bamako (2006) Ministry of Mines, Energy and Water, Mali

[3] http://www.fao.org/countryprofiles/index.asp?lang=en&iso3=GHA&subj=5

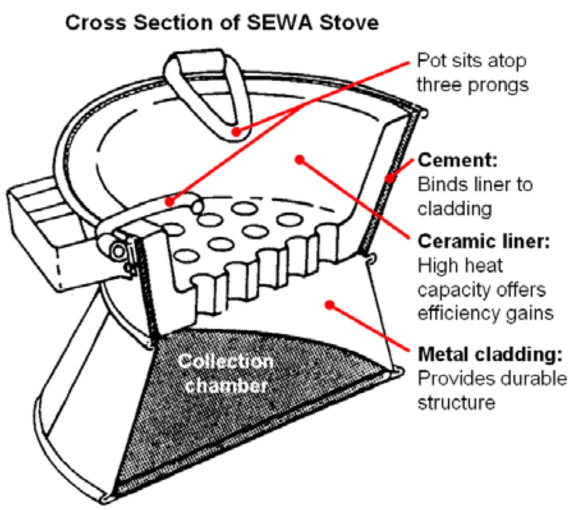
increasing. In 1997, charcoal replaced wood as the primary fuel in Bamako[4], and the positive trend is expected to continue. Fuel-switching from wood to charcoal in city centers is primarily due to changes in the socioeconomic characteristics of urban households that make charcoal a more attractive fuel. The total annual per capita consumption of charcoal countrywide is growing by 10% a year.[5]

The project described herein will reduce greenhouse emissions by dissemination of fuel-efficient charcoal stoves. The project is based on pilot work by Katene Kadji, Mali. Katene was established in 1995 and has been selling improved biomass cook stoves in Mali since 1997. It is owned and managed by Ousmane Samassekou, a highly educated entrepreneur who has started other businesses in Bamako, Mali, and Delhi, India.

Five categories of stoves will be marketed on a large-scale under the auspices of the project. Each features the same design in different size depending upon household size or application. The five categories are:

a. Extra Large
b. Large
c. Medium
d. Small
e. Tea

The improved charcoal stove (SEWA stove) reduces fuel consumption by introduction of a ceramic liner that increases combustion efficiency and retains heat. The SEWA stove consists of hourglass shaped metal cladding with perforated interior ceramic liner that allows ash to fall to the collection chamber at the base. A thin layer of cement is placed between the cladding and the liner. During use, a single pot rests at the top of the stove. See diagram below for further details. The design of all five sizes listed above is identical.




4 World Bank. 2000. ESMAP Household Energy Strategy. Leaflet.

5 ftp://ftp.fao.org/docrep/fao/009/j5838e/j5838e00.pdf

The SEWA stove is one of many variants of the Kenya Jico stove. The Ghanaian GYAPA stove is another variant of the Jico that is nearly identical to the Malian SEWA stove. A 2002 study conducted in Ghana, found that the GYAPA stove was 37% more fuel-efficient than traditional methods[6], though a ceramic liner has the potential to improve fuel-efficiency by up to 50%[7]. While we are confident the SEWA stoves in Mali significantly reduce greenhouse gas emissions, they simultaneously provide co-benefits to users and families in the form of relief from high fuel costs, reduced exposure to health-damaging airborne pollutants, faster cooking (resulting in time-savings), and increased cleanliness and convenience.

Before the project start date, Katene manufactured and sold stoves with the help of various subsidies and aid organizations. Katene received financial support from AMADER[8], a government entity that focuses on initiatives to improve household energy and rural electrification in Mali. This support enabled Katene to lower their prices and make their stoves more affordable to their target market. One of AMADER's goals has been to help facilitate the dissemination of 500,000 improved stoves (both SEWA and other types) in Mali by 2009. However, to reach this goal, collaboration and innovative new approaches such as carbon finance will be necessary since AMADER no longer supports Katene or the efficient stove industry. In 2007 Katene also received machines for a new metal cladding workshop from the German aid organization GTZ. These machines, which are a subsection of Katene's overall manufacturing equipment, are still used today. GTZ no longer provides any support to Katene and prior support was provided in a single disbursement for the aforementioned equipment. Finally, Enterprise Works provided training and marketing services in the late 1990's and early 2000s. Since the project start date, there has not been any development aid funding the project.

Katene made plans in 2007 to secure carbon finance with a view to a major expansion effort that would allow the SEWA stove to be sold at affordable prices to poor customers, and that would dramatically increase sales (see Table A.2). Table A.2 projects the expected volume of sales of SEWA improved charcoal stoves, assuming stoves are installed at a consistent rate through the year, and projects annual offsets based on the conservative assumptions that 20% of the stoves sold cease to be used each year, charcoal is 59% non-renewable, and approximately 219kg of charcoal are saved annually per household using an improved SEWA stove.

The operational lifetime of each improved stove is an important factor, since greenhouse gas (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. The actual drop-off in customer numbers is expected to be less than 20% per year, due to quality assurance measures, and should be monitored carefully by the project. Actual drop-off rates will be substituted for this conservative estimate of 20%; equally the potential drop-off in performance of aging stoves will be measured and the results applied to GHG emission reduction calculations.

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[6] http://www.shellfoundation.org/index.php?newsID=372
[7] http://www.shellfoundation.org/index.php?newsID=419

[8] *Reform of the energy sector has led to the creation of AMADER, a government entity created in 2002 to support rural electrification, urban and household energy issues. AMADER receives its financial support from the World Bank.*

Currently inefficient and polluting cooking regimes are deeply established throughout West Africa and in Mali in particular. With carbon finance this project aims to break the mould and move large populations away from conditions under which GHG emissions are unacceptably high and health effects are unacceptably harmful for the women and children spending long hours each day in traditional kitchens.

Carbon finance provides a basis for maintaining a professional commercial relationship between the user and the disseminators, while also introducing a quality guarantee and an ongoing monitoring and evaluation component. 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 new widespread prevailing practice involving significantly reduced GHG emissions and less-polluted kitchens. The quality assurance system (currently under consideration) will extend the working life-times of the stoves and maintain performance levels by providing free replacement of vulnerable components. It is expected that this strategy will help secure customer loyalty and so strengthen an overall shift of customer preference toward high-efficiency stoves. The effect will be to galvanize competition in the same direction, so securing widespread dissemination of low-emission cooking.

Table A.2 Projected Annual Sales and Annual Offsets

**Fuel-Specific Parameters**

| | Type of fuel | Avg. NRB | EF CO2 | EF CH4 | EF N2O | Baseline Fuel Consumption | Project Fuel Consumption | Average Fuel Savings |
|---|---|---|---|---|---|---|---|---|
| | | % | tCO2 | tCO2e | tCO2e | kg/hh_day | kg/hh_day | kg/hh_day |
| Biomass 1 | **Charcoal *** | 51.00% | 5.106 | 1.141 | 0.096 | 2.41 | 1.79 | 0.62 |
| Biomass 2 | **Wood** | 54.00% | 1.747 | 0.401 | 0.054 | 1.25 | 1.00 | 0.25 |
| Biomass 3 | 0 | 0.00% | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Alternative fuel 1 | 0 | - | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Alternative fuel 2 | 0 | - | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Alternative fuel 3 | 0 | - | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |

**Stove sales and Usage Parameters**

| | |
|---|---|
| Initial Sales (1st year) | 20000 |
| Annual Sales Growth (%) | 10% |
| Avg. Annual Leakage (%) | 0% |
| KS Adjustment Factor | 1.00 |
| Avg. Annual Sales | 31875 |
| Avg. Stove lifetime (yrs) | 3 |

**Annual Usage and Sales Rates**

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Project Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | Calendar Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Stove Usage Rate: | (% in use at end of year) | 90% | 70% | 50% | 30% | 10% | 0% | 0% | 0% | 0% | 0% |
| | **Annual Sales:** | **20,000** | **22,000** | **24,200** | **26,620** | **29,282** | **32,210** | **35,431** | **38,974** | **42,872** | **47,159** |

**Conservative Project Emission Reductions (tCO2e)** — **Fuel Savings Adjustment Factor: 1.00** — **Leakage: 0%**

| **Carbon Flows** | | **Project Year** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Offset Vintage** | **Stoves disseminated** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **2008** | 20,000 | 9,325 | 17,064 | 13,646 | 9,744 | 5,852 | 2,422 | 482 | 0 | 0 | 0 |
| **2009** | 22,000 | 0 | 10,258 | 18,770 | 15,011 | 10,742 | 6,414 | 2,664 | 530 | 0 | 0 |
| **2010** | 24,200 | 0 | 0 | 11,284 | 20,647 | 16,551 | 11,777 | 7,055 | 2,930 | 583 | 0 |
| **2011** | 26,620 | 0 | 0 | 0 | 12,412 | 22,769 | 18,149 | 12,955 | 7,761 | 3,227 | 638 |
| **2012** | 29,282 | 0 | 0 | 0 | 0 | 13,728 | 24,971 | 19,963 | 14,250 | 8,552 | 3,534 |
| **2013** | 32,210 | 0 | 0 | 0 | 0 | 0 | 15,100 | 27,468 | 21,960 | 15,710 | 9,373 |
| **2014** | 35,431 | 0 | 0 | 0 | 0 | 0 | 0 | 16,610 | 30,215 | 24,213 | 17,224 |
| **2015** | 38,974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18,272 | 33,320 | 26,550 |
| **2016** | 42,872 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20,208 | 36,543 |
| **2017** | 47,159 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22,229 |
| **0** | **Carbon Volumes (tCO2e)** | **9,325** | **27,321** | **43,699** | **57,813** | **69,641** | **78,833** | **87,198** | **95,918** | **105,813** | **116,091** |
| | | | | | | | | | **5-year total =** | **207,800** | **tCO2e** |
| | | | | | | | | | **10-year total =** | **691,651** | **tCO2e** |

* Charcoal emissions factors include emissions from both combustion and production of charcoal.

Note that table A.2. projects offsets assuming that the project will sell exclusively the "medium" stove for purposes of simplification. However, calculation of the emission savings during each monitoring period throughout the project will be based on the actual number of different size stoves sold and their associated fuel savings.

The sustainability analysis assesses the project in terms of environmental and sustainable development impact. An overall score, according to the Sustainable Development Matrix, is achieved as follows:

| Sustainable Development Matrix | | Score (-2 to 2) |
|---|---|---|
| Local/Regional/global environment | | |
| | Water quality and quantity | 0 |
| | Air quality* | 2 |
| | Other pollutants* | 0 |
| | Soil condition | 0 |
| | Biodiversity | 1 |
| *Sub-total* | | 3 |
| Social sustainability and development | | |
| | Employment quality* | 1 |
| | Livelihood of the poor* | 2 |
| | Access to energy services* | 1 |
| | Human and institutional capacity | 1 |
| *Sub-total* | | 5 |
| Economic and technological development | | |
| | Employment (numbers)* | 1 |
| | Balance of Payments (sustainability) | 0 |
| | Technological self-reliance | 1 |
| *Sub-total* | | 2 |
| TOTAL | | 10 |

Sustainable Development Assessment:

## Greatest Positive Impacts

1. 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 acute lower respiratory infections (for example, pneumonia) as well as many other respiratory, cardiovascular, and ocular diseases. In Mali, exposure to indoor air pollution (commonly measured by the pollutants carbon monoxide and fine particles) is responsible for the annual loss of 1,290,000 disability-adjusted

life-years (DALY)[9]. The DALY is a standard metric used by the World Health Organization (WHO) to indicate the burden of death and illness due to a specific risk factor. The WHO also estimates that exposure to indoor air pollution is responsible for 38,100 deaths per year in Mali.

**Monitoring Indicator*: Indoor air pollution is assessed qualitatively in the Kitchen Survey (KS) and may be monitored quantitatively during the project by measuring ambient carbon monoxide and particulate matter concentrations in households with improved and unimproved cookstoves.

2. Livelihood for the poor: Livelihood circumstances will be improved since the improved stoves reduce fuel costs. On average, a household using a medium sized stove saves about US$25 per year for an initial investment of $5.33. (resulting in a payback period of 2.66 months per stove[10]). The SEWA stove contributes to reduction in energy budgets on charcoal by about 25%. Fuel savings estimates are based on the results of the Baseline Kitchen Performance Test (KPT).

   **Monitoring Indicator*: Monetary savings due to reduced fuel consumption will be monitored throughout the project in the ongoing KSs. Cost savings will be self reported by end users as well as calculated based quantitative fuel savings and average local fuel prices at that time.

Additional Positive Impacts

3. Biodiversity: Biodiversity will be improved through the stove program reducing pressure on remaining forest reserves. This is especially important in Mali where the expansion of the Sahel is encroaching upon many habitats and forest resources and diversity are diminishing[11][12]. Although important to the project impact, biodiversity is not crucial for an overall positive impact on sustainable development since there is only an indirect linkage between improved biodiversity and efficient stove use. As such, as outlined in the GS VER guidelines, tracking this indicator is not necessary.

4. Employment: The improved stoves give rise to employment opportunities for enterprises manufacturing, distributing, retailing, and maintaining the stoves (though this may be offset by reduced employment for charcoal makers and sellers). Katene currently directly employs 9 ceramic liner artisans and 2 metal cladding artisans. Katene also supplies ceramic liners to 8 independent shops where artisans external to Katene manufacture and attach metal cladding and sell completed stoves. With carbon finance, Katene expects to directly employ 10 new artisans and indirectly create over 400 jobs: 130 new external artisans, 260 new dealers and retailers, and 22 new distributors. The project proponents regonize the need to train new employees if this business is to

[9] World Health Organization, December 2004, at http://www.who.int/healthinfo/bod/en/index.html.

[10] Charcoal savings number from independent Berkeley Air Monitoring Group baseline study while the price of charcoal from ‘Schema Report’, 2006, Agence Malienne pour le Déceloppement de l’Energie Domestique et de l’Electrification Rurale , pg 48’ In fact, charcoal prices vary from time to time based on the price of LPG and other goods.

[11] http://na.unep.net/atlas/profiles/english/Mali.pdf

[12] http://www.fao.org/forestry/23747/en/mli/

grow to meet expectations. The owner of Katene Kadji, Ousmane Samassekou, is a skilled entrepreneur with a long history of growing businesses and providing the needed employee training to do so. He is able to conceive of and implement scaleable solutions to training and employee management, and the project proponent is not concerned about his ability to scale this portion of the business given sufficient availability of funding.

**Monitoring Indicator*: Changes in employment at Katene will be monitored directly and indirect job creation will be estimated based on increased sales volumes and known capacity growth among dealers, distributors, retailers, etc. Employment quality will be qualitatively assessed by observing employment conditions, working hours, safety precautions and other critical determinants of employment quality.

5. <u>Access to energy services:</u> Urban householders will have improved access to energy (estimated at 30-60% more effect from the same fuel). With increased sales of efficient stoves, households will enjoy greater access to energy services for cooking.

   **Monitoring Indicator*: The number of people gaining access to improved energy services will be tracked based on total sales and average household sizes.

6. <u>Human and institutional capacity:</u> Human capacity is raised through the business development component of the project. Contact details for several artisans are listed in the Stakeholder Meeting Minutes (Annex 5) and they may be contacted to examine capacity increases arising directly from carbon finance over the course of the project. Although important to the project impact, this indicator is not crucial for an overall positive impact on sustainable development. As such, as outlined in the GS VER guidelines, tracking this indicator is not necessary.

7. <u>Technological self-reliance:</u> The introduction of locally manufactured technology with optimized energy efficiency helps to build technological self-reliance. Contact details for several artisans and Mali's Designated National Authority are listed in the Stakeholder Meeting Minutes (Annex 5) and they may be contacted to examine increases in technological self-reliance arising directly from carbon finance over the course of the project. Although important to the project impact, this indicator is not crucial for an overall positive impact on sustainable development. As such, as outlined in the GS VER guidelines, tracking this indicator is not necessary.

Neutral Impacts

8. <u>Soil condition, water quality and quantity, and other pollutants:</u> The cookstove manufacturing process is environmentally friendly, as indicated by the Project Letter of Approval from the Malian DNA (Annex 3), which requires all projects to meet national and regional environmental regulations. This indicator is not crucial for an overall positive impact on sustainable development. As such, as outlined in the GS VER guidelines, tracking this indicator is not necessary.

9. <u>Balance of payments:</u> Not applicable. This indicator is not crucial for an overall positive impact on sustainable development. As outlined in the GS VER guidelines, tracking this indicator is not necessary.

10. Other pollutants: Although pollutants are not expected to be a negative impact of the project, this issue was discussed briefly during the stakeholder consultation and will therefore be monitored throughout the course of the project.

**Monitoring Indicator*: The project will monitor whether paint, paint thinner and other manufacturing waste is dealt with and disposed of properly throughout the course of the project.

Negative Impacts

No known negative indicators arise from the project activities.

## A.3. Project participants:

| Name of Party involved<br>((host) indicates a host Party) | Private and/or public entity(ies) project participants<br>(as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Mali<br>USA | Katene Kadji<br>E+Carbon | No<br>No |

## A.4. Technical description of the project activity:

### A.4.1. Location of the project activity:

*Source: [http://www.lonelyplanet.com/maps/africa/mali/](http://www.lonelyplanet.com/maps/africa/mali/)*

The project promotes sales of improved charcoal stoves initially in the urban and peri-urban communities in the Greater Bamako region. The company's distribution network will gradually be expanded to cover major towns and market centers in all regions of the country, including Timbouctou, Kidal, Gao, Mopti, Segou, Sikasso, Koulikoro, and Kayes, through the use of retail points and commission earning agents. For more details on project boundary and how it is defined in the context of the methodology, see section B.4.

According to Katene staff, the charcoal burned in the SEWA stoves is normally sourced from the savannah zones of southern Mali. The Ministry of Energy in Mali defines the supply area as a basin radiating out 200km in each direction from the city. The primary production areas supplying Bamako are found in four administrative regions: Koulikoro, Sissako, Segou and Kayes[13]. Production of charcoal tends to be small-scale and is often organized on a village level[14]. Women are the primary agents in charcoal production[15], which is a dangerous and ill-paying profession. For a detailed description of the non-renewable biomass assessment performed, see the baseline study in annex 6.

Over-dependence by most of the population on charcoal and fuel wood as energy sources has heightened the threat of deforestation and desertification in many parts of the country[16]. The burden of this reliance is carried by natural

[13] FAO Mali country website

[14] Girard, P. 2002. Charcoal production and use in Africa: what future?. Unasylva

[15] Energia News Vol 4 Nr 2, 2001: [http://doc.utwente.nl/42778/1/Sanogo01tale.pdf](http://doc.utwente.nl/42778/1/Sanogo01tale.pdf)

[16] Atakora, S. Biomass Technologies in Ghana. Kumasi Institute of Technology and Environment (KITE). Accessed at: http://www.nrbp.org/papers/046.pdf

forests, as tree plantations have proved less lucrative in Mali than in neighbouring countries[17]. More than 500,000 ha of forests disappear annually in the country[18]. As sources, especially those in the periphery of large urban zones, become depleted and if proper forest management and practices are not implemented, it can be reasonably expected that Charcoal production in Mali, in addition to harvest for fuel wood, construction, agricultural clearing and other needs, presents an ongoing, increasing and significant threat to local forest resources[19].

Accurate and up-to-date data on the charcoal production and consumption profile of Mali is difficult to obtain through desk research. As such, in-country fieldwork was conducted from March 5- March 21, 2008. Section B 2.2 describes the non-renewable biomass baseline research activities.

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

Mali (GIE Katene Kadji is local project participant)

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

Mali

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

Initially urban and peri-urban communities in the Greater Bamako region; the company's distribution network will gradually be expanded to cover major towns and market centers in all regions of the country, including Timbouctou, Kidal, Gao, Mopti, Segou, Sikasso, Koulikoro, and Kayes. See section B.4. for complete summary of project boundary definitions in the context of the methodology.

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

Katene is the implementing organization and will conduct the project from its offices in the capital city of Bamako.

Contact Person(s): Erik Wurster, Manager, Carbon Finance
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Tel: +1.917.225.0125

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[17] Maïga, A. 1999. *Ressources forestieres naturelles et plantations, Cas du Mali.* CE-FAO Programme Partenariat (1998-2000) Projet GCP/INT/679/EC.

[18] Schema Directeur d'Approvisionnement (SDA) en bois energie de Bamako (2006) Ministry of Mines, Energy and Water, Mali

[19] FAO Mali country website

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A.4.2. Size of the project:

Large-scale (more than 60,000 tonnes of CO2 saved per year)

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:

See section B.3. for full additionality rationale.

No ODA funding is being used to purchase VERs and a confidential excerpt from E+Carbon's sales contract for all VERs generated can be provided upon request as a confidential annex to support this statement.

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

| Years | Annual estimation of emission reductions in tons of CO2e |
|---|---|
| 2008 | 9,325 |
| 2009 | 27,321 |
| 2010 | 43,699 |
| 2011 | 57,813 |
| 2012 | 69,641 |
| 2013 | 78,833 |
| 2014 | 87,198 |
| 2015 | 95,918 |
| 2016 | 105,813 |
| 2017 | 116,091 |
| Total emission reductions (tons of $CO_2$e) | 691,651 |
| Total number of crediting years | 10 |
| Annual average over the crediting period of estimated reductions (tons of $CO_2$e) | 69,165 |

## SECTION B. Application of a baseline methodology

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

This project reduces greenhouse gas emissions by facilitating significant savings in the use of non-renewing biomass. This Project Design Document follows the Gold Standard VER Methodology titled "Indicative Programme, Baseline, and Monitoring Methodology for Improved Cook-Stoves and Kitchen Regimes Version 1".

The baseline scenario is based on continued consumption of non-renewable biomass at unsustainable rates, as is currently taking place as outlined in section A.2. The project employs an evolving non-renewable biomass baseline to take into account changing renewability of fuel within Mali over time and to account for the fact that stove installations occur gradually across different geographies within Mali rather than all at one time.

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

Taking the applicability criteria outlined in the methodology in turn, the methodology is applicable to the project activity because:

1. Low emissions cookstoves are replacing a relatively high-emission baseline scenario, as evidenced by the results of the baseline study conducted by Berkeley Air Monitoring Group, which quantifies the baseline scenario and project scenarios. Moreover, the project employs a system whereby end users are offered an additional discount on an efficient stove if the purchase is accompanied by surrendering a functioning inefficient stove of roughly similar cooking capacity. This provides an incentive to more quickly phase out inefficient stove use. Surrendered inefficient stoves are destroyed and sold for scrap metal to avoid them being resold into the market and used again. The initial discount is an additional 20% below the posted price, however, Katene reserves the right to adjust this rate based on market conditions.
2. The project boundary can be and is clearly defined in section B.4. of this PDD.
3. The stoves counted are not part of any other voluntary or compliance carbon finance project. In addition to the project proponent not being aware of any other carbon finance activities in the country around this technology, double counting is also avoided by E+Carbon's legally robust system of 2$^{nd}$ tier ERPAs, whereby all participants in the efficient stove industry with whom Katene Kadji does business are asked to sign contracts that would reveal any possible double counting. A full paper trail of all ownership rights to emissions reductions can be produced. Moreover, each end user, who is the default owner of emission reductions, is notified that they waive ownership of ERs upon sale of each stove. This is done via a rights waiver that is included inside each stove at point of sale to make the customer aware of them waiving ownership rights over emission reductions.
4. The project activity is limited to the stove sales within Mali. Any international stove sales are eliminated from the project activity.
5. There are no kitchens in the project activity that have more than 10 stoves per kitchen. Moreover, each stove has less than 50kW total output , as outlined in the calculations below:

| Wood and Charcoal Net Calorific Values (IPCC 2006 GL) | | | |
|---|---|---|---|
| | NCV (TJ/Gg_ch or MJ/kg_ch) | lower 95% | upper 95% |
| Wood / Wood waste | 15.6 | 7.9 | 31 |
| Charcoal | 29.5 | 14.9 | 58 |

Sample calculation (for large size stove)
NCV charcoal (MJ/kg) * thermal efficiency (%) * daily fuel consumption (kg/day) =29.5 MJ/kg * 0.35 * 2.2 kg/day = 22.715 MJ/day
22.715 MJ/day * 1 day/86,400 seconds *1000 KJ/MJ = 0.26 KJ/sec = 0.26 kW output

| Stove size | Fuel consumption (kg/day) per fuel adjustment factors | Thermal capacity (kW) |
|---|---|---|
| Extra Large | 3.5 | 0.42 |
| Large | 2.2 | 0.26 |
| Medium | 1.8 | 0.22 |
| Small | 0.7 | 0.08 |
| Tea | 0.4 | 0.05 |

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

The methodology is applied in a series of steps:

1. Determine customer groups or "clusters"

*Step 1.1: Establish a pilot Sales Record*

A pilot sales record was established by collecting the contact information of Katene customers. This was done through a combination of having customers complete their contact information on end user cards and sales people and surveying staff going house to house locating Katene customers.

