USAID DIV – Senegal EcoSac Scale Up
The SEM Fund
Grant No. AID-OAA-F-13-00035
Milestone 1 Deliverables

June 13, 2013
USAID – DIV
Grant Number AID-OAA-F-13-00035

William Wes Daye:

As per the Fixed Obligation Grant to: The SEM Fund for "Senegal EcoSac Scale Up" agreement dated May 13, 2013, below please find the Milestone 1 requirements, including:

1) Updated Project Implementation Plan
2) Evaluation Strategy
3) Updated List of Indicators

Please let Siré Diallo (sire@sem-fund.org) and John Fay (john@sem-fund.org) know if you require any further information. Thank you for your support for the EcoSac initiative, we look forward to commencing the implementation phase of the EcoSac Scale Up programme.

Best regards,

Siré Diallo

EcoSac Scale Up Implementation Plan

Our primarily objective of the EcoSac Scale Up is to increase our production capacity to 1500 units per month and distribution capacity to 250 micro-entrepreneurs/sales agents through a micro-consignment arrangement, as well as growing our brand exposure through community-based marketing events. After a successful research and development phase, we have an appropriate, acceptable and affordable product that immediately provides economic benefits to customers. As of now, we are contracting out the manufacturing of the bags to individual tailors. Upon the receiving the DIV grant, workers will be trained at a central facility to perform the four major tasks involved in the EcoSac fabrication process; 1. cutting and measuring, 2. insulation placement, 3. sewing and 4. packaging and labeling. By using a modular approach, manufacturing one unit will take half the amount of time in comparison to the "contracted tailor" model we are currently using. This will significantly reduce our labor costs and increase our production capacity. We will use high-powered industrial sewing machines that produce highest quality units in a fraction of the time. Quality assurance measures will also be put in place to ensure each EcoSac meets high standards.

Product sales are currently conducted in-house; so far small quantities have been sold to few women groups. There is tremendous potential demand as proven by our first phase. We will prioritize engagement with international development organizations and domestic institutions for large sales contracts. By the fourth quarter of the first granting period our centralized manufacturing will allow us to service domestic markets and extended regional; providing the EcoSac for commission-based sales agents and through our own retail sales outlets.

Our key operational challenges are distribution to remote areas and collecting funds for micro-financed EcoSacs. However, we believe we can scale at a decent pace to ensure that we do not jeopardize our success. We intend to leverage our existing model community engagement model, which consists of organizing local communities on a volunteer basis to provide assistance for collecting our funds and liaising the community members. This system has been working well for the past 8 years with slight changes to incorporate lessons learnt to continually improve the business model.

To respond to this opportunity we have developed the following project implementation timeline and plan:

EcoSac Gantt Chart

Date	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014
Finalize EcoSac Design	X					
Finalize DIV Grant/financing	X					
Hire Manager & Facility Managers	-	X				
Hire Sales reps & Tailors		-	X			
Manufacturing Facility est.		-	X			
Mid-term USAID DIV Report				X		
Marketing & Distribution est.		-	-	-	X	
Distribution Partnerships est.		-	-	-	X	
Regional Expansion				-	-	X
Final USAID DIV Report						X

1. Identification of an affordable locally produced product to address the issues of high-energy cost, deforestation, unemployment, and household burden on women.

With the EcoSac, SEM Fund has developed an energy-efficient product that will save a household 30% on cooking fuel costs. Owing to the insulation properties of the EcoSac, food only needs to be brought to a specific cooking temperature for a few minutes and sealed inside the bag. Once the food is placed inside the EcoSac the user need not pay any attention to the cooking process until the food is ready to

be served. There is no worry that the food will burn. Meals will be kept warm for extended amounts of time, allowing for flexible dining hours. This is important in Senegal because families will often make large meals during the day that will be eaten by different people at different times throughout the day. Normally the food would have to be reheated at each time. With the EcoSac the food can be kept warm, and additional cooking fuel to reheat the meal is not necessary.

Within the first three months of the project commencement, SEM will complete a cost-effectiveness and affordability study; this study will include a cost-effective investment analysis regarding the public sector, competing product comparison and EcoSac affordability analysis.

2. Build out management capabilities to scale

The management personnel for the EcoSac project will be active in all production, sales and marketing processes. This is feasible during initial project deployment, but we will need to bring on board additional management personal within one year. Although all important management decisions will continue to be made in collaboration with The SEM Fund Management team, for EcoSac to be a successful brand, middle management personnel must be hired to implement day-to-day marketing and sales strategies.

The overall director of the programme will be the current SEM Fund Director Siré Diallo, who is based in Dakar, Dakar. The Director will be ultimately responsible for all milestone deliverables and required reports (mid-term and end of grant).

The EcoSac Manager is currently being sought and will be hired by July 30, 2013. We will open search for the position in the week of June 17, 2013.

3. Establish centralized manufacturing facility, hire EcoSac production staff and reduce input costs

The success of the EcoSac will be highly dependent on maximizing our labor force and reducing input costs. The fact that a majority of our target market will derive from low-medium income households increases the sales price sensitivity of our product. Our surveys have indicated that our target market in Senegal will not pay up-front over $20 for our product, with 80% stating that they would be willing to purchase our product if priced between $14-19. Therefore we will maximize production efficiency to offer the lowest possible price point. This will be achieved through centralizing manufacturing and by purchasing high quality raw materials at a significantly lower price to create a cost competitive advantage. The EcoSac insulation materials will come from a recycling program that we have initiated alongside a local plastics manufacturer that will reprocess for us the recycled materials. In normal situations these waste materials, used for shipping household appliances, would be sent to landfills in the already overcrowded city waste sites surrounding Dakar. However, our recycling program is only viable if we are dealing in large material volumes. Additionally, the fabric can be purchased at a much lower price once we achieve economies of scale. A centralized manufacturing facility will also allow us to better monitor product quality control.

A facility manager, Ndeye Bineta Sarr, has been identified and will begin July 1, 2013 to establish the production facility, select the sewing machines for purchase, monitor production efficiency and ensure quality control. The tailors will be hired as demand increases, with the first two intended to be hired by August 30, 2013.

4. Hire sales Staff and establish effective marketing campaign, distribution network for retail sales

Since the EcoSac is a new product SEM will develop an extensive marketing campaign to increase product awareness as well as inform individuals where the EcoSac can be purchased. Our sales and marketing personnel will lead a network of community sales agents in specific regions throughout Senegal. These individuals will have the ability to prop up the EcoSac brand through their connections and respected standing in their communities. Our 'community agent' model recognizes the importance of community leaders' support when promoting products. Community agents are trusted sources of information who are able to effectively raise awareness while increasing access to essential goods and services that, under normal circumstances, are unattainable by poor communities due to insufficient market infrastructure and high price points.

Sales and marketing personnel (two full time staff) will be hired by August 30, 2013. Our full time staff will engage and motivate increased product awareness through commission-based sales via a consignment arrangement. Our marketing campaign, which will include a variety of different approaches, will largely focus on the EcoSac's ability to address cooking energy costs. Through the experience with improved cookstove projects, SEM has learned a great deal in developing effective distribution networks to reach urban, peri-urban and rural populations.

5. Expand to key African and developed country markets

Within 12 months, we will have the necessary resources to expand into additional markets. Expansion strategy will include utilizing regional partners to build production facilities in their countries of operations. SEM will maintain control of EcoSac production, raw material sourcing and have final say in major decisions in EcoSac regional facilities, but will allow the partner organization exclusive distribution and sales rights. At this point, SEM will leverage the experience gained in Senegal to advise regional partners on sales and marketing strategies for seamless transition into other regional markets. Additionally, SEM will also explore the EcoSac viability in developed countries, primarily the US, Canada and Germany. For these markets the EcoSac will be sewed in Senegal to increase employment and income generating activities in our primary target country. However, the bags will be filled in a centralized storage and distribution facility in the United States and Europe.

By November 30, 2013, SEM will submit a draft scaling and financial sustainability plan. This will include but not be limited to the following: strategy for financial sustainability in Senegal market, strategy on how to enter new markets and 5-year pro-forma budgets.

The following chart illustrates the above described steps, highlighting the next steps and business processes necessary to implement our key strategies for the EcoSac venture, aligned with the overall SEM mission statement.

Implementation Activity	Processes
1. Identification of an affordable locally produced product to address the issue of high-energy cost and deforestation.	**Technology Development**: ES in-home R&D with continuous product improvements and design. We have continued to refine the EcoSac design and are now ready to take it to market.
2. Build out management capabilities to scale	**Firm Infrastructure:** develop capacity to engage domestic and regional partners. **Human Resources Management:** in-house training programs for EcoSac related sales, monitoring and evaluation capabilities (see evaluation strategy below), marketing and production skills. Ability to shift responsibility to new management personnel as venture scales up.
3. Establish centralized manufacturing facility	**Operations:** modular approach to Ecosac production, which can easily adapt to augmented product demand and sales. Purchase state-of-the art sewing machines. **Inbound Logistics**: source least expensive raw materials available in quantities that will coincide with predicted short-term EcoSac sales. **Physical Infrastructure:** Rent accessible building where production and warehousing can take place.
4. Establish effective marketing campaign and distribution networks	**Domestic Marketing and Sales:** conducted through a variety of media and channels. Cost effective procedures will include sales and marketing through our community agent model, as well as in-house retail sales. **Outbound Logistics:** further strengthening market infrastructure though product delivery and large order fulfillment services. This will also include engaging domestic partners for product promotion and bulk orders.

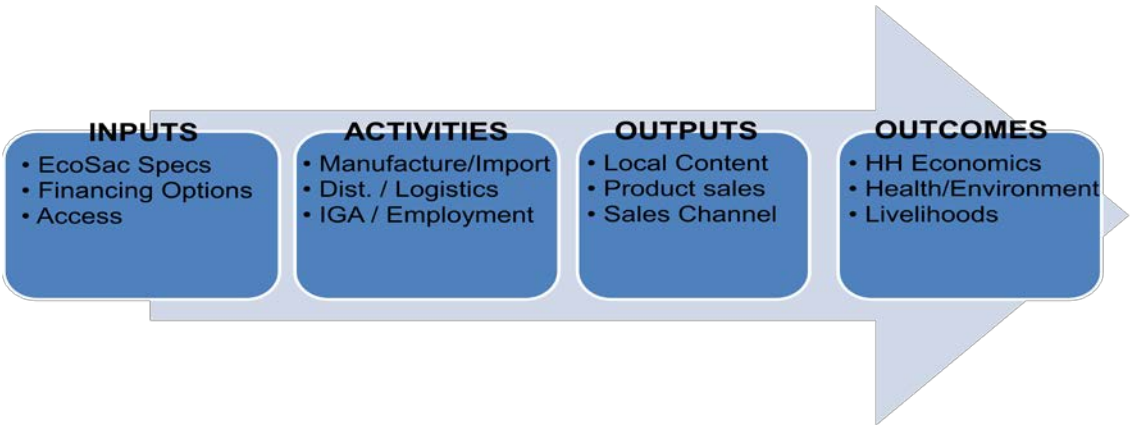
5. Expand to key African countries as well as the EU and North American markets	**International Marketing and Sales:** increase marketing capacity to build brand awareness in additional regional and international markets. Establish trusted international partners for sale and distribution in West Africa, the USA and Canada. **Outbound Logistics:** Identify freight forwarding company to facilitate international shipping**.**

EcoSac Scale Up Evaluation Strategy

An independent baseline study on cooking fuel consumption conducted by Household Energy and Development (HED) and SEM has illustrated that the average daily charcoal consumption is over 2.4 kg in urban Senegal and that average consumption of wood fuel is over 13 kg in rural Senegal. This will serve as the baseline for fuel use in Senegal. We estimate that the use of the EcoSac will bring these numbers down by 30%, translating into less deforestation for cooking fuel. Additionally, households will spend less money on cooking fuel and less time collecting fuel.

We will also perform a baseline survey on cooking practices for 25 EcoSac experimental group and 25 control group users. The control group and EcoSac user group will be selected through random sampling within the same urban target market neighborhoods of Pikine. The survey will be developed and input into Open Data Kit for Android handheld phone survey. The baseline survey will be carried out in October 2013. Thereafter, we will track the impact of EcoSac use by conducting follow up surveys with the original experimental group of 25 EcoSac. Our survey staff will make physical site visits to end-users on a quarterly basis to perform the survey and spot-checking through phone calls on a monthly basis.

The below diagram indicates the key overarching areas within the EcoSac value chain to be tracked throughout the life of the grant. We will track the survey indicators highlighted in the Indicator section below.



Updated List of Indicators

The below list of indicators will be tracked throughout the USAID DIV grant per the plan outlined in the above Evaluation Strategy.

- Financial Cost Metrics (internal Data):
  - Revenues
  - Costs (start-ups, marginal cost like COGS, marketing, distribution, staff, etc.)
  - Break-even points, net profit and cash flow
  - Cost of EcoSac production and all other financial metrics
- Sales Figures (internal data):
  - Across sales channels (wholesale, retail, microfinance) and across distributors
  - Across distributor types including micro-entrepreneurs/sales agents
- Usage and outcome data including (handheld phone survey):
  - Usage per week, e.g. # of times EcoSac is used (experimental group)
  - Amount of fuel used (control & Experimental group)
  - Money saved on purchase of fuel or time saved for fuel collection (experimental group) compared to baseline within the same group
  - Time saved in cooking (experimental group) compared to baseline
  - Meals prepared with EcoSac as in breakfast, lunch, and dinner (experimental group)
  - Other uses of the EcoSac within past month, e.g. cooling, keeping food warm, transporting food, etc., (experimental group)
  - Social impacts such as general livelihood improvement, indicated by self reported ease of life through other benefits such as time saved, IGA started, other activities (experimental group)
  - Health impacts, measured by frequency of visits to health institutions and decrease in usual symptoms caused by exposure to smoke and indoor pollution (experimental group)
  - Household economics, including IGA activities (experimental group)
  - Social return on investment will be evaluated based on the overall results of the survey

North Western Urban Senegal

AMS IIG Baseline Charcoal Consumption Study

For C Quest Capital LLC

HED Consulting Ltd

Kirstie Jagoe

Liz Bates

***Project lead:* Jonathan Rouse**

With assistance from

SVA Senegal

- CONFIDENTIAL -

Final

14th May 2012

HED|Consulting
Household energy & development
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Acronyms

CI	Confidence interval
CQC	C Quest Capital LLC
HED	HED Consulting
HH	Household
SD	Standard Deviation
SE	Standard Error
SVA	Shared Values Africa

Exchange rate (approximate at time of report)

1.00 XOF = 0.00203309 USD

Interpreting the statistical tables in this report

Mean values are presented in tables alongside Standard Deviation (in [square brackets]); standard errors; 90 and 95% confidence intervals (CI); and margin of errors (10 and 5% of the means).

The relationship between the CI and margin of errors are used to indicate the precision of the data as follows:

- Precision '90/10' requires the 90% CI to be ≤ 10% margin of error.
- Precision '95/5' requires the 95% CI to be ≤ 5% margin of error.
- Precision '95/10' requires the 95% CI to be ≤ 10% margin of error.

Document development record

Date	Content	
5 April 2012	Initial analysis of data completed and submitted to CQC	KJ
25 April 2012	Deeper analysis, including space heating and source of charcoal weighed	JR, LB and KJ
27 April 2012	Submission of draft final report to CQC	JR
30 April 2012	Further revisions following KJ feedback; addition of stats interpretation section; additional of Questionnaire Annexures.	JR
12th May	Review of comments on final draft Addition of detail on multi-stove adjustment; further detail in Executive Summary	KJ JR
14th May	Final report submitted	JR

1 Executive summary

This report provides a summary of the results from the Senegal Baseline Charcoal Consumption Survey carried out in three locations during February 2012 - April 2012. The aims of the survey were to:

- estimate the average amount of charcoal used per traditional stove per day (kg/stove/day) in urban households (HH) in north west Senegal;
- account for seasonal variation and multiple stove use;
- investigate the differences in charcoal consumption between different locations (i.e. the degree of homogeneity); and
- investigate other factors to validate findings and inform successful implementation.

The study is further to a request from C Quest Capital LLC to conduct a baseline fuel consumption survey of charcoal-using urban households in North Western Senegal.

Methodology

This report describes the sampling methodology; presents the questionnaire and other methods for household fuel consumption measurement; and outlines analysis of the dataset including QA, data cleaning, assessing variability, and determining the precision of the key outcomes. The annexes present the survey tool used both in English and French (the language of implementation), as well as further detail on some of the key calculations.

The sampling strategy was designed in such a way as to be representative of the proposed area of dissemination of stoves. A literature review and consultation revealed that urban Dakar should be excluded from the baseline survey, as well as certain areas in St Louis and Kalaock. These areas were excluded because they did not comprise a market for the stove, mainly due to little use of charcoal.

After cleaning and removal of outliers the baseline charcoal consumption estimate is 2.48 kg/household/day. Two minor adjustments were made to the daily household fuel consumption estimates: the first to account for reported seasonal variation in charcoal consumption (resulting in an increase of 0.12 kg to the baseline); the second to account for the simultaneous use of multiple stoves (resulting in a decrease of 0.2 kg to the baseline).

Key results

Analysis of the data collected from the three cities concludes that there is no statistically significant difference between them in terms of mean household charcoal consumption, and that a single baseline figure may be applied to them all. Therefore, the final analysis is undertaken on the combined dataset.

The impact of reported current space heating with charcoal was investigated but this was shown to have no significant effect on the amount of fuel charcoal consumed. Other methodological issues were investigated but no further adjustments were considered necessary to the data set.

The **mean baseline household charcoal consumption in the urban areas investigated in NW Senegal is estimated by this study to be 2.40 kg/stove/day.** The data for calculating this meets the precision requirements of the AMS IIG methodology (90/10), including for homogenous Programme of Activities (PoA) (95/10). The study and analysis were planned and executed to conform to the EB 65 Annex 2 guidance.

2 Methods

2.1 Roles

A HED Consulting (HED) team led the planning of this study. Aspects of the study design, such as identification of study locations and questionnaire development, were carried out in collaboration with the team from SVA, Senegal, who also trained and supervised the survey team in Senegal.

Analysis was undertaken using Excel and SPSS 16.0 by HED.

2.2 Sampling strategy

The scope of this study was restricted to the north western area of Senegal, specifically areas of the cities of Dakar, Kaolack and St Louis (See map below[1]). These cities were chosen as the proposed project sales areas due to their widespread use of charcoal as primary cooking fuel. These are indicated in their respective regions in the map below. The study was designed to identify any significant difference, if it existed, between charcoal consumption in the three cities. No further clustering distinctions were made. Charcoal users were identified by the filter-question 'Do you primarily use charcoal on a traditional stove?'

Sampling from within cities

The study sample was selected using probability proportional to size on the primary unit (the area of the

[1] Adapted from: Wikipedia contributors, "Regions of Senegal," *Wikipedia, The Free Encyclopedia,* http://en.wikipedia.org/w/index.php?title=Regions_of_Senegal&oldid=485124339 (accessed March 18, 2012).

city). This takes into account the different populations in each area.

The population for each area within each department zone was taken from the 'Directions des Statistiques Demographiques et Sociales (2002)[2.] A random number generator [www.random.org] was used to select areas.

To qualify for participation in this survey, randomly households were asked 'Is most of your cooking done on a traditional charcoal stove?' This identified households whose main fuel was charcoal but did not exclude users of other stoves and fuels. Attempts were made to minimise the impact of bias associated with non-response. If the household cook was not available, an appointment was made for the following morning. If they were not available at that time, they were classed as unavailable. Any actual refusals to take part were also documented. In the event, cooks were available in all households visited, and there were no refusals.

Dakar

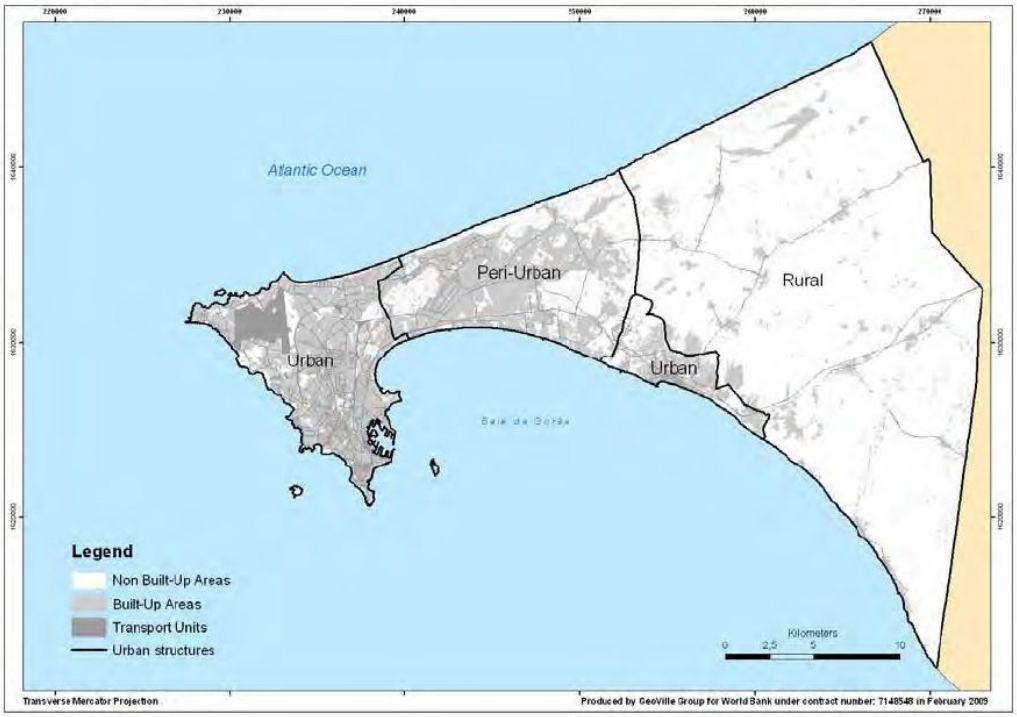
The following map[3] shows the regions of Dakar city. The western-most areas are most urbanized and dense, transitioning into peri-urban, and eventually rural, in the east.

- Dakar Department is largely excluded because most of it consists of wealthier groups who do not use charcoal. The Arrondissement Parecelles Assainies (a district within the Dakar Department) was included in the sample because there is significant charcoal use there, except for the areas of: Camberene (due to inaccessibility, though this is still included in the project area); and Patte D'Oie (as it is particularly affluent, and is excluded from the project area).
- All of Departments Guediawaye and Pikine are included in the sample;
- Some portions of Rufisque are excluded from the sample, in this case because they are rural and will not be a focus of the dissemination strategy.

The Dakar sales area (Guediawaye, Pikine, Rufisque) covers a mix of urban, peri-urban and rural locations (See map below: taken from Gun Wang 2009)

[2] Directions des Statistiques Demographiques et Sociales, Repertoire des Localites, Region de Kaolack, St Loius and Dakar, 2002 Agence Nationale de la Statistique et de la Démographie, Senegal: CD-Rom available on request

[3] Wikipedia contributors, "Dakar Region," *Wikipedia, The Free Encyclopedia,* http://en.wikipedia.org/w/index.php?title=Dakar_Region&oldid=479515941 (accessed March 18th, 2012).



Kaolack and St Louis cities

Project partners SVA provided a list of all areas of Kaolack and St Louis (see Annex 6.1). All areas in the City of Kaolack were included. In St. Louis only the Department NORD was excluded from this baseline because it consists of affluent groups that mainly use gas as their primary cooking fuel.

2.3 Sample size determination

Based on the variance seen using the same approach to measuring daily charcoal fuel consumption in other Sub-Saharan African countries to meet the 90/10 precision, the target sample size was 90 HH for each city in order to give the required resolution to determine heterogeneity or homogeneity.