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

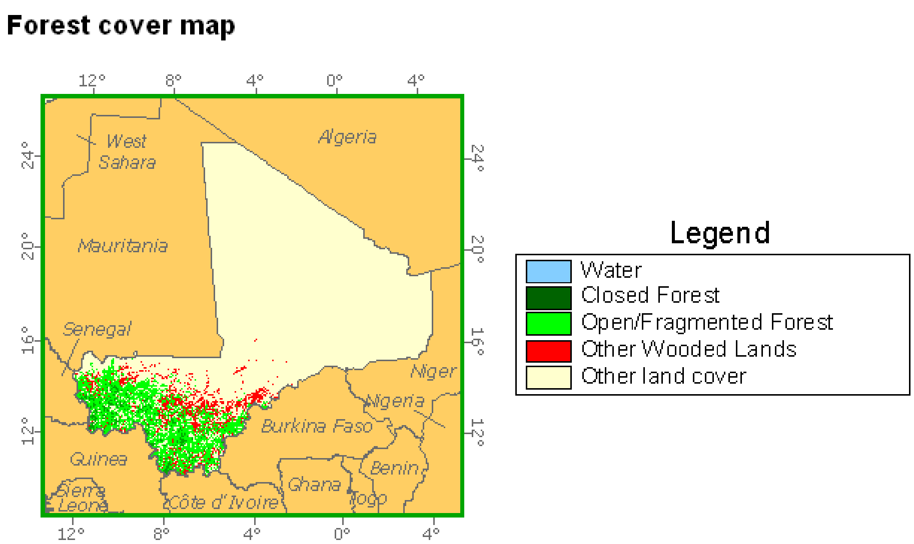
Berkeley Air Monitoring Group examined initial fuel mixture and kitchen regimes prior to determining possible clustering definitions. The entire Baseline Monitoring Study and Report was prepared by Berkeley Air Monitoring Group to avoid any conflict of interest in measurements that are central to emission reduction numbers and overall project profitability.

*Step 1.3: Analyze renewability status of wood-fuels*

In order to obtain the highest possible level of accuracy in regards to the renewability status of charcoal fuel in Mali, two weeks of 3rd party independent fieldwork was conducted by Berkeley Air Monitoring Group in March, 2008. Activities included: consultations and interviews with high-level staff members in the Ministry of Mines, Energy and Water, the Ministry of Forestry and the Ministry of the Environment. Interviews were also held with members of civil society organizations that have expert knowledge of fuel consumption, deforestation and other associated issues in the country. Lastly, site visits and interviews were conducted with rural foresters and charcoal makers in some charcoal-producing villages of southern Mali. These interviews generated information, literature, reports and data that could not be easily accessed through desk research.

1.3.1. Quantify non-renewable biomass[20]

(a) Establish supply area and mean annual increment




Map source: Global Forest Resources Assessment 2000, base map: ESRI

The vegetation in Mali corresponds to climatic zones[21]:

- Guinean savannah either tree or bush in the south, covering about 6% of the country. There are also areas of dry closed forest and gallery forest.
- Sudanian savannah, covering 27% of the country. It comprises savannah park (750 to 1 200 mm rainfall) and grass savannah (500 to 750 mm rainfall), and is the country's farming zone.
- Sahelian shrub steppe, covering 16% of the country, a livestock-raising zone.

[20] See annex 6 for full summary of process by which non-renewable biomass was quantified.

[21] Extracted from FAO Mali country website

- Sub desert tropical steppe with rainfall of 50 to 200 mm, covering 21% of the country.
- Desert, covering 30% of the country.

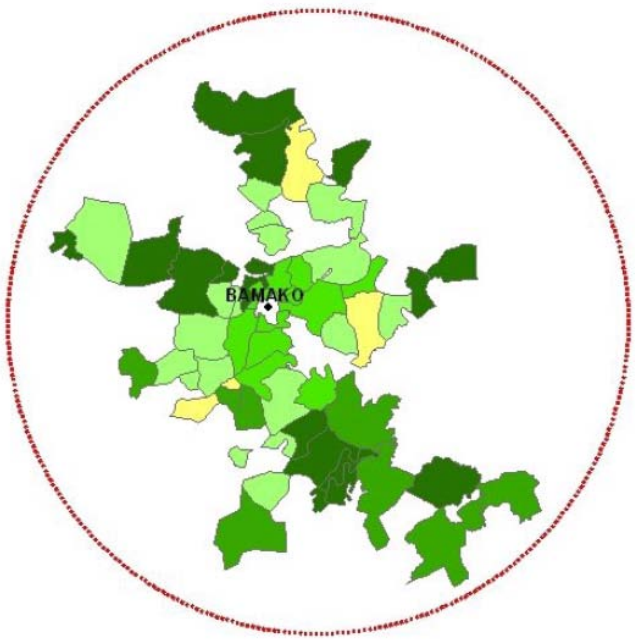
The vast majority of charcoal production comes from southern Mali where wood quality, vegetation, and soil texture are quite suitable for small charcoal production operations. Generally, the Bamako supply basin is defined as an area radiating out 200km in each direction from Bamako. Charcoal use is primarily a feature of urban life in Mali, and three major cities are located in this southern basin. The sustainability of the wood supply situation has become a problem in recent times due to the destruction of woodlands in the supply area, in part from harvesting for charcoal production. From 1994 to 2006, the area experienced an average annual deforestation rate of 6% (to compare, the annual rate of deforestation in Mali is approximately 1%[22] or 500,000 hectares each year[23]).

Given that during the kitchen surveys, target households reported using both charcoal and fuelwood as a household cooking fuel, both charcoal and fuelwood were analyzed for their non-renewability characteristics. We chose to further define the supply area as those sub regions within the Bamako woodshed providing Bamako's charcoal or fuelwood needs[24] (hereafter referred to as "fuel supply basin"), by relying upon an in depth study on the subject that identified 61 communes that supply charcoal or fuelwood needs to Bamako. The communes are outlined in the map[25] on the following page. Communes supplying any charcoal to Bamako total 3,630,607 hectares, while communes supplying any fuelwood to Bamako total 2,908,108 hectares.

[22] Food and Agriculture Organization of the U.N.: The State of the World's Forests 2003, Ministry of the Environment, Mali
[23] 2004 Masters Thesis from University of Sorbonne

[24] Schema directeur d'approvisionnement (SDA) en bois energie de Bamako : Rapport final", Agence Malienne pour le Developpement de l'Energie Domestique et de l'Electrification Rurale, 2006

[25] Schema directeur d'approvisionnement (SDA) en bois energie de Bamako : Rapport final", Agence Malienne pour le Developpement de l'Energie Domestique et de l'Electrification Rurale, 2006




(b) Establish annual harvest

The current annual wood fuel harvest (H) in the supply area is 4.1 million steres/year.[26]

(c) Quantify non-renewable biomass

As mentioned above, non-renewable biomass calculations were performed for both charcoal and wood since kitchen survey respondents reported using both fuels within their household cooking fuel mixture. The logic behind this approach is that when an efficient charcoal stove is introduced, consumption of both charcoal and of fuelwood will change as households adjust their balance of charcoal use versus fuelwood to reflect the new savings in charcoal.

Xnrb_charcoal analysis:

The information collected about the supply area and relevant annual harvest can be summarized and used to quantify the non-renewing biomass (NRB) in the area. This quantity is the total harvest (H) divided by the legitimate harvest of renewing wood, or mean annual increment (MAI). The total annual harvest of woodfuel is 4.1 million steres/year and the mean annual increment is 2.0 million steres/year[27].

The approach used is shown below:

[26] Ibid. According to this report 1 stere = 330 kg

[27] Schema directeur d'approvisionnement (SDA) en bois energie de Bamako : Rapport final", Agence Malienne pour le Developpement de l'Energie Domestique et de l'Electrification Rurale, 2006

MAI = total woodfuel growth in all communes that supply any charcoal to Bamako
= 2,035,048 steres

H = woodfuel harvest in all communes that supply any charcoal to Bamako
= 4,125,013 steres

% Non-renewability ($X_{nrb}$) = 1 - (MAI/H)
= 1 - (2,035,048/4,125,013)
= 0.51 (51%)

An in-depth sensitivity analysis was performed using different parameters to define the charcoal supply area for Bamako. The NRB fraction presented here is a conservative estimate from the sensitivity analysis, which is described in detail in the Baseline Monitoring Report (Annex 6).

Xnrb_wood Analysis:

The total annual harvest of woodfuel in the fuel supply area is 3.4 million steres/year and the mean annual increment is 1.6 million steres/year.

The approach is shown below:

MAI = total woodfuel growth in all communes that supply any fuelwood to Bamako
= 1,557,769 steres

H = woodfuel harvest in all communes that supply any fuelwood to Bamako
= 3,365,580 steres

% Non-renewability ($X_{nrb}$) = 1 - (MAI/H)
= 1 - (1,557,769/3,365,580)
= 0.54 (54%)

Thus, the best estimate of the percent non-renewability of the woodfuel used in Bamako is 54%.

This percentage is applied to the consumption of wood by the project population in both the baseline and project scenarios (since the project activity does not yet make any significant impact on either the harvest or increment quantities).

The corresponding calculations are:

An in-depth sensitivity analysis was performed using different parameters to define the wood supply area for Bamako. The NRB fraction presented here is a conservative estimate from the sensitivity analysis, which is described in detail in the Baseline Monitoring Report (Annex 6).

(d) Maintain conservativeness

The figures presented so far for harvest are under-estimated. Demand for wood has been growing rapidly in previous years and will continue to grow through the project period. Urban growth is very pronounced, and demand for construction timber is rising. General population growth is 2.7% per year[28], and the demand for charcoal is estimated to increase, in part, due to urbanization[29]. The figures quoted from recent studies reflect conditions in the past few years, and many of them need to be updated such that the non-renewable quantity at the start of the project is greater than estimated here.

The equation NRB = H – MAI must therefore be seen in terms of an increasing value of harvest (H) and a subsequent decreasing value of the mean annual increment (MAI), giving an increasing shortfall or a worsening non-renewable biomass condition though the project will have the effect of mitigating these trends.

*Step 1.4: Divide pilot Sales Record into customer groups or clusters*

Berkeley Air Monitoring Group determined possible cluster definitions, which would be later tested in the KSs they conducted. At this stage, Berkeley Air theorized that only one, or potentially two cluster criteria existed. The first cluster criterion considered was that of end users that use or do not use fuelwood. The second cluster criterion considered was stove size.

*Step 1.5: Carry out a qualitative survey (KS)*

Berkeley Air conducted KSs that profiled Katene customers based on various geographic, socioeconomic and demographic characteristics, all of which affect end user fuel use patterns. Further information was gathered from extensive review of the literature, and recommendations by the Katene staff.

Berkeley Air identified households by examining a cross section of Katene's existing customers and identifying three regions within Bamako in which to conduct KSs that they concluded would provide representative results. Within each of these areas, households were randomly selected (i.e. clustered random sampling).

More specifically, Berkeley Air estimates that approximately 50% of the 149 households sampled were taken directly from the detailed customer database of 613, and were not difficult to locate. Of the 50% that were taken from the database to survey, all were located and surveyed. The other 50% were sampled based on randomly selecting the neighbors of the first 50%. That is, once surveyors were in the field with the intent to survey specific households from the detailed customer database, they randomly came upon additional SEWA stoves in the field, which were incorporated in the kitchen survey.

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[28] CIA World Factbook https://www.cia.gov/library/publications/the-world-factbook/print/ml.html

[29] ftp://ftp.fao.org/docrep/fao/009/j5838e/j5838e00.pdf

As such, Berkeley Air is confident of the results as the method used employs a clustered random sampling approach and the sample size far exceeds that which is required in the methodology. More specifically, there are no characteristics that the surveyed customers have in common that are not shared by the rest of Katene customers.

*Step 1.6: Refine demarcation of clusters and populate project database*

Based on the KS performed, Berkeley Air determined that one cluster criterion should be used in the baseline assessment: that of *stove size*. The project population was therefore broken into 5 different clusters based on the 5 sizes of stoves offered.

2. Calculate baseline emissions

*Step 2.1: Estimate expected variation and improvement in emission reductions*

As Berkeley Air considered how they would design the Kitchen Performance Test (KPT), they estimated expected variation and improvement in emission reductions. They are professional statisticians who have significant experience with similar studies, and can readily estimate an appropriate approach in such cases.

*Step 2.2: Specify the units of emission reduction or fuel consumption*

Berkeley Air reported all of their emission saving numbers in kg per household per day, or kg/hh/day.

*Step 2.3: Make quantitative measurements (KPTs)*

In all cases, paired sampling for KPTs – sampling the same users before and after beginning use of a new cook stove - was performed. KPTs were performed on households with similar socioeconomic and demographic characteristics as Katene customers (as defined by the results from the KS), but who did not have stoves prior to the test. They were then provided with a stove for purposes of the test. Any households that already owned SEWA stoves were not included.

To attain fuel savings for each stove model, the lower bound of the 90% confidence interval is taken for each fuel and stove size. Daily charcoal savings parameters are adjusted based on the ratio of fuel saved to stove cooking capacity calculated for the KPT stoves and extended that to other sized stoves and then subtracting 15% from this total. This approach proved to be both quantitatively and technically rigorous as well as conservative. 45% of SEWA stove users in the KS use wood as secondary fuel. To be conservative, typical wood savings is estimated for average, grand and super grand stoves based on the KPT field measurements for the average and grand stoves and the prevalence of wood use as a secondary fuel. More details of the KS and KPT analyses used to develop the following fuel saving numbers are available in the full baseline monitoring report (Annex 6).

The lower bound of the 90% confidence interval of daily charcoal and fuelwood savings for each stove type is outlined below:

| ***Stove Type*** | ***Daily Fuel Savings (kg/HH-day)*** | |
|---|---|---|
| | ***Charcoal*** | ***Fuelwood*** |
| Super Grand | 1.32 | 0.25 |
| Grand | 0.94 | 0.25 |
| Average | 0.62 | 0.25 |
| Small | 0.26 | 0 |
| Tea | 0.16 | 0 |

*Step 2.4: Calculate baseline*

The CEIHD Household Energy Carbon Calculator (CHECC) is a detailed excel model developed by the Center for Entrepreneurship in International Health and Development (CEIHD) that estimates emission reductions of carbon dioxide, methane and nitrous oxide from improved cookstoves. The lower bound 90% confidence interval for fuel savings from the KPT were plugged into this model to project potential emission reductions. Annex 2 summarizes the input data and assumptions that were used in this model. CHECC is a new tool that will be available under license from CEIHD and is in the process of being validated for streamlined use in cookstove carbon offset programs.

3. Net leakage

The project has investigated, and will continue investigating, the following sources of leakage listed here. No significant sources of leakage were identified at this point in the project, but future offset calculations will be adjusted accordingly if significant sources are later identified:

a) The project stimulates increased use of non-renewing biomass (for example, or by stimulating families to eat more or cook more, due to savings in charcoal use). This is sometimes referred to as the 'rebound effect.' This is accounted for in the paired KPT design, as explained below.

b) The project stimulates increased use of non-renewing biomass by virtue of reducing pressure on the resource (for example by lowering prices of charcoal). This is partially accounted for in the paired KPT design, as explained below.

c) Users of efficient stoves replace lower emissions technology than the improved stove. For example, switching from inefficient fuelwood to efficient charcoal can yield an increase in overall emissions in some cases. This is accounted for in the paired KPT design, as explained below.

d) Improved stove users compensate for loss of the space heating effect of inefficient cook-stoves by adopting some other form of heating, such as open fires, or by retaining some use of inefficient stoves. This is accounted for in the paired KPT design, as explained below. In addition, this effect is not relevant in the context of Mali.

e) The traditional charcoal stoves replaced by the improved stoves are re-used by the same families or other families in a manner suggesting increased consumption of charcoal beyond the baseline demand level. This is accounted for in the paired KPT design, as explained below. In cases where replaced stoves are used by other families, they do not replace efficient stoves and therefore do not yield a net increase in emissions. Furthermore, an inefficient stove buyback system is in place, which provides incentives to surrender inefficient stoves in exchange for a discount on efficient stoves. See applicability criteria 1 in section B.1.1. for more details.

f) Manufacture, distribution, or use of the improved stoves gives rise to new emissions associated with transport or manufacturing. Evidence exists that this effect is more than compensated for by reduction in transport emissions due to decreases in charcoal use, as explained below.

The quantitative results of the KPT subsumes[30] the potential sources of leakage a, c, d and e, above. Because the KPT represents fuel savings in actual households, the results already incorporate the effects of these potential leakages.

Should a decrease in price of charcoal as a result of decreased demand result in increased charcoal use (effect b above) a paired KPT will account for increased charcoal use within the project boundary, but not outside of the project boundary. Periodic assessment of NRB baseline as part of the monitoring methodology will inform whether this leakage parameter should be adjusted in the future.

Leakage from transport or manufacturing (effect f above) is also not addressed by the KPT. However, it appears to contribute to surplus emission reductions (from reduced charcoal shipments to Bamako) as much, if not more, than it contributes to leakage.

The potential sources of leakage discussed above will be followed throughout the project period.

## 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:

The project will reduce the amount of GHGs emitted through reduced use of charcoal as a cooking fuel, by introducing widespread use of efficient charcoal stoves that will replace existing inefficient stoves.
The project has not previously been announced for implementation without seeking carbon finance within the last 3 years.

[30] Kitchen Performance Tests are conducting using paired tests and measurement of real, observed reductions in charcoal usage in the field. That is, a household's charcoal use is measured for a period of three days in the absence of a SEWA stove. The family is then provided with a new SEWA stove and is not told specifically to use only the new stove. Charcoal use is then measured for a three day period with the SEWA stove. Charcoal savings is calculated by subtracting usage before the SEWA stove from usage after. Our emissions reduction projections, improved indoor air indicators and other variables that depend upon lower charcoal consumption are derived from these robust, third party measurements.

The UNFCC Additionality Tool (Version 5.2) requires that 4 steps are taken to investigate whether or not the emission reduction would be achieved in the absence of the project activity. Taking these 4 steps in turn:

1. *Identify alternatives to the project activity that are consistent with mandatory laws and regulation.*

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

Four credible alternatives to the project activity exist. 1) First, the project activity could proceed without being registered as a Voluntary Gold Standard project. 2) Alternatively the target population could continue to cook using the same inefficient cooking technology and consume greater amounts of fuel. 3)The target population could also cook with another fuel, such as liquefied petroleum gas (LPG). 4) Finally, the target population might also cook using a solar cooker. Although solar cookers can only be used when the sun is shining and LPG produces a different taste in the food that introduce some cultural barriers, broadly speaking, these alternatives would provide a similar level of service, at least in the near term. Over the long term, continuing the business-as-usual scenario could lead to fuel shortages, thereby decreasing service levels.

*Sub-step 1b : Outline consistency with Malian law*

These alternatives are consistent with Malian law since there is no legislation in Mali that requires the use of efficient stoves. Moreover, none is expected to be introduced during the project period.

*(proceed to step 3, "barrier analysis" since an investment analysis will not be applied)*

3. *Barrier analysis*

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

- *Financial barrier*

With respect to additionality, the Gold Standard VER methodology being applied states that, "the project proponent must show that the project could not or would not take place without the presence of carbon finance. Possible reasons may be that the initial investment… (is) …not affordable to the target project population in the form of high stove prices."

Evidence gathered from end users, independent artisans, retailers, Katene's staff, government officials[31] and experts[32] suggests that at unsubsidized prices Katene stoves are unaffordable to the majority of Malians whose average GDP per capita (PPP) is $1,000[33]. With the addition of carbon finance, efficient charcoal stoves will be

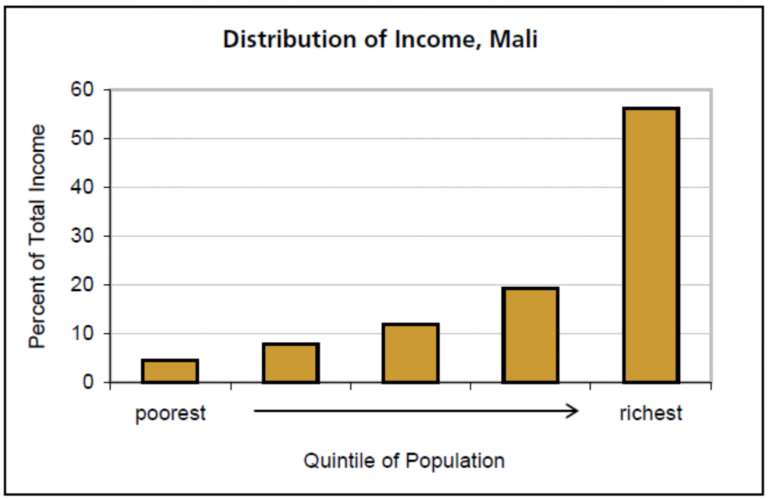
[31] Signed letter from AMADER stating that cost is a major barrier to adoption of efficient stoves.

[32] Barnes, Douglas et al. *What Makes People Cook with Improved Biomass Stoves?* World Bank Technical Paper. http://ehs.sph.berkeley.edu/krsmith/publications/94_barnes_1.pdf

[33] https://www.cia.gov/library/publications/the-world-factbook/geos/ml.html

cheap enough for lower income households in Mali to afford them. That is, some carbon revenues will act as a direct subsidy so that efficient stoves are cost competitive with their business-as-usual counterparts. At unsubsidized prices, purchasing a SEWA stove accounts for several percent of annual incomes and the ability for users to save this amount of money to purchase the stove is extremely limited.

Yet GDP per capita does not tell the whole story with respect to the target population's ability to afford efficient stoves. This is because income distribution is extremely uneven in Mali. In fact, the 20% wealthiest Malians control 56.2% of the nation's wealth, while the 20% poorest only control 4.6%. 72.8% of Mali's population lives on less than $1/day[34]. Since the target population is among the nation's poorest, these stoves without carbon revenues to subsidize their price represent a significant investment for this population. The graph below shows the distribution of income in Mali by quintile:



[35]

Although sales levels have been high in the past (they have steadily dropped since the project start date and are currently at zero as explained in next barrier), high sales was only possible because Katene was selling stoves below cost in hopes of realizing carbon revenues to fill this gap (see next barrier for further explanation). Moreover, prior to the project start, stoves were subsidized by grant funding from AMADER that is no longer available[36]. Once AMADER reached their original goad to disseminate a certain number of stoves, they discontinued the program.

In the absence of carbon revenues, consumer financing mechanisms are also needed to increase affordability of the stoves. The project developers are not aware of large scale stove initiatives in Mali that have received microfinance support or conventional loan support to significantly increase capacity. There is an organization that has the intent

[34] World Resources Institute, Economic Indicators – Mali, 2003. Accessed on 29 May, 2009: http://earthtrends.wri.org/pdf_library/country_profiles/eco_cou_466.pdf

[35] World Resources Institute, Economic Indicators – Mali, 2003. Accessed on 29 May, 2009: http://earthtrends.wri.org/pdf_library/country_profiles/eco_cou_466.pdf

[36] Signed letter from AMADER attesting that subsidies are not available.

to disseminate up to 100,000 stoves, using microfinance, however, this activity has not proceeded beyond the pilot phase as less than 1,000 stoves have been sold[37]. Micro-credit organizations tend to have a strong bias towards productive vs consumptive loans. That is, they prefer to lend for purchases that will lead directly to income generating activities[38]. Although stoves that improve public health and promote sustainable development have linkages to ones income, micro-credit organizations tend not to recognize these linkages, making credit for these stoves and therefore their affordability limited among the target population. Since the discount on stoves with carbon revenues in place will be so significant, the project will not incorporate a microfinance component unless it is later deemed necessary.