2.4 Questionnaire development

A questionnaire was developed to explore the many factors that can impact on HH charcoal use, including seasonal variation; uses of the stove other than for cooking; and use of more than one stove at the same time (see Annex 5.2 and 5.3 Final version of questionnaire [English and French]).

The questionnaire included complex concepts, so, to ensure its reliability and validity, it was first translated into French and then 'back translated' by an independent person who had no prior knowledge of the content of the questionnaire. Any concepts within the questionnaire that were changed during the translation process were reviewed and edited.

The questionnaire was then piloted in the field, along with the data transcribing and reporting spreadsheet and process. After this, any aspects of the questionnaire that caused confusion and/or failed to collect the correct data were reviewed and edited.

2.5 Measurement of charcoal

Households using a traditional charcoal stove were asked 'How much charcoal do you use in an average day? Please make a pile for me to weigh'. In case the respondent did not have sufficient charcoal to demonstrate a full day's amount, the fieldworkers offered a bag of 'fieldwork charcoal' for them to use. It was made clear that this charcoal would be collected and removed at the end of the survey, and was not mixed with household charcoal.

2.6 Quality control

Local field staff received extensive training on how to administer the questionnaire and were given feedback on the pilot data to ensure that concise, complete data was collected. The team were then supervised daily by a trained field manager. The surveyors were given a field guide describing how to implement the survey and how to collect robust, accurate data.

The questionnaire was piloted as described in Section 2.4.

Double-entry of data was completed in Senegal on a randomly selected 10% sample of transcripts. This was compared with the original dataset to identify the frequency and nature of data-entry error.

3 Analysis

3.1 Data checking

There was a minimal rate of refusal – <5% of the total sample – so this would not be expected to have introduced bias (for example, a significant proportion of a certain kind of household refusing to participate).

Examination of the double-entry data showed that there was less than 5% error in the key variables – i.e. charcoal-weighing data. Therefore the data-entry process was deemed accurate.

3.2 Raw data from all sites

The following table presents mean charcoal consumption from the full raw dataset across all areas. This data has had no outliers removed, nor has it been adjusted in any way.

Table 3.1: Overall raw data for mean charcoal fuel use

	Overall N=285
Mean [SD]	2.50 [1.1]
SE[4]	0.06
90% CI	0.10
95% CI	0.12

[4] Standard Error (SE) this is the standard deviation of the sample mean and describes its accuracy as an estimate of the population mean. As sample size increases, the estimator is based on more information and becomes more accurate, so its standard error decreases.

10% mean	0.25
5% mean	0.13

One household was removed from the dataset as their reported daily charcoal consumption was deemed unreasonably high for domestic use (24kg) and therefore seen as not representative of this population.

Table 3.2: Overall raw data for mean charcoal fuel use: outliers removed

	Overall N=285
Mean [SD]	2.48 [1.0]
SE[5]	0.06
90% CI	0.12
95% CI	0.14
10% mean	0.24
5% mean	0.12

3.3 Accounting for seasonal changes in amount of charcoal fuel used

Purpose of step: to account for households using more or less charcoal at different times of the year relative to current use.

Local information stated that the wet season lasts for 3 months of the year and the season during which the study was carried out is described as dry and lasts 9 months. The participants were asked to describe the changes in quantities of charcoal that they used during the wet season compared with the current, using diagrams to represent increases or decreases in fuel use relative to current consumption (See Annex 6.4) This information was then used to calculate an adjusted daily charcoal fuel consumption that takes into account seasonal changes throughout the year (See Annex 6.5 for description of the calculation) (See table 3.3)

Table 3.3: National daily mean HH charcoal fuel consumption: adjusted for seasonal trends

	Overall

[5] Standard Error (SE) this is the standard deviation of the sample mean and describes its accuracy as an estimate of the population mean. As sample size increases, the estimator is based on more information and becomes more accurate, so its standard error decreases.

	N=282*
Mean [SD]	2.60 [1.11]
SE	0.07
90% CI	0.12
95% CI	0.14
10% mean	0.26
5% mean	0.13

*Some HH had data missing for seasonal patterns.

The seasonal fuel use adjustment has resulted in an increase in the mean charcoal fuel value of 0.12kg/day compared with unadjusted data.

3.4 Simultaneous multiple stove use

Purpose of step: to account for households using more than one stove at once, and ultimately to account for occasional continued use of traditional stoves alongside improved stoves as per the requirement of the methodology.

The questionnaire included a series of questions about the simultaneous use of more than one stove for cooking. These were designed to establish the proportion of cooking (and therefore charcoal fuel consumption) that could be attributed to a single improved stove introduced through a carbon project.

The calculation of the average number of stoves used simultaneously for cooking per family unit took into account the frequency of simultaneous stove use as well as the number of times cooking took place per day. This was compared with the stated number of times households cooked (Que C1) and then adjusted for any seasonal changes in multiple stove use patterns to give a fraction adjustment (See Annex 6.6 for full description of this calculation) .

Any household using its stove less than once per week was excluded from this adjustment as the impact of this may be considered negligible.

Table 3.4: Simultaneous stove use from full dataset

	Overall N=285
% Using stoves simultaneously > once per week	46.3%
Stoves used per HH/family unit mean [SD]	**1.1** [0.24]

Overall the average (mean) number of stoves used simultaneously for cooking per household unit was approximately 1.10, which equates to a mean adjustment to charcoal fuel weights of 1/1.10 = **0.91**.

In fact, this adjustment factor is not applied to *mean* fuel consumption values, but each household charcoal weight is adjusted individually according to its pattern of multiple stove use. All further steps in analysis use these adjusted daily charcoal fuel weight values. The result is presented in Table 3.6.

Table 3.6: Overall mean charcoal fuel consumption adjusted for seasonal changes and patterns of multiple stove use

	Overall N=265
Mean [SD]	2.40 [1.04]
SE	0.06
90% CI	0.10
95% CI	0.12
10% mean	0.24
5% mean	0.12

The multiple-stove adjustment has resulted in a decrease in the mean charcoal fuel value of 0.1kg/day compared with unadjusted data and 0.2kg/day compared with data adjusted for seasonal trends.

Prevalence of multiple stove use will be monitored and an adjustment applied accordingly. An example questionnaire for this is included in Section 6.7 and the equation to be used to calculate the adjustment is described in Section 6.8.

3.5 Assessing the difference between region means

Purpose of step: to establish whether the Senegal baseline needs to be described in a series of discrete clusters due to discernible difference, or if it may be described as a homogenous area.

An independent T-test was used to determine any statistical significance difference between the estimated means in each of city. The P value for difference between regions [p=0.623] showed that there is no compelling evidence that the means significantly differ.

3.6 Aggregating data for overall mean

Purpose of step: to establish the mean baseline charcoal fuel consumption across the country, and to determine whether this meets the precision requirements of the methodology.

No significant difference was detected between the mean fuel consumptions in each of the three locations. Thus, the mean baseline household charcoal consumption, adjusted for multiple stove use and seasonal trends is **2.40 kg/day/stove**.

4 Other factors investigated

The questionnaire survey included a number of questions on other aspects of household energy behaviour, some of which may impact charcoal fuel consumption. This section presents the conclusions of analysis of this data.

4.1 Space heating

Only 4.5% of respondents reported using their charcoal cooking stove for space heating when not cooking.

The independent T-test carried out showed that there is no statistically significant difference in the mean amount of fuel used per stove between the groups who do currently space heat with their charcoal cooking stoves when not using it to cook (2.88 SD1.19) and those that do not (2.38 SD1.03) [p=0.108].

Conclusion

The use of charcoal stoves for space heating may be discounted as a factor affecting the integrity of the baseline measurement.

4.2 Impact of using all of a household's charcoal for weighing

Analysis was carried out to explore if there is a difference between the mean amount of fuel in those HH which had *all available* charcoal weighed, those which had some left in addition to that weighed and those in which the study charcoal was used to weigh the estimated daily amount used.

Analysis on overall data**,** adjusted for seasonal trends and multiple stove use, showed that the mean charcoal fuel use for those HH where all available charcoal was weighed was 2.23 kg/day/stove [n=75 SD=1.00] whereas in those HH where there was some charcoal remaining in the original charcoal pile the mean was 2.88 kg/day/stove [n=32 SD=1.26] and HH where the study charcoal was used to approximate the daily consumption was 2.40 kg/day/stove [n=159 SD=1.00].

An ANOVA test showed this difference to be statistically significant [p=0.01]. It is possible, therefore, that including data from households in which all charcoal was weighed introduced bias to the mean and reduced it. This may be because if more charcoal had been available, it would have been added to the amount indicated. However, the questionnaire included provision for households with little charcoal in their houses to indicate daily use using surveyors' charcoal. Moreoever, it is possible that these are accurate measures, and represent a group of households who both keep less charcoal in their homes, and actually use less.

Therefore it is not deemed appropriate to exclude data from households in which all available charcoal was weighed, even though there appears to be a slight difference in the mean values. This decision to include these households makes the dataset conservative.

5 References

Hyoung Gun Wang, Marisela Montoliu-Munoz The Geoville Group,Ndèye Fatou D. Gueye Preparing to Manage Natural Hazards and Climate Change Risks in Dakar, Senegal A Spatial and Institutional Approach Pilot Study Report. June 2009. The World Bank.

6 Annexes

6.1 List of areas included in the sample from Kaolack and St Louis

	City of Kaolack		City of St. Louis
1	BONGRES	1	BAS NDAR TOUTE
2	BOUSTANE	2	CITE NIAKH
3	KASNACK	3	DIAMAGUENE
4	DIALEGNE	4	DIAMI NAR
5	FASS CAMPDE GARDE	5	GOKHOU MBATH
6	GAWANE	6	GUET NDAR
7	IND ET KOUNDAME	7	GUET NDAR LODO
8	LEONA	8	GUINAO RAIL DAROU SALAM
9	MEDINA	9	HAUT NDAR TOUTE
10	NDANGANE	10	KHOR
11	NDORONG	11	LEONA
12	NGANE ALASSANE	12	LEOUNA EAUX CLAIRES
13	NGANE SAER	13	MEDINA COURSE
14	PARCELLES ASSAINES	14	NDIOLOFENE EST
15	SAM	15	PIKINE
16	SARA NDIOUGARI	16	SOR DAGA
17	TABA NGOYE 1	17	SOR NORD
18	TATBA NGOYE 2	18	SOR SUD
19	THIOFACK	19	SUD (SINIDONI)
20	KABATOKI	20	DAKAR BANGO
21	N'GUALEL		
22	LINDIANE JARDIN		
23	SING SING		
24	SAMA MOUSSA		

6.2 Senegal Baseline Charcoal Consumption Questionnaire: French

Evaluation de la consommation de base de combustible: Senegal

Conçu par HED Consulting Mars 2012

- Ce questionnaire est conçu pour être administré à la cuisinière principale dans les ménages sélectionnés.
- L'objectif de cette enquête est de savoir la quantité de charbon de bois utilisé par fourneau par semaine dans les ménages?
- Notez, svp: Sauf indication contraire, toutes les questions portent sur la cuisine des ménages en général pendant la saison actuelle.

Les textes en italique [entre les crochets] sont des instructions pour les agents de terrain.

Le texte en gras souligné doit être lu aux répondants aussi bien que toutes les questions.

[IMPORTANT: *Avant de commencer l'enquête, svp demandez à la répondante si elle/il est la cuisinière principale du ménage. Si ce n'est pas la cuisinière principale, demandez à parler à la cuisinière principale. Si elle n'est pas disponible, arrangez un rendez-vous qui lui convient pour l'interview****]***

Evaluation de la consommation de base de combustible:
SVA- Sénégal

A. Introduction
Lisez: Bonjour/bonsoir, mon nom est . Merci de nous accorder votre temps. Je suis ici aujourd'hui pour vous parler de vos pratiques de cuisine familiale et de votre consommation de combustible. Si vous acceptez de participer à cette enquête, nous aimerions vous poser quelques questions, cela prendra environ 25 minutes. Il n'y a pas de "bonnes" ou "mauvaises" réponses et l'information que vous nous fournissez sera très utile pour aider à améliorer les pratiques de cuisson à travers le Sénégal. Toutes les informations seront confidentielles et votre nom n'apparaîtra nulle part. Néanmoins, on les gardera dans nos dossiers pour qu'on puisse vous contactez dans le futur. Avez vous des

A1	Utilisez-vous la plupart du temps du charbon de bois pour préparer?	1=Oui 2=Non [*Arrêtez l'interview*]	
A2	Utilisez-vous du charbon de bois pour la restauration (utilisation pour le petit commerce)?	1 = Oui [*Arrêtez l'interview]* 2 = Non	
A3	Etes-vous d'accord de participer?	1 = Oui 2 = Non [*Arrêtez l'interview*]	
A4	Avez vous assez de charbon de bois pour une journée chez vous?	1 = Oui 2 = Non	
A5	Numéro d'identification		
A6	Date de l'interview [JJ/MM/AAAA]		
A7	Heure du début de l'interview [Utilisez les 24-heures d'horloge]		
A8	Nom de l'enquêteur		
A9	Nom de la répondante		
A10	Numéro de téléphone de la répondante [si disponible]		
A11	Nom du quartier ou du département		
A12	Nom de la ville		

A13	Le climat d'aujourd'hui	1 = chaud et sec 2 = chaud et humide 3 = froid et sec 4 = froid et pluvieux 5 = mélange	
	B. Structure du ménage		
B1	Combien de personnes habitent dans cette concession au total?		
B2	Dans cette concession, il y a-t-il différentes familles ou groupes qui préparent séparément (par exemple en différents endroits ou à côté de l'un et l'autre mais en utilisant différents foyers et marmites?)	1=Oui 2=Non [*Allez à B4*]	
B3	Combien de familles habitent dans cette concession?		
B4	Combien de personnes sont dans ta propre famille?		

B5 En moyenne, pour combien de personnes préparez-vous généralement chaque jour, en cette période de l'année?

Enfants de 14 ans ou moins	Femmes adultes de 15 ans et plus	Adultes Mâles de 15-59 ans	Adultes Mâles de 60 ans ou plus	Total [NN] *[faites le total de B5_1 à B5_4]*
B5_1	B5_2	B5_3	B5_4	B5_5

B6	*[[Vérifiez: si B5_5 est le même que B4?]*	1 = Oui [Allez à C] 2 = Non	
B7	Pourquoi il y a t-il une différence entre la taille de votre famille et le nombre de personnes pour qui vous préparez? [*Notez tout ce que la répondante dit]*		
	C. Cuisine		
C1	En moyenne, combien de fois par jour utilisez-vous votre fourneau pour cuisiner pour votre famille?		
C2	Quel est le <u>PRINCIPAL</u> type de fourneau à charbon de bois que vous utilisez en cette période de l'année?	1 = Diambaar 2 = Sakkanal 3 = Fourneau traditionnel à charbon de bois 4 = Nopalé 5 = Autres	
	D. Utilisation simultanée de fourneaux pour la cuisson en utilisant le charbon de bois		
D1	Cuisinez-vous avec plus d'un fourneau à **<u>charbon de bois</u>** <u>en</u>	1 = Oui	

	<u>même temps</u> <u>en cette période de l'année</u>? *[Assurez-vous que la répondante **ne parle pas simplement de plusieurs <u>marmites</u>**]*	2 = Non [*Allez à E]*	
D2	Faites-vous ça au moins une fois par semaine?	1 = Oui 2 = Non [*Allez à la E]*	
D3	Combien de jours chaque semaine utilisez-vous deux fourneaux à **<u>charbon de bois</u>** en même temps?		
D4	Pour combien de repas les utilisez-vous pendant ces jours?		
D5	Pendant quelles saisons, utilisez-vous plus d'un fourneau à **<u>charbon de bois</u>** en même temps pour la cuisine?	1 = saison des pluies 2 = saison sèche 3 = toute l'année	
	E. Les fourneaux qui peuvent préparer plus d'un repas à la fois		
E1	Avez vous un fourneau à charbon de bois avec lequel vous pouvez préparez deux plats en même temps?	1 = Oui 2 = Non [Allez à F]	
E2	Utilisez-vous ce fourneau au moins une fois par semaine pour préparer deux repas dans deux marmites en même temps?	1 = Oui 2 = Non [*Allez à F]*	
E3	Combien de **<u>jours</u>** par semaine utilisez-vous ce fourneau à **<u>charbon de bois</u>** pour cuisiner deux plats en même temps?		
E4	Pendant ces jours, pour combien de **<u>repas</u>** l'utilisez-vous pour préparer la nourriture dans deux marmites en même temps?		
E5	Pendant quelles saisons utilisez-vous ce fourneau pour préparer deux repas dans deux marmites en même temps?	1 = saison des pluies 2 = saison sèche 3 = toute l'année	
	F. Chauffage de l'espace		
F1	Utilisez-vous un fourneau à charbon de bois pour le chauffage des chambres en **<u>une certaine période de l'année</u>**?	1 = Oui 2 = Non *[Allez à G]*	
F2	Est-ce le même fourneau que vous utilisez pour faire la cuisine?	1 = Oui 2 = Non *[Allez à G]*	
F3	L'utilisez-vous pour le chauffage quand vous ne cuisinez pas?	1 = Oui 2 = Non *[Allez à G]*	
F4	Pendant quelle(s) saison(s) utilisez-vous un fourneau à charbon de bois pour le chauffage de la chambre?	1 = Saison des pluies 2 = Saison sèche 3 = Toute l'année	

	G. Utilisations additionnelles des foyers/fourneaux		
G1	A part la cuisine (et pour chauffer votre maison), pour quoi d'autres utilisez-vous un fourneau à **charbon de bois** plus d'une fois par semaine pendant la saison actuelle? *[Demandez à la répondante d'énumérer toutes les **autres** activités pour lesquelles elle utilise le **charbon de bois**, et la fréquence de l'activité. Si une ou plusieurs activités ne sont pas énumérées, mettez '20' dans la case, et écrivez 'l'autre activité' dans G1.4*]		
	1 = Rien d'autre	2 = L'eau pour le bain / lavage	3 = Brûler de l'encens
	4 = Faire du thé	5 = Séchage de manioc	6 = Repassage
	7 = Grillade (arachides, mais, etc.)	20 = Autres	

	Utilisation [utiliser le code]	**Nombre de jour par semaine?**
G1.1	G1_1_1	G1_1_2
G1.2	G1_2_1	G1_2_2
G1.3	G1_3_1	G1_3_2
G1.4	Enregistrer toutes les autres activités qui ne sont pas sur la liste	
G1.4	G1_4_1	G1_4_2
G1.5	G1_5_1	G1_5_2

	J. Charbon	
	*[Cette question est très importante – svp prenez le temps de vous assurez que la question est comprise et que votre mesure reflète la quantité de charbon de bois utilisée par le **ménage** de la répondante en une **journée moyenne**]* **Demandez: Avez-vous assez de charbon de bois pour la consommation d'une journée ici à la maison pour nous montrer combien vous utilisez?** *[si oui, continuez, si non, offrez-en de votre sac].* **Demandez: Quelle quantité de charbon de bois utilisez-vous en une journée moyenne en cette période de l'année**? **SVP, faites un tas pour moi pour la pesée.**	
J1	Poids du **charbon de bois** inclus le sac, la boîte, ou la corde *[Inclure les décimaux]*	__ __ . __ __**Kg**
J2	Poids du sac, boîte ou corde pesé avec le charbon de bois	__ __ . __ __**Kg**

J3	Avez-vous peser tout le charbon de bois disponible dans le ménage, ou restait-il un peu à côté de celui pesé?	1= Pesé tout le charbon de bois disponible 2= Il reste encore du charbon de bois 3= J'ai utilisé le charbon de l'étude seulement	

J4	Fabriquez-vous une partie de votre charbon de bois?	1 = Oui 2 = Non	
J5	A peu près quelle proportion de la quantité totale de charbon de bois que vous utilisez en cette période de l'année fabriquez-vous vous même?	1 = Je fabrique la plupart de mon charbon de bois 2 = Je fabrique à peu près la moitié de mon charbon de bois 3 = Je fabrique une petite quantité de charbon de bois	
J6	Combien dépensez-vous chaque fois que vous achetez du **charbon de bois**?		.....FCFA
J7	Pour combien de jours cette quantité de **charbon** dure? *[Exprimez en décimal si nécessaire, i.e. demi journée = 0.5]*		.....jour(s)

	K. Autres combustibles					
	Quelle quantité de votre cuisine est faite avec les combustibles suivants en cette période de l'année? [*énumérez chaque combustible à tour de rôle et encerclez la réponse la plus appropriée*]					
		Rien	Moins d'un repas par semaine	Quelques repas par semaine	A peu près la moitié de toutes mes cuisines	Plus de la moitié de toutes mes cuisines
K1	Bouse	1	2	3	4	5
K2	Bois de chauffe	1	2	3	4	5
K3	Kérosène	1	2	3	4	5
K4	Gaz butane	1	2	3	4	5
K5	Electricité	1	2	3	4	5
K6	Autre [*décrivez]* _____	1	2	3	4	5
	[Vérifiez avec la répondante que vous avez discuté de tous les combustibles que le ménage utilise pour la cuisine]					

	Saisonnalité		
	Codes des saisons	Saison des pluies	Saison sèche et froide
		A	B
S1	Comment décrivez-vous la saison actuelle? *[lisez les noms des saisons sur la liste ci-dessus & entrez le code]*		
	Demandez: Comment chacun de ces facteurs change avec l'autre saison comparer à la saison actuelle? *[si les choses changent, mettez '1 ' dans las seconde colonne, et remplissez les phrases dans la troisième colonne. Si ça ne change pas mettez '2' dans la seconde colonne*		
	Facteur	Est-ce que ça change? 1=oui 2=non	Si oui..
S2	Nombre de	S2_1	Pendant la saison actuelle je prépare normalement pour [S2_2]

	personnes pour lesquelles les repas sont préparés		personnes Pendant la saison des pluies, je prépare normalement pour [S2_3] personnes

S3	Nombre de **repas** préparé par jour	S3_1	Pendant la saison actuelle chaque jour je prépare normalement [S3_2] repas Pendant la saison des pluies chaque jour je prépare normalement [S3_3] repas
	1. Charbon de bois 2. Bois de chauffe 3. Résidus 4. Kérosène 5. Gaz butane 6. Autre		
S4	Principal **type de combustible** utilisé pour la cuisine	S4_1	Pendant la saison actuelle j'utilise normalement [S4_2] pour faire la cuisine, Pendant la saison des pluies, j'utilise [S4_3] pour la faire cuisine

	LISEZ: ***Voici un diagramme montrant la quantité de charbon de bois que vous utilisez présentement chaque jour [montrez du doigt le cercle tout en noir en gras]. Si ce cette croix est 'pas de combustible du tout' [montrez du doigt la croix] et ce grand cercle est 'deux fois plus de charbon de bois que ce que vous utilisez maintenant' [montrez du doigt le grand cercle] svp montrez nous la quantité de charbon de bois que vous pensez que vous utiliserez pendant la saison des pluies.*** *[Encercler le chiffre qui correspond au cercle que la ménagère indique comme consommation de charbon de bois]*								
	Pas de charbon	Un quart	Un demi	Trois quarts	Actuelle	un et un quart	un et demi	Un et trois quarts	Deux fois plus
S5	1	2	3	4	5	6	7	8	9

	Z. Autres observations
Z1	**Il y a-t-il autre chose que vous aimeriez nous dire sur comment vous utilisez les combustibles pour les activités ménagères ?** [*écrivez tout ce que la participante dit]*
	Merci de votre temps et de votre aide à nous fournir ces informations utiles
Z2	*[écrivez toutes vos propres observations que vous pensez seront utiles et pertinentes]*

6.3 Senegal Baseline Charcoal Consumption Questionnaire: English

Baseline Fuel Use Assessment: SVA_Senegal

Designed by HED Consulting March 2012

- This survey is designed to be administered to the primary cook in selected households
- The objective of this survey is find out how much charcoal is used by the MAIN stove on a weekly basis in households
- Please note: Unless stated otherwise, all questions refer to general household cooking during the present season.

Italic text in [square brackets] are instructions for fieldworkers. This text should not be read out to respondents.
Bold underlined text should be read out to respondents as well as the questions

[IMPORTANT: *Before starting the survey, please ask the respondent if she/he is the main cook in the family unit. If it is not the main cook, ask to speak to the main cook, and arrange a convenient time when she/he will be available for interview.* ***]***

Baseline Fuel Use Assessment: SVA- Senegal

B. Introduction
READ: Good morning/afternoon, my name is_____. Thank you for making time for us. I am here today to talk to you about your family cooking practices and fuel use. If you agree to participate in this survey, we would like to ask you a few questions; it will take about 25 minutes. There are no 'right' or 'wrong' answers and the information you provide will be very useful to help use improve cooking practices throughout Senegal. All the information will be kept private and your name will not appear anywhere publically. We will however keep it in our records so that we can contact you in future. Do you have any questions?

A1	Is charcoal your main cooking fuel**?**	1=Yes 2=No [*terminate interview*]	
A2	Do you use charcoal to cook commercially (use it in a small enterprise)?	1 = Yes [*terminate interview]* 2 = No	
A3	Do you agree to participate?	1 = Yes 2 = No [*terminate interview*]	
A4	Do you have a days worth of charcoal in your home?	1 = Yes 2 = No	
A5	ID number		
A6	Date of interview [DD/MM/YYYY]		
A7	Start time of interview [Use 24-hour clock]		
A8	Interviewer's name		
A9	Respondent's name		
A10	Respondent's telephone number [if available]		
A11	Name of district		
A12	Name of city or urban area		
A13	Today's weather	1 = Hot and dry 2 = Hot and wet 3 = Cold and dry 4 = Cold and rainy	

	C. Household structure				
B1	How many people live in your household in total?				
B2	Within your household, do different family units or groups cook separately (for example in different locations or near each other but using separate fires and pots?)			1=Yes 2=No [*go to B5*]	
B3	How many family units live within your household?				
B4	How many people are in your own family unit?				
B5	On average, how many people do you usually cook meals for each day, at this time of year?				
	Children 14 year or younger	Female adults 15 years and older	Male adults 15 -59 years	Male adults 60 years or older	Total [NN] *[add up B5_1 to B5_4]*
	B5_1	B5_2	B5_3	B5_4	B5_5
B6	*[Check: Is the total in B5_5 the same as B4?]*			1 = Yes [Go to C] 2 = No	
B7	Why is there a difference between your family unit size and the number cooked for? [*Write down everything the respondent says]*				
	D. Cooking				
C1	On average, how many times each day do you use your stove to prepare food for your family?				
C2	What is the <u>main</u> type of charcoal stove that you use at this time of year?			1 = Diambar 2 = Sakkanal 3 = Traditional charcoal stove 4= Other (please describe)	
	E. Simultaneous stove use for cooking using charcoal				
D1	Do you ever cook on more than one **<u>charcoal</u>** stove **<u>at the same time</u>** <u>at this time of year</u>? *[Make sure respondent is **not simply talking about multiple <u>pots]</u>***			1 = Yes 2 = No [*go to Section E]*	
D2	Do you do this at least once per week?			1 = Yes 2 = No [*go to Section E]*	
D3	How many days each week do you use two **<u>charcoal</u>** stoves at the same time				
D4	How many meals do you use them for on those days?				

D5	During which seasons do you use more than one **charcoal** stove at the same time for cooking?	1= wet season 2=dry season 3= All year	
	F. Stoves which can cook more than one dish at once		
E1	Do you own a charcoal stove on which you can cook two dishes at once?	1 = Yes 2 = No [go to Section F]	
E2	Do you use this stove at least once per week to cook two dishes in two pots at the same time?	1 = Yes 2 = No [*Go to Section F]*	
E3	How many **days** each week do you use the **charcoal** stove to cook two dishes at the same time?		
E4	On those days, how many **meals** do you use it for to cook food in two pots at the same time?		
E5	During which seasons do you use this stove to cook two dishes in two pots at the same time?	1= wet season 2=dry season 3= All year	
	F. Space heating		
F1	Do you use a charcoal stove for room heating at **any time of year**?	1 = Yes 2 = No *[Go to Section G]*	
F2	Is it the same stove as you use for cooking?	1 = Yes 2 = No *[Go to Section G]*	
F3	Do you use it for heating **when not cooking**?	1 = Yes 2 = No *[Go to Section G]*	
F4	During which seasons do you use a charcoal stove for room heating?	1 = Wet season 2 = Dry season 3 = All Year	
F5	What type of **charcoal** stove do you use to heat your home?	1 = Diambar 2 = Sakkanal 3 = Traditional charcoal stove 4= Other (please describe)	
	H. Additional uses of fires/stoves		
G1	Other than for cooking and heating your house, for what purposes do you use a **charcoal** stove more than once per week in this current season? [*Ask the respondent to list all the **other** tasks for which they use **charcoal**, and the frequency of the task. If a task is not is not listed, record '20' in the box, and write in the 'other task*]		
	1= No other purpose	2= Water heating bathing	3= Burning incense
	4= Brewing tea	5= Cassava drying	6=Ironing

	7= Roasting (nuts/corn/yams)	20= Other	

	Use [use coding]	**Number of days per week?**
G1.1	G1_1_1	G1_1_2
G1.2	G1_2_1	G1_2_2
G1.3	G1_3_1	G1_3_2
G1.4	Record any other tasks that are not on the list	
G1.4	G1_4_1	G1_4_2
G1.5	G1_5_1	G1_5_2

	L. Charcoal		
	*[This question is very important – please take time to ensure the question is understood and your measure reflects charcoal used for the respondents **family unit** in an **average day**]* **Ask: Do you have a full day's charcoal here in the house to show us how much you use?** [If yes, carry on, if no, **use the charcoal in your bag- do not use any of the household charcoal**]. **Ask: How much charcoal do you use on an average day at this time of year**? **Please make a pile for me to weigh.**		
J1	Weight of **charcoal** including bag, tin or binding *[Include decimal places]*		__ __ __ . __ __**Kg**
J2	Weight of bag, tin or binding weighed with the charcoal		__ __ __ . __ __**Kg**
J3	Did you weigh all the charcoal available in the household, or was some left besides that weighed?	1= Weighed all available charcoal 2= More charcoal remained	
J4	Do you make any of your charcoal?	1 = Yes 2 = No [Go to J6]	
J5	About what proportion of the total charcoal fuel you use do you make at this time of year?	1 = I make most of my charcoal fuel 2 = I make about half my charcoal fuel 3 = I make a small amount of charcoal fuel	
J6	How much do you spend each time you buy **charcoal**?		CFA
J7	How many days would this amount of **charcoal** last? *[Express as decimal if necessary, e.g. half a day = 0.5]*		.....days

	M. Other fuels					
	How much of your cooking is done with the following fuels at this time of year? [*List each fuel in turn and circle the most appropriate response*]					
		None	Less than one meal per week	A few meals per week	About half of all cooking	More than half of all cooking

K1	Dung	1	2	3	4	5
K2	Fuelwood	1	2	3	4	5
K3	Kerosene	1	2	3	4	5
K4	LPG [gas]	1	2	3	4	5
K5	Electricity	1	2	3	4	5
K6	Other [*describe*] _____	1	2	3	4	5
	[Check with the respondent that you have discussed all of the fuels the household uses for cooking]					

	Seasonality		
	Season codes	Wet season	Dry warm season
		A	B
S1	How would you describe the current season? *[Read names of seasons from list above & enter code]*		
	Ask: How do each of these factors change with season compared to the current season? *[If things change, put '1 'in the second column, and fill in the sentences in the third column. If it does not change put '2 'in the second column*		
	Factor	Does it vary? 1=yes 2=no	
S2	Number of **people** for whom meals are cooked	S2_1	In the present season I usually cook for [S2_2]people In the WET season, I usually cook for [S2_3]people
S3	Number of **meals** cooked per day	S4_1	In the present season each day I usually cook [S3_2] meals In the WET season each day I usually cook [S3_3] meals
	2. Charcoal 2. Fuelwood 3. Residues 4. Kerosene 5. Bottled Gas (LPG) 6. Other		
S12	Main **type of fuel** used for cooking	S12_1	In the present season I usually use [S12_2] for cooking, In the WET season, I usually use [S12_3] for cooking

	READ using the diagram on separate sheet: **Here is a diagram showing the amount of charcoal you use currently each day *[point to the all-black circle]*. If this cross is 'no fuel at all' *[point to the cross]* and this big circle is 'twice as much charcoal as you use now' *[point to the largest circle]* please show us the amount of charcoal you think you would use in the WET season.** *[Circle the number that refers to the circle the participant indicates for charcoal use]*								
	No charcoal	Quarter	Half	Three quarters	Current	One and a quarter	One and a half	One and three quarters	Twice as much charcoal
S13	1	2	3	4	5	6	7	8	9

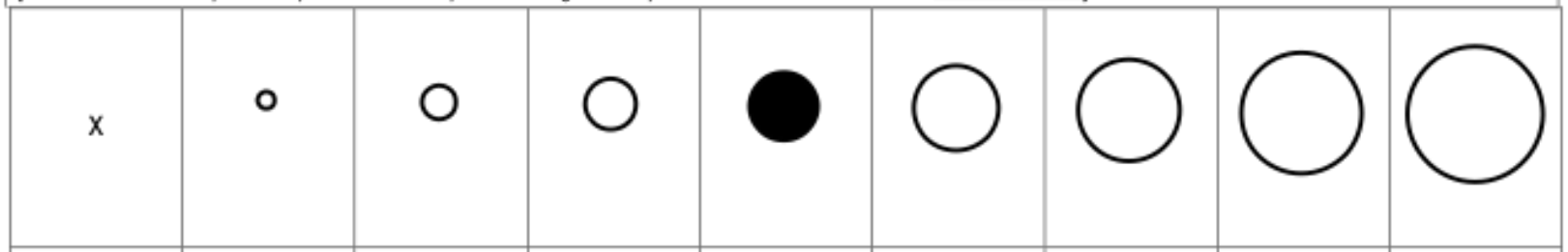
	Z. Other observations
Z1	**Is there anything else you would like to tell us about how you use your fuel for household purposes?** [*Write down everything the participants says*]
	Thank you for your time and help in providing us with this useful information
Z2	*[Write down any observations of your own that you feel would be helpful and relevant]*

6.4 Proportional seasonal fuel changes diagram

Baseline fuel Assessment: Senegal. March 2012

LISEZ: ***Voici un diagramme montrant la quantité de charbon de bois que vous utilisez présentement chaque jour [montrez du doigt le cercle tout en noir en gras]. Si ce cette croix est 'pas de combustible du tout' [montrez du doigt la croix] et ce grand cercle est 'deux fois plus de charbon de bois que ce que vous utilisez maintenant' [montrez du doigt le grand cercle] svp montrez nous la quantité de charbon de bois que vous pensez que vous utiliserez pendant la saison des pluies.***

[Encercler le chiffre qui correspond au cercle que la ménagère indique comme consommation de charbon de bois]



Pas de charbon	Un quart	Un demi	Trois quarts	Actuelle	un et un quart	un et demi	Un et trois quarts	Deux fois plus
1	2	3	4	5	6	7	8	9

6.5 Calculation of adjustment for seasonal fuel use

The study was carried out during the dry season, which according to local information lasts for 9 months of the year. There is one other season (wet), which lasts for 3 months.

The participants were asked how much charcoal they use in the wet season compared to their current use (see question M6.1 in Annex 6.2/6.3).

Each response provided a fraction related to the current charcoal use as per the table below.

Relative amount of charcoal	Adjustment fraction
No charcoal	0
A quarter of the amount	0.25
Half of the amount	0.5
Three quarters of the amount	0.75
No change	1
A quarter more	1.25
A half more	1.5
Three quarters more	1.75
Double the amount	2

The current daily charcoal consumption was multiplied by this fraction to give a daily amount during the wet season.

For example: If the HH currently using 2.08kg of fuel per day reported using a quarter more during the wet season, the daily fuel consumption for the wet season was calculated by:

2.08*1.25= 2.6kg

The overall daily charcoal consumption was adjusted to reflect the reported seasonal changes using the following calculation:

((2.08*9)+ (2.6*3))/12 = 2.21 kg/day

6.6 Calculation of simultaneous stove use

Baseline Charcoal Consumption Assessment 2012

This section outlines the process of gathering and analysing information on simultaneous stove use in Senegal as part of the baseline assessment.

The survey provides the following information:

- Average number of meals cooked per week
- Average number of 1 stove meals cooked per week
- Average number of 2 stove meals cooked per week.
- Average number of months per year this occurs

Using this information and assuming equal amounts of fuel used on each stove (which is the most conservative approach), the fuel correction factor is calculated as follows:

(2*total meals per week with 2 stoves)+total meal using 1 stove= stove meals

Stove meals/7= stove meals per day

Stove meals per day/number of meals per day= Household (HH) mean stoves used /day

Fuel correction factor= 1/ (HH mean stoves used /day)

The table below shows the calculations for various combinations of simultaneous stove use.

Total meals/week	Total meals with 2 stoves /week	Total meals with 1 stove /week	Stove meals total /week	Stove meals/day	HH mean stoves used per day	Fuel correction factor
21	21	0	42	6.00	2.00	0.50
21	18	3	39	5.57	1.86	0.54
21	14	7	35	5.00	1.67	0.60
21	10	11	31	4.43	1.48	0.68
21	7	14	28	4.00	1.33	0.75
21	4	17	25	3.57	1.19	0.84
21	1	20	22	3.14	1.05	0.95
21	0	21	21	3.00	1.00	1.00
14	14	0	28	4.00	2.00	0.50
14	12	2	26	3.71	1.86	0.54
14	10	4	24	3.43	1.71	0.58
14	8	6	22	3.14	1.57	0.64
14	7	7	21	3.00	1.50	0.67
14	4	10	18	2.57	1.29	0.78
14	3	11	17	2.43	1.21	0.82
14	2	12	16	2.29	1.14	0.88
14	0	14	14	2.00	1.00	1.00

These adjustments are further refined according to seasonal variation. Based on the wet season lasting three months and the dry lasting nine months, adjusted fuel consumption for a HH reporting multiple stoves during the dry season but not during the wet season would be calculated as follows:

((3*1) + (1*fuel correction factor))/4

Example

Total meals per week: 21 Total 1 stove meals: 17 Total 2 stove meals: 4

Daily HH charcoal use: 2.32kg

Calculation

(2*4)+17= 25

25/7= 3.57 stove meals per day

3.57/3 meals per day= **1.19 stoves per day**

1/1.19= a fuel correction factor of 0.84

Therefore a HH with a daily charcoal use of 2.32kg would be adjusted to

2.32*0.84 = 1.95kg of charcoal used per day per stove.

If this HH **only used multiple stoves in the wet season** this would be adjusted to:

((3*0.84) + (1*1))/4 = 0.88

Any HH reporting simultaneous stove use less than once per week was given a default adjustment factor of 1.

6.7 Example monitoring questionnaire

Stove Use Patterns and Operation Monitoring Survey

Prepared by HED Consulting

Example key question to determine the percentage of households that use more than one stove at the same time at least once per week (monitored data parameter SSy): Question B3

	G. Identifying house and cook		
A1	Sales record number	A2	Village
A3	Ward	A4	District
A5	Participant telephone number		
A6	Date of interview [DD/MM/YYYY]		
A7	Start time of interview [Use 24-hour clock]		
A8	Interviewer's name		
A9	Date of stove installation		

	H. Stove use		
B1	Do you still use your '[INSERT INTERVENTION STOVE NAME]' for most cooking tasks?	1=yes 2=no [*go to C1*]	
B2	Do you use any other cooking stoves at least once per week?	1=yes 2=no [go to D1]	
B3	Do you use this other stove at the same time as your primary stove at least once per week?	1=yes [go to D1] 2=no [go to D1]	

	I. Reasons for stopping use of '[INSERT INTERVENTION STOVE NAME]	
C1	Why do you no longer use the '[INSERT INTERVENTION STOVE NAME]? [*Write down everything the participant says]*	
C2	Which stove do you use as your primary stove now?	

	J. **Stove breakage and repair**		
D1	Since starting to use your '[INSERT INTERVENTION STOVE NAME] stove has anything broken on it?	1=yes 2=no [*go to E1*]	
D2	If yes, please describe what broke [*Write down everything the respondent says*]		
D3	Did you repair the break?	1=yes 2=no	

	K. **Observations and comments**			
E1	[O*bserve the* '[INSERT INTERVENTION STOVE NAME] *and note any signs of recent use or otherwise]*			
E2	[*Please check the stove for all components- enter a 1 if present and if in correct position. Enter a 2 if not.]*	1=yes 2=no	Present	Correct
		[ENTER COMPONENT 1]		
		[ENTER COMPONENT 2]		
E3	[*Please note any comments from the stove user*]			
E4	[*Interviewer note and observations*:]			

6.8 Adjusting for prevalence of simultaneous multiple stove use in future monitoring

The following formula is proposed by CQC for calculating the $B_{old,adjusted}$ to account for different prevalence of significant levels of simultaneous stove use compared with that determined at baseline:

$$B_{old,adjusted} = B_{old} \cdot \left[\frac{1.1}{1 + \left(SS_y/0.463\right) * (1.1 - 1)} \right]$$

where:

- B_{old} is the baseline value presented in this report after adjustment for seasonal variation and multiple stove use *as determined at baseline;*
- SS_y is the percentage of households that continue to use baseline stoves (second stoves) at least once week in addition to ICS *as determined at monitoring*;
- 0.463 is the percentage of households in the baseline study who use a second stove at least once per week;
- 1.1 is the mean household stove usage found in the wood fuel baseline.

Applying this formula to the two known scenarios, we test its performance:

- where future monitoring determined the same prevalence of simultaneous stove use, then $B_{old,adjusted} = B_{old} = 2.40$ kg/ stove/day
- where future monitoring determined zero prevalence of simultaneous stove use, $B_{old,adjusted}$ for = 2.64 kg/ stove/day

The actual value for baseline data adjusted for seasonal variation but with no adjustment for multiple stove use (i.e. zero % multiple stove users) is 2.60 kg/ stove/day. This difference is likely to be because during analysis adjustments for multiple stove use were applied at an individual household level: this formula is therefore a *very close approximation* of the actual adjustment. In order to make this formula conservative, an amendment to the mean household stove usage is proposed, from 1.1 to 1.08.

Applying this $B_{old,adjusted}$ for 0% multi-stove usage = 2.59 kg/ stove/day which is more accurate and conservative.

Therefore the proposed amended formula is:

$$B_{old,adjusted} = B_{old} \cdot \left[\frac{1.08}{1 + \left(SS_y/0.463\right) * (1.08 - 1)} \right]$$

Senegal Baseline Firewood Consumption Study

For C Quest Capital LLC

HED Consulting Ltd

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With assistance from

SVA Senegal

- CONFIDENTIAL -

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Acronyms

CQC	C Quest Capital LLC
HED	HED Consulting
HH	Household
SD	Standard Deviation
SE	Standard Error
SVA	Shared Values Africa

Exchange rate (approximate at time of report)

1.00 XOF = 0.00203309 USD

Interpreting the statistical tables in this report

Mean values are presented in tables alongside Standard Deviation (in [square brackets]); standard errors; 90 and 95% confidence intervals (CI); and margin of errors (10 and 5% of the means).

The relationship between the CI and margin of errors are used to indicate the precision of the data as follows:

- Precision '90/10' requires the 90% CI to be ≤ 10% margin of error.
- Precision '95/5' requires the 95% CI to be ≤ 5% margin of error.
- Precision '95/10' requires the 95% CI to be ≤ 10% margin of error.

Document development record

Date	Content	
5 March 2012	Draft report completed	KJ
27 March 2012	Revisions post discussions on log use with Sire Diallo	KJ
4 April 2012	Addressing outstanding comments	JR
5 April 2012	Comments from CQC	CL
11 April 2012	Amendments and completion of Executive Summary Final Version signed off by CQC and submitted to proofreader	KJ and JR JR
25 April 2012	Final submitted to CQC LLC	JR
May 14th 2012	Edits in response to questions from DOE Addition of multi-stove adjustment annexes	KJ JR
May 14th 2012	Submission of Revised Final report	JR

1 Executive summary

This report provides a summary of the results from the Senegal Baseline Fuel Use Survey carried out in four regions during December 2011 - February 2012. The aims of the survey were to:

- estimate the average amount of firewood used per stove per day in rural households (HH) (kg/stove/day) including accounting for seasonal variation and multiple stove use;
- investigate the differences in firewood consumption between geographical zones (i.e. the degree of homogeneity); and
- gather further data to validate findings and inform successful implementation.

The study is further to a request from C Quest Capital LLC to conduct a baseline fuel consumption survey of wood-burning rural households in Senegal.

Methodology

This report describes the sampling methodology; presents the questionnaire and other methods for household fuel consumption measurement; and outlines analysis of the dataset including QA, data cleaning, assessing variability, and determining the precision of the key outcomes. The annexes present the survey tool used both in English and French (the language of implementation), as well as further detail on some of the key calculations.

The sampling strategy was designed in such a way as to be representative of the different climatic, firewood supply and economic aspects of the country. A literature review and consultation revealed two main clusters: a southern zone characterised by high rainfall and a surplus of wood; and a northerly zone characterised by low rainfall and wood-supply deficit.

After cleaning and removal of outliers the baseline firewood consumption is estimated to be 14.29 kg/household/day. Two adjustments were made to the daily household fuel consumption estimates: the first to account for reported seasonal variation in firewood consumption (resulting in a 0.85 kg increase in the baseline); the second to account for the simultaneous use of multiple stoves (resulting in a 1.27 kg decrease in the baseline).

Key results

Analysis of the data collected from the four regions in two clusters concludes that there is no statistically significant difference between them in terms of mean household firewood consumption, and that collectively they can be seen as representative of the country as a whole. Therefore, the final analysis is undertaken on a national dataset.

The impact of reported current space heating with firewood was investigated but this was shown to have no effect on the amount of fuel wood consumed. A number of further quality checks were undertaken which were found to validate the data and reported trends.

The **mean baseline household firewood consumption across the whole of Senegal is estimated by this study to be 13.87 kg/stove/day.** The data for calculating this meets the precision requirements of the AMS IIG methodology (90/10), including for homogenous Programme of Activities (PoA) (95/10). The study and analysis were planned and executed to conform to the EB 65 Annex 2 guidance.

2 Methods

2.1 Roles

A HED Consulting (HED) team led the planning of this study. Aspects of the study design, such as identification of study locations and questionnaire development, were carried out in collaboration with the team from SVA, Senegal, who also trained and supervised the survey team in Senegal.

Analysis was undertaken using Excel and SPSS 16.0 by HED.

2.2 Sampling strategy

Clusters

A literature review was carried out to explore factors within Senegal potentially influencing patterns of rural household firewood use across the country. The collated data from this indicated that there were two broad zones within the country based on climatic and firewood scarcity factors. The literature identified to support this process is described in Annex 6.1.

Clusters may be broadly defined as:

- Northern zone with low rainfall and wood deficit[1]; and
- Southern zone with high rainfall and wood surplus (shaded green on the map below).

These are outlined in the map below[2].