The chart below outlines the prices at which Katene's stoves have been sold and were later sold with a discount:

| Stove model | Undiscounted Price - CFA (USD[39]) | New Price - CFA (USD) (decreased with hope of carbon revenues, further decrease are planned after revenues are realized) |
|---|---|---|
| Extra Large | 5,500 (11.74) | 4,000 (8.53) |
| Large | 4,000 (8.53) | 3,000 (6.40) |
| Medium | 3,500 (7.47) | 2,500 (5.33) |
| Small | 3,000 (6.40) | 2,250 (4.80) |
| Tea | 1,500 (3.20) | 1,000 (2.13) |

As highlighted in the column heading on the right, the discount offered in the chart is only the current discount, and once carbon revenues are realized, this discount will increase significantly. The discount will be based on studies of price elasticity of demand to determine what price is required to maximize total sales numbers. Project profitability increases as more stoves are sold, regardless of how much is charged for stoves. This is because carbon revenues from the stoves are worth more than the stoves themselves. As such, the goal will be to maximize sales at any price, while avoiding the situation of giving the stoves away for free since this will cause other unintended consequences of misuse and waste.

- *Investment barrier*

As highlighted in the UNFCCC additionality tool, credible investment barriers include evidence that "similar activities have only been implemented with grants or other non-commercial finance terms." Katene has been fortunate to receive past support from AMADER and GTZ. While support from GTZ allowed Katene to purchase certain manufacturing equipment, it was AMADER's subsidy program that allowed Katene's activities to reach scale since,

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[37] Accessed 15 August, 2009: http://www.infosdelaplanete.org/5467/remerciements-a-gerard-druet-1er-delegue-planete-urgence-a-bamako.html, http://www.fondation-poweo.org/index.phtml/content/actions-action_projets_en_cours#plusdinfo , and, Personal interview conducted by phone between Cathy Diam of E+Co and Danielle Roy, Planete Urgence's Coordinator for their Mali Program, 18 August, 2009

[38] Cortiglia et al. Using Microfinance to Expand Access to Energy Services: Summary of Findings, November 2007. Sustainable Energy Solutions and the Small Enterprise Education and Promotion (SEEP) Network.

[39] Interbank exchange rate from 25 May, 2009.

as described in the previous section, cost is the primary barrier to widespread use of efficient stoves among the target population of low income Malian households. AMADER's program is, however, no longer available and no foreseeable plans exist to reinstate this program.[40] In the absence of an AMADER subsidy program, sales have steadily decreased and as of 6/2/2009[41], Katene closed their doors pending news regarding carbon finance. They simply cannot cover costs under current conditions and will be forced to file for bankruptcy if carbon finance is not approved. At the onset of this project activity, when the AMADER subsidy was no longer available, Katene chose to keep prices artificially low and sell below cost to maintain sales levels in hopes that carbon finance would soon fill this gap. The subsidy program had distorted the market to the point where consumers expected this below market price.

The methodology being applied also states that, "…possible reasons (that the project might not take place in the absence of carbon finance) may be that on-going costs for marketing, distribution, quality control and manufacture are not affordable…" As a result of Katene selling stoves below cost to enable sales among the target population, they are in serious financial trouble. In fact, an independent, professional financial audit of Katene's activities in January, 2009 concluded that Katene has been operating at a financial loss since 2004[42]. During some of this period, Katene was able to survive financially because the owner owns two other profitable businesses, a print shop and a private school. Both of these businesses provided income over the last years that subsidized the unprofitable activities of Katene. In other words, the owner was pumping in his own capital to keep Katene afloat. Then the AMADER subsidy ended, further exacerbating losses. Since the project start date, this financial loss has caused serious shortages of working capital for manufacturing, purchasing of raw materials, distribution and marketing. The lack of capital caused a significant decrease in sales since, although the market is willing the buy stoves at below cost prices, Katene is unable to manufacture sufficient volumes since they cannot buy enough supplies and employ enough people to meet demand due to lack of funds. Ultimately, they were forced to close their doors for all of the above mentioned reasons on 6/2/2009[43]. As outlined in the chart below[44], sales have dropped precipitously in 2008 compared with 2007:

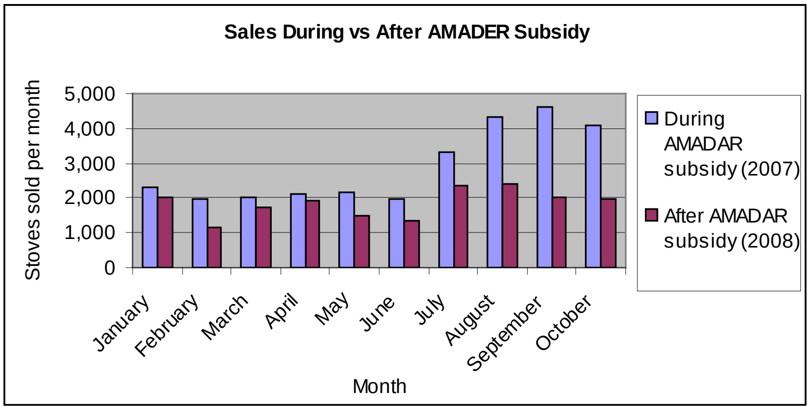
[40] Signed letter from AMADER attesting that subsidies are not available.

[41] Email dialogue between Katene and E+Carbon

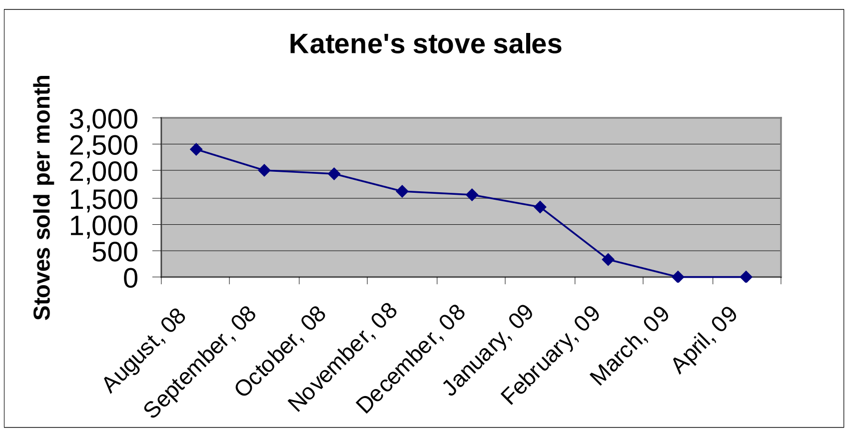
[42] Rapport d'Audit de la Rentabilite du GIE Katene Kadji: Periode 2004-2008. Cabinet d'Expertise Comptable et d'Audit Nicolas. Bamako, January, 2009.

[43] Email dialogue between Katene and E+Carbon

[44] Katene sales records, reported by Katene and verifiable.




Yet by February, 2009, Katene was unable to continue operation due to lack of funds and closed its doors, bring sales to zero. The chart on the following page tracks sales from August, 2008 through April, 2009 in the absence of carbon finance[45]:




The UNFCCC additionality tool suggests that credible investment barriers include evidence that "no private capital is available from domestic or international capital markets due to real or perceived risks associated with investment in the country where the proposed CDM project activity is to be implemented."

In the absence of carbon finance, Katene will have no alternatives for private funding, either from domestic or from international sources due to its current financial situation and the challenges of securing a loan from financial institutions in Mali. In fact, a 2007 World Bank survey found that only 10% of Malian firms have a loan or a credit line with financial institutions compared to 22% for the West African region. The same survey found that Malian loan

[45] February, 2009 sales are projected as 25% of January sales based on a 6 February closure date, and March is projected to be zero since the company has closed its doors.

applicants are often required to provided 179% of the loan amount as collateral compared to 136% for the region [46]. Moreover, Mali's low credit rating of 24.1 out of 100[47], makes capital exceedingly difficult if not impossible to access. E+Co is considering an investment in Katene, but this will only be attractive if they gain carbon finance revenues as the value simply is not there in its absence.

- *Knowledge barrier*

The methodology being applied also states that, "…possible reasons (that the project might not take place in the absence of carbon finance) may be that on-going costs for … marketing and distribution … are not affordable…"

Indeed, a key obstacle to the project activity taking place in the absence of carbon revenues is a lack of awareness among potential users regarding the benefits associated with SEWA stove use. As Katene expands into new regions, further sales and promotional activities will be required to foster a vibrant market. Non-traditional marketing techniques using informal village networks and other capacity building methods may be as important as traditional marketing approaches such as branding through radio advertisements. In fact, cooking practices are deeply entrenched in culture, and therefore changing them requires a very specific, culturally appropriate and community-based type of marketing that is resource intensive and involves far more than simply paying for radio advertisements.

- *Prevailing practice*

Habitual use of traditional stoves imposes a very strong influence on the baseline scenario, resulting in continued use of traditional inefficient charcoal stoves. In Mali, efficient charcoal stoves have not been sold in the absence of support programs such as equipment grants, direct subsidy, marketing and training, making this project the first of its kind since it aims to disseminate stoves using only carbon revenues to fulfil these functions.

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

*Financial barrier:* Financial barriers will not prevent, alternative 2, the business-as-usual alternative of continuing to use inefficient cooking technologies from occurring. Cooking on three-stone stoves and other ad hoc technologies is virtually free, while inefficient stoves are less expensive than their efficient counterparts, offering fewer financial hurdles. In Bamako for instance, the average sized inefficient "Malgache" stove - the stove most widely used in urban areas - cost about $2 compared to $5 for the average sized Sewa stove.[48] Alternatives 3 and 4, cooking with LPG and solar cookers respectively, are eliminated at this stage since they face considerably larger financial barriers than the project activity. Solar cookers can cost from $30 to over $100 depending on their design. LPG burners and cylinder cost on the order of $30, while LPG fuel is significantly more expensive than charcoal and fuelwood. Fuel

[46] http://www.enterprisesurveys.org/ExploreEconomies/?economyid=121&year=2007

[47] Institutional Investor Magazine. Accessed December, 2008.
http://www.iimagazinerankings.com/countrycredit/RegionsRptP3.asp

[48] Personal interviews conducted by E+Carbon staff in stores, markets and among manufacturers, June, 2008.

mixing in Malian households in common, as was revealed in the kitchen surveys performed under this project. Different fuels are used for different cooking tasks depending on the resources and needs of the household. While LPG is reasonably common in urban and peri-urban areas in Mali - the kitchen survey revealed that 53% of Bamako households without efficient charcoal stoves use LPG at least once - LPG is generally used for boiling water in the morning, for example, a task that does not consume too much fuel. Meeting the thermal requirements needed to cook entire meals with LPG is far more costly. Although solar cookers and LPG are clean and beneficial technological alternatives, they are prohibitively expensive for most Malians.

*Investment barrier*: The investment barriers identified will not prevent the business-as-usual alternative of continuing to use inefficient cooking technologies. Ad hoc technologies such as three stone fires do not require any manufacturing and therefore do not require financing. Inefficient stoves can be manufactured using less expensive and more common practices. Since the target population can afford less expensive inefficient stoves, it is possible to create a market-based business in which profits are realized. When reinvested, these profits lead to excess working capital to grow a company, thereby alleviating investment barriers. Moreover, inefficient stoves can more easily be manufactured in cottage industries and informal economies where traditional investment is not an essential ingredient to success. Manufacturing inefficient stoves requires little equipment and facilities that require financing. Efficient stoves, on the other hand, require capital intensive kilns and other equipment for which formal investment is required. The prevalence of inefficient stoves among the target population supports the assertion that manufacturing and selling such stoves is a profitable venture. Indeed, about 80% of the target population currently cooks with inefficient technologies[49].

*Knowledge barrier*: Knowledge barriers do not plague inefficient cooking technologies in the same way due to their prevalence. The target population is aware of and accustomed to this technology, and do not require special training or targeted marketing prior to purchasing or using this technology. Knowledge of inefficient stoves is deeply entrenched in Malian culture.

*Prevailing practice:* As explained in previous sections, inefficient stoves are present in most Malian kitchens and are deeply entrenched in Malian culture. They define the prevailing practice and are therefore not deterred by this barrier.

4. *Common practice analysis.*

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

As stated earlier, sales of efficient stoves in the absence of subsidies have not occurred in Mali to date. Since we cannot observe other cases of market-based efficient stove dissemination efforts in Mali, it is instructive to highlight examples in other African nations in similar circumstances. To identify additional examples, we take a nation's per capital gross domestic product (GDP) as a proxy for end users' ability to afford efficient stove technology and a nation's credit rating as a company's ability to gain access to market sources of finance other than carbon finance. We then compare these variables with how efficient stove efforts are being funded in those nations.

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[49] Schema Directeur d'Approvisionnement (SDA) en bois energie de Bamako (2006) Ministry of Mines, Energy and Water, Mali

Nigeria – With a per capita GDP (PPP) of 2,100[50], Nigerians should find improved stove technology more affordable than Malians. Moreover, Nigeria's credit rating is 40 out of 100[51], suggesting slightly fewer barriers to borrow in that nation compared with Mali. Yet an efficient stove project is currently under consideration for CDM funding in Nigeria[52].

Ghana – With a per capita GDP of $1,400[53], Ghanaians' purchasing power is similar to that of Malians'. Their credit rating is 37.6 out of 100[54], and business loans are very difficult to attain, especially for such ventures as efficient stove manufacturing. Two efficient stove projects are currently under consideration for carbon finance in Ghana[55].

Uganda – Uganda's per capital GDP of $1,000[56] also suggests that efficient stoves pose a similar burden on household budgets. With a credit rating of 29.9 out of 100[57], financing for such business is equally unattainable. Uganda is host to at least one efficient stove project funded entirely through carbon finance[58].

As is clear from these examples, carbon finance is quickly becoming the primary mechanism with which to fund improved stove technologies in countries with similar economic circumstances to Mali. These examples provide an additional credibility check to the additionality rationale outlined in steps 1-3 above.

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

All similar options discussed necessitate access to carbon finance, and thus do not contradict the claim that the proposed project activity is subject to the barriers outlined in step 3.

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[50] CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html Accessed December, 2008.

[51] Insitutional Investor Magazine. Accessed December, 2008. http://www.iimagazinerankings.com/countrycredit/RegionsRpt.asp?PageID=RegionsRpt&Type=1

[52] PDD: *Efficient Fuel Wood Stoves for Nigeria,* October, 2008.

[53] CIA World Fact Book. Accessed July 30, 2008: https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html

[54] Institutional Investor Magazine. Accessed December, 2008. http://www.iimagazinerankings.com/countrycredit/RegionsRpt.asp?PageID=RegionsRpt&Type=1

[55] Voluntary Gold Standard APX Registry.

[56] CIA World Fact Book. Accessed December, 2008: https://www.cia.gov/library/publications/the-world-factbook/geos/ug.html

[57] Institutional Investor Magazine. Accessed December, 2008. http://www.iimagazinerankings.com/countrycredit/RegionsRptP2.asp

[58] Voluntary Gold Standard APX Registry.

Greenhouse gases to be included in the project:

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| Baseline | Cooking, production of fuel, and transport of fuel | $CO_2$ | Yes | Important source of emissions |
| | | $CH_4$ | Yes | Important source of emissions |
| | | $N_2O$ | Yes | Important source of emissions |

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| Project | Cooking, production of fuel, and transport of fuel | $CO_2$ | Yes | Important source of emissions |
| | | $CH_4$ | Yes | Important source of emissions |
| | | $N_2O$ | Yes | Important source of emissions |

**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 here is defined as the domestic or institutional kitchens of the project population using Katene SEWA stoves. The target area and fuel collection area, as defined in the methodology being applied here, are outlined over the course of the project in the table below:

| | Target area | Fuel collection area |
|---|---|---|
| Initial | Katene's current distribution network, mostly in Greater Bamako. | The 61 communes that supply fuelwood or charcoal to Bamako according to the "Scheman Report." Each commune is listed in that study, which was the primary source for the non-renewable biomass calculations performed by Berkeley Air Monitoring Group[59]. |
| Expanded over course of project | Will gradually expand to cover major towns and market centers in all regions of Mali, including Timbouctou, Kidal, Gao, Mopti, Segou, Sikasso, Koulikoro, and Kayes | To be determined based on the monitoring procedures outlined in the methodology and in section D.B. task 1 of this PDD. |

As required by the methodology being applied, the non-renewability of biomass being consumed will be reassessed every two years as the target area and fuel collection area expands. Future non-renewability calculations will take into account the expanding geography of end users and apply an appropriate average non-renewability percentage as this geography expands.

**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:**

Baseline monitoring was completed by the Berkeley Air Monitoring Group in May, 2008. Calculations in this document are based on Berkeley Air's findings, presented in full in the Baseline Monitoring Report (Annex 6).

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[59] Schema directeur d'approvisionnement (SDA) en bois energie de Bamako : Rapport final", Agence Malienne pour le Developpement de l'Energie Domestique et de l'Electrification Rurale, 2006

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

### C.1 Duration of the project activity:

**C.1.1. Starting date of the project activity:** 27/11/2007 (The start date used is the date when the first carbon finance contract was signed between E+Carbon and Katene)

**C.1.2. Expected operational lifetime of the project activity:** NA (stoves last for about 3 years and are continuously replaced within the target area.)

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

The crediting period is non-renewable.

**C.2.1. Renewable crediting period:** NA

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

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

**C.2.2. Fixed crediting period:** 10 years

**C.2.2.1. Starting date:** 27/11/2007

**C.2.2.2. Length:** 10 years, 0 months

## SECTION D. Application of a monitoring methodology and plan

Ongoing monitoring will be conducted according to the prescribed approach in the methodology and as detailed below.

A. The recommended monitoring tasks are:

1. Maintenance of a Total Sales Record.

E+Carbon assists the project implementing body Katene to maintain and make available accurate records. E+Carbon collates a composite electronic Total Sales record and Ketene keeps backup paper records. Katene's existing accounting and records system accurately tracks sales, inventories and supply and purchases. Katene maintains a full sales database in Excel of all sales that take place, listed according to the sales mechanism, date and stove type. Sales databases are cross checked with production records and other data to ensure consistency and accuracy.

The Total Sales Record is comprised the following data:

- Date of Sale
- Mode of use: Resale, direct residential use, direct institutional use (sold via which sales depot)
- Model/type of stoves purchased
- Number of stoves purchased

2. Maintenance of a Detailed Customer Record

The Detailed Customer Record is comprised of the following data:

- Date of Sale
- Mode of use: Resale, direct residential use, direct institutional use (sold via which sales depot)
- Model/type of stoves purchased
- Number of stoves purchased
- Name and telephone number
    - All bulk purchasers: stove retailers
    - End users: as many as possible, see below.
- Address: as many as possible, see below.

The sales information is collected using the following methods:

Once an initial database consisting of 613 end users was created using end user cards, from which the baseline assessment was conducted, surveyors now conduct house to house surveys to satisfy the quarterly KS requirement in the methodology. These households are sampled in a geographic proportion consistent with Katene's sales breakdown from the previous quarter.

In terms of process, Katene reports total sales numbers broken down by sales depot to E+Carbon in the form of an excel file with sales depot codes for each sales record. E+Carbon analyzes this data to determine the proportion of stoves sold via each sales depot. E+Carbon then breaks down the number of KSs that should be performed in each sales area based on the proportion of sales conducted via each depot. E+Carbon sends this analysis to Berkeley Air, who instructs monitoring staff to sample houses based on this proportion for the upcoming quarterly KSs. Such a system allows the project to detect the need for new clusters based on changing sales geography and fuel use patterns, in spite of the illiteracy problem that prevented the collection of end user contact information on an ongoing basis.

Quality assurance measures will be implemented by an external third party, Berkeley Air Monitoring Group, to check the validity records, as discussed in Section D.3, below.

### 3. Continuous updating of the Project Database

The Project Database will be derived from the Total Sales Record, dividing the purchasers into the clusters defined by the most recent KS results, and excluding:

- any sales that do not fall into the cluster categories;
- any sales deemed to be erroneous records; and/or
- stoves within each cluster present on the Sales Record but no longer in use.

### 4. Calculation of emission reductions

Emission reductions should be calculated using the results of the most recent Monitoring KPTs following the methodology. Stove usage should be calculated from the Project Database by counting days of usage since sales date, and then modifying the result by application of Aging and Usage factors derived from the Stove-Age KPT and Usage Survey respectively. Emission reduction calculations will also take into account any findings of the monitoring process with respect to NRB fraction and Net Leakage.

The formulae that will be used in project progress reports are as prescribed for the Baseline Study in the methodology, with the difference that the time period will be quarters rather than years, and the Usage Factor and Aging Factor are added, thus:

$$ER_q = \sum BE_{i,q} - \sum PE_{i,q} - \sum LE_{i,q}$$

Where:

$ER_q$ = Emission reduction in total project population in quarter q ($tCO_2e/qr$)
$BE_{i,q}$ = Baseline emissions of cluster i in quarter q ($tCO_2e/qr$)
$PE_{i,q}$ = Project emissions of cluster i in quarter q ($tCO_2e/qr$)
$LE_{i,q}$ = Net Leakage of cluster i in quarter q ($tCO_2e/qr$)

Within each cluster the emissions are calculated thus:

$$BE_{i,q} = N_{i,q} \,.\, PE_q \,.\, \text{Usage Factor} .\ \text{Age Factor}$$
$$PE_{i,q} = N_{i,q} \,.\, BE_q \,.\, \text{Usage Factor} .\ \text{Age Factor}$$

Where $PE_q$ and $BE_q$ are calculated as set out in the appropriate section, and

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

B. The recommended periodic monitoring tasks are:

1. The renewability status of wood-fuel used by each cluster (NRB fraction) should be re-assessed, bi-annually.

2. Survey the Net Leakage factors identified in the PDD and investigate the possibility of new leakage and surplus effects, bi-annually. Many relevant survey questions are included in the KS.

3. A Usage Survey should be undertaken bi-annually for sales made in the first year of the project, to establish the fraction of end-users who are no longer using the stove purchased from Katene over time. The sample size will be as defined for the baseline KS. The approach will be to randomly sample from users having made their purchase in the first year of the project.

4. A "Stove-age KPT"[60] should be undertaken bi-annually for sales made in the first year for each cluster, to measure emission reduction performance in successive years of stoves of Age x months, Age y months, and so on. A linear extrapolation is applied to all stoves of intermediate age and extended age, when calculating overall project GHG reductions.

5. A baseline monitoring KPT should be performed if quarterly KSs suggest this is required. A monitoring KS[61] for sales made in the previous two year, should take place quarterly. The sample size will exceed that defined in the methodology and households will be identified by going house to house. The purpose is, as defined in the methodology, to make observations in kitchens to check that the cluster definitions are appropriate for statistically significant KPTs as well as to confirm that the Project Database is limited to sales eligible for emission reduction calculations. If cluster definitions need to be updated, new KPTs will be performed for each additional cluster identified bi-annually.

6. A "New-Stove KPT" should take place for new models and designs upon product launch, and should be repeated bi-annually.

7. In addition, the wider social and economic impact of the project should be investigated biannually and an assessment made of its contribution, positive or otherwise, to sustainable development in the area.

[60] Monitoring KPTs do not address the baseline scenario.

[61] Monitoring KS's are distinct from Baseline KS's in that they do not address the baseline scenario.

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

Gold Standard Voluntary Methodology entitled: “Indicative Programme, Baseline, and Monitoring Methodology for Improved Cook-Stoves and Kitchen Regimes Version 1”

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

The methodology is specifically designed to match the project conditions.