[1] The literature provided inclusive evidence on whether the region of Matam should be classed as part of the Northern or Southern zone. Local advice was taken and the consensus was that Matam is a wood scarce area with significantly different rainfall patterns compared to the other Southern regions. Based on this information Matam was included in the northern zone.

[2] Wikipedia contributors, "Regions of Senegal," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/w/index.php?title=Regions_of_Senegal&oldid=485124339 (accessed December 2011, 2012).

Sampling from within clusters

Senegal is divided into fourteen regions. In turn, each region is subdivided into departments. The rural populations of each department are then divided into rural communities. The primary sampling unit used was the region.

In order to ensure a nationally representative sample, two study locations were identified from each of the two zones. Ziguinchor and Sedhiou were excluded from the sampling framework for safety reasons. The study sample was selected using a stratified three-stage cluster design (i.e. by region, department, rural community) using probability proportional to size on the primary unit (the region) and then simple random sampling at the next two levels. This takes into account the different rural populations in each region.

The rural population for each region within each zone was taken from the 'Rapport enquete villages de 2009 sur l'acces aux services sociaux de base'[3]. A random number generator [www.random.org] was then used to select two regions in each zone. A department was then randomly selected from within each of the chosen regions and two rural communities randomly selected from each department.

The locations selected for this study were:

Northern Regions:
Site N1: Rural communities Diender Geudi and Ndiayene Sirah, which are in the Thies department of the Thies region.
Site N2: Rural communities Barkedji and Thiamene Djolof, which are in the Linguere department of the Louga region.

Southern Regions:
Site S1: Rural communities Bembou and Khossanto, which are in the Saraya department of the Kedougou region.
Site S2: Rural communities Nemataba[4] and Kandia, which are in the Velingara department of the Kolda region.

The following map indicates the study locations.

[3] (http://www.ansd.sn/autres_publications.html). Agence Nationale de la Statistique et de la Démographie, Senegal

[4] The rural community Medina Gounass was originally chosen for this location. However, access to the area was denied by the local Imam.

To remove the potential for bias created by selecting only larger or smaller villages, local advice was then taken to identify two to three villages of different sizes within each of these rural communities. A screening questionnaire was designed to identify households that used wood as their main cooking fuel and had sufficient fuel available to be able to show one full day's use. This identified households whose main fuel was wood, but did not exclude users of other stoves and fuels. Households were chosen at random within the villages and, once it was established that the household met the inclusion criteria and were willing to participate, the survey was carried out. These protocols are available on request.

Attempts were made to minimise the impact of bias associated with non-response. If the household cook was not available, an appointment was made for the following morning through the village headman. If they were not available at that time, they were classed as unavailable. Any actual refusals to take part were also documented.

2.3 Sample size determination

Based on the variance[5] seen using the same approach to measuring daily firewood consumption in other Sub-Saharan African countries to meet the 90/10 precision, the target sample size was 150 HH for each cluster, including allowing for 15 HH to drop out. However, because two sites were being selected in each of the North and South clusters, and there was a chance that these would be found to be distinct from each other, a total of 240 HH were identified – 120 in each – in order to give the required resolution to determine heterogeneity or homogeneity.

[5] Average COV 70%: 90/10 precision requires sample size of 135 households.

2.4 Questionnaire development

A questionnaire was developed to explore the many factors that can impact on HH firewood use, including seasonal variation; uses of the stove other than for cooking; and use of more than one stove at the same time (see Annex 6.2 and 6.3 Final version of questionnaire [English and French]).

The questionnaire included complex concepts, so, to ensure its reliability and validity, it was first translated into French and then 'back translated' by an independent person who had no prior knowledge of the content of the questionnaire. Any concepts within the questionnaire that were changed during the translation process were reviewed and edited.

The questionnaire was then piloted in the field, along with the data transcribing and reporting spreadsheet and process. After this, any aspects of the questionnaire that caused confusion and/or failed to collect the correct data were reviewed and edited. A second pilot was carried out before progressing to the full study.

In all regions except Kolda, the surveyors translated the French survey into Wolof. The surveyors received extensive training prior to going into the field to ensure the concepts and meanings within the questions were not lost during this process. In Kolda the survey was administered in Al Pulaar via local interpreters.

2.5 Measurement of firewood

Households were asked 'How much wood do you use in an average day? Please make a pile for me to weigh'. If the respondent used a large log over a few days, they generally cut pieces off for each day's consumption and so were again asked to pile up the equivalent wood used in a day. That pile was then weighed.

2.6 Quality control

Local field staff received extensive training on how to administer the questionnaire and were given feedback on the pilot data to ensure that concise, complete data was collected. The team were then supervised daily by a trained field manager. The surveyors were given a field guide describing how to implement the survey and how to collect robust, accurate data.

The questionnaire was piloted as described in Section 2.4.

Double-entry of data was completed in Senegal on a randomly selected 10% sample of transcripts. This was compared with the original dataset to identify the frequency and nature of data-entry error.

3 Analysis

3.1 Data checking

Data on 476 households was provided by SVA:

- Northern region 240 HH (121 Thies and 119 Louga)
- Southern region 236 HH (134 Kolda and 102 Kedougou)

There was a minimal rate of refusal – <5% of the total sample – so this would not be expected to have introduced bias (for example, a significant proportion of a certain kind of household refusing to participate). However, one village did refuse permission to the team to administer questionnaires, but a nearby location was randomly sampled in its place. There is no reason to expect that this should have introduced any bias.

Examination of the double-entry data showed that there was less than 5% error in the key variables – i.e. wood-weighing data. Therefore the data-entry process was deemed accurate. Ten (10) households were removed as they had missing data in key variables. This left a final sample size of 466 households.

3.2 Raw data nationally

The following table presents mean firewood consumption from the full raw dataset across all areas. This data has had no outliers removed, nor has it been adjusted in any way.

Table 3.1: National raw data for mean firewood use

	National N=466
Mean [SD]	14.42 [5.54]
SE[6]	0.26
90% CI	0.43
95% CI	0.51
10% mean	1.44
5% mean	0.72

Two households were removed from the dataset as their reported daily firewood consumption was deemed unreasonable for domestic use (42.91kg and 47.41kg) and was therefore seen as not representative of this population.

[6] Standard Error (SE): this is the standard deviation of the sample mean and describes its accuracy as an estimate of the population mean. As sample size increases, the estimator is based on more information and becomes more accurate, so its standard error decreases.

Table 3.2: National raw data for mean firewood use: outliers removed

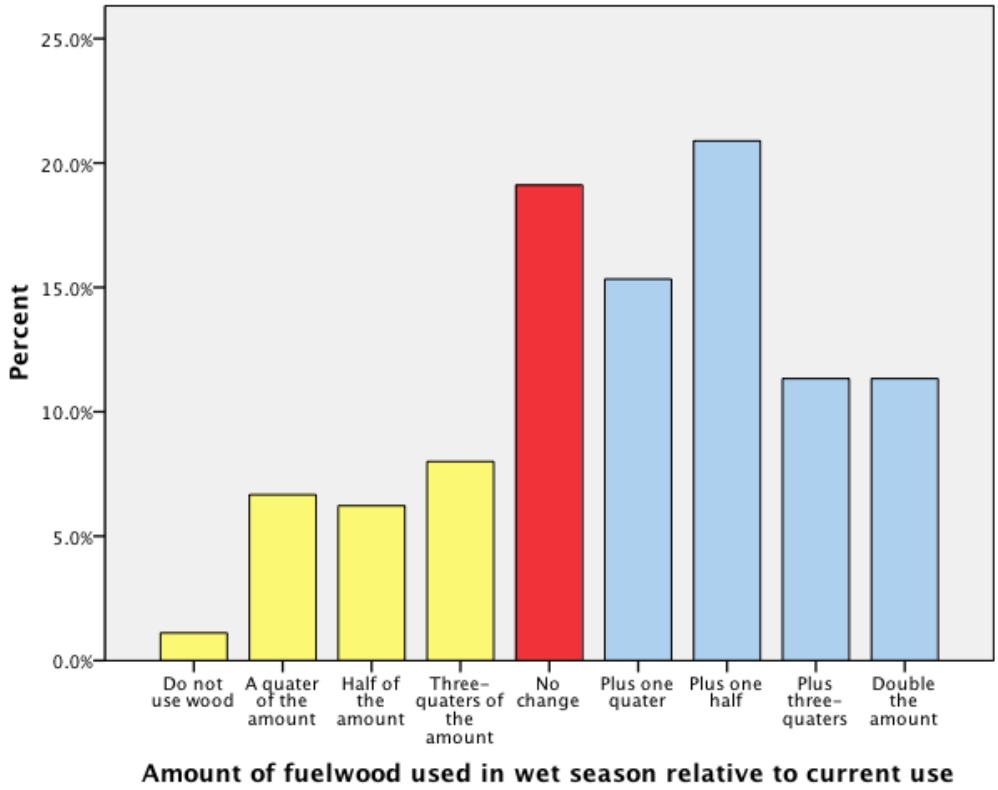
	National N=464
Mean [SD]	14.29 [5.17]
SE	0.24
90% CI	0.40
95% CI	0.47
10% mean	1.43
5% mean	0.71

3.3 Accounting for seasonal changes in amount of firewood used

Purpose of step: to account for households using more or less firewood at different times of the year relative to current use.

Women were asked to describe the changes in quantities of wood that they used during the wet season compared with the current (dry), using diagrams to represent increases or decreases in fuel use relative to current consumption (see Annex 6.2). A total of 58.9% (n=265) of households reported using more wood during the wet season (shaded blue in Figure 4) with 11.3% using double the current quantity. 19.1% reported no change in the amount of wood used (see Figure 4).

Figure 4: Season changes in fuel consumption relative to current use



Local information stated that the wet season lasts for three months of the year and the dry nine months. This information was then used to calculate an adjusted daily firewood consumption that takes into account seasonal changes throughout the year (see Table 3.3). Annex 6.4 describes the calculation.

Table 3.3: National daily mean HH firewood consumption: adjusted for seasonal trends

	National N=450*
Mean [SD]	15.14 [5.77]
SE	0.27
90% CI	0.45
95% CI	0.53
10% mean	1.51
5% mean	0.76

*Some HH had data missing for seasonal patterns.

The seasonal fuel use adjustment has resulted in an increase in the mean firewood value of 0.85kg/day compared with unadjusted data.

3.4 Simultaneous multiple stove use

Purpose of step: to account for households using more than one stove at once, and ultimately to account for occasional continued use of traditional stoves alongside improved stoves as per the requirement of the methodology.

The questionnaire included a series of questions about the simultaneous use of more than one stove for cooking. These were designed to establish the proportion of cooking (and therefore firewood consumption) that could be attributed to a single improved stove introduced through a carbon project.

The calculation of the average number of stoves used simultaneously for cooking per family unit took into account the frequency of simultaneous stove use as well as the number of times cooking took place per day. This was compared with the stated number of times households cooked (Que C1) and then adjusted for any seasonal changes in multiple stove use patterns to give a fraction adjustment (see Annex 6.5 for full description of this calculation) .

Any household using its stove less than once per week was excluded from this adjustment as the impact of this may be considered negligible.

Table 3.4: Simultaneous stove use from full dataset

	National N=459
% Using stoves simultaneously > once per week	54.9%
Stoves used per HH/family unit mean [SD]	**1.10** [0.16]

Thus, 55% [n=252] of those surveyed reported cooking on more than one stove at once, at least once per week.

The following table presents data on the stated *reasons* for use of more than one stove simultaneously.

Table 3.5: Primary reason for simultaneous stove use

Reasons given for using >1 stove at same time	North N=104		South N=147	
	n	%	n	%
Faster/saves time	36	34.6	80	54.4
Need to finish dishes at the same time	63	60.6	63	42.9
Other	5	4.8	4	2.8

Overall 50% of respondents giving a reason stated that the need to finish dishes at the same time was the most significant factor in motivating them to use more than one stove simultaneously. Therefore, the calculation of the impact of this uses the assumption that no more food is cooked, or wood used, in cooking a meal using two stoves, but that each stove cooks half the meal and consumes half of the fuel used to prepare a meal.

Overall the average (mean) number of stoves used simultaneously for cooking per household unit was approximately 1.10, which equates to a mean adjustment to firewood weights of 1/1.10 = **0.91**.

In fact, this adjustment factor is not applied to *mean* fuel consumption values, but each household wood weight is adjusted individually according to its pattern of multiple stove use. All further steps in analysis use these adjusted daily firewood weight values. The result is presented in Table 3.6.

Table 3.6: National mean firewood consumption adjusted for seasonal changes and patterns of multiple stove use

	National N=450
Mean [SD]	13.87 [5.40]
SE	0.26
90% CI	0.43
95% CI	0.51
10% mean	1.39
5% mean	0.69

The multiple-stove adjustment has resulted in a decrease in the mean firewood value of 0.55kg/day compared with unadjusted data and 1.27kg/day compared with data adjusted for seasonal trends.

Prevalence of multiple stove use will be monitored and an adjustment applied accordingly. An example questionnaire for this is included in Section 6.6 and the equation to be used to calculate the adjustment is described in Section 0.

3.5 Region-wise means

Purpose of step: to establish estimates of mean firewood consumption in each region which meet the 90/10 precision requirements.

The total dataset was divided into two subsets by North/South regions.

Table 3.7: Mean adjusted region-wise baseline firewood consumption

	North N=225	South N=225
Mean [SD]	13.61 [5.21]	14.13 [5.59]
SE	0.35	0.37
10% mean	1.36	1.41

5% mean	0.68	0.71
90% [SE*1.65]	0.58	0.61
95% [SE*1.96]	0.69	0.73

3.6 Assessing the difference between region means

Purpose of step: to establish whether the Senegal baseline needs to be described in a series of discrete clusters due to discernible difference, or if it may be described as a homogenous area.

An independent T-test was used to determine any statistical significance difference between the estimated means in each of region. The P value for difference between regions [p=0.310] showed that there is no compelling evidence that the means significantly differ.

3.7 Aggregating data for national mean

Purpose of step: to establish the mean baseline firewood consumption across the country, and to determine whether this meets the precision requirements of the methodology.

No significant difference was detected between the mean fuel consumptions in each of the two regions, and because we are confident that the regions represent their respective zones and therefore collectively the entire country, the mean baseline fuel consumption for Senegal as a whole can be presented as per Table 3.6

Thus, the mean baseline household firewood consumption, adjusted for multiple stove use, across the whole of Senegal is **13.87 kg/day/stove**.

4 Other factors investigated

The questionnaire survey included a number of questions on other aspects of household energy behaviour, some of which may impact firewood consumption. This section presents the conclusions of analysis of this data.

4.1 Space heating

79% of respondents reported space heating at some point during the year, and 25% reported space heating during the present season using wood.

The following table presents the mean firewood consumption from the national adjusted dataset for those presently using wood stoves for space heating, compared with the remainder not space heating with wood at the time of the survey.

Table 4.1: Mean kg fuel consumption per stove by current space-heating status

	n	Mean kg wood per day [SD]
Currently heating with wood	113	13.49 [5.45]
Not heating currently with wood	336	14.01 [5.39]

An independent T-test showed that there is no statistically significant difference in the amount of fuel used per stove between the two groups [p=0.374].

Conclusion

Although there is a small difference between the mean firewood consumption of both groups, and space heating appears to marginally increase the baseline, a statistical analysis concludes that the difference is not statistically significant. Therefore, the use of wood fires for space heating may also be discounted as a factor affecting the integrity of the baseline measurement.

5 Other baseline issues emerging

5.1 Use of charcoal during the present season

The respondents were asked if they used charcoal or another fuel source to replace firewood in the wet season. 22.8% [n=103] stated that they did. The reasons for doing this are presented in Table 6.1 below. Note: respondents could give more than one answer.

Table 5.1: Reasons for not using wood during the wet season

	National data N=103
Wood too wet to cook	83
To stay out of the rain	47
Poor access to firewood	7
Other	5

This may be interpreted along with the seasonal adjustment described in Section 3.3, which showed that although the majority of people increased their firewood consumption during the wet season, around 20% reported a decrease during the rainy season. The above data describes the likely reason for this behaviour, and it is reassuring to see a similar proportion (22%) reporting this, which further validates the seasonal adjustment.

5.2 Impact of using all of a household's wood for weighing

Analysis was carried out to explore if there is a difference between the mean amount of fuel in those HH which had *all available* wood weighed and those which had some left in addition to that weighed.

Analysis on national data**,** adjusted for seasonal trends and multiple stove use, showed that the mean firewood use for those HH where all available wood was weighed was 12.52 kg/day/stove [n=122 SD=4.09] whereas in those HH where there was some wood remaining in the original wood pile the mean was 14.33 kg/day/stove [n=317 SD=5.60].

An independent T-test showed this difference to be statistically significant [p=0.02]. Therefore we are not able to discount data from households in which all available wood was weighed, even though there appears to be a slight difference in the baselines. This decision to include these households makes the dataset conservative.

6 Annexes

6.1 Senegal clustering literature review

Overview of data available on factors that could potentially impact the fuel use in wood-burning households across Senegal
Thursday, December 2011

6.1.1 **Firewood availability** (Masera O et al 2006 p.633-635)

Table 5
Summarized features of the WISDOM analysis in Senegal

Main features of woodfuel use in Senegal	• Intensive use of woodfuels, including charcoal • In recent years LPG is rapidly replacing charcoal in urban areas but at the same time charcoal is becoming a preferred fuel by village dwellers due to the increasing distance of stocked woodlands that limit self-gathering and other socio-economic factors • Production areas often over 500 km far from consumption sites
Objectives of Senegal WISDOM	• To review, harmonize and integrate, the available information related to production and consumption of fuelwood and charcoal at the level of Rural Communities (CR) in a spatial explicit format • To review possible scenarios to the year 2010
Minimum administrative spatial unit of analysis	• The base layer consists of 321 Rural Communities (CR) • Additional map layers included the distribution of rural villages (13,211 villages), the road network (8 categories) and protected areas
Demand module data sources	• Urban and rural population data by CR and 1990–2010 time series • Saturation of fuelwood, charcoal and LPG by urban and rural users and by Region and estimated per-capita consumption rates • Socio-economic parameters (access to drinking water, health services, market, roads and school) for 13,000 villages and summarized by CR • Time series of household urban and rural consumption 1990–2010 by CR were developed, according to two different scenarios: ○ Scenario A. 1996 consumption pattern (Semis survey) projected using urban/rural population growth rates ○ Scenario B. Scenario "A" plus 1992–1996 consumption trends (comparison of ABF/DE 1992 and Semis 1996)
Supply module data sources	• Senegal vegetation map (based on USAID/DAT 1982) with stocking and productivity for each of the 30 classes of the map (derived from PSACD 1998) • Map of Senegal Protected areas with 5 categories • Estimated exploitable fraction of wood resources according to protection categories and distance from roads and villages • Time series of wood stocking and productivity (total and accessible fraction) by CR according to two change scenarios: ○ EROS = stocking and productivity reduced in time according to the land use change estimated by EROS/USGS–CSE over the period 1965–2000 [56] ○ FRA = stocking and productivity reduced in time according to the forest area change estimated by FAO FRA 2000 [40].
Integration module	• Time series (1990–2010) of balance between household fuelwood and charcoal consumptions and total/accessible wood resources (scenarios EROS and FRA). The balance analysis represents the first level of integration of supply and demand variables
Priority zoning	• A simple Woodfuel Priority Index (WPI) was developed using several indices, for each Rural Community, based on three main elements: ○ the possible levels of charcoal consumption at year 2010 according to scenario B ○ the local balance between total demand of wood for energy (fuelwood and wood for charcoal) and the estimated accessible and exploitable wood growth ○ socioeconomic parameters that represent the poverty level (CSE poverty index)

Source: Adapted from Drigo [32]. Please refer to the list of abbreviations for a better understanding of the special terms used in this table.

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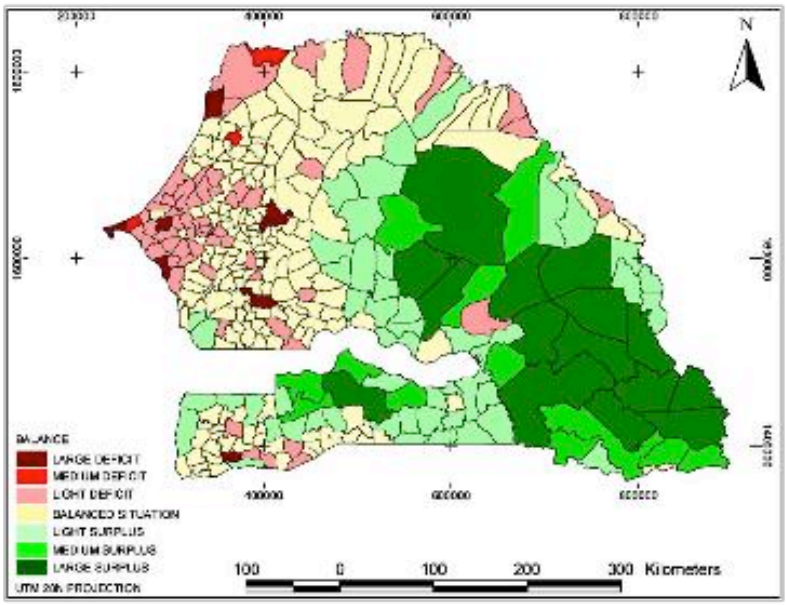


Fig. 9. Fuelwood balance scenario in Senegal for the year 2010-A. *Notes*: The map shows the balance between household woodfuel consumption (fuelwood and wood for charcoal) and estimated sustainable productivity according to the "static" scenario (A) (see text), which used the 1996 consumption survey data projected according to population growth rates in urban and rural areas.

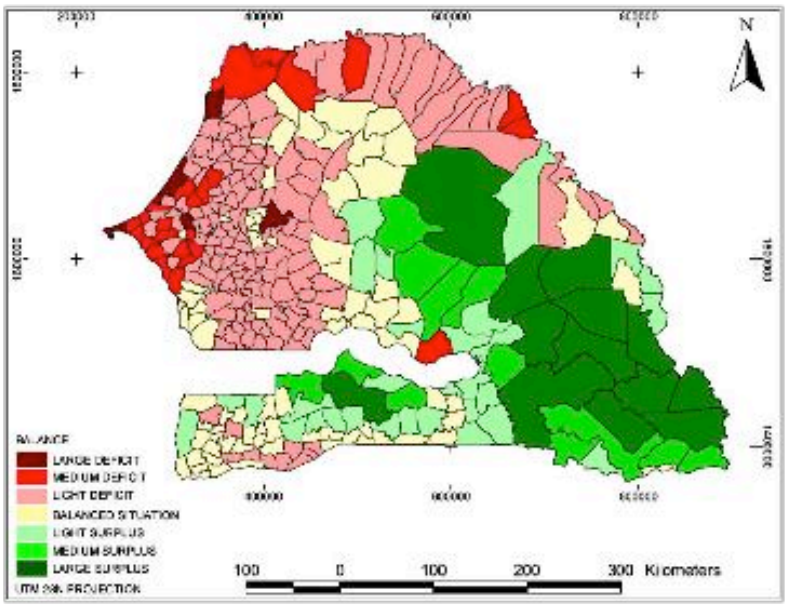


Fig. 10. Fuelwood balance scenario in Senegal for the year 2010-B. *Notes*: The map shows the balance between household woodfuel consumption (fuelwood and wood for charcoal) and estimated sustainable productivity according to the "dynamic" scenario (B) which used the 1996 consumption survey data but projected the consumption according to the 1992–1996 trends and to population growth rates. Also shown are the "traditional" charcoal production areas.

O. Masera et al. / Biomass and Bioenergy 30 (2006) 618–637 635

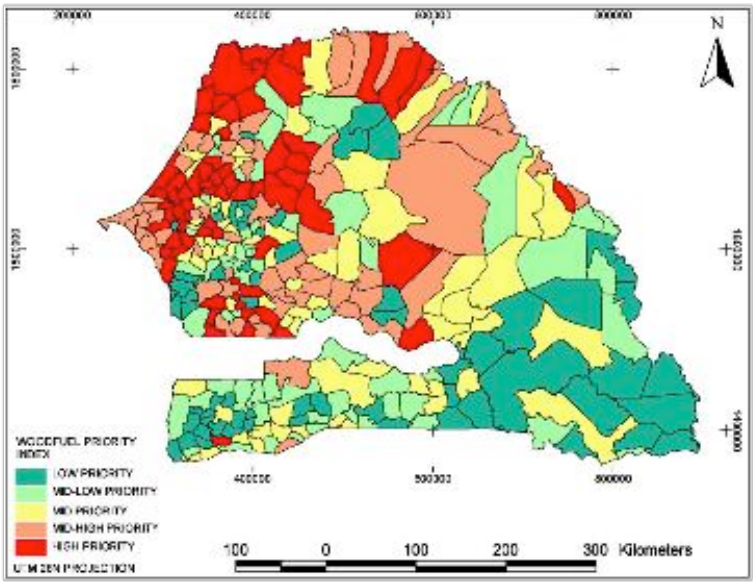


Fig. 11. Overall woodfuel priority areas in Senegal, 2010. *Notes*: The map shows the estimated woodfuel priority areas within Senegal for the year 2010. The figure highlights the Rural Communities that deserve particular attention in view of their combined levels of consumption and balance (according to scenario B in Fig. 10) and of their limited access to basic social services and infrastructures, defined by the poverty index developed by the Dakar's Centre de Suivi Ecologique (CSE), Senegal 2002.

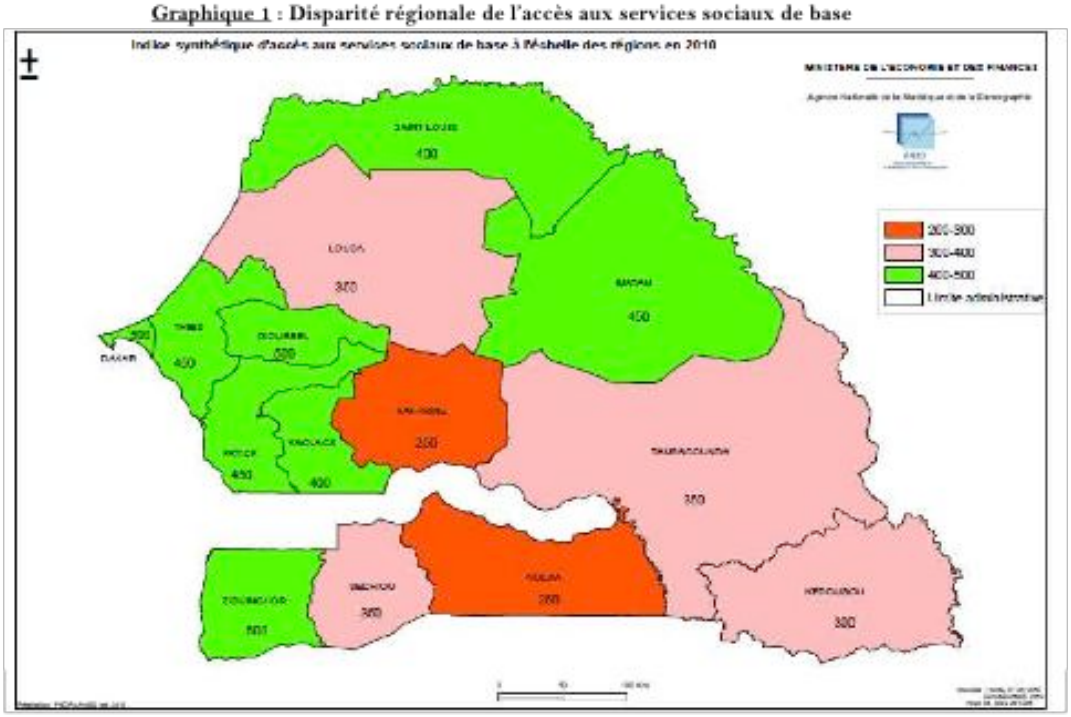
6.1.2 Precipitation

http://www.bestcountryreports.com/Precipitation_Map_Senegal.php

6.1.3 Proxies of poverty levels **(ANSD 2011 p4)**

Generally pointing to lower socio-economic levels in southerly areas

Graphique 1 : Disparité régionale de l'accès aux services sociaux de base



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1. Masera O et al. Biomass and Bioenergy 30 (2006) 618–637
2. Les Disparities Geographiques de l'acces aux services sociaux de base au Senegal. Ministere de l'economie et des finaces ; Agence Nationale de la Statistique et de la Démographie (ANSD) Republique du Senegal 2011

6.2 Senegal Baseline Firewood Consumption Questionnaire: French

Evaluation sur la Consommation de Base de Combustible: SVA - Sénégal

Conçu par HED Consulting Décembre 2011

- Ce questionnaire est destiné à la cuisinière principale dans les ménages sélectionnés.
- L'objectif de cette enquête est de savoir la quantité de bois de chauffe utilisé par fourneau par semaine dans les ménages?
- Notez: Toutes les questions portent sur la cuisine des ménages en général **pendant la saison actuelle sauf indication contraire.**

Le texte en italique dans [les crochets carrés] sont des instructions pour les enquêteurs. Ce texte ne doit pas être lu aux répondants.

Le texte en gras souligné doit être lu aux répondants.

[IMPORTANT: *Avant de commencer l'enquête, svp demandez au répondant si elle est la cuisinière principale du ménage. Si ce n'est pas la cuisinière principale, demandez à parler à la cuisinière principale. Si elle n'est pas disponible, arrangez un rendez-vous qui lui convient pour l'interview****]***

Evaluation sur la Consommation de Base de Combustible: SVA-Sénégal
Page de Garde et consentement

Notez que cette feuille est détachable: Pour maintenir la confidentialité, cette page de garde doit être conservée dans un lieu sécurisé séparément des questionnaires remplis.

Introduction			
Lisez: Bonjour/bonsoir, mon nom est . Merci de nous accorder votre temps. Je suis ici aujourd'hui pour vous parler de vos pratiques de cuisine familiale et de votre consommation de combustible. Si vous acceptez de participer à cette enquête, nous aimerions vous poser quelques questions, cela prendra environ 25 minutes. Il n'y a pas de "bonnes" ou "mauvaises" réponses et l'information que vous nous fournissez sera très utile pour aider à améliorer les pratiques de cuisson à travers le Sénégal. Toutes les informations seront confidentielles et votre nom n'apparaîtra nulle part. Néanmoins, on les gardera dans nos dossiers pour qu'on puisse vous contactez dans le futur. Avez vous des questions?			
A1	Utilisez-vous la plupart du temps du bois de chauffe pour préparer?	1 = Oui	2 = Non [*Arrêtez*
A2	Etes-vous d'accord de participer?	1 = Oui	2 = Non [*Arrêtez*
A3	Avez vous assez de bois dans votre maison pour tenir au moins une journée entière ordinaire de cuisine?	1 = Oui	2 = Non [*Arrêtez l'interview*]
A4	Numéro d'identification		
A5	Date de l'interview [**JJ/MM/AAAA**]		
A6	Heure du début de l'interview [Utilisez les 24-heures d'horloge]		
A7	Nom de l'enquêteur		
A8	Nom de la répondante		
A9	Numéro téléphone de la répondante [si disponible]		
A10	Région ou Communauté Rurale		
A11	Village		
A12	Saison Actuelle	1 = Hivernage 2 = Sèche	

A13	Climat d'aujourd'hui	
	A. Structure du ménage	
B1	Combien de personnes **habitent** dans votre ménage?	
B2	En moyenne, pour combien de personnes préparez-vous chaque jour, en cette période de l'année?	

Enfants de 14 ans ou moins	Femmes adultes de 15 ans et plus	Adultes Mâles de 15-59 ans	Adultes Mâles de 60 ans ou plus	Total [NN]

B3	*[Vérifiez: si B2_5 est le même que B1?]*	1 = Oui [Allez à C] 2 = Non	
B4	Pourquoi il y a t-il une différence entre la taille du ménage et le nombre de personnes pour qui vous préparez? [*Notez tout ce que la répondante dit]*		
	B. Cuisine		
C1	**<u>En moyenne</u>,** combien de fois par jour votre foyer ou fourneau principal est allumé pour la préparation de repas ou de boisson?		
C2	En moyenne combien d'heures dans la journée passez vous entrain de préparer les repas ou boissons? [*Notez la demi heure la plus proche]*		
C3	Quel est votre <u>principal</u> foyer ou fourneau en cette période de l'année? *[Utilisez la liste ci dessous, sinon écrivez le type dans la colonne 'autre']*		

1. Foyer à 3 pierres	2. Foyer en argile pour bois	3. Foyer métallique pour bois	7. Autre fourneau
4. Fourneau à charbon de bois	5. Fourneau à Kérosène	6. Fourneau à gaz	

	Décrivez si un « autre » type de fourneau qui n'est pas sur la liste ci-dessus est utilisé (7)

C4	Quels autres types de foyer ou de fourneau utilisez-vous au moins une fois par semaine? *[Utilisez-la liste ci-dessus [ou écrivez le nom] si un autre type est mentionné. Ecrivez 99 s'il n'y a pas d'autres fourneau}*	*C4_1*	
		C4_2	

	C. Chauffage de l'espace		
D1	Utilisez-vous un foyer ou un fourneau pour chauffer votre chambre dans l'année?	1 = Oui 2 = Non *[Allez à la Section E]*	
D2	Pendant quelle saison utilisez vous votre foyer ou fourneau pour chauffer votre chambre?		
D3	Quel type de fourneau/foyer ET <u>combustible utilisez</u> vous pour le chauffage intérieur? *[Utilisez la liste ci dessous, sinon écrivez le type dans la colonne 'autre']*		

1. Foyer à 3 pierres	2. Foyer en argile pour bois	3. Foyer métallique pour bois	4. Fourneau à charbon de bois
5. Fourneau à Kérosène	6. Fourneau à gaz	7. Autre fourneau	*8. Encensoir* à charbon de bois

	Décrivez si un « autre » type de fourneau qui n'est sur la liste ci-dessus est utilisé (7)

	D. Préparation simultanée sur fourneau ou foyer		
E1	Utilisez-vous plus d'un fourneau à bois **<u>en même temps</u>** pour faire la cuisine? *[Assurez-vous que la répondante ne parle pas de plusieurs marmites mais de plusieurs fourneaux]*	1 = Oui 2 = Non [*Allez à la Section F*]	
E2	Faites vous ça au moins une fois par semaine?	1 = Oui 2 = Non [*Allez à la Section F*]	

E3	Pour quelles raisons utilisez vous plus qu'un fourneau à bois <u>en même temps</u>? ***[Ne faites pas de suggestion –*** *encerclez autant de réponses applicables]*					
	Besoin de finir les plats ensembles au même moment	Besoin d'avoir un fourneau chaud et un plus froid en même temps	Plus rapide/ gain de temps	Visiteurs	Festivals/ cérémonies?	Autre
	1	2	3	4	5	6

E4	Si c'est pour une "autre" raison [6], SVP décrivez [*écrivez tout ce que la répondante dit]*			
E5	Quel fourneau ou foyer à bois utilisez vous **<u>en même temps</u>** pour cuisiner et à quelle fréquence? *[Utilisez la liste ci dessous, sinon écrivez le type dans la colonne 'autre']*			
	1. Foyer à 3 pierres	2. Foyer en argile pour bois	3. Foyer métallique pour bois	4. Autre fourneau
	Décrivez si « autre » type de fourneau qui n'est sur la liste ci-dessus est utilisé (4)			
	Nom du fourneau 1	Nom du fourneau 2	Pour combien de repas est-il utilisé en une semaine?	
Exemple A	*1*	*4*	2 fois par semaine pour un repas à la fois	
Exemple B	*1*	*1*	Tous les dimanches pour un repas	
Combi1				
Combi2				
E6	Pendant quelles saisons utilisez-vous plus d'un fourneau ou foyer à bois? *[Ecrivez toutes les réponses ex. saison humide, sèche, toute l'année, etc.]*	1 = Hivernage 2 = Sèche 3= toute l'année		
E7	Combien d'heures par semaine utilisez vous un second foyer ou un fourneau à bois en même temps que votre fourneau principal? *[Noter la demi heure près] [Aidez la personne à se rappeler en demandant si les habitudes de cuisine diffèrent le weekend/ ou certains jours de la semaine]*			
	E. Fourneau à faible consommation			
F1	Avez vous déjà entendu parler des fourneaux à faible consommation énergétique à bois? [fourneau qui utilise moins de bois]	1 = Oui 2 = Non		
	<u>Les fourneaux à faible consommation énergétique consomment moins de bois et ont tendance à produire moins de fumée</u>			
F2	Si vous avez un fourneau à faible consommation énergétique, auriez vous toujours besoin d'utiliser un autre fourneau ou foyer <u>en même temps?</u>	1 = Oui 2 = Non		
F3	Pouvez vous me dire pourquoi vous auriez besoin d'utiliser (ou non) un autre fourneau ou foyer à bois avec votre fourneau à faible consommation énergétique <u>en même temps?</u> [demander seulement si approprié]			
	F. Utilisations additionnelles des fourneaux/foyers			
G1	Pourquoi utilisez vous les fourneaux et foyers plus d'une fois par semaine autre que la cuisine?			

	[Demandez que la répondante énumère toutes les activités pour lesquelles elle utilise un fourneau/foyer et demandez quel type de fourneau elle utilise et à quelle fréquence] *[Utilisez la liste ci dessous, sinon écrivez le type dans la colonne 'autre']*			
	1. Foyer à 3 pierres	2. Foyer en argile pour bois	3. Foyer métallique pour bois	7. Autre fourneau
	4. Fourneau à charbon de bois	5. Fourneau à Kérosène	6. Fourneau à gaz	
	Décrivez si un « autre » type de fourneau qui n'est pas sur la liste ci-dessus est utilisé (7)			
	Utilisation [i.e chauffer de l'eau pour la douche]	**Type de foyer / fourneau utilisé**	**Combien de fois <u>par semaine</u>?**	**Pour quelle durée à chaque fois? [note en heure]**
G1.1				
G1.2				
G1.3				
G2	G2.1 Si vous avez un fourneau à faible consommation énergétique pensez vous que vous pouvez l'utiliser pour toutes les tâches énumérées ci-dessus?		1 = Oui [*Allez à H*] 2 = Non	
	G2.2 Si non, expliquez les tâches que vous ne pourriez pas faire et pourquoi [*Ecrivez tout ce que le répondant dit*]			
	G. Les fourneaux multi-marmites			
H1	Avez vous un fourneau à bois avec lequel vous pouvez		1 = Oui 2 = Non [Allez à la Section J]	

	préparez plus de deux plats en même temps?		
H2	Utilisez vous les deux brûleurs en même temps une fois par semaine ou plus?	1 = Oui 2 = Non [Allez à la Section J]	
H3	Environ combien d'heures par semaine utilisez vous plus d'un brûleur <u>en même temps</u>? *[notez à la demi heure près]*		
H4	Il y a-t-il des raisons particulières pourquoi vous utilisez plus d'un brûleur en même temps? [*Ne suggérez pas et encerclez tout ce qui est mentionné par le répondant]*		

	Plus rapide/ Gain de temps	Besoin d'un fourneau chaud et un plus froid en même temps	Besoin de finir les repas ensemble	Une marmite trop petite	Les invités	Chauffer de l'eau	Autres
	1	2	3	4	5	6	7

H5	Si autres raisons [7], décrivez svp	
	J. Bois de chauffe	
	[Cette question est très importante – svp prenez le temps d'être sûr que la question est bien comprise et que vos mesures reflètent la quantité de bois utilisée par le ménage de la répondante en une journée ordinaire] Quelle quantité de bois utilisez vous en moyenne par jour? SVP, faites un tas pour la pesée. *[Si la répondante utilise une grande bûche en quelques jours demandez leur d'entasser l'équivalent en bois pour une journée]*	
J1	Poids du bois de chauffe inclus le sac ou la corde ***[<u>Inclure les chiffres décimaux]</u>***	**__ __ __ , __ __Kg**
J2	Poids de la corde/sac pesé sans le bois	**__ __ __ , __ __g**
J3	*[Si vous aviez à peser une grosse bûche qui va durer plus d'une journée, indiquez combien de jours elle durera?]*	Jours
J4	Avez-vous peser tous le bois disponible dans le ménage, ou restait-il un peu à côté de celui pesé?	1= A pesé tout le bois disponible 2= Il restait du bois
J5	Vous achetez ou ramassez le bois normalement en cette période de l'année?	1 = Achète [*Allez à J6]* 2 = Ramasse [*Allez à J9]* 3 = Achète et Ramasse *[Allez à J6]*
J6	A peu près quelle proportion de bois total	1 = J'achète la majorité de mon bois

	utilisé achetez-vous en cette époque de l'année??	2 = J'achète à peu près la moitié de mon bois de chauffe 3= J'achète une petite quantité de bois de chauffe	
J7	Combien dépensez vous en bois de chauffe et à quelle fréquence? *[Notez la réponse complète. Soyez sûr d'inclure **quantité, le prix et la fréquence, etc**.] i.e : 100 fcfa par jour, 100f par semaine.*		
J8	[En utilisant les informations ci-dessus calculez les dépenses moyennes hebdomadaires du bois de feu, et vérifier avec le répondant que c'est logique]		_____ ***CFA***
	[Posez seulement les questions J8-J10 si la répondante dit qu'elle a recueilli une partie ou tout leur bois]		
J9	Combien de fois vous ou votre famille rassemble le bois de chauffe à usage domestique en cette période de l'année? *[Notez le nombre de fois et encerclez la fréquence [i.e. 3 fois par semaine]*		
	Nombre de fois [J9_1]	Fréquence [J9_2]	
	Par jour	Par semaine	Par mois / Par année
	1	2	3 / 4
J10	SVP montrez moi quelle quantité de bois vous [/votre famille] amène à la maison à chaque collecte? [*si faisable [i.e. pas un chariot rempli, pesez le combustible]*		__ __ , __ __**Kg**
J11	Ramassez vous la même quantité de bois durant toute l'année?	1 = Oui 2 = Non	

J12	Avez-vous noté des changements de prix pour le bois de chauffe la dernière année?				
	Beaucoup plus cher	Un peu plus cher	A peu près le même [*Allez à J14*]	Un peu Moins cher	Beaucoup moins cher
	1	2	3	4	5
J13	Dites-moi les raisons pour lesquelles vous pensez que le prix du bois de chauffe a changé dans la dernière année? [*Ecrivez tout ce que le répondant dit]*				
J14	Avez-vous remarqué un changement dans l'effort requis pour recueillir du bois de chauffe les trois dernières années?				
	Beaucoup plus d'effort pour la collecte	Un peu plus d'effort pour la collecte	A peu près le même [*Allez à J16]*	Un peu moins d'effort pour la collecte	Beaucoup moins d'effort pour

					la collecte
	1	2	3	4	5
J15	Dites moi les raisons pourquoi vous pensez que l'effort pour la collecte a changé dans la dernière année? [*Ecrivez tout ce que le répondant dit]*				
	[Observez le bois que le ménage utilise et décrivez en encerclant toutes les réponses pertinentes]				
J16	Sécheresse de bois	Sec, bien vieux	Mouillé [de la pluie]	Vert: juste coupé en vie	Non disponible pour le voir
		1	2	3	4
J17	*[Ajoutez toutes autres observations que vous pensez pertinentes par rapport à la consommation du bois de chauffe par ce ménage. Surtout si le ménage ramasse différentes quantités de bois comme un chariot / tas etc.]*				
	K. Utilisation du charbon				
K1	Utilisez vous le charbon comme combustible de cuisine plus d'une fois par semaine?			1=Oui 2 = Non [*Allez à L*]	
K2	Combien de repas cuisinez-vous avec du charbon de bois à cette époque de l'année?				
	Aucun	Moins d'un repas par semaine	Quelques repas par semaine	Environ près de la moitié de toute la cuisine	Plus de la moitié de toute la cuisine
	1	2	3	4	5
K3	A quelle fin utilisez vous le charbon de bois, et pourquoi utilisez vous le charbon de bois au lieu du bois de chauffe pour ces mêmes fins? [Ecrivez tout ce que le répondant dit*]*				
K4	***[SVP, prenez le temps de vous assurez que cette question est bien comprise et que votre mesure reflète la quantité de charbon de bois utilisée en moyenne par jour]*** Les jours où vous utilisez le charbon, quelle est **la quantité moyenne de charbon** que vous utilisez pour tous les besoins de votre ménage? SVP, faites un tas pour moi pour la pesée.				
K5	Poids du charbon [inclure la boîte ou le sac] [*Inclure les décimaux]*			**__ __ __ , __ __Kg**	
K6	Poids du contenant ou du sac pesé sans le charbon [*Inclure les décimaux]*			**__ __ __ , __ __ g**	

K7	Avez vous constaté des changements dans le prix du charbon ces trois dernières années?			1 = Oui 2 = Non [*Allez à K9*]		
K8	Décrivez les changements (s'il y en a eu) dans les prix du charbon les trois dernières années?					
	Beaucoup plus cher	Un peu plus cher	Un peu moins cher	Beaucoup moins cher		
	1	2	3	4		
K9	*[Notez toutes autres observations sur l'utilisation du charbon dans ce ménage]*					
	L. Autres combustibles					
	A quelle fréquence utilisez vous les combustibles suivants pour la cuisine en cette période de l'année? *[Enumérez chaque combustible par ordre et encerclez la réponse appropriée]*					
		Aucun	Moins d'un repas par semaine	Quelques repas par semaine	Environ la moitié de tous les repas	Plus de la moitié de tous les repas
L1	Résidus [Décrivez le type] _____	1	2	3	4	5
L2	Bouse	1	2	3	4	5
L3	Kérosène	1	2	3	4	5
L4	Gaz butane	1	2	3	4	5
L5	Electricité	1	2	3	4	5
L6	Autre [Décrivez] _____	1	2	3	4	5
	[*Vérifiez avec le répondant que vous avez discuté de tous les combustibles du ménage utilisés pour la cuisson et allez *à* M*]					

	M. Saisonnalité		
M1	Utilisez-vous du charbon ou une autre source de combustible pour remplacer le bois de chauffe pendant la saison des pluies?	**1=Oui** **2=Non [*Allez à M3*]**	
M2	Pourquoi utilisez-vous charbon de bois ou autres sources de combustible pour remplacer le bois dans la saison des pluies? [Vous pouvez cocher plus d'une réponse]	1. Bois trop mouillé pour préparer avec 2. Pour être à l'abri de la pluie 3. Autre raison *[spécifiez:]*_____	

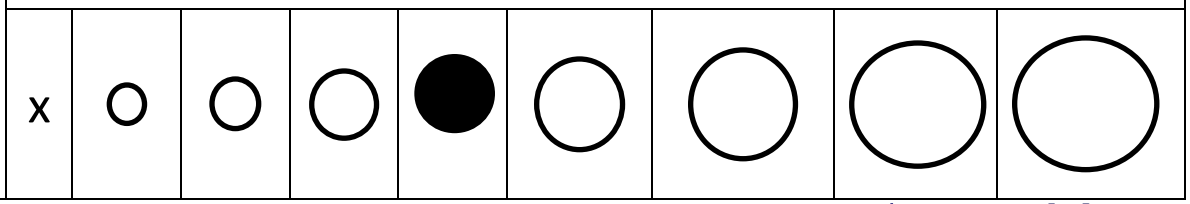
[*Dans la table ci-dessous, demandez chaque <u>facteur</u> individuellement, et comment ça change pendant l'année comparée à la saison actuelle. Si ça change, mettez '1' dans la deuxième colonne et décrivez comment ça change dans la troisième colonne en suivant les instructions. Si ça ne change pas mettez '2' dans la seconde colonne. Il est important que vous demandiez le plus d'information possible. Faites toute autre note nécessaire en M12]*

	Facteur	**Est-ce que ça varie?** **1=Oui** **2=Non**	Si oui, décrivez comment cela varie au cours de l'année. ***Remplissez les crochets [ ] là où c'est nécessaire, et mettez une raison à la fin de la phrase. Soyez sûr d'écrire tout ce que la participante dit et qui a un sensé***
M3	Nombres de personnes pour qui vous cuisinez	M3_1	Dans la saison actuelle je prépare **normalement** pour [M3_2] personnes, et en saison des pluies, je prépare **normalement** pour [M3_3] personnes parce que [M3_4]..
M4	Nombres de repas cuisinés par jour	M4_1	Dans la saison actuelle, généralement chaque jour je prépare [M4_2] repas et pendant la saison des pluies, je prépare généralement [M4_3] repas par jour parce que..[M4_4].
M5	Principal fourneau utilise	M5_1	Pendant la saison actuelle j'utilise généralement un fourneau/foyer [M5_2] comme fourneau/foyer principal, et pendant la saison des pluies, j'utilise généralement un foyer/ fourneau [M5_3] comme foyer/fourneau principal parce que …..[M5_4]

Quantité de bois utilisé

LISEZ: Voici un diagramme qui représente la quantité de bois que vous utilisez chaque jour présentement [montrez du doigt le cercle en gras]. Si ce cercle veut dire « pas de bois de chauffe du tout » [montrez du doigt la croix] et ce grand cercle veut dire « deux fois plus de bois de chauffe que vous utilisez maintenant » [montrez du doigt le grand cercle] svp montrez moi la quantité de bois de chauffe que vous pensez que vous utilisez pendant la saison des pluies.