### 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:

All data will be archived for a period of at least two years after the end of the project crediting period. The table below attempts to simplify the variables from the methodology into what data is actually collected in the field and relate that data to the variables outlined in the methodology. This is useful since many of the variables outlined in the methodology are several steps removed from the data actually collected in the field. A full list of monitored variables according to the methodology is available in annex 3.

| *ID #* | *Data variable (relation to variables from methodology)* | *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* | *Non-Renewable Biomass fraction (Xnrb,bl,y & Xnrb,pj,y from methodology)* | *FAO, FOSA, Rural KS surveys* | *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* |
| *2* | *Stove Sales (input to variables* Bbl,y, Bpj,y from methodology) | *Sales Records* | *Stoves by type* | *M* | *Daily* | *All sales* | *Electronic and paper* | |
| *3* | *Eligibility of Project database for KPT sampling (input to* Bbl,y, Bpj,y from methodology) | *Monitoring KS* | *As specified above* | *E* | *Quarterly* | *As defined in methodology* | *Quarterly monitoring reports* | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *4* | *Emission savings in new clusters*[62] *(input to* Bbl,y, Bpj,y from methodology) | *Monitoring KPT* | *Tonnes of fuel/yr* | *M* | *Biannually* | *Statistically Significant and Representative Sample* | *Reports* | |
| 5 | *Leakage (directly from methodology)* | *Monitoring KS* | *% of total emissions* | *E* | *Biannually* | *As defined in methodology* | *Annual monitoring reports* | |
| 6 | *Usage drop-off in year y (directly from methodology)* | *Usage Survey* | *Fraction* | *E* | *Biannually* | *Statistically Significant and Representative Sample* | *Electronic* | |
| *7* | *Age - fuel savings per stove due to aging (directly from methodology)* | *Stove-age KPT* | *Fraction* | *M* | *Biannually* | *As defined in methodology* | *Electronic and paper* | |
| *8* | *New Stove (directly from methodology)* | *New Stove KPT* | *Fraction* | *M* | *Biannually* | *As defined in methodology* | *Electronic and paper* | |

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* | *Self-reported IAP reduction, and/or ambient CO & PM concentrations* | *Reduced indoor air pollution (IAP)* | *Ambient IAP concentration* | *M, E* |
| *Livelihood of the Poor* | *Survey results* | *Household fuel cost savings* | *$ saved/year* | *M, C* |
| *Employment* | *New employment* | *Job creation* | *Jobs/Year* | *M, E* |
| *Employment quality* | *Periodic assessment of conditions* | *Employment* | *Qualitative* | *E* |

[62] Results from monitoring KPT combined with stove sales (ID#2) will determine the values for variables Xre,bl.y, Xre,pj,y, Bbl,y and Bpj,y from methodology.

| | | | | |
|---|---|---|---|---|
| | | *quality* | *assessment* | |
| *Access to energy services* | *Extrapolated based on total sales and average household size* | *Improved energy access* | *People/year* | *C* |
| *Other pollutants* | *Periodic assessment of conditions* | *Proper disposal* | *Qualitative assessment* | *E* |

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

The formulae used are:

$$ER_q = \sum BE_{i,q} - \sum PE_{i,q} - \sum LE_{i,q}$$

Where:

$ER_q$ = Emission reduction in total project population in quarter q ($tCO_2e/qr$)
$BE_{i,q}$ = Baseline emissions of cluster i in quarter q ($tCO_2e/qr$) taking NRB fraction into account
$PE_{i,q}$ = Project emissions of cluster i in quarter q ($tCO_2e/qr$) taking NRB fraction into account
$LE_{i,q}$ = Net Leakage of cluster i in quarter q ($tCO_2e/qr$)

Within each cluster the emissions are calculated thus:

$$BE_{i,q} = \sum ( F_{bio,fuel,yr} * ( \%NR_{bio,fuel,yr} * EF_{bio,fuel,CO2} + EF_{bio,fuel,non\text{-}CO2} ) * D_{bio,fuel,yr} )$$
$$+ \sum ( F_{fuel,yr} * \%NR_{fuel,yr} * ( EF_{fuel,CO2} + EF_{fuel,non\text{-}CO2} ) * D_{fuel,yr} )$$

$$PE_{i,q} = \sum ( F_{bio,fuel,yr} * ( \%NR_{bio,fuel,yr} * EF_{bio,fuel,CO2} + EF_{bio,fuel,non\text{-}CO2} ) * D_{bio,fuel,yr}$$
$$* ( 1 - U_{bio,fuel,yr}) )$$

$$+ \sum ( F_{fuel,yr} * \%NR_{fuel,yr} * ( EF_{fuel,CO2} + EF_{fuel,non\text{-}CO2} ) * D_{fuel,yr}$$

$* ( 1 – U_{bio,fuel,yr}) )$

Biomass Fuels

$F_{bio,fuel,yr}$ : Daily fuel savings (tonnes/day) for a given biomass fuel in a given year of usage (baseline, year 1, year 2, etc.) of the project cluster's improved cooking device or regime.

$\%NR_{bio,fuel,yr}$ : Fractional non-renewability of biomass baseline for a given biomass fuel in a given year.

$EF_{bio,fuel,CO2}$ : CO2 Emissions Factor (tCO2/t_fuel) for a given biomass fuel[63].

$EF_{bio,fuel,non\text{-}CO2}$ : Non-CO2 Emissions Factor (tCO2e/t_fuel) for a given biomass fuel[64]; includes all non-CO2 gases accounted.

$D_{bio,fuel,yr}$ : Days (days) of fuel savings accounted for a given biomass fuel in a given year of usage (baseline, year 1, year 2, etc.) of the project cluster's improved cooking device or regime.

$U_{bio,fuel,yr}$ : Annual fractional *drop-off* in the usage of the project cluster's improved cooking device or regime in a given year of usage (year 1, year 2, etc.).

Non-Biomass Fuels

$F_{fuel,yr}$ : Daily fuel savings (tonnes/day) for a given non-biomass fuel in a given year of usage (baseline, year 1, year 2, etc.) of the project cluster's improved cooking device or regime.

$\%NR_{fuel,yr}$ : Fractional non-renewability for a given non-biomass fuel in a given year. For fossil fuels the value will be 1, for renewables, 0.

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[63] For a fuel such as charcoal this EF includes CO2 emissions from production and consumption. See Annex 2 for justification of non IPCC EFs used.

[64] For a fuel such as charcoal this EF includes CO2 emissions from production and consumption.

$EF_{fuel,CO2}$ : CO2 Emissions Factor (tCO2/t_fuel) for a given non-biomass fuel. This can include production and consumption.

$EF_{fuel,non\text{-}CO2}$ : Non-CO2 Emissions Factor (tCO2e/t_fuel) for a given non-biomass fuel; includes all non-CO2 gases accounted. This can include production and consumption.

$D_{fuel,yr}$ : Days (days) of fuel savings accounted for a given non-biomass fuel in a given year of usage (baseline, year 1, year 2, etc.) of the project cluster's improved cooking device or regime.

$U_{fuel,yr}$ : Annual fractional *drop-off* in the usage of the project cluster's improved cooking device or regime in a given year of usage (year 1, year 2, etc.).

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 #* | *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* |
|---|---|---|---|---|---|---|---|---|
| *3* | *Eligibility of Project database for KPT sampling* | *Baseline KS* | *As specified above* | *E* | *Quarterly* | *As defined in methodology* | *Quarterly monitoring reports* | |
| *Not included in D.2.1.1.* | *Traditional Stove Fuel Consumption* | *Baseline KPT* | *Tonnes of fuel/yr* | *M* | *Biannually* | *As defined in methodology* | *Electronic and paper* | |

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

See Section D.2.1.3.

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

Option 1 chosen due to evolving baseline scenario. See section D.2.1.

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

Option 1 chosen. See section D.2.1.1.

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

Option 1 chosen. See section D.2.1.3.

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 variable | 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) | Comment |
|---|---|---|---|---|---|---|---|---|
| *1* | *Fuel-Switching* | *Monitoring KS* | *Fraction of HHs switching fuels* | *E* | *Biannually* | *Statistically Significant and Representative Sample* | *Paper and electronic* | |
| *2* | *Further defined Net Leakage factors* | *Monitoring KS* | *Emission reduction adjustment factor* | *E* | *Biannually* | *Sufficient depth and conservative approach* | *Biannual monitoring reports* | |
| *3* | *Undefined Net Leakage factors* | *Monitoring KS* | *Emission reduction adjustment factor* | *E* | *Biannually* | *Sufficient depth and conservative approach* | *Biannual monitoring reports* | |

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

The application of the leakage methodology is discussed in section B.2 above.

The monitoring procedure requires that leakage is re-investigated periodically and any findings taken into account. The governing formulae are:

$LE_y$ = Leakage in year y – Surplus in year y

where
$LE_y$ = net leakage in year y (in tonnes CO2e per year) specific to cluster

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

Where:

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

$LE_{i,y}$ = Net Leakage of cluster i in year y ($tCO_2e/yr$)

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.)

The formulae applied for the Baseline Study utilize “Approach 1” as defined in the Methodology:

a) Baseline emissions:

$$BE_y = X_{nrb} \, . \, B_{bl,y} \, . \, EF_{bio,CO2} + \sum(AF_{bl,i,y} . \, EF_{af,CO2,i}) + \sum(\text{Non-CO2 emissions during cooking}) + \sum(\text{GHG emissions during production of the fuels})$$

Where

$BE_y$ = baseline emissions in year y (in tonnes CO2e per year) specific to cluster and Unit chosen

$X_{nrb}$ = the non-renewable component of the woody biomass harvested in the project collection area

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

$EF_{bio,co2}$ = the CO2 emission factor for use of the biomass fuel in tonnes CO2 per tonne fuel

$AF_{bl,i,y}$ = The mass of alternative fuel i in the baseline in year y in accordance with trends projected throughout the project period, in tonnes

$EF_{af,co2,i}$ = The CO2 emission factor for use of the alternative fuel i in the baseline in tonnes of CO2 per tonne fuel

Non-CO2 emissions during cooking = $\sum (B_{bl,y} \, . \, EF_{bio,non\text{-}co2,i}) + \sum(AF_{bl,i,y} \, . \, EF_{af,i,non\text{-}co2 \, gas \, i})$

GHG emissions during production of the fuels = $X_{nrb} \, . \, B_{bl,y} \, . \, EF_{bio,prod,co2} + \sum(AF_{bl,i,y} \, . \, EF_{af,prod,co2,i}) + \sum (B_{bl,y} \, . \, EF_{bio,prod,non\text{-}co2 \, gas \, i}) + \sum(AF_{bl,i,y} \, . \, EF_{af,i,prod,non\text{-}co2 \, gas \, i})$

Where
$EF_{bio,non\text{-}co2,i}$ = Emission factor for GHG gas i in tonnes gas / tonnes wood-fuel
$EF_{af,i,non\text{-}co2 \, gas \, i}$ = Non-CO2 Emission factor during cooking for alternative fuel i for GHG gas i in tonnes gas / tonnes fuel
$EF_{bio,prod,co2}$ = CO2 Emission factor for wood-fuel during production in tonnes gas / tonnes fuel
$EF_{af,prod,co2,i}$ = CO2 Emission factor for fuel i during production in tonnes gas / tonnes fuel
$EF_{bio,prod,non\text{-}co2 \, gas \, I}$ = Non-CO2 Emission factor for wood-fuel during production in tonnes gas / tonnes fuel
$EF_{af,i,prod,non\text{-}co2 \, gas \, I}$ = Non-CO2 Emission factor alternative fuel i for GHG gas i during production in tonnes gas / tonnes fuel

Project emissions:

Approach 1:

$PE_y = X_{nrb} \,.\, B_{pj,y} \,.\, EF_{bio,CO2} + \sum(AF_{pj,i,y} .\, EF_{af,CO2,i})$
$+ \sum(\text{Non-CO2 emissions during cooking})$
$+ \sum(\text{GHG emissions during production of the fuels})$

Where

$PE_y$ = project emissions in year y (in tonnes CO2e per year) specific to cluster and Unit chosen

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

$AF_{pj,i,y}$ = The mass of alternative fuel i in the project in year y in accordance with trends projected throughout the project period, in tonnes

Non-CO2 emissions during cooking = $\sum (B_{pj,y} \,.\, EF_{bio,non\text{-}co2,i}) + \sum(AF_{pj,i,y} \,.\, EF_{af,i,non\text{-}co2\ gas\ i})$

GHG emissions during production of the fuels = $X_{nrb} \,.\, B_{pj,y} \,.\, EF_{bio,prod,co2}$
$+ \sum(AF_{pj,i,y} \,.\, EF_{af,prod,co2,i})$
$+ \sum (B_{pj,y} \,.\, EF_{bio,prod,non\text{-}co2\ gas\ i})$
$+ \sum(AF_{pj,i,y} \,.\, EF_{af,i,prod,non\text{-}co2\ gas\ i})$

$EF_{af,pj,i(ebasis)}$ = The CO2 emission factor for use of the alternative fuel i in the project in tonnes of CO2 per GJ fuel

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

Regular monitoring will be performed by E+Co monitoring and evaluation staff and a local surveyor, while quarterly, semi-annual and annual analysis will be performed by a third party, Berkeley Air Monitoring Group.

| Data *(All from Table 2.1.1)* | 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* | *Non-Renewable Biomass fraction (Xnrb,bl,y & Xnrb,pj,y from methodology)* | *Low* | *These variables will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. A third party will conduct periodic assessments of the fraction of non-renewable biomass by consulting experts, third party research and conducting field surveys as was performed in the baseline assessment. Each assessment will conclude with a report, written by the third party that assesses the fraction of non-renewable biomass. The findings of these reports will be incorporated into annual monitoring reports upon which verifications are based.* |

| | | | |
|---|---|---|---|
| *2* | *Stove Sales* | *Low* | *Sales records will be cross-checked by 3rd party with Katene financial accounts, production records, retailers' records, observations of retailer activity and observations made during monitoring surveys and tests. This cross check will ensure consistency between these various sources of information to confirm that sales are being reported accurately. Sales records in Excel are sent to the project proponent at least once every quarter, which not only serves to cross check records, but also acts as an electronic backup of records.* |
| *3* | *Eligibility of Project database for KPT sampling (KS)* | *Low* | *This variable will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. As part of their quarterly assessment, the third party analyzes findings of the kitchen surveys to determine whether new clusters (and therefore new KPTs) are required. The Total Sales Record includes sales location of all stoves, as reported by Katene and Katene's sales outlets. Each sales outlet tracks how many stoves they sell, and reports the number sold to Katene twice per month. However, Katene cross checks these numbers with the number of stoves delivered to the sales outlet for the same period. When any discrepancy exists between the two numbers, the lower of the two are reported in Katene's sales records. These records are sent to the project proponent and third party statisticians. The data is then checked for consistency and accuracy, and is analyzed to determine the geographic breakdown of Katene's sales in that quarter. A local surveyor conducts the kitchen surveys according to this breakdown, going randomly, house to house to identify and survey Katene customers. Using this survey design, an inability to identify households will not affect survey results. Surveys are sent both in hard copy via DHL and in Excel form to the third party statisticians. Allowing the third party to see the paper surveys adds an additional level of QA/QC since they should show signs of having been collected in the field. Third party analyzes the data, cross checking any disparities where appropriate with Katene and surveyor, and writes a report that outlines the quarterly findings. The third party archives all raw data. Findings are summarized and referenced by the project proponent in the annual monitoring report upon which verifications are based.* |

| | | | |
|---|---|---|---|
| *4* | *Emission savings in new clusters (Monitoring KPT)* | *Low* | *This variable will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. If third party determines that a new cluster is required based on quarterly KSs, third party conducts a KPT among the new cluster in the same way that KPTs were performed as part of the baseline study, archiving all data. The results of the KPT are summarized in a report, which are incorporated into an annual monitoring report upon which verifications are based.* |
| *5* | *Leakage* | *Low* | *This variable will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. The effect of leakage is assessed by the third party as part of quarterly KSs, and reported on in reports to the project proponent. Findings are incorporated into annual monitoring reports upon which verifications are based. Raw data from KSs and KS results are cross checked for quality and archived by third party.* |
| *6* | *Usage drop-off in year y* | *Low* | *This variable will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. Usage drop-off will be checked by the third party by surveying the households that were incorporated in the baseline study at least every two years to determine the fraction of stoves that are still operational. Third party archives all data. These results are analyzed and summarized by the third party in reports to the project proponent. The results are incorporated in monitoring reports upon which the annual verifications are based.* |
| *7* | *Age - fuel savings per stove due to aging* | *Low* | *This variable will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. Third party conducts stove age KPT, archives all raw data and incorporates findings in report to project proponent. The results are incorporated in monitoring reports upon which the annual verifications are based.* |
| *8* | *New Stove* | *Low* | *This variable will be monitored by a third party. This will eliminate any incentive to alter data to the project's advantage, which will provide significant QA/QC. Should a new stove model be introduced, third party conducts a KPT with the new model in the same way that KPTs were performed as part of the baseline study, archiving all data. The results of the KPT are summarized in a report, which are incorporated into an annual monitoring report upon which verifications are based.* |

| 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 |
|---|

E+Co employs Monitoring & Evaluation staff that track non-carbon sustainability indicators such as employment and environmental impacts. Carbon related monitoring tasks, such as quarterly KSs, assessment of leakage and other such tasks are handled by a third party, the Berkeley Air Monitoring Group. Berkeley Air Monitoring Group instructs a local surveyor, paid by E+Carbon, to conduct these surveys. Survey results are delivered both electronically and via DHL in hard copy directly to Berkeley Air, who analyze the data and compile quarterly and annual reports. E+Carbon contracts a third party to undergoes additional monitoring tasks, such as creating new clusters and performing additional KPTs for these clusters, based on Berkeley Air's third party recommendations. Berkeley Air Monitoring Group also performs biannual monitoring tasks according to the methodology. The integrity of data is constantly cross checked with other variables to ensure consistency and avoid mistakes.

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

The monitoring methodology has been determined by application of the generic Gold Standard voluntary methodology "Indicative Programme, Baseline, and Monitoring Methodology for Improved Cook-Stoves and Kitchen Regimes Version 1", developed for a range of improved stove programs.

## SECTION E. Estimation of GHG emissions by sources

The equations used in calculating baseline emissions, project emissions, and emission reductions are as outlined in the Methodology and in section D.2.4 of this PDD.

### E.1. Estimate of GHG emissions by sources:

| Project Emissions (tCO2e) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Flows | | Project Year | | | | | | | | | |
| Offset Vintage | Stoves disseminated | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| 2008 | 20,000 | 28,254 | 51,699 | 41,345 | 29,522 | 17,731 | 7,338 | 1,461 | 0 | 0 | 0 |
| 2009 | 22,000 | 0 | 31,079 | 56,869 | 45,479 | 32,545 | 19,432 | 8,072 | 1,607 | 0 | 0 |
| 2010 | 24,200 | 0 | 0 | 34,187 | 62,556 | 50,145 | 35,682 | 21,376 | 8,879 | 1,767 | 0 |
| 2011 | 26,620 | 0 | 0 | 0 | 37,606 | 68,985 | 54,987 | 39,250 | 23,513 | 9,777 | 1,933 |
| 2012 | 29,282 | 0 | 0 | 0 | 0 | 41,592 | 75,657 | 60,485 | 43,175 | 25,912 | 10,708 |
| 2013 | 32,210 | 0 | 0 | 0 | 0 | 0 | 45,751 | 83,223 | 66,534 | 47,597 | 28,399 |
| 2014 | 35,431 | 0 | 0 | 0 | 0 | 0 | 0 | 50,327 | 91,545 | 73,360 | 52,184 |
| 2015 | 38,974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55,359 | 100,953 | 80,443 |
| 2016 | 42,872 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 61,226 | 110,717 |
| 2017 | 47,159 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67,348 |
| **Total Annual Carbon Volumes (tCO2e)** | | **28,254** | **82,778** | **132,401** | **175,163** | **210,998** | **238,847** | **264,193** | **290,612** | **320,593** | **351,732** |
| | | | | | | | | | **5-year total =** | **629,593** | **tCO2e** |
| | | | | | | | | | **10-year total =** | **2,095,570** | **tCO2e** |

### E.2. Estimated leakage:

Leakage is estimated to be 0[65], as is explained in section B.2.

[65] The leakage is calculated to be higher than this, but the KPT method used incorporates several aspects of leakage into the fuel savings numbers. See section B.2. for further explanation.

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

Same as E.1 as leakage is estimated to be 0[66].

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

**Baseline Emissions (tCO2e)**

| Carbon Flows | | Project Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Offset Vintage | Stoves disseminated | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| 2008 | 20,000 | 37,579 | 68,763 | 54,991 | 39,265 | 23,583 | 9,760 | 1,943 | 0 | 0 | 0 |
| 2009 | 22,000 | 0 | 41,337 | 75,639 | 60,490 | 43,287 | 25,846 | 10,736 | 2,137 | 0 | 0 |
| 2010 | 24,200 | 0 | 0 | 45,471 | 83,203 | 66,696 | 47,459 | 28,431 | 11,809 | 2,351 | 0 |
| 2011 | 26,620 | 0 | 0 | 0 | 50,018 | 91,753 | 73,135 | 52,205 | 31,274 | 13,004 | 2,571 |
| 2012 | 29,282 | 0 | 0 | 0 | 0 | 55,320 | 100,628 | 80,449 | 57,425 | 34,464 | 14,242 |
| 2013 | 32,210 | 0 | 0 | 0 | 0 | 0 | 60,852 | 110,691 | 88,494 | 63,307 | 37,772 |
| 2014 | 35,431 | 0 | 0 | 0 | 0 | 0 | 0 | 66,937 | 121,760 | 97,573 | 69,408 |
| 2015 | 38,974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 73,631 | 134,273 | 106,993 |
| 2016 | 42,872 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 81,434 | 147,260 |
| 2017 | 47,159 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89,577 |
| **Total Annual Carbon Volumes (tCO2e)** | | **37,579** | **110,100** | **176,100** | **232,976** | **280,639** | **317,680** | **351,390** | **386,529** | **426,405** | **467,823** |
| | | | | | | | | | **5-year total =** | **837,393** | **tCO2e** |
| | | | | | | | | | **10-year total =** | **2,787,221** | **tCO2e** |

[66] The leakage is calculated to be higher than this, but the KPT method used incorporates several aspects of leakage into the fuel savings numbers. See section B.2. for further explanation.

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

| Conservative Project Emission Reductions (tCO2e) | | Fuel Savings Adjustment Factor: | | | | | 1.00 | Leakage: | | | 0% |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Flows | | Project Year | | | | | | | | | |
| Offset Vintage | Stoves disseminated | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| 2008 | 20,000 | 9,325 | 17,064 | 13,646 | 9,744 | 5,852 | 2,422 | 482 | 0 | 0 | 0 |
| 2009 | 22,000 | 0 | 10,258 | 18,770 | 15,011 | 10,742 | 6,414 | 2,664 | 530 | 0 | 0 |
| 2010 | 24,200 | 0 | 0 | 11,284 | 20,647 | 16,551 | 11,777 | 7,055 | 2,930 | 583 | 0 |
| 2011 | 26,620 | 0 | 0 | 0 | 12,412 | 22,769 | 18,149 | 12,955 | 7,761 | 3,227 | 638 |
| 2012 | 29,282 | 0 | 0 | 0 | 0 | 13,728 | 24,971 | 19,963 | 14,250 | 8,552 | 3,534 |
| 2013 | 32,210 | 0 | 0 | 0 | 0 | 0 | 15,100 | 27,468 | 21,960 | 15,710 | 9,373 |
| 2014 | 35,431 | 0 | 0 | 0 | 0 | 0 | 0 | 16,610 | 30,215 | 24,213 | 17,224 |
| 2015 | 38,974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18,272 | 33,320 | 26,550 |
| 2016 | 42,872 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20,208 | 36,543 |
| 2017 | 47,159 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22,229 |
| Total Annual Carbon Volumes (tCO2e) | | 9,325 | 27,321 | 43,699 | 57,813 | 69,641 | 78,833 | 87,198 | 95,918 | 105,813 | 116,091 |
| | | | | | | | | 5-year total = | | 207,800 | tCO2e |
| | | | | | | | | 10-year total = | | 691,651 | tCO2e |

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

| Year | Estimation of project activity emissions (tons $CO_2e$) | Estimation of baseline emissions (tons CO2e) | Estimation of leakage (tonnes $CO_2e$) | Estimation of emission reductions (tons $CO_2e$) |
|---|---|---|---|---|
| 2008 | 28,254 | 37,579 | 0 | 9,325 |
| 2009 | 82,778 | 110,100 | 0 | 27,321 |
| 2010 | 132,401 | 176,100 | 0 | 43,699 |
| 2011 | 175,163 | 232,976 | 0 | 57,813 |
| 2012 | 210,998 | 280,639 | 0 | 69,641 |
| 2013 | 238,847 | 317,680 | 0 | 78,833 |
| 2014 | 264,193 | 351,390 | 0 | 87,198 |
| 2015 | 290,612 | 386,529 | 0 | 95,918 |
| 2016 | 320,593 | 426,405 | 0 | 105,813 |
| 2017 | 351,732 | 467,823 | 0 | 116,091 |
| Total | 2,095,570 | 2,787,221 | 0 | 691,651 |

## SECTION F. Environmental impacts

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

The host country does not require an EIS. However, the Designated National Authority in Mali has already granted approval of the project (upon their request). This letter specifically highlights that the project is consistent with Mali's environmental regulations. The approval letter is included in Annex 3.

During manufacturing of the stoves, small amounts of paint are used. Although the painting releases fumes, there is no waste from the paint except for paint cans, which are sold to metal scrappers. Used cans are collected in bags to avoid excess release of fumes. Clay is also harvested as a source of raw materials for the ceramic liners. Clay is harvested from a small quarry far from any residential use, and harvesting of clay is not expected to have any consequences on water supplies or the soil's ability to effectively filter groundwater.

## SECTION G. Stakeholders' comments

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

The stakeholder consultation was announced in several ways. First, a full list of potential stakeholders was compiled by all project participants that included a full spectrum of government officials, NGOs, multilateral development organizations, end users and manufactures in Bamako and elsewhere. For those stakeholders that had email addresses, invitations were sent via email. This letter is included in Annex 5. For those stakeholders who lacked email addresses, project participants made in person visits to the offices of each stakeholder in Bamako more than one week in advance to hand deliver hard copies of the invitations. For illiterate stakeholders, project participants relayed the invitation verbally. Finally, the invitation was posted in two local newspapers in Mali.

A total of 53 stakeholders from Mali's government, NGO community, stove users, stove manufacturers, artisans and retailers convened to discuss the carbon finance project aimed at disseminating efficient household cookstoves in Mali. Virtual input was also requested from the 11 invited guests who were unable to attend. One professional note taker was hired to record all comments at the meeting in addition to two professional translators. A videographer filmed the entire event and delivered a professionally edited video, which provided backup to the written notes that were taken during the event.

For more details, the minutes of the Stakeholder Consultation Meeting are included in Annex 5.

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

Stakeholders overwhelmingly expressed support for and appreciation of the project and its socioeconomic and environmental benefits.

*Literate group* – The overwhelming majority of respondents expressed strong support for the project. Respondents tended to be convinced that the project will promote human well-being and help to safeguard the environment. Respondents sent the clear message that the project has far more positive effects than negative ones. It will reduce exploitation of non-renewable biomass and help combat deforestation and desertification. Moreover, the project will result in increased employment opportunities in Mali. There was some concern regarding the need to handle contaminants during the manufacturing process, such as paint, in an appropriate way.

*Illiterate group* – Illiterate respondents, largely composed of stove artisans and manufacturers, also viewed the project very positively. They felt confident that negative effects on the environment due to handling raw materials and other aspects of the manufacturing process were minimal. More importantly, they were strongly supportive of the project's potential socioeconomic effects, including but not limited to job creation and improved wages. In spite of expressing strong support for their management, some expressed concern about their current low wages, a condition that they hope will change after receiving carbon finance.

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

The few recommendations going forward included:

- Confirming that raw materials and waste from manufacturing were dealt with properly.
- Ensuring proper working conditions and pay for those employed in the industry.

Katene has confirmed that all raw materials and waste from manufacturing, especially paint and thinner, will be recycled or disposed of properly. Workers at Katene have started wearing earplugs and face masks are also available to reduce dust exposure.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Katene Kadji |
| Street/P.O.Box: | Porte: 253 Rue: 199 |
| Building: | |
| City: | Bamako |
| State/Region: | Koulikoro |
| Postfix/ZIP: | |
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| Telephone: | (00223) 222 98 08 |
| FAX: | |
| E-Mail: | sewakadji@yahoo.fr |
| URL: | |
| Represented by: | |
| Title: | Entrepreneur and managing director of Katene Kadjii |
| Salutation: | Mr. |
| Last Name: | Samassekou |
| Middle Name: | S. |
| First Name: | Ousmane |
| Department: | |
| Mobile: | (00223) 673 05 85 / 641 77 00 |
| Direct FAX: | |
| Direct tel: | |
| Personal E-Mail: | sewakadji@yahoo.fr |

| | |
|---|---|
| Organization: | E+Carbon |
| Street/P.O.Box: | 383 Franklin St. |
| Building: | |
| City: | Bloomfield |
| State/Region: | NJ |
| Postfix/ZIP: | 07003 |
| Country: | USA |
| Telephone: | 917.225.0125 |
| FAX: | |
| E-Mail: | |
| URL: | |
| Represented by: | |
| Title: | Carbon Finance Manager |
| Salutation: | Mr. |
| Last Name: | Wurster |
| Middle Name: | |
| First Name: | Erik |

| | |
|---|---|
| Department: | |
| Mobile: | |
| Direct FAX: | |
| Direct tel: | 917.225.0125 |
| Personal E-Mail: | erik.wurster@eandco.net |

Annex 2

BASELINE INFORMATION

| Data / Parameter: | $EF_{bl.bio,co2}$ |
|---|---|
| Data unit: | tCO2/t_biomass |
| Description: | CO2 emission factor arising from use of wood-fuel in baseline scenario |
| Source of data: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Tables 1.2/1.4 |
| Value applied: | 1.747 |
| Justification of data choice or description of measurement methods and procedures actually applied: | Default IPCC values for wood / wood waste are applied. |
| Any comment: | |

| Data / Parameter: | $EF_{pj.bio,co2}$ |
|---|---|
| Data unit: | tCO2/t_biomass |
| Description: | CO2 emission factor arising from use of wood-fuel in project scenario |
| Source of data: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Tables 1.2/1.4 |
| Value applied: | 1.747 |
| Justification of data choice or description of measurement methods and procedures actually applied: | Default IPCC values for wood / wood waste are applied. |
| Any comment: | |

| Data / Parameter: | $EF_{bl.bio,non-co2}$ |
|---|---|
| Data unit: | tCO2/t_biomass |
| Description: | Non-CO2 emission factor arising from use of wood-fuel in baseline scenario |
| Source of data: | CH4 and N2O: IPCC 2006 GL for emission factors and NCVs, IPCC SAR 1996 for GWPs. |
| Value applied: | 0.455 |
| Justification of data choice or description of measurement methods and procedures actually applied: | Default IPCC values for wood / wood waste are applied. |
| Any comment: | |

| Data / Parameter: | $EF_{pj.bio,non-co2}$ |
|---|---|
| Data unit: | tCO2/t_biomass |
| Description: | Non-CO2 emission factor arising from use of wood-fuel in project scenario |
| Source of data: | CH4 and N2O: IPCC 2006 GL for emission factors and NCVs, IPCC SAR 1996 for GWPs. |
| Value applied: | 0.455 |
| Justification of data choice or description of measurement methods and procedures actually | Default IPCC values for wood / wood waste are applied. |

| | |
|---|---|
| applied: | |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $EF_{ch,prod,co2}$ |
| Data unit: | tCO2/t_ch |
| Description: | CO2 emission factor arising from production of charcoal |
| Source of data: | 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. |
| Value applied: | 1.802 |
| Justification of data choice or description of measurement methods and procedures actually applied: | There are no IPCC default values available. Therefore, scenario-specific values are applied. 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 there is clear evidence that the same techniques for charcoal production are used currently in Mali[67]. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $EF_{ch,prod,non-co2}$ |
| Data unit: | tCO2/t_ch |
| Description: | Non-CO2 emission factor arising from production of charcoal |
| Source of data: | CO2, CH4, N2O GWPs from (IPCC SAR 1996). |
| Value applied: | 0.983 |
| Justification of data choice or description of measurement methods and procedures actually applied: | Default IPCC values for wood / wood waste are applied. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $EF_{ch,use,co2}$ |
| Data unit: | tCO2/t_ch |
| Description: | CO2 emission factor arising from consumption of charcoal |
| Source of data: | Product of NCVch (IPCC 2006 GL default 29.5 MJ/kg) and Emission factor (energy basis) for charcoal (IPCCC 2006 GL default 112 tCO2/TJ) x 10^-3 |
| Value applied: | 3.304 |
| Justification of data choice or description of measurement methods and procedures actually applied: | Default IPCC values for wood / wood waste are applied. |

[67] *Etude Sur la Disponibilite de Poussier de Charbon a Bamako*, Environnement et Développement du Tiers Monde (ENDA-TM), Dakar, Sénégal, Mars 2004, pg 9.

| | |
|---|---|
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $EF_{ch,use,non-co2}$ |
| Data unit: | tCO2/t_ch |
| Description: | Non-CO2 emission factor arising from consumption of charcoal |
| Source of data: | CH4 and N2O: IPCC 2006 GL for emission factors and NCVs, IPCC SAR 1996 for GWPs. |
| Value applied: | 0.255 |
| Justification of data choice or description of measurement methods and procedures actually applied: | Default IPCC values for wood / wood waste are applied. |
| Any comment: | |

Other Baseline Information

| Description | Parameter | Value | Units | Source |
|---|---|---|---|---|
| Non-Renewable Biomass Baseline (Charcoal) | | | | |
| Fractional Non-Renewability | %NRbio,ch,yr | 51% | fractional | 2008 Baseline Study, Project-Specific, as detailed in section B.1.3.1. of the PDD |
| Non-Renewable Biomass Baseline (Wood) | | | | |
| Fractional Non-Renewability | %NRbio,wd,yr | 54% | fractional | 2008 Baseline Study, Project-Specific, as detailed in section B.1.3.1. of the PDD |
| Leakage and Surpluss | | | | |
| Net Leakage | LE | 0.00 | fractional | 2008 Baseline and Monitoring Kitchen Survey |
| Cumulative Usage | | | | |
| Usage rate after 1st year | Ubio,ch,yr1 | 0.90 | fractional | conservative projection |
| Usage rate after 2nd year | Ubio,ch,yr2 | 0.70 | fractional | conservative projection |
| Usage rate after 3rd year | Ubio,ch,yr3 | 0.50 | fractional | conservative projection |
| Usage rate after 4th year | Ubio,ch,yr4 | 0.30 | fractional | conservative projection |
| Usage rate after 5th year | Ubio,ch,yr5 | 0.10 | fractional | conservative projection |
| Usage rate after 6th year | Ubio,ch,yr6 | 0.00 | fractional | conservative projection |
| Usage rate after 7th year | Ubio,ch,yr7 | 0.00 | fractional | conservative projection |
| Usage rate after 8th year | Ubio,ch,yr8 | 0.00 | fractional | conservative projection |
| Usage rate after 9th year | Ubio,ch,yr9 | 0.00 | fractional | conservative projection |
| Usage rate after 10th year | Ubio,ch,yr10 | 0.00 | fractional | conservative projection |

## Detailed Carbon Projections

**Fuel-Specific Parameters**

| | Type of fuel | Avg. NRB | EF CO2 | EF CH4 | EF N2O | Baseline Fuel Consumption | Project Fuel Consumption | Average Fuel Savings |
|---|---|---|---|---|---|---|---|---|
| | | % | tCO2 | tCO2e | tCO2e | kg/hh_day | kg/hh_day | kg/hh_day |
| Biomass 1 | **Charcoal *** | 51.00% | 5.106 | 1.141 | 0.096 | 2.41 | 1.79 | 0.62 |
| Biomass 2 | **Wood** | 54.00% | 1.747 | 0.401 | 0.054 | 1.25 | 1.00 | 0.25 |
| Biomass 3 | 0 | 0.00% | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Alternative fuel 1 | 0 | - | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Alternative fuel 2 | 0 | - | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Alternative fuel 3 | 0 | - | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |

**Stove sales and Usage Parameters**

| | |
|---|---|
| Initial Sales (1st year) | 20000 |
| Annual Sales Growth (%) | 10% |
| Avg. Annual Leakage (%) | 0% |
| KS Adjustment Factor | 1.00 |
| Avg. Annual Sales | 31875 |
| Avg. Stove lifetime (yrs) | 3 |

**Annual Usage and Sales Rates**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Calendar Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Stove Usage Rate: (% in use at end of year) | 90% | 70% | 50% | 30% | 10% | 0% | 0% | 0% | 0% | 0% |
| **Annual Sales:** | **20,000** | **22,000** | **24,200** | **26,620** | **29,282** | **32,210** | **35,431** | **38,974** | **42,872** | **47,159** |

**Conservative Project Emission Reductions (tCO2e)** — **Fuel Savings Adjustment Factor:** **1.00** — **Leakage:** **0%**

**Carbon Flows** — **Project Year**

| Offset Vintage | Stoves disseminated | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2008** | 20,000 | 9,325 | 17,064 | 13,646 | 9,744 | 5,852 | 2,422 | 482 | 0 | 0 | 0 |
| **2009** | 22,000 | 0 | 10,258 | 18,770 | 15,011 | 10,742 | 6,414 | 2,664 | 530 | 0 | 0 |
| **2010** | 24,200 | 0 | 0 | 11,284 | 20,647 | 16,551 | 11,777 | 7,055 | 2,930 | 583 | 0 |
| **2011** | 26,620 | 0 | 0 | 0 | 12,412 | 22,769 | 18,149 | 12,955 | 7,761 | 3,227 | 638 |
| **2012** | 29,282 | 0 | 0 | 0 | 0 | 13,728 | 24,971 | 19,963 | 14,250 | 8,552 | 3,534 |
| **2013** | 32,210 | 0 | 0 | 0 | 0 | 0 | 15,100 | 27,468 | 21,960 | 15,710 | 9,373 |
| **2014** | 35,431 | 0 | 0 | 0 | 0 | 0 | 0 | 16,610 | 30,215 | 24,213 | 17,224 |
| **2015** | 38,974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18,272 | 33,320 | 26,550 |
| **2016** | 42,872 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20,208 | 36,543 |
| **2017** | 47,159 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22,229 |
| **0** | **Carbon Volumes (tCO2e)** | **9,325** | **27,321** | **43,699** | **57,813** | **69,641** | **78,833** | **87,198** | **95,918** | **105,813** | **116,091** |
| | | | | | | | | | **5-year total =** | **207,800** | **tCO2e** |
| | | | | | | | | | **10-year total =** | **691,651** | **tCO2e** |

* Charcoal emissions factors include emissions from both combustion and production of charcoal.

Annex 3

**MONITORING PLAN**

See section D for detailed outline of the monitoring plan. E+Co has regional monitoring and evaluation officers that will assess Katene's progress on a regular basis. In addition, E+Carbon will hire specialists to perform various tests to be verified on a regular basis, as outlined in section D.

Specific variables to be monitored (Alternative fuels variables in methodology omitted since they are not applicable to this project activity):

| Data / Parameter: | Xnrb,bl,y |
|---|---|
| Data unit: | Fraction |
| Description: | Non-renewability status of woody biomass fuel in year y in baseline scenario |
| Source of data: | Study |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | Xnrb,pj,y |
|---|---|
| Data unit: | Fraction |
| Description: | Non-renewability of woody biomass fuel in year y in project scenario |
| Source of data: | Study |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | Leakage |
|---|---|
| Data unit: | t_CO2e per year |
| Description: | Potential GHG emissions outside project boundary caused by project activity |
| Source of data: | Study |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | Bbl,y |
|---|---|
| Data unit: | t_biomass/unit-year |
| Description: | Mass of woody biomass combusted in the baseline in year y |
| Source of data: | Measurements of sample or whole of cluster population |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | Bpj,y |
|---|---|
| Data unit: | t_biomass/unit-year |
| Description: | Mass of woody biomass combusted in the project in year y |
| Source of data: | Measurements of sample or whole of cluster population |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | Usage in year y |
|---|---|
| Data unit: | Fraction |
| Description: | Percentage of stoves of age x remaining in use in year y |
| Source of data: | Survey |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | Age |
|---|---|
| Data unit: | Fraction |
| Description: | Adjustment to values of $B_{pj,,y}$ and $AF_{pj,i,y}$ for stoves of age x |
| Source of data: | Survey |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

| Data / Parameter: | New Stove |
|---|---|
| Data unit: | Fraction |
| Description: | Adjustment to values of $B_{pj,,y}$ for new stove models |
| Source of data: | Measurements of sample or whole of cluster population |
| Monitoring frequency: | Bi-annual |
| QA/QC procedures: | 3rd party study and report – for additional details on QA/QC procedures, see section D.3. |
| Any comment: | |

The host country does not require an EIS. However, the Designated National Authority in Mali has already granted approval of the project (upon their request). This letter specifically highlights that the project is consistent with Mali's environmental regulations. The approval letter is included on the following page.

MINISTERE DE L'ENVIRONNEMENT ET
DE L'ASSAINISSEMENT

SECRETARIAT GENERAL

**REPUBLIQUE DU MALI**
Un Peuple - Un But - Une Foi

Bamako, le 28 MAR 2008

*LE MINISTRE DE L'ENVIRONNEMENT ET
DE L'ASSAINISSEMENT*

*A*

**Monsieur le Président du Conseil Exécutif du Mécanisme pour un Développement Propre (MDP)**

N° 00249 /MEA-SG.

Objet : Lettre de non objection concernant le Projet de Fourneaux à basse consommation de charbon de bois.

Monsieur,

Comme suite à la requête de non objection adressée parle GIE Katene Kadji Mali, portant sur le projet cité en objet, j'ai l'honneur de vous informer de ce qui suit :

1. Suite à l'examen dudit projet par l'Organe Interne de l'Autorité Nationale Désignée du Mécanisme pour un Développement Propre (MDP) au Mali, en l'occurrence le Secrétariat Technique Permanent du Cadre Institutionnel de la Gestion des Questions Environnementales, il est ressorti que ce projet cadre avec la Politique Nationale de Protection de l'Environnement et les critères de Développement durable définis dans le cadre du MDP au Mali ;
2. Que le projet, s'il était mis en oeuvre pourrait permettre de contribuer à la réduction des émissions de gaz à effet de serre l'utilisation de fourneaux à basse consommation de bois ;
3. Qu'il permettra également la création d'emplois permanents.

Par conséquent, la République du Mali en tant que signataire à la fois de la Convention Cadre des Nations Unies sur les Changements Climatiques et du Protocole de Kyoto, n'a aucune objection quant à la mise en œuvre de ce projet sur son territoire national.

De plus, la République du Mali ne ménagera aucun effort, dans les limites de ses moyens, pour faciliter la validation et la certification des réductions d'émissions générées par le projet.

Vous en souhaitant bonne réception, veuillez agréer Monsieur, l'expression de ma haute considération.

P/LE MINISTRE/P-O
LE SECRETAIRE GENERAL

Abdoulaye BERTHE
Magistrat

Ampliations :

- Monsieur David Craig, Directeur pour le Mali de la Banque Mondiale, 1818 h Street NW Washington DC ;
- Monsieur Ousmane S. Samassekou, Promoteur du projet.

Annex 4

## LEGAL DOCUMENTATION

*This annex offers legal documentation to help prove that double counting can be avoided. In the case that other carbon offset projects are developed for stoves in Mali, proper documentation is required to be sure that these projects do not count one stove as part of both of their projects. In addition to this documentation, SEWA stoves are uniquely identifiable in the field. Although the project developer is not aware of any large scale efficient stove projects in Mali, should one arise, we do not foresee a problem with double counting due to legal precautions already taken and Ketene-specific design attributes of the SEWA stove that make them uniquely identifiable. While there is one other stove program in Mali[68], the project has not proceeded beyond the pilot phase since it has disseminated less than 1,000 stoves, does not include any carbon finance mechanism[69], nor is there any reason to believe that the stoves are similar enough in design to be confused in the field.*

Letter of agreement

This was signed between Katene and E+Carbon on November 27, 2007.

*(This documentation has been provided confidentially to the DOE.)*

ERPA + Amendment

This was signed between Katene and E+Carbon on December 3, 2007.

*(This documentation has been provided confidentially to the DOE.)*

2nd tier ERPAs

2nd tier ERPAs are already signed with all artisans and companies that supply Katene with stove components.

*(This documentation has been provided confidentially to the DOE.)*

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[68] Accessed 15 August, 2009: http://www.infosdelaplanete.org/5467/remerciements-a-gerard-druet-1er-delegue-planete-urgence-a-bamako.html, http://www.fondation-poweo.org/index.phtml/content/actions-action_projets_en_cours#plusdinfo

[69] Personal interview conducted by phone between Cathy Diam of E+Co and Danielle Roy, Planete Urgence's Coordinator for their Mali Program, 18 August, 2009.

End user ownership rights waiver

A small piece of paper is included inside each stove so end users, the default owners of emission reductions, are aware that they are giving up their ownership rights to emission reductions in exchange for a discount on their stove. In the future, this may be replaced by a metal plate on the stove explaining the waiver of rights.

Annex 5

# Voluntary Gold Standard
# Mali Stakeholder Consultation Meeting Minutes

*Friday, 27 June, 2008, 10 am - 12 pm*
*CCA ONG Meeting Center, Bamako, Mali*

## Summary

A total of 53 stakeholders from Mali's government, NGO community, stove users, stove manufacturers, artisans and retailers convened to discuss the carbon finance project aimed at disseminating efficient household cookstoves in Mali. Virtual input was also requested from the 11 invited guests who were unable to attend. Stakeholders overwhelmingly expressed support for and appreciation of the project and its socioeconomic and environmental benefits. The few recommendations going forward included:

- Confirming that raw materials and waste from manufacturing were dealt with properly.
- Ensuring proper working conditions and pay for those employed in the industry.

## Introduction

The meeting began with a brief introduction of E+Co and the Center for Entrepreneurship in International Health in Development (CEIHD) staff members present. Those conducting the meeting included:

*Catherine Diam* – Ms. Diam is a Monitoring and Evaluation officer for E+Co. A Senegalese national, she is based in E+Co's New Jersey office but spends about 50% of her time in the field in West Africa.

*Erik Wurster* – Mr. Wurster is a Carbon Finance Officer for E+Co and E+Carbon and is based in Boston. He spends extensive time in the field implementing E+Co's carbon finance activities worldwide.

*Evan Haigler* – Mr. Haigler is the Executive Director of CEIHD. He was commissioned by E+Carbon to provide technical assistance in developing this project.

## Presentation summary

Catherine Diam conducted the entire formal presentation in French, while both a professional Bambara translator and the Mali Designated National Authority (DNA), Mr. Boubacar Sidiki Dembele, translated the presentation verbally to Bambara speakers.

Ms. Diam first offered a short history of the project and outlined E+Co as an organization. In addition to E+Carbon's work in the carbon finance arena, E+Co invests business support services and capital in sustainable energy businesses in Africa, Asia and Latin America. E+Co's 15 year track record and investments in 25 countries ensure that they are a reliable and competitant project partner and investor. She outlined Mali's household fuel use conditions, highlighting the public health and environmental implications of cooking with fuelwood and charcoal in 80-90% of households in Mali. The SEWA stove, which saves some 30% of charcoal compared with its business-as-usual counterpart, has the potential to address this issue. Katene Kadje, the company selling these stoves in Mali, was founded in 1995.

Ms. Diam then outlined cap-and-trade and emissions trading, and explained how the voluntary markets fit within this broader framework. She explained Katene Kadji's sales growth ambitions after carbon finance, outlining how carbon revenues would be utilized. Among other things, one key use of carbon revenues will be to decrease the price of stoves so even the poorest Malians can afford the technology. Ms. Diam finally discussed the environmental and social implications of the proposed project.

Upon completion of the formal presentation, Ms. Diam explained that we would first open the floor to questions by participants (participants were asked to state their names and affiliation prior to each question), and later break into two groups to complete the Gold Standard stakeholder questionnaire. The first group would complete the written questionnaire in French, while illiterate participants would be brought to a separate room where a professional Bambara translator will discuss each question with them and note their responses.

Question and answer session

Cheick Ahmed Sanago (Malian Government Department of Energy) – Given Mali's vulnerable environment, this is a particularly suitable project that will alleviate pressure that unsustainable fuelwood harvesting is placing on our forests. I support any project that will help put more efficient stoves in Mali's households. Currently the efficient stoves that are sold tend to be used in urban areas, but I would strongly support their use in rural areas as well. Can you elaborate more upon the methodology used to implement this project? Specifically, I am curious to know whether the methodology was developed for use in a developed world context, or whether it was intended for use in a developing world context. Do you think that it is economically and culturally appropriate for our situation in Mali? I see from the project summary that you distributed that Berkeley Air is responsible for some of this monitoring work. Are they conducting all of the monitoring?