[Cercler le chiffre qui correspond à ce que la ménagère indique comme consommation de BOIS DE CHAUFFE.]



	Pas de bois	Un quart	Un demi	Trois quarts	**Actuelle**	Un et un quart	Un et demi	Un et trois quarts	Deux fois plus de bois
M6_1	1	2	3	4	**5**	6	7	8	9
M6_2	La quantité de bois de chauffe change pendant la saison des pluies parce que....[*écrivez tout ce que la participante dit]*								
	Quantité de charbon utilisé *[demandez seulement si la personne utilise du charbon de bois]* *[Ci-dessous est le même diagramme, cette fois-ci montrant la quantité de **charbon de bois** que la répondante utilise actuellement].* LISEZ: Comme tout de suite montrez moi la quantité de charbon de bois que vous pensez que vous utilisez pendant la saison des pluies. *[Cerclez le chiffre du cercle qu'elle indique pour sa consommation de CHARBON DE BOIS]*								
	X	○	○	○	●	○	○	○	○
	Pas de charbon de bois	Un Quart	Un demi	Trois quarts	**Actuelle**	Un et un quart	Un et demi	Un et trois quarts	Deux fois plus de charbon
M7_1	1	2	3	4	5	6	7	8	9
M7_2	La quantité de charbon de bois change pendant la saison des pluies parce que....[*écrivez tout ce que la participant*								
	N. Autres observations								
N1	Est-ce qu'il y aurait autre chose que vous aimeriez nous dire sur vos pratiques de cuisson qu'on a pas encore discuté avec vous?								
	Merci pour votre temps et votre aide à nous fournir des informations utiles								
N2	*[Notez toute autre information que vous jugez sera utile et pertinente]*								

6.3 Senegal Baseline Firewood Consumption Questionnaire: English

Baseline Fuel Use Assessment:
SVA- Senegal

Designed by HED Consulting December 2011

- This survey is designed to be administered to the primary cook in selected households
- The objective of this survey is find out how much firewood is used PER STOVE on a weekly basis in households
- Please note: All questions refer to general household cooking during the present season.

Italic text in [square brackets] is instructions for fieldworkers. This text should not be read out to respondents.

Bold underlined text should be read out to respondents

[IMPORTANT:** Before starting the survey, please ask the interviewee if she/he is the main cook in the family unit. If it is not the main cook, ask to speak to the main cook, and arrange a convenient time when she/he will be available for interview**.]

Baseline Fuel Use Assessment:
SVA- Senegal

H. Introduction			
READ: Good morning/afternoon, my name is_____. Thank you for making time for us. I am here today to talk to you about your family cooking practices and fuel use. If you agree to participate in this survey, we would like to ask you a few questions; it will take about 25 minutes. There are no 'right' or 'wrong' answers and the information you provide will be very useful to help us improve cooking practices throughout Senegal. All the information will be kept private and your name will not appear anywhere publicly. We will however keep it in our records so that we can contact you in future. Do you have any questions?			
A1	Do you mostly use firewood for cooking in your home?	1=Yes	2=No *[terminate interview]*
A2	Do you agree to participate?	1=Yes	2=No *[terminate interview]*
A3	Have you enough wood in your home to last at least one day?	1=Yes	2=No *[terminate interview]*
A4	ID number		
A5	Date of interview [DD/MM/YYYY]		
A6	Start time of interview [Use 24-hour clock]		
A7	Interviewer's name		
A8	Respondent's name		
A9	Respondent's telephone number [if available]		
A10	Region or rural community		
A11	Village		
A12	Current season	1=Wet 2=Dry	
A13	Today's weather		

	I. Household structure				
B1	How many people are in your family unit?				
B2	On average, how many people do you usually cook meals for each day, at this time of year?				
	Children 14 years or younger	Female adults 15 years and older	Male adults 15 - 59 years	Male adults 60 years or older	Total [NN]
B3	*[Check: Is B2_5 the same as B1?]*			1 = Yes *[Go to C]* 2 = No	
B4	Why is there a difference between your family size and number cooked for? *[Write down everything the respondent says]*				
	J. Cooking				
C1	**On average,** how many times is your fire or stove lit to cook meals or heat drinks each day for your family?				
C2	On average, how many hours do you spend each day cooking? *[Record to the nearest half hour]*				
C3	What is your main cooking fire or stove at this time of year? *[Use the list below and put in the type for 'other']*				
	1. Three stone fire	2. Mud wood stove	3. Metal wood stove	7. Other stove	
	4. Charcoal stove	5. Kerosene stove	6. LPG stove		
	Please describe if 'other' type of stove is used and not on the list.				
C4	What other fires or stoves do you use at **least once per week?** *[Use the list above [or write down the name] for any stove or stoves mentioned]*			*C4_1*	
				C4_2	
	K. Space heating				
D1	Do you use a fire or stove for room heating at **any time of year**?			1 = Yes 2 = No *[Go to Section E]*	
D2	During which seasons do you use a fire or stove for room heating?				

D3	What type of stove/fire and fuel do you use to heat your home? *[Use the list below or describe if 'other']*			
	1. Three stone fire	2. Mud wood stove	3. Metal wood stove	4. Charcoal stove
	5. Kerosene stove	6. LPG stove	7.Other	8. Charcoal censer
	Describe below if 'other' type of stove used for room heating.			

	L. Simultaneous stove use for cooking		
E1	Do you ever cook on more than one wood-fuelled fire or stove **at the same time**? *[Make sure the respondent is **not simply talking about multiple pots**]*	1 = Yes 2 = No *[Go to Section F]*	
E2	Do you do this at least once per week?	1 = Yes 2 = No *[Go to Section F]*	

E3	For what reasons do you use more than one wood-burning stove at the same time? ***[Do not prompt –** circle as many as required]*					
	Need to finish dishes all together	Need one hot and one cooler stove at once	Faster/ saves time	Guests visiting	Festivals/ ceremonies?	Other
	1	2	3	4	5	6
E4	If 'other' reason [6], please describe *[Write down everything the respondent says]*					

E5	Which wood-fuelled fires or stoves do you use **at the same time** for cooking, AND how often? *[Use the list below or describe if 'other']*			
	1. Three stone fire	2. Mud wood stove	3. Metal wood stove	4. Other
	Name of stove 1	Name of stove 2	For how many meals is this used in one week?	
Example A	*1*	*1*	Two times per week for one meal each time	
Example B	*2*	*1*	Every Sunday for one meal	
Combo 1				
Combo 2				

E6	Which seasons do you use more than one wood-burning stove at the same time?	1=Wet 2=Dry 3=All year	

E6	About how many hours per week do you use a second **wood-burning** fire or stove **at the same time as the main stove** ?*[Enter to the nearest half-hour]* *[Help the person to recall by asking about whether cooking patterns are different at the weekend or during the week on certain days]*		
	M. Energy-efficient stoves		
F1	Have you ever heard anything about energy-efficient wood-burning stoves? *[Stoves that use less fuel]*	1 = Yes 2 = No	
	Energy-efficient stoves burn less wood and tend to produce less smoke		
F2	If you had an energy-efficient stove, would you still need to use another woodfuel-burning fire or stove with it at the same time?	1 = Yes 2 = No	
F3	Can you tell me why/why not you would need to use another woodfuel-burning fire or stove with it at the same time? [Ask as appropriate]		
	N. Additional uses of fires/stoves		
G1	What else do you use fires or stoves for more than once per week other than cooking? *[Get the respondent to list all the tasks they use a fire/ stove for and then ask about the type of stove they use and the frequency and duration of the task]*		

	Use [e.g. heating water for bathing]	**Type of fire / stove used**	**Number of times per week?**	**For how long each time? [hrs]**
G1.1				
G1.2				
G1.3				

G2	If you had an efficient stove do you think you would be able to use it for all the tasks above?	1 = Yes *[Go to H]* 2 = No	
	If no, please explain what tasks you will not be able to do and why *[Write down everything the respondent says]*		
	O. Stoves with more than one pot hole		
H1	Do you own a wood-fuelled stove on which you can cook two dishes at once?	1 = Yes 2 = No *[go to Section J]*	
H2	Do you use both burners at the same time once a week or more?	1 = Yes 2 = No *[go to Section J]*	

H3	About how many hours per week do you use more than one burner at the same time? *[enter to the nearest half-hour]*	

H4 Are there particular reasons for using more than one burner at the same time?

[*Do not prompt & circle all that are mentioned]*

Faster/ saves time	Need one hot burner and one cool burner	Need to finish dishes all together	One pot is too small	Guests visiting	Water heating	Other
1	2	3	4	5	6	7

H5	If 'other' reason [7], please describe

L. Firewood

[This question is very important – please take time to ensure the question is understood and your measure reflects wood used for the respondent's family unit in an average day]

How much wood do you use in an **average day**? Please make a pile for me to weigh.

[*If the respondent uses a large log over a few days, ask them to pile up the equivalent wood used in a day*]

J1	Weight of **woodfuel** including bag or binding *[Include decimal places]*	**__ __ __ . __ __Kg**
J2	Weight of string/ bag weighed with the wood	**__ __ __ . __ __Kg**
J3	*[If the HH uses a large log which lasts more than one day please ask how many days it lasts for]*	**days**
J4	Did you weigh all the wood available in the household, or was some left besides that weighed?	1= Weighed all available wood 2= More wood remained
J5	Do you usually buy or gather your wood at this time of year?	1 = Buy [*Go to J6]* 2 = Gather [*Go to J9]* 3 = Buy and gather *[Go to J6]*
J6	About what proportion of total wood used do you buy at this time of year?	1 = I buy most of my fuel 2 = I buy about half my fuel 3 = I buy a small amount of fuel
J7	How much do you spend on fuelwood, and how often? *[Record the full answer. Make sure you include **amount and frequency** etc.]*	

J8	*[Using the information above calculate the average weekly expenditure on woodfuel, and check with respondent that it makes sense]*				_____ ***CFA***
	[Only ask questions L8-L10 if the respondents said they gathered some or all of their fuel wood]				
J9	How often do you or your family gather woodfuel for household use at this time of year? *[Enter number of times, and circle time period [e.g. 3 per week]]*				
	Number of times [J9_1]	Time period [J9_2]			
		Per day	Per week	Per month	Per year
		1	2	3	4
J10	Please show me how much wood you [/your family] bring home on each fuel collection trip? *[If feasible [i.e. not a cart load, weigh fuel]*				__ __ . __ __**Kg**
J11	Do you gather the same amount of wood throughout the year?			1 = Yes 2 = No	
J12	Have you noticed any change in the price of firewood in the last year?				
	A lot more expensive	A little more expensive	The price has not changed	A bit less expensive	Much less expensive
	1	2	3	4	5
J13	Tell me the reasons why you think the price of firewood has changed in the last year? *[Write down everything the respondent says]*				
J14	Have you noticed any change in the last three years in the effort required to gather firewood?				
	Much more effort to gather	A bit more effort to gather	About the same [*Go to J16]*	A bit less effort to gather	Much less effort to gather
	1	2	3	4	5
J15	Tell me the reasons you think the effort to gather firewood has changed in the last year? *[Write down everything the respondent says]*				
	[Observe the wood that the household is using and describe by circling as many as relevant]				
J16	Dryness of wood	Dry, well-seasoned	Wet [from rain]	Green: just cut from live	Not available to view
		1	2	3	4
J17	*[Add any other observations that you think are relevant about the woodfuel used by this family]*				
	M. Charcoal use				

K1	Do you use charcoal as a cooking fuel more than once per week?			1 = Yes 2 = No *[Go to L]*	
K2	For how many meals per week do you use charcoal at this time of year?				
	None	Less than one meal per week	A few meals per week	About half of all cooking	More than half of all cooking
	1	**2**	**3**	**4**	**5**
K3	For what purposes do you use charcoal, and why do you use charcoal rather than wood for these purposes? *[Write down everything the respondent says]*				
K4	***[Please take time to ensure this question is understood and your measure reflects charcoal used in <u>an average day</u>]*** On the days you use charcoal, what is the **<u>average amount of charcoal</u>** you use for all household purposes? Please make a pile for me to weigh.				
K5	Weight of **charcoa**l [including tin or bag] *<u>[Include decimal places]</u>*			**__ __ __ . __ __Kg**	
K6	Weight of container or bag weighed with the charcoal *<u>[Include decimal places]</u>*			**__ __ __ . __ __Kg**	
K7	Have you noticed any changes in the price of charcoal over the last three years?			1 = Yes 2 = No *[Go to K9]*	
K8	Describe changes (if any) in charcoal prices in the last three years?				
	Much more expensive	A bit more expensive	A bit less expensive	Much less expensive	
	1	2	3	4	
K9	*[Record any other observations on charcoal use in this household]*				
	N. Other fuels				
	How much of your cooking is done with the following fuels? *[List each fuel in turn and circle the most appropriate response]*				

		None	Less than one meal per week	A few meals per week	About half of all cooking	More than half of all cooking
L1	Dung	1	2	3	4	5
L2	Kerosene	1	2	3	4	5
L3	LPG [gas]	1	2	3	4	5
L4	Electricity	1	2	3	4	5
L5	Other *[describe]* _____	1	2	3	4	5

	[Check with the respondent that you have discussed all of the fuels the household uses for cooking]

Please go to Section M on next page

	M.		
M1	Do you use charcoal or another fuel source to **replace** firewood ***in the wet season***?	1 = Yes 2 = No *[Go to M3]*	
M2	Why do you use charcoal or other fuel sources to replace wood in the wet season?	1. Wood too wet to cook with 2. To stay out of the rain when cooking 3. Other *[specify:]*_____	

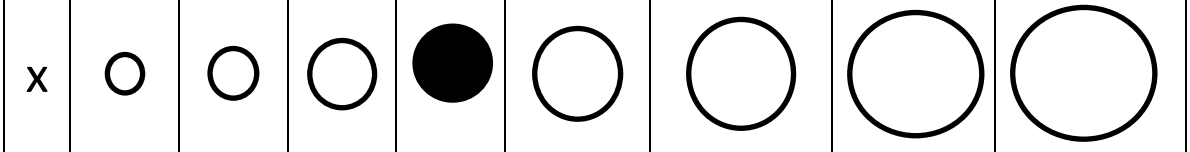
[In the table below, ask each factor individually, and how it changes during the year compared to the current season. If things change, put '1 'in the second column, and describe how it changes in the third column by following the instructions. If it does not change, put '2 'in the second column. It is important that you get the most information possible. Make any other notes required in M12]

	Factor	**Does it vary?** **1 = Yes** **2 = No**	If yes, describe how it varies over the year. *[Fill in the [ ] where possible, and put a reason at the end of the sentence. Make sure you write everything the particpnats says and that it makes sense]*
M3	Number of people cooked for	M3_1	In the present season I **usually** cook for [ ] people, and in the wet season I **usually** cook for [ ] people because.....
M4	Number of meals cooked per day	M4_1	In the present season each day I **usually** cook [ ] meals and in the wet season, I **usually** cook [ ] meals because.....
M5	Main stove used	M5_1	In the present season I usually use a [ ] stove and in the wet season I use a [ ] stove because.....

Quantity of wood used.

READ: Here is a diagram showing the amount of wood you use currently each day *[point to the circle with the bold edge]*. If this cross is 'no fuel at all' *[point to the cross]* and this big circle is 'twice as much woodfuel as you use now' *[point to the largest circle]* please show us the amount of woodfuel you think you would use in the wet season.

[Circle the number that refers to the circle she indicates for WOODFUEL use]



	No fuel	Quarter	Half	Three quarters	**Current**	One and a quarter	One and a half	One and three quarters	Twice as much fuel
M6_	1	2	3	4	**5**	6	7	8	9

1									
M6_2	The amount of woodfuel used changes in the wet season because....*[write down everything the participant says]*								
	Quantity of charcoal used *[only ask this question if the person uses charcoal]* *[Below is the same diagram, this time showing the amount of charcoal the participant uses currently].* READ: As before, please show us the amount of charcoal you think you would use in the wet season. *[Circle the number that refers to the circle she indicates for CHARCOAL use]*								
	X	○	○	○	●	○	○	○	○
	No fuel	Quarter	Half	Three quarters	**Current**	One and a quarter	One and a half	One and three quarters	Twice as much charcoal
M7_1	1	2	3	4	5	6	7	8	9
M7_2	The amount of charcoal changes in the wet season because....*[write everything participant says]*								
	N. Other observations								
N1	Is there anything else you would like to tell us about how you use your fuel for household purposes? *[Write down everything the participants says]*								
	Thank you for your time and help in providing us with this useful information								
N2	*[Write down any observations of your own that you feel would be helpful and relevant]*								

6.4 Calculation of adjustment for seasonal fuel use

The study was carried out during the dry season, which according to local information lasts for 9 months of the year. There is one other season (wet), which lasts for 3 months.

The participants were asked how much firewood they use in the wet season compared to their current use (see question M6.1 in Annex 6.2/6.3).

Each response provided a fraction related to the current firewood use as per Table 6.1 below.

Relative amount of firewood	Adjustment fraction
No wood	0
A quarter of the amount	0.25
Half of the amount	0.5
Three quarters of the amount	0.75
No change	1
A quarter more	1.25
A half more	1.5
Three quarters more	1.75
Double the amount	2

The current daily wood consumption was multiplied by this fraction to give a daily amount during the wet season.

For example: If the HH currently using 12.08kg of fuel per day reported using a quarter more during the wet season, the daily fuel consumption for the wet season was calculated by:

12.08*1.25= 15.1kg

The overall daily firewood consumption was adjusted to reflect the reported seasonal changes using the following calculation:

((12.08*9)+ (15.1*3))/12=12.84kg/day

6.5 Calculation of simultaneous stove use

Baseline Firewood Consumption Assessment 2012

This document outlines the process of gathering and analysing information on simultaneous stove use in Senegal as part of the baseline assessment.

1. Key questions in survey

C1	On average, how many times is your fire or stove lit to cook meals or heat drinks each day for your family?	
C2	On average, how many hours do you spend each day cooking? [Record to the nearest half hour]	

AND

E1	Do you ever cook on more than one **wood-fuelled** fire or stove **at the same time**? *[Make sure the respondent is **not simply talking about multiple pots on a single fire**]*		1 = Yes 2 = No *[Go to Section F]*	
E2	Do you do this at least once per week?		1 = Yes 2 = No *[Go to Section F]*	
E5	Which **wood-fuelled** fires or stoves do you use **at the same time** for cooking, AND how often?			
	Name of stove 1	Name of stove 2	How many MEALS/ DRINKS is this combination used each week? ***Be specific: 'occasionally' is not sufficient detail***	
***Example** A*	*Three stone fire*	*Three stone fire*	Two times per week for one meal each time	
***Example** B*	*Mud woodstove*	*Three stone fire*	Every Sunday for one meal	
Combo 1	E5_1	E5_2	E5_3	
Combo 2	E5_4	E5_5	E5_6	
E6	Which seasons do you use more than one wood-burning stove at the same time?		1=Wet 2=Dry 3=All year	

2. Interpretation

From these questions we have the following information:

- Average number of meals cooked per week
- Average number of 1 stove meals cooked per week
- Average number of 2 stove meals cooked per week.
- Average number of months per year this occurs

Using this information and assuming equal amounts of fuel used on each stove (which is the most conservative approach), the fuel correction factor is calculated as follows:

(2*total meals per week with 2 stoves)+total meal using 1 stove= stove meals

Stove meals/7= stove meals per day

Stove meals per day/number of meals per day= Household (HH) mean stoves used /day

Fuel correction factor= 1/ (HH mean stoves used /day)

The table below shows the calculations for various combinations of simultaneous stove use.

Total meals/week	Total meals with 2 stoves /week	Total meals with 1 stove /week	Stove meals total /week	Stove meals/day	HH mean stoves used per day	Fuel correction factor
21	21	0	42	6.00	2.00	0.50
21	18	3	39	5.57	1.86	0.54
21	14	7	35	5.00	1.67	0.60
21	10	11	31	4.43	1.48	0.68
21	7	14	28	4.00	1.33	0.75
21	4	17	25	3.57	1.19	0.84
21	1	20	22	3.14	1.05	0.95
21	0	21	21	3.00	1.00	1.00
14	14	0	28	4.00	2.00	0.50
14	12	2	26	3.71	1.86	0.54
14	10	4	24	3.43	1.71	0.58
14	8	6	22	3.14	1.57	0.64
14	7	7	21	3.00	1.50	0.67
14	4	10	18	2.57	1.29	0.78
14	3	11	17	2.43	1.21	0.82
14	2	12	16	2.29	1.14	0.88
14	0	14	14	2.00	1.00	1.00

These adjustments are further refined according to seasonal variation. Based on the wet season lasting three months and the dry lasting nine months, adjusted fuel consumption for a HH reporting multiple stoves during the dry season but not during the wet season would be calculated as follows:

((3*1) + (1*fuel correction factor))/4

3. Example

Total meals per week: 21 Total 1 stove meals: 17 Total 2 stove meals: 4

Daily HH firewood use: 16.32kg

Calculation

(2*4)+17= 25

25/7= 3.57 stove meals per day

3.57/3 meals per day= **1.19 stoves per day**

1/1.19= a fuel correction factor of 0.84

Therefore a HH with a daily firewood use of 16.32kg would be adjusted to

16.32*0.84= 13.71kg of wood used per day per stove.

If this HH **only used multiple stoves in the wet season** this would be adjusted to:

((3*0.84) + (1*1))/4 = 0.88

Any HH reporting simultaneous stove use less than once per week was given a default adjustment factor of 1.