Evan Haigler – The Gold Standard methodology used was developed for use specifically on household stoves in the developing world. Just like there are specific methodologies for more efficient centralized power plants, this methodology is specifically designed to account for geographically dispursed households. The methodology requires that we survey a statistically significant and representative subset of end users, and draw conclusions about the entire end user population based on these responses. Household surveys and other methods used were reviewed by several Malian nationals prior to implementation, and adjustments were made based on culturally specific conditions in Mali to improve survey accuracy.

Badou Samounou (Malian Consumer Association) – Mr. Samounou outlined at length his support for the project and reinforced its environmental and public health benefits. He stressed that projects that promote efficient stove use will have a direct effect on reducing charcoal consumption. Interestingly, he pointed out that If Malians keep using firewood at current rates, plant species extinction will have implications on discovery of new medicinal plants. Mr. Samounou asked if we could explain more about the requirements of the Gold Standard, as he does not fully understand their seemingly complex rules. Finally, he expressed curiousity about the broader emissions trading system in which this project will play a part. He wondered why developed nations do not cut their emissions rather than just paying Mali to cut theirs, when indeed, Mali's emissions are insignificant compared to those of most developed nations. He questioned whether such a system is a long term solution to the climate problem.

Boubacar Sidiki Dembele (Mali DNA) – The Mali DNA took the liberty of offering an initial response to one of Mr. Samounou's questions. With respect to international emissions trading, he emphasized that it is less expensive for a country that is in the process of developing their infrastructure to adopt new clean technologies than to require an already developed country to alter existing infrastructure. Therefore, one of the goals of such projects is to leapfrog obsolete technologies and circumvent mistakes that have been made by more developed countries.

Evan Haigler – A functioning cap-and-trade system caps emissions in developed countries, while providing the option to meet some of their emissions reductions by investing in projects in developing countries. This provides an incentive to move capital from developed to developing nations. The initial goal is abating greenhouse gas emissions, yet the final outcome is improved living standards in developing countries – in this case, co-benefits such as curbing deforestation, improving public health creating jobs and promoting sustainable development. Although this project is being structured in the voluntary markets and thus does not comply with a formal cap in the developed world, the principle and the outcome is much the same. But you are quite right, the developed world emits an overwhelming majority of greenhouse gases, and thus should shoulder a higher proportion of the burden to address climate change than their developing world counterparts.

Tiémoko Seuleyman Sahgaré (FDS, a non-profit organization) – What is the price per ton expected in the market for offsets from this project in the international market and what volumes to you expect over time?

Erik Wurster – For the expected volumes of this project, see the project description available at this meeting in hard copy. There is a chart that outlines the expected offsets by year from 2008 through 2017. The price is a bit tricky to identify. There are two broad carbon markets in the world, the compliance markets (under Kyoto) and the voluntary markets. Each have quite different prices for offsets. This project is being structured in the voluntary markets. The offsets are not yet sold, so we do not know the final price. But voluntary market offsets tend to sell in the wholesale markets at anywhere from $5 to $15/ton.

Evan Haigler– The price also depends on the volume being sold, the vintage of offsets, the country and sector of origin and the standard according to which the project is developed. This project is originated in a least developed nation, has significant co-benefits and is being developed according to the most rigorous standard currently available within the voluntary markets. This meeting is part of our quest for transparency, which will fulfill a commitment to the Gold Standard to gain their seal of approval. All of these factors suggest that it should sell towards the higher end of the range that Erik mentioned.

Boubacar Sidiki Dembele (Mali DNA) – The DNA offered an analogy that provided some clarity with respect to different market prices for different offsets. When one buys rice, one is offered different qualities of rice, which is reflected in the price. Moreover, the price of rice increases as you get closer to the final product. That is, rice still in the fields is worth less than rice that has been harvested, husked, bagged and brought to market. That is because if one buys rice while still in the field, one shoulders some level of risk that that rice will never make it to market due to drought or other circumstances beyond a farmer's control. The same is true for carbon offsets. If you purchase offsets before they have been brought to market, they are worth less simply because the buyer is shouldering risk of those offsets not being delivered.

### Gold Standard questionnaire

Upon concluding the question and answer session, participants were asked to complete Gold Standard's stakeholder questionnaire. The first group completed the written questionnaire in French, while illiterate participants were brought to a separate room where a professional Bambara translator discussed each question with them and summarized their responses. Although 53 people signed into the meeting on the signup sheet, only 42 attendees completed the Gold Standard questionnaire. Of those, 32 were literate and 10 were illiterate.

A qualitative summary of responses is included below, followed by a quantitative summary addressing each question in the form of two tables. Copies of the original, hand written surveys are available upon request.

Qualitative response summaries

*Literate group* – The overwhelming majority of respondents expressed strong support for the project. Respondents tended to be convinced that the project will promote human well-being and help to safeguard the environment. Respondents sent the clear message that the project has far more positive effects than negative ones. It will reduce exploitation of non-renewable biomass and help combat deforestation and desertification. Moreover, the project will result in increased employment opportunities in Mali. There was some concern regarding the need to handle contaminants during the manufacturing process, such as paint, in an appropriate way.

*Illiterate group* – Illiterate respondents, largely composed of stove artisans and manufacturers, also viewed the project very positively. They felt confident that negative effects on the environment due to handling raw materials and other aspects of the manufacturing process were minimal. More importantly, they were strongly supportive of the project's potential socioeconomic effects, including but not limited to job creation and improved wages. In spite of expressing strong support for their management, some expressed concern about their current low wages, a condition that they hope will change after receiving carbon finance.

Quantitative and qualitative response summaries broken down by question
(Note that not all respondents answered each question)

*Range of responses for environmental impacts*

| Question # | Environmental Impacts | | Is this likely to result in a significant effect? | | Brief response summary |
|---|---|---|---|---|---|
| | Yes | No | Yes | No | |
| 1 | 24 | 2 | 10 | 6 | The execution and construction of the project will affect natural resources in a positive way. It will save forest resources and emissions, and decrease consumption of non-renewable biomass. |
| 2 | 7 | 21 | 2 | 12 | Most respondents indicate that there are no negative environmental aspects of the project. |
| 3 | 2 | 26 | 1 | 14 | Most respondents claim that environmental contamination of lands or waters is not an issue with the project. |
| 4 | 9 | 15 | | 12 | Causing light, heat, noise, vibration or electromagnetic radiation was not identified as a significant concern. |
| 5 | | 32 | | 16 | Most respondents claim there is no risk of pollution or contamination of nature. |
| 6 | 8 | 25 | 2 | 11 | There are no areas that will be adversely affected by the project. Some areas that will benefit from the project are protected by Malian law. |
| 7 | 6 | 20 | 1 | 8 | Any adverse effects resulting from manufacturing will only occur in urban areas since the manufacturing facility is in urban Bamako. |
| 8 | 3 | 28 | 3 | 6 | There is no evidence to suggest that manufacturing, selling or using fuel efficient stoves will have a |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | negative effect on sensitive species. |
| 9 | 2 | 19 | 2 | 7 | No. |
| 10 | | 31 | | 10 | No. Of the natural disasters listed, the project can only have a positive effect, such as decreasing incidence of landslides due to curbed deforestation. |

*Range of responses for socioeconomic and health impacts*

| Question # | Socioeconomic and Health Impacts | | Is this likely to result in a significant effect? | | Brief response summary |
|---|---|---|---|---|---|
| | Yes | No | Yes | No | |
| 11 | 6 | 23 | | 17 | Of the few respondents who foresaw any issues with substances used in the project, there were minor concerns with paint used to paint stoves. They stressed the need to handle the paint appropriately. |
| 12 | 9 | 26 | | 7 | Respondents noted that charcoal is required to fire the kilns, however, this would be more than compensated for by saved charcoal from the project. |
| 13 | 14 | 12 | 10 | 8 | The engines used during the manufacturing process sometimes cause noises but have no effect on health. |
| 14 | 4 | 22 | | 6 | Pollution will be insignificant. |
| 15 | 20 | 6 | 9 | 3 | Some answered that workers could face accidents on the job. Workers could be injured by manufacturing equipment. |
| 16 | 22 | 2 | 11 | 5 | Some noted the risk of injury during manufacturing of stoves, and the need to ensure a safe working environment. |
| 17 | 2 | 24 | | 6 | No. |
| 18 | 2 | 23 | | 8 | No. |
| 19 | 17 | 9 | | 11 | Only retail sales activity will be highly visible, as it should be. |
| 20 | 3 | 18 | | 10 | No, the manufacturing facility is located far from these places. |
| 21 | 1 | 16 | | 13 | No. |
| 22 | 4 | 20 | 3 | 24 | Stoves are produced in a confined area that dos not have any such resources. |

| | | | | | |
|---|---|---|---|---|---|
| 23 | | 22 | | 26 | No. Of the natural disasters listed, the project can only have a positive effect. However, from a socioeconomic or health perspective, this positive effect will be negligible in the context of such natural events. |

Sign in sheet of all stakeholders in attendance

**Consultation des Parties**

| Nom | Prénom | Encerclez votre choix | Nom de votre organisme/ compagnie | Fonction ou Activité | Adresse Complète | E-mail | Numéro de Téléphone | Signature |
|---|---|---|---|---|---|---|---|---|
| Traoré | Mariam | Usager - Artisan / ONG - Gouvernement / Université | CAFO | organisatrice | Commune 3 Badialan I Rue 462 porte 109 | | ~~681-4461~~ 463-0289 | |
| Doumbia | Hamadou | Usager - Artisan / ONG - Gouvernement / Université | Independant | Artisan organisation | Kalaban Koura A.C.I | | 9360436 | |
| Daou | Moussa | Usager - Artisan / ONG - Gouvernement / Université | Independant | Revendeur Independant | Medina-coura | | 6108232 | |
| Dembélé | Oumar | Usager - Artisan / ONG - Gouvernement / Université | ONG AMASSIF | Chargé de suivi | Djelibougou Face à l'école Kalanbo | AMASSIF@cefib.com | Fax: 2245344 P: 2085672 | |
| Konaté | Seydou | Usager - Artisan / ONG - Gouvernement / Université | Independant | Artisan Revendeur | Badalabougou | | 5310364 | |
| Barry | Hamadou | Usager - Artisan / ONG - Gouvernement / Université | Fourneaux SE-WA | Agent Commercial | Sogoniko Commercial | | 6055750 | |
| THERA | Aminata | Usager - Artisan / ONG - Gouvernement / Université | CNESOLER | Responsable Recherche [illegible] | Badala CRES | batomafly@yahoo.fr | 669-67-98 | |
| DEMBELE | Boubacar Sidiki | Usager - Artisan / ONG - Gouvernement / Université | STP/CIGQE | STP/A | Faladie Sema Rue 706 Porte 48 | boubacar.dembele@yahoo.fr | 6731538 | |
| KEITA | Hamadoun | Usager - Artisan / ONG - Gouvernement / Université | CA-ONG | Chargé de Communication | Hamdallaye ACI [illegible] Nafadji | kambeli_s@yahoo.fr | 9017038 | |
| Sidibé | Bamadou | Usager - Artisan / ONG - Gouvernement / Université | SOMAGED | Directeur | Magnambougou | [illegible]@yahoo.fr | 2200794 6721015 | |
| Mme Ly | Fatimata | Usager - Artisan / ONG - Gouvernement / Université | CAFO | CEDRUD /CAFO | Bolibana | fatimatly@yahoo.fr | 6495332 2237474 | |
| SANGARE | Tiémoko Souleymane | Usager - Artisan / ONG - Gouvernement / Université | FDS | Directeur | Badalabougou 2 Rue Mondial | fdsafrique@... | 632[illegible] | |
| BEAUJAULT | Patrice | Usager - Artisan / ONG - Gouvernement / Université | Winrock International | Representant | BPE457 Bamako | pbeaujault@winrock-mali.org | 9015079 | |
| NIANG | Emma KOUROUMA | Usager - Artisan / ONG - Gouvernement / Université | AMADER | Chef de Service | | emaniang@yahoo.fr | 6440524 2238567 | |
| Holst | Jennifer | Usager - Artisan / ONG - Gouvernement / Université | CRS | Chargée Qualité des Programmes | Badala | jholst@ml.waro.crs.org | 6745951 | |
| Bambara | Ylonan | Usager - Artisan / ONG - Gouvernement / Université | Africare | chargé de programme | Korofina | [illegible]@hotmail.com | 6868851 | |
| DOUMBIA | Moussa | ONG | CSTZ | Conseiller | Boulkassoumbougou Cit Bmo | doumbia@[illegible].de | 6755584 | |

## Consultation des Parties

| Nom | Prénom | Encerclez votre choix | Nom de votre organisme/ compagnie | Fonction ou Activité | Adresse Complète | E-mail | Numéro de Téléphone | Signature |
|---|---|---|---|---|---|---|---|---|
| Mana | Aminata | Usager - Artisan / ONG - Gouvernement / Université | CAFO | organisat | [illegible] 1008 Lgt 620 Porte 28 | | 643-27 22 | |
| MARIKO | ISSA | Usager (Artisan) / ONG - Gouvernement / Université | Indépendant | Revendeur Indépendant | Banankabou-gou marché | | 589-90-09 | SC |
| Dembélé | Bakary | Usager (Artisan) / ONG - Gouvernement / Université | Indépendant | Revendeur | Daoudabougou | | 648-57-61 | |
| KAMATE | Abdoulaye | Usager (Artisan) / ONG - Gouvernement / Université | Indépendant | Revendeur | N'golonina | | 916-63-53 | |
| TOURE | Fatoumata | Usager - Artisan / ONG - Gouvernement / Université | RDL | transformation des produits | Korofina Nord porte 194 | | 636-84-69 | |
| Sanassidi | Aïssata | Usager (Artisan) / ONG - Gouvernement / Université | Katené Kadji | Directrice Commerciale | Faladié Sococo Rue 326 P185 | | 644 38 16 | |
| SAMASSEKOU | Ousmane | Usager (Artisan) / ONG - Gouvernement / Université | Katene Kadji | Directeur | Faladié IER Rue 1 P 153 / Rue 199 | Kenekadj@ yahoo .fr | 6790581 | |
| DAO | Bakary | Usager (Artisan) / ONG - Gouvernement / Université | Indépendant | Revendeur | Badalabougou | | | ce |
| Soumbia | Daouda | Usager (Artisan) / ONG - Gouvernement / Université | indépendant | Artisan | Kalaban ACI | | 469 8227 | DA |
| Dembélé | Abdoulaye | Usager - Artisan / ONG - Gouvernement / Université - Revendeur | indépendant | Revendeur atelier Dousama | Hamdallaye Diélibougou | | 617-5561 | |
| F. Zoubaye | Fatiméton | Usager - Artisan / ONG - Gouvernement / Université | REBECOMA | organisation | Daoudabougou Rue 410 P 210 | | 6783782 | |
| SAMOUNA | Badou | Usager - Artisan / ONG - Gouvernement / Université MSS | Radecoma (Comm Wateau) | Président | Rue 395 porte 22 BP 7002 Bagadadji | radecoma2002 @yahoo.fr | 679-13-93 / 220-52-78 | |
| SANOGO | CHEICK AHMED | Usager - Artisan / ONG (Gouvernement) / Université | Direction Nationale Energie | C. Div. Etudes Générales planification | CRES Badalabougou BP 1872 | [illegible] @yahoo.fr | 6989940 | |
| Diawara | Diawara | Usager - Artisan / ONG - Gouvernement / Université | CEDAVI/CAFO | Secrétaire | SEMA II Rue 607 P 57 | [illegible] @yahoo.fr | 636 7300 | |
| Sissoko | Goundo | Usager - Artisan / (ONG) Gouvernement / Université | CAFO | Coalition Environnement & Développement durable | Bamako Coura BPE 194 | goundo21 @yahoo.fr | 6780081 | |
| Iwa | Niaga | Usager - Artisan / ONG - Gouvernement / Université | Waye Gondy Cafo | Résidente | Badalabougou Cours | | 6439964 | |

## Consultation des Parties

| Nom | Prénom | Encerclez votre choix | Nom de votre organisme/ compagnie | Fonction ou Activité | Adresse Complète | E-mail | Numéro de Téléphone | Signature |
|---|---|---|---|---|---|---|---|---|
| TRAORE | MAME ANNA | Usager - Artisan / ONG - Gouvernement / Université | ADAF/ Gallé | Suivi/ Evaluat | Badala Rue G Nasser P 211 | adafgalle@afribone.net.ml | 2220033 | |
| Traoré | Fatoumata [illegible] | Usager - Artisan / ONG - Gouvernement / Université | GAD | Animatrice | Hippodrome | | 9384015 | |
| SIMBE | Adama Yoro | Usager - Artisan / ONG - Gouvernement / Université | D.N.E | Chef Section | CRES Badalabougou | [illegible]@yahoo.fr | 639 11 82 | |
| Sidibé Niaré | Maïmouna | Usager - Artisan / ONG - Gouvernement / Université | CAFO | CEDRUD | TSF S [illegible] P 202 R 577 | maimouna_sidibe50@yahoo.fr | 671 1689 | |
| [illegible] | [illegible] | Usager - Artisan / ONG - Gouvernement / Université | Indépendant | | Kalaban | | 6420[illegible] | |
| Diarra | Mahamadou | Usager - Artisan / ONG - Gouvernement / Université | Mali - Folkecenter | Coord. [illegible] Projet | Faladié SEMA R 848 P181 | [illegible]@malifolkecenter.org | 6471707 | |
| SENE | Aïchata Touré | Usager - Artisan / ONG - Gouvernement / Université | CAFO | CEDRUD | Kalaban coura [illegible] | | 6439616 5729910 | |
| Kamissoko Berthé | F. Jean Fourné | Usager - Artisan / ONG - Gouvernement / Université | STOP-SAHEL STOP-SAHEL | S. Exécutif [illegible] | Badala 2233380 223 3380 | stopsahel@orangemali.net | 2233380 223 3380 | |
| Cissé | Mamadou | Gouvernement | DNACPN | Chargé d'Etude | Boc[illegible] | [illegible]@yahoo.fr | 6764845 | |
| Sy Diabaté | Nana | CAFO | Chargé Energie | Bko Coura Bolibana | | nanacafo@yahoo.fr | 6715261 | |
| Gama | [illegible] | CAFO | | | | | | |
| Kata | Sira | CAFO | | Hamdallaye | | | 6333742 | |
| Diallo | Fanta | cafo | | Hamdallaye | | | 642 55 32 | |
| Doumbia | Tenimbé | cafo | | Hamdallaye | | | 902 54 15 | |
| Alhousseini Sow | | Boutique Energie | AMADER | | | | 546-17 [illegible] | |
| | | | | | | | 611 91 64 | |
| Doumbia | Ibelé | ONG. AVAC | AVAC | Chargé de Projets | Hamdallaye ACI 2000 | | 939-98-99 | |
| Sindié | DIALLO | ONG | AVAC | Secrétaire permanent | Bamako Hamdallaye | | 681-47-[illegible] | |
| Tiédiery | Traoré | Gouvernement | DNCN | chargé Foresterie communautaire | | | | |
| Mariko | Mahamadou | Katéni Kaji (Artisan) | Katéni Kaji | | | | 645-77-62 6420922 | |
| Sidibé | Cheickna | ONG | Dambo | [illegible] | BPE M 41 [illegible] | | 671 9701 | |

Virtual stakeholder consultation

Since not all invitees attended the event in person, invited guests were given the opportunity to comment on the project design virtually via email. The project summary was distributed in French, in addition to Gold Standard's stakeholder consultation questionnaire. One additional questionnaire was received via this forum, the response from which is reflected in the records above. The following 11 stakeholders were invited to comment on the project design after the in person consultation took place:

| Name | Given name | Title | Affiliation | E-mail address |
|---|---|---|---|---|
| Dembele | Toumany | | STP/Ministere de L'Environnement | toumanydem5@yahoo.fr |
| Bürer | Meinrad | Technical Director | Gold Standard Foundation | meinrad@cdmgoldstandard.org |
| Schlup | Michael | President | Gold Standard Foundation | michael@cdmgoldstandard.org |
| Tyler | Emily | | Gold Standard Foundation - South Africa Expert | emilyt@genesis-analytics.com |
| Coche | Laurent | Coordonnateur Programme Regional Energie-Pauvreté/PTF | UNDP Regional Programme | laurent.coche@undp.org |
| Oualy | Aboubacar | Responsable Micro-Entreprises et AGRs Programme Régional Energie-Pauvreté/PTF | UNDP Mali | bouba.oualy@ptfm.net |
| Byll-Cataria | Joseph | Resident Representative UNDP Mali | UNDP Mali | joseph.byll-cataria@undp.org |
| Poinsot | Philippe | | UNDP | philippe.poinsot@undp.org |
| Newton | Alexander | Mission Director | USAID - Mali | anewton@usaid.gov |
| Haïdara | Moussa Doudou | World Bank Private Sector Liaison Officer | Chambre de Commerce et d'Industrie du Mali (World Bank Private Sector Liaison Officer) | haidara_moussa@yahoo.fr |
| Diarra | Moussa | Communications officer | World Bank Mali | mdiarra@worldbank.org |

Brief description how comments by local stakeholders have been invited and compiled

The stakeholder consultation was announced in several ways. First, a full list of potential stakeholders was compiled by all project participants that included a full spectrum of government officials, NGOs, multilateral development organizations, end users and manufactures in Bamako and elsewhere. For those stakeholders that had email addresses, invitations were sent via email. This letter is included on the following page.

*Stakeholder invitation letter*

E+Co
ENERGY THROUGH ENTERPRISE



**E+Co**
**363 Franklin Street**
**Bloomfield, NJ 07003**
**Tel: +1-973-680-9100**
**Fax: +1-973-680-8066**
**www.EandCo.net**

Jeudi 12 Juin 2008

Objet : Consultation des Parties Prenantes

Cher Monsieur ou Madame:

Nous avons le plaisir de vous inviter à participer à une réunion consultative pour discuter des impacts sociaux et environnementaux d'un projet de vulgarisation de foyers améliorés au Mali. La réunion aura lieu le Vendredi 27 Juin, 2008 de 10 :00 à midi au CCA ONG à Bamako au Mali.

Une grande partie des ménages maliens utilise des fourneaux à charbon de bois qui sont peu efficaces. Ceci à des effets néfastes sur la sante publique à cause de la pollution intra-domiciliaire. Elle entraine aussi le déboisement et provoque une émission assez abondante de gaz à effet de serre qui sont à la base des changements climatiques. L'utilisation des foyers à basse consommation de charbon pourrait atténuer ces effets. Ce projet a pour but d'employer la finance carbone pour amener plus de gens à utiliser les foyers améliorés.

Au cours de la réunion, vous aurez l'occasion de donner votre point de vue sur le projet pour assurer que son exécution se fasse de la façon la plus efficace et la plus avantageuse possible sur le plan social et environnemental.

Nous vous prions de bien vouloir transmettre cette invitation à vos collègues qui s'intéressent à ce projet. Toutes les parties intéressées sont conviées. Veuillez répondre à cette invitation avant le 20 Juin 2008 en envoyant un courrier électronique à sewakadji@yahoo.fr; et en mettant en copie erik.wurster@eandco.net et catherine.diam@eandco.net . Si vous ne pouvez pas répondre avant le 20 Juin, nous vous prions tout de même d'être présent.

Dans l'attente de vous rencontrer et de travailler avec vous pour améliorer la santé des populations maliennes et lutter contre le déboisement, nous vous prions d'agréer l'assurance de notre très haute considération.

| | | |
|---|---|---|
| Ousmane Samassekou<br>Directeur<br>GIE Katene Kadji | Catherine Diam<br>Monitoring and Evaluation Officer<br>E+Co | Erik Wurster<br>Carbon Finance Officer<br>E+Co |

"Best in America" 2006, Independent Charities of America

For those stakeholders who lacked email addresses, project participants made in person visits to the offices of each stakeholder in Bamako more than one week in advance to hand deliver hard copies of the invitations. For illiterate stakeholders, project participants relayed the invitation verbally. Finally, the invitation was posted in two local newspapers in Mali. Each advertisement appears below:

Advertisement 1

Le SoirdeBamako ACTUALITE PAGE 4

E+Co
ENERGY THROUGH ENTERPRISE

AVIS AU PUBLIC

Consultation des Parties Prenantes à la Finance Carbone

Nous avons le plaisir d'inviter toutes les parties intéressées à une réunion publique pour discuter des impacts sociaux et environnementaux d'un projet qui vise à vulgariser l'utilisation des foyers améliorés au Mali grâce à la finance carbone. La réunion aura lieu le vendredi 27 Juin 2008 de 10 heures 00 à 12 heures 00 au siège de la CCA ONG à Bamako.

***Veuillez contacter M. Samassékou au (223) 222 98 08 ou aux 673 05 85 et 641 77 00 si vous comptez assister à la réunion.***

Advertisement 2


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AVIS DE REUNION

ENERGY TROUGH ENTERPRISE

Consultation des parties prenantes à la finance carbone

Nous avons le plaisir d'inviter toutes les parties intéressées à une réunion publique **pour discuter des impacts sociaux et environnementaux d'un projet qui vise à vulgariser l'utilisation des foyers améliorés au Mali grâce à la finance carbone. La réunion aura lieu le vendredi 27 juillet 2008 de 10 heures à 12 heures au siège du CCA-ONG à Bamako.**
**Veuillez contacter Monsieur Ousmane S. Samassekou au :222- 98- 08 ou aux 673- 05- 85 et 641- 77- 00 si vous comptez assister à la réunion.**

One professional note taker was hired to record all comments at the meeting in addition to two professional translators. A videographer filmed the entire event and delivered a professionally edited video, which provided backup to the written notes that were taken during the event.

Full Stakeholder Invitee List

| | Last name | First name | Organization | E-mail address | Telephone number |
|---|---|---|---|---|---|
| 1 | Dembele | Boubacar Sidiki | STP/Ministere de L'Environnement | boubacar_dembele@yahoo.fr | (223) 223 1074, cell: (223) 673 1538 |
| 2 | Dembele | Toumany | STP/Ministere de L'Environnement | toumanydem5@yahoo.fr | NA |
| 3 | Togola | Ibrahim | Mali Folkecenter | NA | NA |
| 4 | Diarra | Mahamadou | Mali Folkecenter | NA | NA |
| 5 | | | Mali Folkecenter | NA | NA |
| 6 | Bürer | Meinrad | Gold Standard Foundation | meinrad@cdmgoldstandard.org | NA |
| 7 | Schlup | Michael | Gold Standard Foundation | michael@cdmgoldstandard.org | NA |
| 8 | Tyler | Emily | Gold Standard Foundation - South Africa Expert | emilyt@genesis-analytics.com | NA |
| 9 | Coche | Laurent | UNDP Regional Programme | laurent.coche@undp.org | Tel: + 221- 33 867.27.91 Port/mobile: + 221- 77 637 97 44 Fax: + 221- 33 867.22.55 |
| 10 | OUALY | Aboubacar | PNUD | bouba.oualy@ptfm.net | Tél: + 221- 33 867.27.96. Fax: + 221- 33 867.22.55 Port/mobile: + 221- 77 540.88.40 |

| | | | | | |
|---|---|---|---|---|---|
| 11 | BYLL-CATARIA | Joseph | PNUD | joseph.byll-cataria@undp.org | Switchboard/Receptionist (223) 222 01 81 Resident Representative (223) 222-20-52 |
| 12 | POINSOT | Philippe | PNUD | philippe.poinsot@undp.org | Switchboard/Receptionist (223) 222 01 81 |
| 13 | General invitation | | ELCOM/GTZ | NA | NA |
| 14 | General invitation | | AMADER | NA | NA |
| 15 | General invitation | | CAFO | NA | NA |
| 16 | General invitation | | Ministere de la Sante | NA | NA |
| 17 | General invitation | | DNCN | NA | NA |
| 18 | General invitation | | DNAPCM | NA | NA |
| 19 | General invitation | | PAPE/GTZ | NA | NA |
| 20 | General invitation | | CNESOLER | NA | NA |
| 21 | Dembele | Bakarou | Artisan/revendeur | NA | (223) 648-5761 |
| 22 | Doumbia | Daouda | Artisan/revendeur | NA | (223) 469-8227 |
| 23 | Kamate | Abdoulaye | Artisan/revendeur | NA | (223) 916-6853 |
| 24 | Mariko | Mamadou | Artisan/revendeur | NA | (223) 913-9106 |
| 25 | Kante | Issa | Artisan/revendeur | NA | none |

| | | | | | |
|---|---|---|---|---|---|
| 26 | Daou | Moussa | Artisan/revendeur | NA | (223) 610-8832 |
| 27 | Konate | Mahamadou | Artisan/revendeur | NA | (223) 531-0364 |
| 28 | Dembele | Abdoulaye | Revendeur | NA | NA |
| 29 | Sylla | Mohamed | Revendeur | NA | NA |
| 30 | Doucoure | Bakome | Revendeur | NA | NA |
| 31 | Sow | Alhousseini | Revendeur | NA | NA |
| 32 | General invitation | | Association Malienne pour la Protection de L'Environnement | stopsahel@datatech.toolnet.org | (223) 647 1496/223 3380 |
| 33 | General invitation | | Association Kilabo | kilabo@spider.toolnet.org | (223) 222-3652 |
| 34 | General invitation | | Fondation pour le Developpement du Sahel | fds@malinet.ml | (223) 223 4108 |
| 35 | General invitation | | Groupe Action Developpement | gad@datatech.toolnet.org | (223) 221-1325 |
| 36 | General invitation | | Developpement a la Base | donko@datatech.toonet.org | (223) 221-3881 |
| 37 | General invitation | | Cabinet de Recherche Action pour le Developpement Endogene | crade@afribone.net.ml | (223) 229-7005 |
| 38 | General invitation | | Association Malienne pour la Conservation de la Faune et de l'Environnement | amcfe@afribone.net.ml | (223) 223 5179 |
| 39 | General invitation | | Association Malienne pour la Sauvegarde du bien-etre Familial | | |
| 40 | General invitation | | Association Malienne pour la Promotion du Sahel | amapros@datatech.toolnet.org | (223) 229-5395 |

| | | | | | |
|---|---|---|---|---|---|
| 41 | General invitation | | Agence du Kharta pour l'Action et la Recherche Developpement | akared@spider.toolnet.org | (223) 229-1518 |
| 42 | General invitation | | Association pour le Developpement du Sahel | NA | (223) 679-7249 |
| 43 | General invitation | | Association Malienne d'Initiatives et d'Actions pour le Developpement | aidmali@spider.toolnet.org | (223) 229-8158 |
| 44 | General invitation | | Action Couverture et Developpement | NA | (223) 220-3076 |
| 45 | General invitation | | Association pour le Developpement des Activites de Production et de Formation | alassane@ceci.ca | (223) 221-0033/ 229-4844 |
| 46 | General invitation | | Carrefour Developpement | card@cefib.com; diabiroumaiga@yahoo.fr | (223) 224-5210/671-0163 |
| 47 | General invitation | | Regroupement des Consommateurs du Mali | NA | NA |
| 48 | General invitation | | USAID - Mali | mdoumbia@usaid.gov | NA |
| 49 | General invitation | | USAID - Mali | lchandonnet@usaid.gov | NA |
| 50 | Newton | Alexander | USAID - Mali | anewton@usaid.gov | 223-222-3684 |
| 51 | Haïdara | Moussa Doudou | Chambre de Commerce et d'Industrie du Mali (World Bank Private Sector Liaison Officer) | haidara_moussa@yahoo.fr | NA |
| 52 | Diarra | Moussa | World Bank Mali | mdiarra@worldbank.org | (223) 222 22 83 |

Annex 6

BERKELEY AIR
MONITORING GROUP

2124 KITTREDGE STREET #57, BERKELEY, CA 94704

# Carbon Monitoring Report on the Sewa Improved Charcoal Stoves of Katene Kadji, Mali

for

**E+Carbon**

prepared by:

**Berkeley Air Monitoring Group**

August 2008

# I. Methods and Approach

## *I.A. Kitchen Survey*

About 95% of Katene's current Sewa charcoal stove sales occur in Bamako. Kitchen Surveys were therefore administered on customers within Bamako's six sub-regions (or communes). As Katene is beginning to market stoves in other regions of the country, namely the cities of Segou, Mopti, and Sikassou, future, on-going KSs may be performed in such other regions of Mali. 149 KSs were collected in total by a field team of three plus one supervisor in March 2008. The KS households were chosen from Katene Kadji's sales record using clustered random sampling inside of three areas of Bamako, covering two communes and eight districts of the city.

The three chosen survey areas in Bamako were a part of Katene's highest sales regions and were representative of and demographically similar to Katene's typical Bamako customer. The breakdown of the KSs by area, commune, and district is shown below:

- 57 surveys in Commune 6 from the following districts: Banakabougou (8), Faladie (14), and Magnombougou (35)
- 56 surveys in Commune 6 from the following districts: Songoniko (25) and Sagoniko (31)
- 36 surveys in Commune 5 from the following districts: Torokorobougou (22), Senou (1), and BACO-ACI (13)

## *I.B. Kitchen Performance Test*

Kitchen Performance Tests (KPTs) were performed in 53 households (HHs) in Bamako by a field team of four and a supervisor in April 2008. The KPT was conducted over three full days, requiring daily household visits for four days. Charcoal and, where applicable, fuelwood, were weighed daily using Accu-Weigh spring scales. A survey was also administered daily to record information about cooking stove and fuel usage, the number and type of meals prepared, and the number of people cooked for. The KPT was performed using a Before and After (paired) study design. The KPT was performed in the households Before the introduction of the Sewa charcoal stove (traditional charcoal stove phase), the Sewa stove was then introduced, the HHs were then given several days to become accustomed to the Sewa stove, and finally the After KPT was performed.

The KPT households were selected using screening criteria based on the 149 KSs, so as to be representative of the typical Sewa stove customer. KPT households came from four communes covering six districts of Bamako. The breakdown of the 53 KPT households by commune and district is shown below:

- 14 KPTs in Commune 2, from the following district: Quinzambougou
- 14 KPTs in Commune 3, from the following districts: Dar Salam (5) and N'tomikorobougou (7)
- 13 KPTs in Commune 5, from the following districts: Kalabankoro (12) and Bacodjicoroniaci (1)
- 12 KPTs in Commune 6, from the following district: Faladie

The KSs revealed that about 45% of Sewa stove purchasers also cooked daily with fuelwood; this percentage was generally confirmed by local knowledge of the Sewa stove customers. Hence, the screening criteria were used to include both HHs who were not fuelwood users and HHs who were daily fuelwood users. In the end, the KPT included 35 HHs who did not use fuelwood and 18 who used fuelwood daily.

Katene Kadji's sales record of 4579 Sewa charcoal stoves sold in December 2007 through February 2008 was analyzed to determine the percentage of sales for each of their five stove models. This data is shown in Table 1 below.

Table 1. Percentage of Sewa stove sales by stove type.

| ***Stove Type*** | ***Percentage of Sales*** |
|---|---|
| Super Grand | 28.1% |
| Grand | 51.9% |
| Average | 19.3% |
| Small | 0.3% |
| Tea stove (smallest) | 0.4% |

The KPT focused on two of Katene's Sewa stove types, the most popular Grand model and the Average model. The low sales percentages of the Small and Tea models helped to inform this decision. Hence, of the 53 KPT HHs, 33 HHs were given Grand stoves and 20 HHs were given Average stoves. As the stove sizes are typically matched to family size, HHs with a family size of 10 or greater were given the Grand stove, while those of 9 or less were given the Average stove.

## *I.C. Non-renewable Biomass Baseline Study*

Non-renewable biomass baseline (NRBB) research is typically performed via desk research combined with visits to local experts in forestry and energy. Interviews and site visits held in-country generate the data used in the quantitative determination of the percent non-renewability in the area.

Between March 6$^{th}$ and March 27$^{th}$, 2008 the Berkeley Air field team conducted non-renewable biomass baseline research in the fuel supply basin around Bamako, Mali. In particular, this research was performed to determine to what extent the project population's use of woody biomass for charcoal is not balanced by re-growth in the supply area.

<u>Interviews Held</u>

- Malian Consumer's Association
- Ministry of Forestry

- Kasela Charcoal-Maker's Collective
- Ministry of Mines, Energy and Water
- Ministry of Environment
- Malian Agency for Domestic Energy Development and Rural Electrification (AMADER)
- United Nations Development Programme (UNDP)

Documents Consulted

- "Schema directeur d'approvisionnement (SDA) en bois energie de Bamako: Rapport final", Agence Malienne pour le Developpement de l'Energie Domestique et de l'Electrification Rurale, 2006
- Food and Agriculture Organization of the United Nations, Forestry Outlook Study for Africa (FOSA), Subregional Report: West Africa, 2003.
- "Is there a fuelwood crisis in rural Mali?" Banjaminsen, Tor A. 1997 (October) *Kluwer Academic Publishers*
- "Charcoal production and use in Africa: what future?" Girard, P. 2002, *Unasylva* 211, Vol. 53
- "Actualisation des donnees statistiques sur l'energie domestique malienne", Ministere des Mines, de L'Energie et de l'Eau, Direction Nationale de l'Energie, le Gouvernment du Mali
- "La biomasse au Mali: Situation actuelle et perspectives", Sanogo, Cheick Ahmed. Conference Internationale sur la biomasse, Rome 10-14 Mai, 2004.
- "Enquete de consommation de combustibles domestiques au Mali", réalisé par le BEAGGE, Permanent Interstate Committee for Drought Control in the Sahel, August 2004
- 2004 Masters Thesis from University of Sorbonne
- "Etude sur la disponibilite de poussier de charbon a Bamako" Sanogo, C.A. and CRETAS, March 2004
- Food and Agriculture Organization of the United Nations, The State of the World's Forests , Ministry of the Environment, Mali

Quantitative Approach

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.

Supply area (A):

The fuel supply area for Bamako is generally defined as the 61 communes that contribute to fuelwood or charcoal supply in Bamako according to the "Schema Report."

Mean annual increment (MAI):

MAI is the annual amount of biomass regrowth within the supply area, either from natural vegetative growth or replantings. Although the MAI would ideally be calculated for biomass used for charcoal production only, the growth and renewability of wood converted to charcoal cannot be separated from the renewability of fuelwood in general, because the same tree species are often used for both fuel types. Consequently, in this case, we focused on the MAI for total woodfuel (charcoal + fuelwood) production.

Annual harvest (H):

H is the total annual amount of biomass removed from the supply area. While we can define H for charcoal, in order to accurately compare H to MAI, we must use figures for total woodfuel harvest.

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

$$X_{nrb} = 1 – (MAI/H)$$

# II. Results

## *II.A. Kitchen Survey*

Among the 149 Kitchen Survey respondents (who had already purchased a Sewa improved charcoal stove), the number of people being cooked for in these household covered a wide range, with an average of 11.4 and a median of 10, as shown in Figure 1 below.

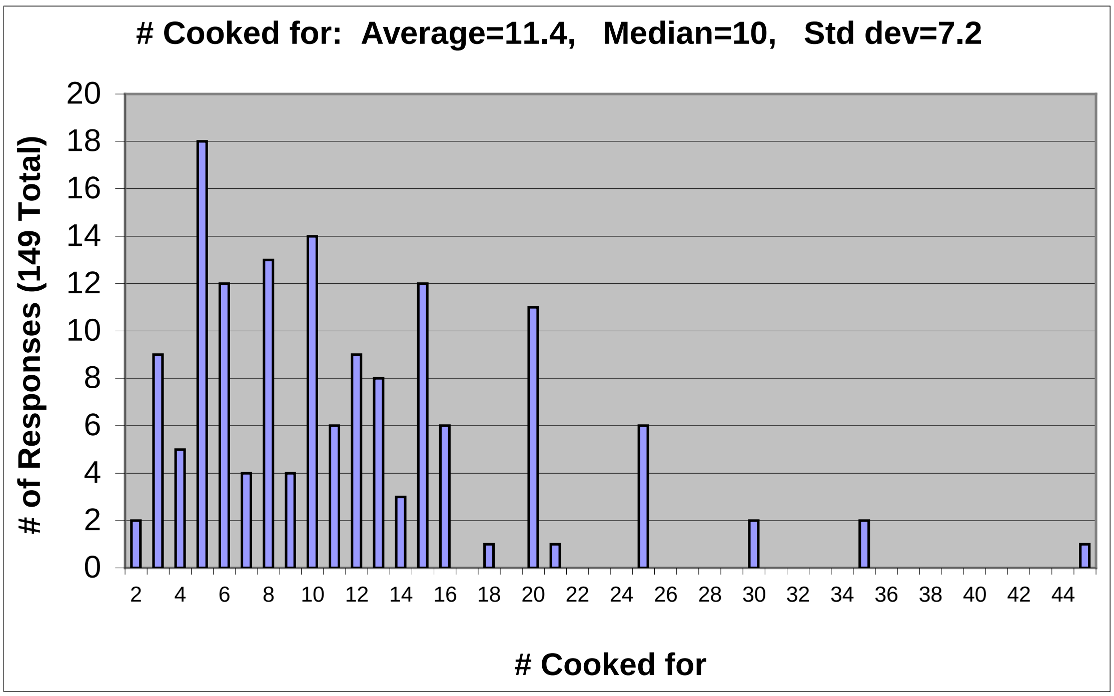


Figure 1. KS responses for the number of people being cooked for.

The data in Figure 1 was used to create criteria for the KPT household selection process.  In order to cover the typical range of people being cooked for and to avoid the outliers, households cooking for between 4 and 19 people were included in the KPT.  Very large family sizes (greater than 19) were excluded from the KPT so as to be conservative with overall fuel savings estimates and to avoid performing the KPT in these less common situations where multiple families share cooking stoves and food, making it difficult to track and weigh the charcoal associated with one household’s charcoal stove.

The survey results on fuelwood and LP gas use are shown in Table 2 below.

Table 2. Survey results on the number of households using fuelwood and LP gas at least once per day, Before and After purchase of a Sewa stove.

| | ***Before Sewa (HHs with 1 or more uses per day)*** | ***After Sewa (HHs with 1 or more uses per day)*** |
|---|---|---|
| ***Fuelwood*** | 67 of 149 (45%) | 39 of 149 (26%) |
| ***LP Gas*** | 79 of 149 (53%) | 65 of 149 (44%) |

Table 2 shows that 45% of Sewa customers reported cooking with fuelwood at least once per day before they purchased their Sewa stove. This data led to the KPT household selection criteria that approximately 45% of the HHs should be daily fuelwood users. Table 2 also shows the relatively common usage of LP gas, both before and after purchase of the Sewa stove. LP gas usage was not included in the KPT HH selection process, due to the fact that its use goes down, though not dramatically, after purchase of a Sewa stove and the difficulty of quantifying LP gas use over a 3-day period. The average number of times LP gas was used per day in the survey group was 0.84 before and 0.63 after, a significant reduction (p= 0.027).

The KS thus identified two potential clustering criteria for Sewa stove users, that of daily usage of fuelwood or not. The size of Sewa stove was the other factor considered as a clustering criterion for estimating fuel savings.

## *II.B. Kitchen Performance Test*

Measured Charcoal Savings Results

Table 3 below summarizes the charcoal use results of the 3-day KPT before and after purchase of a Sewa stove, in units of kilograms per household-day (kg/HH-day). The charcoal savings (Before – After) is also shown, along with the p-value of a paired, two-sided t-Test for significance. Results for all 53 households and each of the four sub-groups are shown.

Table 3. Daily charcoal use results of the KPT in kg per household per day (kg/HH-day). The standard deviations are shown in parentheses.

| ***Sub-group*** | ***# of HHs*** | ***Before Sewa charcoal use*** | ***After Sewa charcoal use*** | ***Charcoal Savings, Before-After*** | ***t-Test*** |
|---|---|---|---|---|---|
| | | ***(kg/HH-day)*** | ***(kg/HH-day)*** | ***(kg/HH-day)*** | ***(p value)*** |
| All households | 53 | 2.9 (1.5) | 2.1 (1.3) | 0.82 (1.1) | 0.000001 |
| No fuelwood HHs | 35 | 3.1 (1.5) | 2.2 (1.4) | 0.88 (0.9) | 0.000004 |
| Daily fuelwood HHs | 18 | 2.5 (1.4) | 1.8 (1.2) | 0.71 (1.3) | 0.037 |
| Grand stove | 33 | 3.2 (1.7) | 2.2 (1.4) | 0.94 (1.2) | 0.0001 |
| Average stove | 20 | 2.4 (1.1) | 1.8 (1.1) | 0.62 (0.9) | 0.007 |

As the t-Test p-values in Table 3 above reveal, all groups shown above had significant charcoal savings. There was, however, no statistical difference in the charcoal savings between the '*No fuelwood*' and '*Daily fuelwood*' sub-groups; the p-value of the t-Test comparing the two sub-groups was 0.63.

Therefore, daily use of fuelwood or not was not considered a valid clustering criterion, as this criterion had so little effect on the measured charcoal savings.

The difference in charcoal savings between the Grand stove and the Average stove was statistically stronger; the p-value of the t-Test comparing the two sub-groups was 0.27. While not significant at the 0.05 level, it was nonetheless deemed valuable to assign the two stove sizes different charcoal savings values. Thus, size was determined to be a legitimate clustering criterion and each of the five stove sizes sold by Katene were treated as their own cluster, with fuel savings assigned to each using either measured or estimated methods, as described below.

<u>Charcoal Savings for Super Grand, Small, and Tea Stoves</u>

Daily charcoal savings for the Super Grand, Small, and Tea stoves were estimated based on the fuel savings results for the Grand and Average stoves.

Larger stoves typically save more fuel (i.e. charcoal) than their smaller counterparts on a daily and annual basis for two reasons. First, larger stoves have greater capacity and can accommodate more fuel and perform more cooking. Second, larger stoves have higher thermal efficiency than smaller ones, mostly due to a lower ratio of surface area to volume and, therefore, less heat loss, as heat loss is proportional to the surface to volume ratio. The KPT results herein demonstrate this effect as well, as the Grand stove saved 0.94 kg/HH-day compared to the Average stove's savings of 0.62 kg/HH-day. Keeping in mind thermodynamic properties, the KPT results, and applying our considerable field experience, we propose three different approaches for estimating the fuel savings of the three non-measured stoves.

One approach (#1) to estimating the non-measured stove savings was to multiply the Average stove savings by the ratio of the Average stove savings to the Grand stove savings (Average/Grand). The Tea stove savings could be estimated by multiplying the Average stove savings by the Average/Grand ratio a second time. These calculations are shown below:

$$\begin{aligned}\text{Average/Grand} &= \text{(Average savings)/(Grand savings)}\\ &= 0.62/0.94\\ &= 0.66\end{aligned}$$

$$\begin{aligned}\text{Small stove savings} &= \text{Average savings} * \text{(Average/Grand)}\\ &= 0.62 * 0.66\\ &= 0.41\ \text{kg/HH-day}\end{aligned}$$

$$\begin{aligned}\text{Tea stove savings} &= \text{Average savings} * \text{(Average/Grand)} * \text{(Average/Grand)}\\ &= 0.62 * 0.66 * 0.66\\ &= 0.27\ \text{kg/HH-day}\end{aligned}$$

Similarly, one could calculate the Super Grand stove savings by multiplying the Grand stove savings by the ratio of the Grand stove savings to the Average stove savings (Grand/Average). These calculations are shown below:

$$\begin{aligned}\text{Grand/Average} &= \text{(Grand savings)/(Average savings)}\\ &= 0.94/0.62\end{aligned}$$

= 1.5

Super Grand savings = Grand savings * (Grand/Average)
= 0.94 * 1.5
= 1.43 kg/HH-day

A second approach (#2), and perhaps the most technically robust, is to calculate the ratio of fuel savings to stove capacity for the measured Medium and Large stoves and then use that average ratio to extrapolate the fuel savings to the Tea, Small, and Super Grand stoves. Several measures of capacity were considered, including stove diameter, internal stove volume, and the maximum number of people for whom each stove was designed to cook. The ratio of fuel savings to stove capacity was calculated using these three different measures of capacity. The ratio was most similar for the Medium and Large stove when using the maximum number of people metric of capacity, as expected, based on Berkeley Air's field experience. Thus, the average ratio of fuel savings to the 'max cooked for' metric for Medium and Large stoves was used to calculate the fuel savings for the Super Grand, Small, and Tea stoves. The table below shows the relevant data:

Table 4. Calculated charcoal savings using ratio between savings and stove capacity

| | ***Measured savings (kg)*** | ***Capacity (max people cooked for)***[70] | ***Savings/ capacity*** | ***Calculated savings*** |
|---|---|---|---|---|
| Super Grand | x | 25 | x | 1.56 |
| Grand | 0.94 | 15 | 0.06 | x |
| Average | 0.62 | 10 | 0.06 | x |
| Small | x | 5 | x | 0.31 |
| Tea | x | 3 | x | 0.19 |

The final approach (approach #3) is to simply discount approach #2 by a 15% to be very certain that these estimated fuel savings values are conservative. Such an approach yields the following:

Super Grand: 1.56 * 0.85 = 1.32
Small: 0.31 * 0.85 = 0.26
Tea: 0.19 * 0.85 = 0.16

This approach (#3) was chosen as it was the most conservative of the three while still using the robust ratio of savings to stove capacity as a benchmark.