6.6 Example monitoring questionnaire

Stove Use Patterns and Operation Monitoring Survey

Prepared by HED Consulting

Example key question to determine the percentage of households that use more than one stove at the same time at least once per week (monitored data parameter SSy): Question B3

	P. Identifying house and cook		
A1	Sales record number	A2	Village
A3	Ward	A4	District
A5	Participant telephone number		
A6	Date of interview [DD/MM/YYYY]		
A7	Start time of interview [Use 24-hour clock]		
A8	Interviewer's name		
A9	Date of stove installation		

	Q. Stove use		
B1	Do you still use your '[INSERT INTERVENTION STOVE NAME]' for most cooking tasks?	1=yes 2=no [*go to C1*]	
B2	Do you use any other cooking stoves at least once per week?	1=yes 2=no *[go to D1]*	
B3	Do you use this other stove at the same time as your primary stove at least once per week?	1=yes [go to D1] 2=no [go to D1]	

	R. Reasons for stopping use of '[INSERT INTERVENTION STOVE NAME]	
C1	Why do you no longer use the '[INSERT INTERVENTION STOVE NAME]? [*Write down everything the participant says]*	
C2	Which stove do you use as your primary stove now?	

	S. **Stove breakage and repair**		
D1	Since starting to use your '[INSERT INTERVENTION STOVE NAME] stove has anything broken on it?	1=yes 2=no [*go to E1*]	
D2	If yes, please describe what broke [*Write down everything the respondent says*]		
D3	Did you repair the break?	1=yes	

			2=no	
	T. **Observations and comments**			
E1	[O*bserve the* '[INSERT INTERVENTION STOVE NAME] *and note any signs of recent use or otherwise]*			
E2	[*Please check the stove for all components- enter a 1 if present and if in correct position. Enter a 2 if not.]*	1=yes 2=no	Present	Correct
		[ENTER COMPONENT 1]		
		[ENTER COMPONENT 2]		
E3	[*Please note any comments from the stove user*]			
E4	[*Interviewer note and observations*:]			

6.7 Adjusting for prevalence of simultaneous multiple stove use in future monitoring

The following formula is proposed by CQC for calculating the $B_{old,adjusted}$ to account for different prevalence of significant levels of simultaneous stove use compared with that determined at baseline:

$$B_{old,adjusted} = B_{old} \cdot \left[\frac{1.10}{1 + \left(SS_y/0.549\right) * (1.10 - 1)} \right]$$

where:

- B_{old} is the baseline value presented in this report after adjustment for seasonal variation and multiple stove use *as determined at baseline;*
- SS_y is the percentage of households that continue to use baseline stoves (second stoves) at least once week in addition to ICS *as determined at monitoring*;
- 0.549 is the percentage of households in the baseline study who use a second stove at least once per week;
- 1.10 is the mean household stove usage found in the wood fuel baseline.

Applying this formula to the two known scenarios, we test its performance:

- where future monitoring determined the same prevalence of simultaneous stove use, then $B_{old,adjusted} = B_{old} = 13.87$ kg/ stove/day
- where future monitoring determined zero prevalence of simultaneous stove use, $B_{old,adjusted} = 15.26$ kg/ stove/day

The actual value for baseline data adjusted for seasonal variation but with no adjustment for multiple stove use (i.e. zero % multiple stove users) is 15.14 kg/ stove/day. The difference is likely to be because during analysis, adjustments for multiple stove use were applied at an individual household level: this formula is therefore a *very close approximation* of the actual adjustment. In order to make this formula conservative, an amendment to value for the mean household stove usage is proposed, from 1.10 to 1.09.

Applying this $B_{old,adjusted}$ for 0% multi-stove usage = 15.12 kg/ stove/day, which is more accurate and conservative.

Therefore the proposed amended formula is:

$$B_{old,adjusted} = B_{old} \cdot \left[\frac{1.09}{1 + \left(SS_y/0.549\right) * (1.09 - 1)} \right]$$

Senegal EcoSac Scale Up

Funded by USAID

Milestone 2 Reporting by SEM Fund

Dakar, Senegal

September 25, 2013

Authors:

Siré A. Diallo

John Fay

USAID DIV – Senegal EcoSac Scale Up
The SEM Fund
Grant No. AID-OAA-F-13-00035
Milestone 2 Deliverables

Sept 25th, 2013
USAID – DIV
Grant Number AID-OAA-F-13-00035

William Wes Day:

As per the Fixed Obligation Grant to: The SEM Fund for "Senegal EcoSac Scale Up" agreement dated May 13, 2013, below please find the Milestone 1 requirements, including:

1) Cost-Effectiveness assessment and affordability
2) Centralized Eco-Sac Manufacturing Facility Established and Sewing Machines Purchased
3) EcoSac advertisements printed in le Soleil, Walf, and L'OBS

Please let Siré A. Diallo (sire@sem-fund.org) and John Fay (john@sem-fund.org) know if you require any further information. Thank you for your support for the EcoSac initiative, we look forward to commencing the implementation phase of the EcoSac Scale Up program.

Best regards,

Siré Diallo

This initial investment from public funds will actually allow us to demonstrate proof of concept that the EcoSac can be a self-sustaining social enterprise once the public funding allows it to achieve economies of scale. Ultimately, an extended marketing campaign ~~will be~~is underway ~~undertaken which~~that will require increased revenues for product advertisements, design, and branding development. The success of the EcoSac will be highly dependent on maximizing our labor force and reducing input costs. We have found that we will need to focus on awareness building and marketing because the EcoSac is an entirely new product in Senegal. Moreover, we also have found there to be very strong demand for the EcoSac from international markets through product feedback from North American and German users. We are confident that the EcoSac will be a very aspirational product for the eco-conscious customer in these international markets. However, achieving sales in those markets will require us to aligned with various norms and standards and develop a robust international supply chain. We may be able to work with USAID to prepare us to take advantage of AGOA. That being said, o~~O~~ur assessment plan is quite straightforward because~~, as~~ our cost-effectiveness plan should get us to positively answer the following questions:

a) Are we achieving sales of 500 EcoSac per month in Senegal for a year?
b) Have we developed a regional market: distributing in 2 of the 7 countries of the West African Economic and Monetary Union by year 2 of the program?
c) Are we aligned with AGOA and EU trade norms and capable of leveraging such mechanisms by end of year 2?

In order to answer the above questions positively or to demonstrate the cost-effectiveness of the EcoSac, the team will administer several short surveys based on our data collection and evaluation metrics specified in Milestone 1 to measure the financial and non-financial benefits of EcoSac. We will provide a discount to 20~~5~~ EcoSac customers in order to conduct recurring surveys in the following manner:

- 1 survey before use of EcoSac to establish the baseline on the financial and non-financial indicators such as current usage of cooking fuels; current cooking energy budget; length of meals preparation using current cooking stove; self-reported health issues (red eyes, chronics coughs, breathing problems, etc.)
- 1 survey after 3 months of use to compare to the baseline scenario with post distribution of ES. We are still unsure~~ of~~ if we should and how to~~ better~~ capture health related data beyond the self-reported qualitative data. Our conversations with the M&E Specialist at USAID proved that as a business we should not look to get involved in heavy research activities such as indoor-air pollution testing~~this should suffice we are not an academic institution looking to publish a statistically valid article~~. Our surveys will show changes in the various indicators we established for the M&E reporting.

Our cost-effectiveness plan will allow us to gauge the impact of the ES on the household and the end-user. Questionnaires are being developed for use in our hand-held electronic surveys.

- Usage and outcome data including (handheld phone survey):
  - Willingness to buy at various price points and financing mechanisms
  - Usage per week, e.g. # of times EcoSac is used~~.~~
  - Amount of fuel used compared to baseline~~.~~
  - Money saved on purchase of fuel or time saved for fuel collection compared to baseline~~.~~
  - Time saved in cooking compared to baseline~~.~~
  - Meals prepared with EcoSac as in breakfast, lunch, and dinner~~.~~

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- Other uses of the EcoSac within past month, e.g. cooling, keeping food warm, transporting food, etc.
- Social impacts such as general livelihood improvement, indicated by self-reported ease of life through other benefits such as time saved, IGA started, other activities.
- Health impacts, measured by frequency of visits to health institutions and decrease in usual symptoms caused by exposure to smoke and indoor pollution.

We plan to measure the cost of selling, buying, and using the EcoSac in relation to competing products by collecting data in form of market surveys and consumer surveys. Currently, the only competing products on the market in Senegal are regular coolers and Chinese-made heat retention containers. Our EcoSac thermal cooking and cooling bag is a combination of both and above all, offers what none of the available products have: the ability to actually cook meals in it. This really creates ~~the unique "wow" factor separating the~~ a competitive advantage for the EcoSac from competing products. Our surveys will capture the characteristics of the ES compared to the similar existing products.

According to data from demo sessions, the EcoSac aligns in terms of pricing with the regular coolers and is cheaper than the Chinese-made heat retention containers. ~~Though we need to confirm this through a more formal and thorough survey.~~ The Chinese heat retention containers come in sets ~~so~~ for a household that wants the whole set they can spend more than USD $50; whereas, one EcoSac fits several container sizes. Our product positively affects socio-economic issues by addressing the negative consequences of using biomass fuels, which include indoor air pollution resulting in health hazards, high levels of deforestation and high economic cost to poor households. The EcoSac addresses global issues such as climate change, poverty, environmental degradation, health, and unemployment in Africa. On African markets, the number one benefit of the EcoSac to our customers will be ~~an estimated~~ up to 30% reduction on energy expenditures resulting in potential financial savings of ~~about~~ an estimated USD $150 per year for the average Senegalese household. Our surveys will produce data to prove or disprove these claims ~~substantiate these claims or not~~. From our small-scale surveys, we will also explore end consumer sentiments toward the~~the~~ EcoSac ~~is also positively received~~ in Senegal regarding~~because of the large~~ energy and time savings ~~it produces~~. To date we have found people extremely keen not only to use the EcoSac for cooking white rice but also to keep food warm so re-heating is no longer required throughout the course of the day.

We will track information about competing solutions in order to provide an effective comparison to the EcoSac by doing surveying competing products for:

- Availability/accessibility
- Revenues of distributors
- Price evolution of competing products
- Cost of EcoSac production and all other financial metrics.

To provide an effective comparison of the competing products to the EcoSac by tracking the above indicators, our team will conduct market and consumers surveys. For instance, spot-visits to local markets to ~~first do~~perform a market observation, where the surveyors just identify the merchandise~~s~~ available for sale to determine whether the EcoSac is already available and also what other competing products are on display. During this market observation survey, the enumerators do not actually speak with vendors or customers as the goal is to get a sense of what product are obviously on display and

marketed. Afterward, the enumerators will conduct trader surveys to capture first hand data about competing product they have identified with the goal to know the pricing, the use, its availability, its popularity, etc. This survey will be directed at vendors only because a subsequent short survey will allow us to capture customer's insight about the competing products.~~–~~ This last survey will be mostly qualitative to determine what consumers think of the product, its price, and availability.

Our recently established centralized manufacturing facility will be the first step towards producing large amounts of product and reaching economies of scales. The per unit Cost of Goods Sold (COGS) price is drastically lowered by increased efficiency in the production side and volume materials purchasing power, giving us a huge pricing advantage over cottage industries attempting to replicate our product. The team is currently doing Financial Cost Metrics (internal Data) to determine cost of good sold of various sizes of EcoSac using different types of raw materials:

In our African market, the number one benefit of EcoSac to our customers will be the 30% reduction on energy expenditures. Therefore, our baseline survey is the right tool to provide data regarding the financial benefits of using the EcoSac to our customers. The fact that a majority of our target market in Senegal will come from low-medium income households increases price sensitivity of our product. Our willingness to buy surveys conducted during demos have indicated that our target market in Senegal will not pay up-front over $20 for our product, with 80% stating that they would be willing to purchase our product if priced between $14-18. Given that EcoSac is a complementary product in Senegal, whereas it does not cook most traditional dishes, our customers are looking for financial and time savings as the first buying arguments.

Consequently, we have strategically priced the EcoSac ($14-wholesale, $18-retail and $22-microfinance) so that it is affordable to the most vulnerable Senegalese households and individuals. These sales prices will act as a large barrier to entry for competitors, who will not be cost competitive on labor and materials inputs.~~–~~ We anticipate expanding the EcoSac brand in to E.U, and North American markets, once we increase our manufacturing capacity. We have begun discussions with two potential partners for North American Distribution. For these markets we estimate the price between $35 and $40 without local shipping. This is an affordable price point for a niche product that promotes environmentalism, cooking convenience and development in Africa.

Internationally, Wonder Bag is the only direct competitor of EcoSac. The company has established long-term business deals with large companies such as *Uniliver*, a large super market with international distribution network, to promote the Wonder Bag. We had an initial conversation with founders of Wonder Bag about their business model and their expansion plans in to West Africa. We will continue to monitor this competitor with online research because their website and online articles provide a great deal of information. The project Manager will do this research once a month stating in December.

Centralized manufacturing established:

Centralized EcoSac manufacturing facility is established with four sewing machines. The shop has been designed to allow modular manufacturing of the EcoSac with two desks: 1 desk for cutting out the design and one for filling up the bags after they have been sewn. Our current manufacturing shop is 12 m x 8 m however it is located on the ~~floor flour~~fourth floor with no elevator, which is not ~~too user-~~

~~friendly~~efficient at large production. Scaled-up production is to begin the week of October 9th as the machines were back-ordered, which meant they were delivered only on Monday, September 23rd. The SEM Fund is looking to move to a larger facility in Q4 2013 with enough space capable of accommodating both the office and the manufacturing unit. We believe our marketing plan when fully executed will get us to scale. Therefore, we will increase the number of sewing machines. Pictures of the shop are in **Attachment 1.** Please note that some of the pictures show our weekly demonstration in peri-urban areas of Dakar under a tent.

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EcoSac Advertisement Published in Newspaper:

EcoSac advertisements were printed in three of Senegal newspapers: le Soleil, Walf, and L'OBS. The message of the campaign is as follow:

Do you think you spend too much money in cooking fuels (gas, charcoal and firewood)?

Would you like to save on your expenses for cooking fuels?

Did you know that the use of charcoal and firewood is harmful to your health and the environment?

If you answer "yes" to any of these questions, buy the new cooking technology EcoSac that allows you to save time, energy, and money.

Contact the SEM Fund at 77 792 6108 or 77 332 5943 for additional information.

To date the team has received 46 phone calls inquiring about the products. They are now organizing a demonstration for all those who called. **Attachment 2** shows the ads in the three newspapers.

Senegal EcoSac Scale Up

Funded by USAID

Milestone 3 Reporting by SEM Fund

Dakar, Senegal
17 January 2014

Authors:
Sire A. Diallo
Constanza I. Robles Fumarola

USAID DIV – Senegal EcoSac Scale Up
The SEM Fund
Milestone 3 Deliverables
Jan 17th, 2014
USAID – DIV
Grant Number AID-OAA-F-13-00035

William Wes Day:

As per the Fixed Obligation Grant to: The SEM Fund for "Senegal EcoSac Scale Up" agreement dated May 13, 2013, below please find the Milestone 3 requirements, including:

1) Update on project implementation;
2) Production of EcoSac reaches 500 per month;
3) Sale of EcoSac reaches 500 per month;
4) Facility manager hired to monitor and ensure production efficiency and quality control;
5) Draft scaling and financial sustainability plan.

Please let Siré A. Diallo (sire@sem-fund.org) and Constanza I. Robles Fumarola (constanza@sem-fund.org) know if you require any further information.
Thank you for your support for the EcoSac initiative.

Best regards,

Siré Diallo

Update on implementation:

1. SEM Fund established a central manufacturing facility to increase its production capacity via a modular production. This newly established facility includes four sewing machines, a desk for cutting the material, a desk for filling the sacs once they have been sewn, and a storage room for all finished products. Eight tailors were interviewed, and four were hired to manufacture the product. Even though this facility has significantly increased the number of EcoSacs produced, we still have not reached production of 500 units per month per month as of February 2014.

   We have been concentrating on our marketing activities. We expect that once we streamline marketing, our sales will pick-up. Once demand increases, we will add two more tailors to the team. Furthermore, we have hired a Production Manager who is tasked with reorganizing the workstation to optimize production among other things. During the interview process she suggested adding one person on a part-time basis to handle the non-tailoring tasks of the production process, such as filling up the bags, storing, and packaging them.

   The production area has been optimally designed to allow modular manufacturing of the EcoSac. The recently established centralized manufacturing facility was a first step toward increasing the number of EcoSacs produced and sold. At the time of the agreement, we estimated that six tailors could produce 500 EcoSacs per month but four tailors are manufacturing and average of 342 EcoSacs. We believe that one of the reasons the number of EcoSacs produced was lower than previous estimates is that the tailors' learning curve was not taken in consideration. However, it must be noted that these projections were made based on the assumption of operating 6 sewing machines. Currently our peak production stands at 360 bags per month with 4 tailors. Hence we care confident that with 6 tailors we will eventually exceed the 500 units production target. The tailors also produced 520 reusable bags for carrying biomass for cooking, a new addition to our product line.

   During Q4 of 2013, 30 micro-entrepreneurs attended three separate training sessions hosted at SEM Fund's office. They were trained on sales and marketing strategies for the eco-products, with the goal of becoming sales agents within their communities, and consequently increasing the distribution capacity of the EcoSac throughout Dakar's peri-urban areas. However, due to human resources issues, we are not currently able to fully implement this program. We are currently demanding too much of current staff and their output is suffering.

   During Q3 and Q4 of 2013, SEM Fund hosted a total of 12 demonstrations throughout Dakar's peri-urban areas, which were attended by a total of 576 participants. During these demonstrations, the EcoSac was presented, and its usability shown to local women and community groups, who showed significant interest in buying the EcoSacs, as well as becoming sales agents within their communities.

   Some of the main challenges we faced include:

- Periodic power cuts have hampered production. Though these power cuts are not that lengthy or frequent it may worsen during the dry season starting in June. We will need to purchase a generator when our cashflow situation allows us to do so.
- Sourcing the inputs has not been as user-friendly as we expected. The polystyrene cost has not decreased commensurate to our expectation even with our large-scale purchase. We hired a full-time Production Manager, who will handle sourcing and procurement of inputs. She will have more time to devote to this aspect of the operations. We believe we will be able to better negotiate.

2. In Q4 2013, we began the implementation of our marketing strategy for the EcoSac. In addition to advertisements being placed in three national newspapers, the EcoSac is now regularly promoted through SEM Fund's social media platforms. Furthermore, the EcoSac has continually been presented at product demonstrations throughout Dakar's peri-urban areas, where participants have shown interest in buying the product. As of December 2013, 152 EcoSacs were sold. However, we expect that the full implementation of our marketing strategy will significantly increase demand. Our best marketing strategies will be through t.v. and radio. A project Manager with a strong marketing and sales background is due to start on March on 2014. We certainly believe this is the last piece to making our projections realities.

   As part of the Q1 marketing strategy, an individual will be hired to market and promote the EcoSac in the local market. This person will be in charge of establishing sales channels and executing the marketing plan to increase brand visibility at the national level. We expect that the recruitment of a dedicated marketing and sales individual will increase the visibility of the EcoSac in designated markets, and consequently, increase the sales of the EcoSac.

- Draft scaling and financial sustainability plans developed to include:
  - Strategy on how to achieve financial sustainability in the Senegalese market. This should discuss EcoSac's micro- consignment and microfinance efforts and partnerships with other stakeholders.

Our scale-up and financial sustainability highly depends on how successfully we are in the implementation of our innovative marketing and our distribution strategies. The EcoSac being a new product on the Senegalese market, we have to combine various marketing and distribution methods to reach our target population. A sub-group of this population are poor women from peri-urban and rural areas who are most affected by the lack of clean cooking energy. Hence we cannot rely on solely television advertisements and an online campaign to reach this group. The strategy will be heavily reliant on guerrilla marketing and word-of-mouth, as mentioned in milestone 2. However, these publicity methods are time and money intensive. Nonetheless, we believe that they will allow us to reach our sales targets.

Since our objective is to establish a last mile distribution model for household energy solutions, we have designed an approach we believe solves the most challenging access issues. Through a combination of direct and indirect sales network, the ES will reach our target customer.

Micro-consignment:
This strategy will allow us to reach customers through our indirect sales channels. We will provide a stock of EcoSac to distributors who have a market or have proven to be able to achieve decent sales volumes. The advantage is that the distributor will not have to purchase the product in advance. They pay SEM once the products are sold. This allows us to get our product to a wider network of vendors/distributors who otherwise would not be able to sell the ES. As a social enterprise, the key is to remove access barriers and reduce poverty. Micro-consignment is the perfect tool to remove financial barriers on the supply side. This is being used with success by some organizations in East Africa, which is a reason we adopted it as a best practice. At scale we hope to have around 30 young people who report to our office everyday to get up to $100 worth of products to sell. They earn an average of $1.5 or $2.00 on each product sold, depending on the size of the EcoSac.

Microfinance:
The availability of microcredit and microfinance options in order to buy the EcoSac removes the financial barriers that currently limit the access to clean cooking technologies. Globally, the uptake for eco-products has been hampered by the low buying power of the target customers. We recognize this and our experience with microfinance allows us to successfully offer this service to our customers. By allowing customers to make small payments towards the EcoSac, we can drastically increase the uptake. Instead of making a one-time payment of $16, the customer will be able to make small instalments of any amount towards the price until its fully paid. Even distributors involved in our indirect channel are trained and required to make a use of microfinance as a tool to facilitate access. Some of the current distributors have innovated our proposed microfinance by allowing women to make a $4 deposit, take the EcoSac, and make monthly instalments, paying off the product in no more than 3 months.

The use of microfinance as a catalyst to improve access to modern energies services has been well-documented. However, micro-consignment is a new strategy that we are using to address financial issues at the supply side. This makes the removal of financial barriers more holistic.

Partnerships with other organizations:
We are aggressively seeking partnerships with local organisations and CBOs, but also with major international NGOs, such as UNHCR and GiZ. These two organizations have shown interest in the EcoSac in their programs. UNHCR made the strategic decision to put the emphasis on efficient cooking technologies in its humanitarian intervention across the world. Therefore, we are discussing how to make the EcoSac part of the kits that refugees and internally displaced people receive. GiZ also has strategically focused on access to energy (cooking and lighting) as the main issue

they will assist the Senegalese government with. Thus they are looking at the EcoSac as a potential product to support.

We are currently planning an open house to be held on March 20th, 2014 where we will invite key national and international organisations working on following issues: women/gender, children/education, health, youth employment, poverty, climate change, and environment. We have invited 30 organizations that we believe are open to innovation and are proactive in our areas of work. These partnerships will increase our sales volumes drastically. Furthermore, we signed two MoUs with STAESEN and Action Solidaire, two national NGOs that have wide networks of women's groups. Activities under these MoUs are scheduled to start in April.

- Strategy on how to market and distribute product to consumers and enter new markets, including an assessment of the timeline. Preliminary plans on engaging other relevant stakeholders (e.g. investors, policymakers, and/or other firms.

There is a considerable market for improved and clean cooking solutions in Senegal and in SSA in general due to increasing fuel prices, the hardship associated with collecting wood, and the negative health impact women endure using 3-stone stoves or other traditional cooking equipments. A report by the National Agency for demographics and Statistics (ANSD) showed a sharp increase in the price of LPG from 2006 to 2007. This increase of 33.8% and 49% respectively for the 6 kg and 3.5 kg tank of gas, ultimately affected the price of other fuels such as charcoal (31.4% increase) and fuel wood (13.5%). Now that the subsidies have been totally removed, and the price of LPG has increased further, even more people have turned to other cooking fuels/technologies. Women prefer using charcoal and firewood because they are able to buy small amounts everyday as opposed to LPG tanks.