Table 5. Daily charcoal savings for all five Sewa stove types.

| ***Stove Type*** | ***Method*** | ***Daily Charcoal Savings (kg/HH-day)*** |
|---|---|---|
| Super Grand | Ratio of savings/capacity minus 15% | 1.32 |
| Grand | measured in KPT | 0.94 |

[70] From Katene nameplate estimates for each product

| | | |
|---|---|---|
| Average | measured in KPT | 0.62 |
| Small | Ratio of savings/capacity minus 15% | 0.26 |
| Tea | Ratio of savings/capacity minus 15% | 0.16 |

Fuelwood Use Results

Along with charcoal use, fuelwood use was measured in all daily fuelwood-using households. The results are shown in Table 6 below.

Table 6. Daily fuelwood use results of the KPT. The standard deviations are shown in parentheses.

| ***Sub-group*** | ***# of HHs*** | ***Before Sewa fuelwood use*** | ***After Sewa fuelwood use*** | ***Fuel wood savings ( Before–After)*** | ***t-Test*** |
|---|---|---|---|---|---|
| | | ***(kg/HH-day)*** | ***(kg/HH-day)*** | ***(kg/HH-day)*** | ***(p value)*** |
| Daily fuelwood HHs | 15 | 3.2 (2.4) | 2.7 (2.1) | 0.6 (2.5) | 0.34 |

Average fuelwood savings were 0.56 kg/HH-day, with a p value of 0.34. In order to be conservative, three households with very high, outlying daily fuelwood savings were removed from the analysis.

Fuelwood savings adjustment factors

The daily fuelwood savings will be applied to Average and Grand stoves (those on which the fuelwood KPT was based) and Super Grand stoves (although not increased for this larger stove), but, in order to be conservative, will not be applied to Small and Tea stoves. The KS revealed that about 45% of Sewa stove purchasers also cooked daily with fuelwood; this percentage was generally confirmed by local knowledge of the Sewa stove customers. Thus, an adjustment of 0.45 is used.

Table 7. Adjusted daily fuelwood savings for each stove type.

| ***Stove Type*** | ***Adjusted Daily Fuelwood Savings (kg/HH-day)*** |
|---|---|
| Super Grand | = 0.56 * 0.45 = 0.25 |
| Grand | = 0.56 * 0.45 = 0.25 |
| Average | = 0.56 * 0.45 = 0.25 |
| Small | 0 |
| Tea | 0 |

Final Daily Fuel Savings for Each Stove Type

The final daily charcoal and fuelwood savings for each stove type are shown in Table 8.

Table 8. Daily charcoal and fuelwood savings for each stove type

| ***Stove Type*** | ***Daily Fuel Savings (kg/HH-day)*** | |
|---|---|---|
| | ***Charcoal*** | ***Fuelwood*** |
| Super Grand | 1.32 | 0.25 |
| Grand | 0.94 | 0.25 |
| Average | 0.62 | 0.25 |
| Small | 0.26 | 0 |
| Tea | 0.16 | 0 |

## *II.C. Non-renewable Biomass Baseline Study*

The biomass fuel supply area for Bamako is generally defined as the 61 communes that contribute to the supply of fuelwood or charcoal to Bamako according to the "Schema Report" (Agence Malienne pour le Développement de l'Energie Domestique et de l'Electrification Rurale, 2006). For each commune, the Schema Report provided annual totals (in steres) for: woodfuel growth (mean annual increment, MAI), woodfuel harvest (H), the amount of charcoal sent to Bamako, and the amount of fuelwood sent to Bamako. Woodfuel consists of charcoal plus fuelwood. The Schema Report also defines one stere = 0.43 $m^3$ = 330 kg. As both charcoal and fuelwood savings were documented for Sewa stove users, non-renewability fractions of both charcoal and fuelwood were determined below.

<u>Non-renewability of charcoal</u>

Knowing the amount of charcoal sent to Bamako by each commune allowed us to better estimate the overall non-renewability of the charcoal. We considered the following three approaches.

*Approach #1 (charcoal)*:

In approach 1, the fuel collection area (A), consisting of 3,630,607 hectares, excludes the seven communes in the supply area which do not supply any charcoal to Bamako, since the renewability of the charcoal used in Bamako is not at all related to the production and harvesting of fuelwood in these communes. Hence, A, MAI, and H were defined as follows:

Fuel collection area (A) = all communes that supply any charcoal to Bamako (54 communes in total)

MAI = total woodfuel growth in all communes that supply any charcoal to Bamako
= 2,035,048 steres

H = woodfuel harvest in all communes that supply any charcoal to Bamako
= 4,125,013 steres

$$\begin{aligned}\% \text{ Non-renewability } (X_{nrb}) &= 1 - (MAI/H) \\ &= 1 - (2{,}035{,}048/4{,}125{,}013) \\ &= 0.51\ (51\%)\end{aligned}$$

*Approach #2 (charcoal)*:

In case 2, the fuel collection area (A), consisting of 1,658,304 hectares, includes the top charcoal-producing communes in the supply area which supply 95% of the charcoal to Bamako (26 communes). Doing so focused the supply area on the major charcoal-producing regions. Those areas collectively providing a total of only 5% of the charcoal to Bamako were excluded. Hence, A, MAI, and H were defined as follows:

Fuel collection area (A) = the top charcoal-producing communes which account for 95% of the charcoal supply to Bamako (26 communes)

MAI = total woodfuel growth in those 26 communes
= 854,143 steres

H = woodfuel harvest in those 26 communes
= 2,504,710 steres

$$X_{nrb} = 1 - (MAI/H)$$
$$= 1 - (854{,}143/2{,}504{,}710)$$
$$= 0.66\ (66\%)$$

*Approach 3 (charcoal)*:

Because each of the communes has a distinct supply area (with each commune having distinct values for H and MAI for woodfuel), each has a specific, localized non-renewability fraction. To account for this, approach 3 used a weighted, commune-specific non-renewability fraction method. The non-renewability fraction of each of the 54 communes supplying any charcoal to Bamako (totalling 3,630,607 hectares as in approach 1) was multiplied by the fraction of the total charcoal to Bamako that it supplies. These weighted non-renewability fractions for each commune were then summed to give the overall non-renewability fraction. The approach is shown below:

$$X_{nrb,overall} = \sum [X_{nrb,i} * (\text{charcoal fraction}_i)]$$

where

$X_{nrb,i}$ = non-renewability fraction for region i

$\text{charcoal fraction}_i$ = (charcoal to Bamako from region i)/(total charcoal to Bamako)

$$X_{nrb} = 0.59$$

Of the three methods, Approach 1 was chosen because it is the most easily reproduced on a bi-annual basis, as is required by the methodology, and is the most straight forward, all encompassing of the three. Thus, the best estimate of the percent non-renewability of the woodfuel providing the charcoal used in Bamako is 51%. This estimate is the most conservative of the three.

<u>Non-renewability of fuelwood</u>

Knowing the amount of fuelwood sent to Bamako by each commune allowed us to better estimate the overall non-renewability of the fuelwood. We considered the following three approaches.

*Approach #1 (fuelwood)*:

In approach 1, the fuel collection area (A), consisting of 2,908,108 hectares, excludes communes in the supply area which do not supply any fuelwood to Bamako, since the renewability of the fuelwood used in Bamako is not at all related to the production and harvesting of fuelwood in these communes. Hence, A, MAI, and H were defined as follows:

Fuel collection area (A) = all communes that supply any fuelwood to Bamako (45 communes in total)

MAI = total woodfuel growth in all communes that supply any fuelwood to Bamako
= 1,557,769 steres

H = woodfuel harvest in all communes that supply any fuelwood to Bamako
= 3,365,580 steres

% Non-renewability ($X_{nrb}$) = 1 - (MAI/H)
= 1 - (1,557,769/3,365,580)
= 0.54 (54%)

*Approach #2 (fuelwood):*

In approach 2, the fuel collection area (A), consisting of 1,605,778 hectares, includes the top fuelwood-providing communes in the supply area which supply 95% of the fuelwood to Bamako (22 communes). Doing so focused the supply area on the major fuelwood-providing regions. Those areas providing only 5% of the fuelwood to Bamako were excluded. Hence, A, MAI, and H were defined as follows:

Fuel collection area (A) = the top fuelwood-providing communes which account for 95% of the fuelwood supply to Bamako (22 communes)

MAI = total woodfuel growth in those 22 communes
= 823,469 steres

H = woodfuel harvest in those 22 communes
= 2,282,057 steres

$X_{nrb}$= 1 - (MAI/H)
= 1 - (823,469/2,282,057)
= 0.64 (64%)

*Approach 3 (fuelwood):*

Approach 3,

In approach 3, the non-renewability fraction of each of the 45 communes supplying any fuelwood to Bamako (same land area as approach 1) was multiplied by the fraction of the total fuelwood to Bamako that it supplies. These weighted non-renewability fractions were then summed to give the overall non-renewability fraction. The approach is shown below:

$$X_{nrb,overall} = \sum [X_{nrb,i} * (\text{fuelwood fraction}_i)]$$

where

$$X_{nrb,i} = \text{non-renewability fraction for region i}$$
$$\text{fuelwood fraction}_i = (\text{fuelwood to Bamako from region i})/(\text{total fuelwood to Bamako})$$

$$X_{nrb} = 0.47$$

As described in the charcoal non-renewability section above, using Approach 1 was considered the most reproducible, straight forward and all encompassing of the three, and was therefore used in this case. Thus, the best estimate of the percent non-renewability of the woodfuel used in Bamako is 54%.

*Future biomass non-renewability estimates*

Over the next several years, potential changes in the non-renewability fractions of charcoal and fuelwood in Mali will depend on many factors including population growth, forest replanting, the economy, the affordability of petroleum and electricity, the spread of biomass fuel saving products such as the Sewa stove, and other factors. It is difficult to predict the trend of biomass non-renewability in Mali. While the Sewa stove project will help reduce the pressure on biomass resources, we do not, however, expect this project or others like it to have a highly significant impact on the biomass non-renewability estimates in this report. The 2-year follow-up biomass non-renewability study will capture any significant changes due to the Sewa stove project and any others. Additionally, within the next 2 years, more high-quality data may become available, which could improve or further validate the non-renewability estimates in this report.

*Sensitivity Analysis*

In order to see the affect of variability or error in the parameters used to estimate the non-renewability fraction, a simple sensitivity analysis was performed. The non-renewability of charcoal (Approach #1 above) was used for this sensitivity analysis. As $X_{nrb}$ is equal to 1–(MAI/H), MAI and H are the two parameters of interest.

- The best estimate for charcoal (Approach #1): $X_{nrb} = 0.51$
- A 10% increase in MAI for each commune: $X_{nrb} = 0.46$ (a 9.7% decrease)
- A 10% increase in H for each commune: $X_{nrb} = 0.55$ (a 8.9% increase)

*Sense-check*

In order to provide a sense-check of the non-renewability fraction calculated for the Bamako supply basin in this report, Table 9 below illustrates a rough calculation of non-renewability for several countries in West Africa, based on national forest cover, fuel consumption, and growth statistics provided by the FAO (FAOSTAT-Forestry Database, 2005, http://faostat.fao.org).

Note that established non-renewability fractions are not readily, if at all, accessible for several countries in West Africa. As the FAO notes, "[d]espite several past attempts at improving biofuel information systems in Africa, woodfuel information is still very scarce or [of] poor quality, which prevents countries from undertaking detailed diagnosis and relevant planning activities”[71].

Table 9. National biomass non-renewability estimates for West Africa

| Country | Growing stock ($m^3$) (forest + wooded land) | MAI ($m^3$) (growing stock * 2.5% growth rate) | Annual Wood Harvest ($m^3$) | $X_{nrb}$ |
|---|---|---|---|---|
| Burkina Faso | 248,000,000 | 6,200,000 | 7,338,000 | 0.16 |
| Cameroon | 1,313,000,000 | 32,825,000 | 19,772,000 | -0.66 (0) |
| Ghana | 321,000,000 | 8,025,000 | 29,458,000 | 0.73 |
| Guinea | 520,000,000 | 13,000,000 | 14,001,000 | 0.07 |
| Guinea-Bissau | 51,000,000 | 1,275,000 | 1,417,000 | 0.10 |
| Liberia | 498,000,000 | 12,450,000 | 5,918,000 | -1.1 (0) |
| Mali | 443,000,000 | 11,075,000 | 6,386,000 | -0.73 (0) |
| Niger | 25,000,000 | 625,000 | 12,473,000 | 0.95 |
| Nigeria | 1,386,000,000 | 34,650,000 | 86,627,000 | 0.60 |
| Senegal | 347,000,000 | 8,675,000 | 5,110,000 | -0.70 (0) |
| Western Sahara | 38,000,000 | 950,000 | 6,332,000 | 0.85 |

* MAI calculated from total growing stock (FAO 2005) and a generic 2.5% growth rate

The NRB fractions in Table 9 are limited in the extent to which they can be compared with the fraction generated herein for the Bamako supply basin, because they are national averages, whereas the Bamako NRB fraction represents a more accurate picture of the situation on a local level. Still, it is interesting to see the extent to which non-renewability varies from country to country. Each of the NRB fractions in Table 9 exists within 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 so-called energy ladder.

There are a number of reasons why the Mali national biomass non-renewability estimate above is very different from our NRB baseline assessment for Bamako. First, the Mali national biomass non-renewability assessment includes a large amount of inaccessible, protected, or otherwise unusable biomass. As there is little data at the national level on fuelwood supply in Mali, the national estimate is based on the growth and harvesting of all wood, whereas the Bamako estimate is based specifically on fuelwood. In any case, the national estimates are not considered accurate. Bamako's situation is non-

[71] http://www.fao.org/docrep/009/j8227e/j8227e06.htm#TopOfPage

renewable because of the high population density, high rate of growth, and the recent dramatic switch among the urban population from fuelwood to charcoal. Finally, outside of Bamako, the use of charcoal (more fuelwood-intensive than fuelwood itself), is quite low.

# APPENDIX I: Copy of the Kitchen Survey

**Survey #: ______**

## KITCHEN SURVEY

## Individual Questionnaire

**Introductory Remarks:**

Good morning /afternoon, my name is _______________________. I am here on behalf of Berkeley Air Monitoring Group, based in the USA. Berkeley Air is an organization dedicated to protecting human health and climate. I am happy that you have made time for us. We are here today to talk to you about the Sewa improved charcoal stove you purchased from Katene Kadji and any other cooking device that you have in your household. If you would like to participate in the survey, we will ask you to answer some questions. This survey will take about 40 minutes. During this survey, we will ask you about your cooking practices and cooking devices. By participating in this survey, you will help us to improve the Sewa stoves. All of the information we collect will be kept private. Your name will not appear anywhere. Any other facts that might point to you will not appear when we report the findings of this survey.

* Do you agree to participate? 1. Yes 2. No (**Terminate the interview)**

Date of interview: _______________ (format: ddMonYYYY)

Time interview started: ____________ Interviewer's name: ________________________

| | **SECTION A: General Information** | |
|---|---|---|
| 1 | CITY: | 5. HH ID (only for KPT homes): |
| 2 | DISTRICT: | 6. Date of Purchase: |
| 3 | VILLAGE/ZONE: | 7. Stove Type/Size: |
| 4 | OTHER: | |

| | **SECTION B: Household Socio-demographic Characteristics** | |
|---|---|---|
| | **QUESTION** | **RESPONSE** |
| 8 | Sex of the respondent **(tick as appropriate, do not ask)** | 1. Male 2. Female |
| 9 | What is your highest level of education attained? | 1. None 2. Primary 3. Secondary<br>4. Tertiary 5. University<br>6. Other *(specify)*: ……...............................…. |

| | | |
|---|---|---|
| 10 | What is your marital status? | 1. Married\Cohabiting 2. Single/Never married 3.Divorced\Separated 4. Widowed |
| 11 | What relationship do you have with the head of household? | 1. Wife 2. House Help 3. Daughter 4. Other Relative |
| 12 | How many people live in your household? | Number: ________ |
| 13 | What is your households' main source of income? | 1. Trade 2. Employment 3. Farming 4. Casual laborer |
| 14 | Please describe your household type. | 1. Permanent 2. Semi Permanent 3. Temporary |
| 15 | Where is the **main** cooking place for your household? | 1. Inside house 2. Outside house 3. On the veranda 4. Separate kitchen 5. Other (specify): |
| | **Section C: Confirm Purchase of Sewa Stove** | |
| 16 | Do you have a Sewa stove? | 1. Yes 2.No **(Terminate the interview)** |
| 17 | For how long have you had the Sewa stove? | Time: ____________ |
| 18 | How many Sewa stoves do you have? | Number: _______ |
| 19 | Are you currently using the Sewa stove? | 1. Yes **(skip to Q 21)** 2.No |
| *20* | If no, why are you not using the Sewa stove? | 1. Got spoilt 2. Fuel expensive 3. Inconvenient 4. It is not effective (result not good) 5. It is not efficient (slow) |
| 21 | Are you satisfied with the Sewa stove? | 1. Yes 2.No |
| 22 | What do you like about the Sewa stove? | 1. Saves on fuel 2. Cooks faster 3. Portable 4. Lights faster 5. Good results 6. Other (specify): …………………………… |
| 23 | What don't you like about the Sewa stove? | 1.Uses a lot of fuel 2. Not portable 3. Does not cook faster 4. No good results 5. Takes long to light 6. Other (specify)………………………………… |
| 24 | Since you bought the Sewa stove, do you spend more, less, or the same amount of time cooking? | 1. More 2. Less 3. Same |
| *25* | If more or less time, why? (if the same, skip this Q) | 1.Family increased 2. Family reduced 3. Stove saves on fuel 4. Cook more foods 5. Stove retains heat 6. Stove cooks faster 7. Other (specify)……………………… |
| 26 | Since you bought the Sewa stove do you use more, less, or the same amount of fuel? | 1. More 2. Less 3 Same |
| 27 | If more or less fuel, why? (if the same, skip this Q) | 1. Family increased 2. Family reduced 3. Stove saves fuel 4. Cook more foods 5. Other (specify)………………….. |
| | **Section D: Fuel Use (Before)** | |
| 28 | **Before** buying the Sewa stove, what type of fuel(s) were you using? (select one here; list others below) | 1. Charcoal 2. Gas 3. Wood 4. Electricity 5. Husks 6. Paraffin 7. Other (specify): ....................................... |
| 29 | [fuel #2, if any] | 1. Charcoal 2. Gas 3. Wood 4. Electricity 5. Husks 6. Paraffin 7. Other (specify): ..................................... |
| 30 | [fuel #3, if any] | 1. Charcoal 2. Gas 3. Wood 4. Electricity 5. Husks 6. Paraffin 7. Other (specify): ..................................... |

| | | | |
|---|---|---|---|
| 31 | **Before** buying the Sewa stove, how often did you use each of the following cooking devices? | **Type of fuel** | **Number of times per day** |
| | | Ordinary charcoal stove | |
| | | 3 stone fire (wood) | |
| | | Paraffin stove | |
| | | Gas cooker | |
| | | Electricity cooker | |
| | | Other (specify).................................. | |

| | | | |
|---|---|---|---|
| 32 | **Before** buying the Sewa stove, what foods (including tea/coffee) did you cook using each fuel type? | **Type of fuel** | **Type of food** |
| | | Charcoal | |
| | | Wood | |
| | | Paraffin | |
| | | Gas | |
| | | Electricity | |
| | | Other specify...................... | |

## Section E: Fuel Use (After)

| | | | |
|---|---|---|---|
| 33 | **After** purchase of the Sewa stove, what type of fuel(s) were you using? (select one here; list others below) | 1. Charcoal 2. Gas 3. Wood 4. Electricity 5. Husks 6. Paraffin 7. Other, specify.......................................... | |
| 34 | [fuel #2, if any] | 1. Charcoal 2. Gas 3. Wood 4. Electricity 5. Husks 6. Paraffin 7. Other, specify.......................................... | |
| 35 | [fuel #3, if any] | 1. Charcoal 2. Gas 3. Wood 4. Electricity 5. Husks 6. Paraffin 7. Other, specify.......................................... | |
| 36 | **After** purchase of the Sewa stove, how often do you use each cooking device? | **Type of fuel** | **Number of times per day** |
| | | Sewa charcoal stove | |
| | | Ordinary charcoal stove | |
| | | 3 stone fire (wood) | |
| | | Paraffin stove | |
| | | Gas cooker | |
| | | Electricity cooker | |
| | | Other (specify)................................ | |
| | | | |
| 37 | **After** purchase of the Sewa stove, what foods (including tea/coffee) do you cook using each fuel type? | **Type of fuel** | **Type of food** |
| | | Charcoal | |
| | | Wood | |
| | | Paraffin | |
| | | Gas | |
| | | Electricity | |

| | | | |
|---|---|---|---|
| | | Other specify...................... | |
| | | | |
| | | | |
| 38 | Have you changed the types of fuels used since buying the Sewa stove? | 1 Yes 2. No **(skip to Q 40)** | |
| 39 | If yes, from what to what? | **Before Purchase** | **After Purchase** |
| | | | |
| 40 | Other than cooking (food and coffee/tea), do you use fuel for any other purposes? | 1 Yes 2. No **(skip to Q 42)** | |
| 41 | If yes, what purposes? | **Type of fuel** | **Purpose** |
| | | | |
| | | | |
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## SECTION F: Cooking Habits

| | | | |
|---|---|---|---|
| 42 | For what type of cooking do you use the Sewa stove? | 1. Domestic 2. Commercial 3. Both Domestic & Commercial 4. Institutional (specify)…………………… | |
| 43 | What is your family size? | Enter number: | |
| 44 | How many people do you cook for per day (on average)? | Enter number: | |
| 45 | How many meals do you cook for your family per day (on average)? | Enter number: | |
| 46 | How many bags/tins of fuel do you use per day (on average)? | Number used per day: ___________ | Size/type of bag: ____________________ |
| 47 | Do you collect or buy your fuel? | 1. Collect 2. Buy 3. Both | |
| 48 | How much do you spend on fuel per day (on average)? | **Cost:** ______________ | |
| 49 | Since you started using the Sewa stove, do you save money on fuel costs? | 1. Yes; amount_______________<br>2. No | |
| 50 | Do you intend to continue using the Sewa stove? | 1. Yes 2. No **(Skip to Q 50)** | |
| 51 | * If Yes, why | 1. It saves time 2. It saves money 3. It is easy to use 4. It is portable 5. It produces less smoke<br>6. Less coughing and eye irritation<br>6. Other (specify ………………..) | |
| 52 | * If No, why | 1. It is costly 2. It is difficult to use 3. It is not portable<br>4. It is not convenient 5. It produces more smoke<br>6. Other (specify …………...................................................) | |

| | | |
|---|---|---|
| 53 | What can be done to improve on the Sewa stove? | ……………………………………………….......... ............................................................................................ ............................................................................................ ...................................... |

**Time Interview ended: ____________________**

**Please record any useful observations or comments by respondents:**

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