Only a few pilot projects were implemented to address these issues by GIZ and PROGEDE, a world bank funded project. PROGEDE distributed 225K stoves and PERACOD 158K stoves between 2007 an 2011. In the 7 regions covered under our program, there are 524K households. Hence our target distribution goals fulfil fewer than 50% of the demand in these 7 regions. Considering that there are 14 regions in Senegal, this demonstrates the size of the improved cooking solution market and the potential for the EcoSac uptake.

Approach 1: Youth micro-entrepreneurship and consignment:

The implementation of a 'direct sales' approach that will be a variant of the various models championed by global companies such as Avon, Mary Kay and Herbalife. Our approach relies heavily on local context and adds the microfinance component to remove the financial barrier. We believe our direct sales model will work extremely well within the Senegalese context and facilitate rapid expansion to other regions and countries.

This approach focuses on word-of-mouth sales via commission-based qualified distributors, initially sourced through SEM's partnerships with women's groups and youth in the target areas (rural and peri-urban mostly). Our staff will screen

interested candidates for distribution. Once selected to join our distribution pool, the candidate will attend our two-day training, which explains the program and provides them with the tools to be successful.

The qualified distributors will have the ability to purchase the products at a lower price than the advertised retail price. The key tenant of this direct sales model is that anyone that purchases our products from a qualified distributors will receive a preferred price and will be eligible to receive a commission on referral-based product sales to family, friends or by going door-to-door, regardless if they are interested in becoming a distributor or not.

SEM's approach will also include a multi-level marketing (MLM) approach whereby qualified distributors can also earn money by recruiting and training a downline team of distributors to sell our products to programme members. Distributors can be tiered as Gold, Silver or Bronze based on their volume of sales. Gold and Silver distributors will have a downline team of sellers, while Bronze distributors will be the single-level distributors without a downline. Individuals can also purchase products from the SEM sales hub at retail pricing or via distributors who will individually determine if any preferential discount is provided.

Training:
The distributors will continue to receive training to expand their sales volumes effectively and learn about the business model, products and promotions. The last mile branded goods such as pins and t-shirts will be distributed to proven distributors. Below is an example of our training approach. We plan to train 50 youth; 30 young women and 20 young men between the ages of 18 to 35. They will undergo two weeks of training during which they learn about customer service, effective sales pitches, marketing, and other necessary soft-skills inherent to good entrepreneurs, such as finance and savings. Those who successfully complete the training will start their own small business through micro-consignment of ES. They will report to our offices everyday at 8 a.m. in uniform to collect their daily consignment of $100 worth of products. They will then head to conduct door-to-door sales and report back the next day for a group meeting where they will report on their previous day and receive feedback and support from coaches and peers. These micro-entrepreneurs have to sell cash as they are going door-to-door and we do not have the mechanism to extend micro-finance through that channel as of yet. This specific part of our sales strategy will be mainly deployed in Dakar during year 1. We will add other regions in year 2.

Approach 2: Establish Distributorship with consignment and micro-enterprise:
We have built a database of close to 200 intermediary distributors consisting primarily of women groups (120 groups), youth-owned corner stores (50), and 30 community-based organizations in the regions of Dakar only. These distributors go through a similar training as the Youth Micro-Entrepreneurs. However, they are able to use micro-finance to allow customers to purchase the ES. They are selected after a due diligence visit from our recruiting team. We then discuss terms of the agreement before they are trained.
The commission is 15% of the sales price for both groups. If the group buys the stock

in one-time payment the commission is increased to 20% or the group.

Training Module:

1. **Build your business plan:**
    - Do you want to work full time or part time?
    - How much money do you want to make?
    - How soon can you start?
2. **Use the Products**
   Learn the products firsthand and become your own best advertising.
3. **Call People You Know**
   How many people can you talk to about the programme in the first 72 hours? Write down your Circle of Influence – friends, relatives and acquaintances – and get started. Here are some helpful points to get you going:
    - Use the products and talk about their benefits.
    - Wear the button and encourage conversation.
    - Talk to everyone you know.
4. **Share Your Story**
   When you use the products, the results you achieve make you a product of the product.
    - Get out and share your success story.
    - Always show your passion for the products.
    - Inspire others to achieve their own goals.
5. **Create Long-Term Customers**
   Find out what your potential customers want.
    - Invite prospects to a presentation.
    - Place their orders.
    - Follow up with each potential customer.
6. **More Building Blocks for Long-Term Success**
    - Build relationships with customers and potential Distributors by staying in touch.
    - Ask for referrals. Teach others what you have learned. Duplicate this over and over.
    - Talk to your upline.
    - Attend a training seminar.

Our activities with women and youth groups give us a competitive advantage, as we are engaging quickly with various such groups looking to distribute the EcoSac through this micro-consignment method.

Approach 3: EcoBoutiques: A sales point and training hub located in a high traffic location within our target geographic will be established in all major cities. This will serve as the primary distribution hub for the EcoSac. The hub will also serve as a central hub for awareness building (cooking, economic, health, environmental benefits), training our customer on the use of the EcoSac. We will also use the hub to hold marketing events such as regular demonstrations, cooking competitions, etc.

The tracking of sales volumes by each qualified distributor and their adjoining sales agents will be done via volume points. All commission payments for product sales will be done electronically at the SEM hubs, whereby sales agents and distributors are paid using Mobile Money after the product has been paid for in full for ease of administration.

Assessment of the timeline: We have entered a new market already; through a partnership with Shared Value Africa (SVA, LLC) the EcoSac has been available on the Zambian market for about one month now. We, however, plan on entering other markets by May 2014 after we launch our EcoSac website in April. This website will have a shopping cart enabling customers to purchase online. Thus we can ship products in many countries. Our focus will be on Europe and North America in the first year of the online marketplace. This timeline is aggressive but we believe it is appropriate, as it will be supported by our social media and Internet marketing activities. By Q4 of 2014 we will be in the US market through partnerships and distribution deals with grocery store chains.

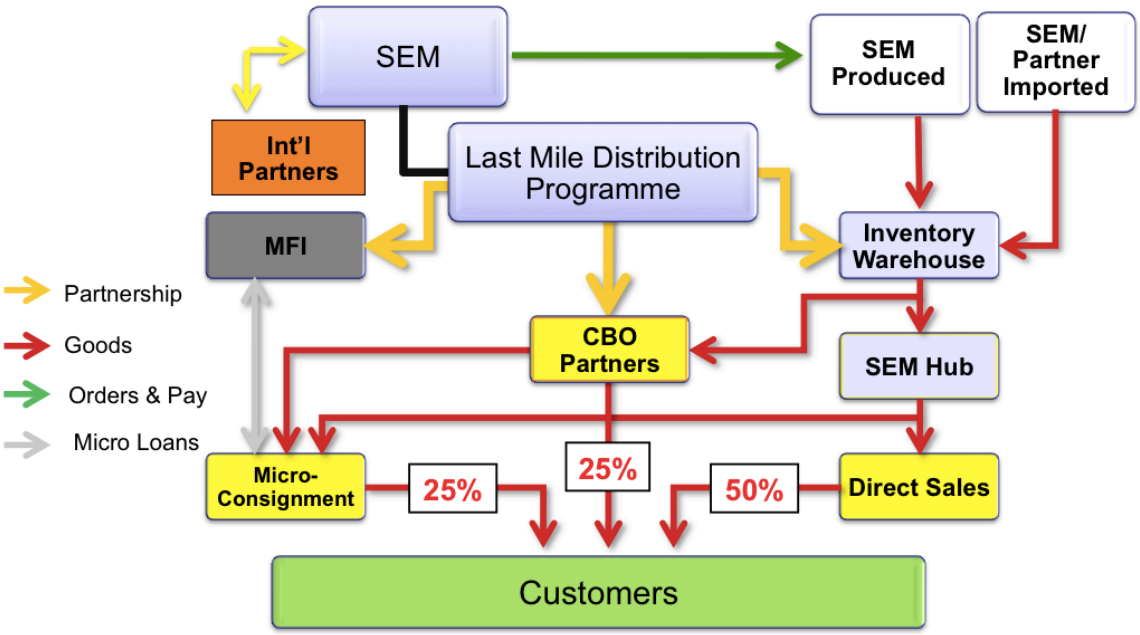

Figure 1: SEM Last Mile Distribution Schematic

Preliminary plans on engaging other relevant stakeholders (e.g. investors, policymakers, and/or other firms.

This EcoSac represents a great opportunity for social investors or companies looking to put their Social Responsibility (SR) funds towards solving a real global issue. Moreover, policymakers will be targeted through our marketing strategy to raise

their awareness on the issue of indoor-air pollution resulting from lack of access to clean cooking technologies which kills about 4 millions people worldwide according the WHO. The lack of cooking energy represents one of the biggest obstacles to sustainable development as it touches every facet of our lives (social, economic, health, education, etc). Up until recently, it did not receive the attention it deserved. Until stakeholders fully comprehended the impact that the lack of clean and affordable cooking fuel and technology has on the success of most livelihood improvement programs. The majority of victims are women and children who spend a great deal of time in the kitchen and/or fetching wood.
Policymakers need to create an enabling environment, which support the success of clean cooking solutions such as the EcoSac. Additionally they can be of a great assistance in the awareness-raising by financing countrywide campaigns.

1. *Establish regional strategy to grow our market*

Develop objectives with specific action items attached to key personnel; identify key stakeholders and capabilities to deliver the objectives, prepare a clear, simple, actionable strategy that is followed daily. This long-term strategic plan will have short and medium term objectives in terms of partnership development, fundraising target, and income generation activities/approach. Compiled a list of resources (human, financial, technical, and logistical) in order to reach the objectives of the regional strategy.

2. *Profile raising and networking*

Establish an online presence, including engaging with social networks, host numerous events in Senegal and other targeted countries to identify and leverage synergies with all relevant stakeholders - i.e. talks; PR; receptions (open house), etc. Develop and execute a strong marketing plan to present the EcoSac as a viable solution. Develop key collaterals and brochures, banners, etc. Key personnel will go on “road shows” to leverage existing network while developing leads for other actors in the field. We will attend appropriate trade fairs, make presentations, and disseminate publications in both French and English. We will invite key stakeholders to press conferences and an open house. Share the key strength of SEM and build on synergies with various actors. Register SEM on listserv and other platforms to receive and disseminate information. We organized two such events already.

3. *Raising Capital/income generation*

Though the EcoSac business will be financially self-sustaining by mid 2015 if all projections and assumptions hold true, we will still leverage contacts with institutional donors and social investors in targeted countries. Though this is a social business, we would register on listservs, newsletters, and other platforms to receive call for proposals and tenders. An innovative strategy will be to work with local authorities such as city halls, which are now more active in seeking funding in partnership with technical groups. The sustainable development department within city hall contacted us to schedule a meeting regarding the EcoSac and our micro-entrepreneurship training.

4. *Develop strategic partnership with consultants and other local/regional actors*

Go on 'road show' to introduce SEM Fund all possible partners/ collaborators in targeted countries. Continually follow-up leads via phone, face-to-face, and emails.

5. *Promoting knowledge sharing*

Develop and share newsletters, maintain a good amount of publications and quarterly reports. To get knowledge to the grassroots level, we hold community-based events. We have to maintain a strong online presence via webinars and social media.

6. *Project Management*

Ensure objectives are aligned with resources; roles, deliverables and timeline are clearly defined.

Press Conference on Energy-related Issues

We held a conference on December 19th, 2013 on indoor-air pollution, which was attended by more than 30 journalists from audio, video, and print media. National experts on climate change and domestic energy issues raised-awareness on the issues related to lack of efficient cooking technologies/fuels. This increased the visibility of the EcoSac. On Mars 4th, a workshop was co-organized with Practical Action, Enda-Energy on Access to Sustainable Energy for All. Our presentation was well-received many organizations showed an interest in the acquisition or distribution of the EcoSac.

Send plea letters to keys stakeholders:

As part of our fundraising strategy, which is being drafted at the moment, we are planning to send appeal letters to key organizations in order to highlight the negative effects of lack of clean cooking energy. The goal is to present the EcoSac as one of the viable solutions currently available.

Launch a task force on clean cooking:

We are planning to launch a task force on clean cooking. This team will lobby with government and other stakeholders to put access to clean cooking energy at the centre of their interventions. The task force will hold two events and draft 3 articles per year.

African Clean Cooking Energy Solution (ACCES)

We have engaged with this initiative of the World Bank to promote clean cooking in Africa. We were associated to launch of the initiative and are having on-going conversations with the local focal point regarding funding and other support to promote the EcoSac in Senegal.

Join platforms and events:

SEM Fund is already a member of the following international and national platforms/associations: the Global Alliance on Clean Cooking, Mitigation of Climate

Change in Agriculture (Micca), AfrICAN Climate (online knowledge-sharing platform). Aside from this activity we need to also attend relevant professional gathering to increase our visibility.

Establish MoUs and build beneficial partnership.

We have already partnered with Zidisha Inc., an online peer-to-peer micro lending platform to provide seed capital to 100 micro-entrepreneurs who go through our training to sell the ES. Our first batch of 30 micro-entrepreneurs was trained in January. They have created their online profile on Zidisha.org. They are now waiting to complete the due diligence process to ensure their eligibility. This program will run for two-years. More partnerships are being discussed at the moment with local and international organizations such as UNHCR, Plan International, Helen Keller, GiZ, Tostan, etc.

A Ghanaian and a Kenyan company we met at the Africa EU Energy Partnership's high-level meeting in Addis are interested in distributing the EcoSac in their respective countries. The Ghanaian organization is keen to also produce the fabric for us with our logo encrusted into the material.

Senegal EcoSac Scale Up

Funded by USAID

Milestone 4 Reporting by SEM Fund

Dakar, Senegal
07 July 2014

Authors:
Sire A. Diallo
Constanza I. Robles Fumarola

USAID DIV – Senegal EcoSac Scale Up
The SEM Fund
Grant No. AID-OAA-F-13-00035
Milestone 4 Deliverables
June 29th, 2014
USAID – DIV
Grant Number AID-OAA-F-13-00035

William Wes Day:

As per the Fixed Obligation Grant to: The SEM Fund for "Senegal EcoSac Scale Up" agreement dated May 13, 2013, below please find the Milestone 4 requirements, including:

1) Mid-project report summarizing overall progress to date;
2) Production of EcoSac reaches 1000 per month;
3) Sale of EcoSac reaches 1000 per month;
4) Update on proforma's established in milestone 3;
5) Middle management personnel must be hired.

Please let Siré A. Diallo (sire@sem-fund.org) and Constanza I. Robles Fumarola (constanza@sem-fund.org) know if you require any further information.
Thank you for your support for the EcoSac initiative.

Best regards,

Siré Diallo

Update on implementation:

1. SEM Fund has focused on establishing a professional and functional manufacturing and distribution supply chain for its EcoSac. The EcoSac tailors have been testing new design, which would resonate with our targeted international audience, such as bottle-size coolers and lunch boxes, as well as products aimed for restaurants and food delivery services, such as pizza-shaped EcoSac and bowl shaped bags. Furthermore, based on feedback from local customers and results from a series of cooking tests, SEM Fund is working on adapting the EcoSac to make it more user-friendly (easier to carry). Therefore, an EcoSac with a stronger plain material on the inside and a printed wax cover on the outside is being designed and tested. In addition, we have designed and printed a total of 4000 EcoSac labels, 2000 of which are in English (attachment 2) and 2000 in French. These labels provide further information on the use of the EcoSac, as well as washing recommendations. These labels reinforce the EcoSac as an independent brand and product, and provide a uniform identifier between SEM Fund's and SVA's products. During Q1 2014, SEM Fund established a partnership with Shared Value Africa (SVA) in order to manufacture and retail the EcoSac in East Africa starting with Zambia. While the EcoSac manufactured by SVA follows the same product specifications, it has been adapted to the materials available on the Zambian market. SVA's EcoSac is made with local wax and filled with Styrofoam instead of polystyrene. So far, they have established a successful small-scale manufacturing and distribution chain the Lusaka area, which they are looking to expand. This expansion to Zambia through SVA is about 1 year ahead of schedule based on our objectives. We are especially proud of this accomplishment knowing the millions of households in Zambia can now enjoy the benefits of the ES. SVA is making and selling a 200 ES per month, which is a small number, however, they have the right strategies to increase this number considerably.

2. During Q1 and Q2, SEM Fund focused on the international communications and marketing of the EcoSac. SEM Fund has been working to brand the EcoSac as an internationally adaptable and useful kitchen appliance with major socioeconomic benefits. To do this, SEM Fund is concentrating on three tools: 1) video; 2) twitter; and 3) website. The online marketing and communication campaign aims to build momentum for the launch of the online EcoSac shop. All platforms are designed to highlight the key essential benefits of the EcoSac: 1) money, time and energy savings; 2) support for a locally relevant micro-entrepreneurship programme; 3) Less deforestation (climate change). However, locally we are stressing the health benefits by highlighting the consequences of cooking with inefficient cooking products and solid fuels, which causes indoor-air pollution responsible of 4.3 million deaths annually around the world.

3. Building on the momentum created by SEM Fund's twitter account, an EcoSac twitter account was created to link the EcoSac to social issues, such as energy poverty, and to promote the EcoSac as an essential kitchen utensil. The twitter account is connecting with international "eco" product brands and bloggers to

advertise the EcoSac within those actors. Furthermore, connections are being made with food bloggers who might be interested in receiving a free sample of the EcoSac when the online shop opens so they can provide a product review. In addition, we are looking to promote the EcoSac with environmental influencers to try to create a supporter base.

With the support of a videographer, SEM Fund developed a 4-minute video that tells the story of two potential EcoSac users, a Senegalese user and an international customer. The video highlights cooking and food as an extremely important activity regardless of socioeconomic backgrounds, shows the disparities in energy access between two users, and presents the EcoSac as a viable and durable solution. The video, which was just recently finalized, was launched on July 2 through a large social media campaign to promote the new EcoSac site. We are happy to note the excitement around the product generated by the video. Within two days, we received about 30 orders online through our Facebook page as a result of our video. We are confident that once the promotion of the video reaches an optimal number of people our sales numbers will drastically increase. The video is on YouTube and can be found on this link https://www.youtube.com/watch?v=cqWooi7Rod4

Furthermore, a dedicated ES website will be launched the week of July 14th with the following URL www.ecoboutique.org. We took a scientific approach to designing and building this site, as it will be our 24-hour marketing tool. It was built to promote and to raise awareness about the EcoSac and to allow customer from the world over to purchase the product. This website will become the principal platform for both potential and existing EcoSac users. The website both introduces the EcoSac to interested parties, and provides a base for users to share recipes, experiences and comments. A total of 19 recipes, ranging from soups to deserts, have been tried and tested using the EcoSac, and are shown on the site. In addition, visitors can submit recipes and photos.

4. Developing a successful distribution chain for the international online EcoSac shop has proven increasingly difficult. An initial strategy considering shipping the EcoSacs directly to customers from Senegal; however, price and timing constraints eliminated that possibility. Furthermore, the potential of establishing an EcoSac filling station in the US, where empty EcoSacs could be cheaply shipped from Senegal and filled on the spot in the US was studied. However, the upfront cost of establishing the facility is beyond our financial means currently. Finally, the plan is to vacuum-package the finished EcoSacs, and to ship them to Amazon's shipping and handling facility. Once they have arrived, the EcoSac eshop page will be linked to the Amazon store, which will handle the orders, payment and shipment of EcoSacs. We are finalizing the opening of our Amazon business account.

   Currently, 103 small and 122 medium EcoSacs are being prepared for shipping to the US to satisfy orders. Each EcoSac will come with a one-page pamphlet (attachment 1), which contains our cooking tips, recommended cooking times and contact information. All of these EcoSacs have an English label and we have

ES with French labels as well to ensure better communication with our international audience.

5. We are going to fall slight short on our sales prediction of 5000 units by the end of Q4 as mentioned in Milestone 3 due to the cashflow situation we faced in Q1 of 2014. Our cost predictions for our marketing activities were not in line with realities, which affected our capacity to run TV and radio ads as we intended. We are currently in advanced conversations with 3 major TV and 5 radio stations. Developing the concept of the ads proved challenging to do internally. Therefore, a communication, company is going to work on developing our ads campaign on a pro-bono basis.

6. Since milestone 2, we established that we could reach production of 1000 ES monthly. Since our sales did not follow the same trend we have scaled back production. We expect to run full steam by end of August due the buzz created by the video and the website.

7. A Sales and Marketing Manager and Program Coordinator have been hired with detailed scope of work to further the mission of the ES. Lack of human resources and logistics have negatively affected our progress. Therefore, these hiring will increase our visibility and sales.

8. We have recruited 120 women groups to promote the ES. Currently, we are building their capacity to run a micro-enterprise. Once these trainings are finalized our last-mile distribution chain should be fully operational in the Dakar and Diourbel regions.

Who we are

SEM offers viable options to vulnerable communities, which empower them to satisfy their basic needs in a safer, cheaper and more environmentally-friendly way. Specifically, we focus on making improved household energy products and services accessible to the bottom of the pyramid.

We remove the barriers, which make improved household energy products and services inaccessible by leveraging innovative financing mechanisms and viable distribution channels. By setting up effective last mile distribution channels, we ensure that appropriate, acceptable and affordable technologies are accessible to those who need it to the most.

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SEM
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ECOSAC
COOKING FOR LIFE

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1. Butter a 9-by-3-inch springform pan.
2. In a food processor, pulse graham crackers until fine crumbs form; add melted butter, sugar, and salt, and pulse to combine.
3. Press crumb mixture into bottom and about 1 inch up side of pan.
4. Using an electric mixer beat cream cheese on medium until fluffy, scraping down side of bowl.
5. Gradually add sugar, beating until fluffy.
6. Beat in lemon zest and juice.
7. Beat in eggs, one at a time, scraping down side of bowl after each addition.
8. Beat in sour cream.
9. Once filling is prepared, pour over your crust.
10. Then wrap the entire spring form pan in enough aluminum foil so that no water will seep or drip into the pan from the sides or above.
11. Put the wrapped springform pan into your dutch oven.
12. Pour water into the Dutch oven until it is half way up the spring form pan.
13. Cover and place on stove, bring to boil and let simmer for 25 minutes.
14. Place covered pot in EcoSac and let cook for 5 hours.
15. Put it into the refrigerator until you are ready to eat it.

Classic Cheesecake

10 minutes	**25 minutes**	**5 hours**
Prep Time	Cook Time	EcoSac Time

Ingredients

- 25 grams butter
- 12 graham crackers
- 50 grams sugar
- 1.1 kg cream cheese
- 300 grams sugar
- 1 teaspoon lemon zest
- 4 large eggs
- 225 ml sour cream
- ½ teaspoon salt

You are now the owner of one of our EcoSacs. Not only are you saving time and energy during cooking, you're also reducing the burden of cooking for households throughout Sub-Saharan Africa.

We hope that you enjoy cooking for life.

Thank you!

EcoSac

The EcoSac is a non-electrical slow cooker, which saves time and energy. All you have to do is start the cooking process, and let the EcoSac take over!

After a pot of food has been partially cooked, it is removed from its original cooking source and sealed inside the Eco-Sac. The Eco-Sac will continue to cook the food without any need for additional fuel. In addition, the EcoSac can also be used as a safe short-term alternative for refrigeration.

Thanks to your EcoSac purchase, we can continue to subsize our production and distribution line, so that the cooking process no longer burdens hundreds of households throughout Sub-Saharan African.

Reduces financial, health, time and labor burden of cooking

1. Place rice and water into a pot
2. Bring to the boil and allow to simmer covered for 5 minutes
3. Place into the EcoSac for 1hr to finish cooking

Rice

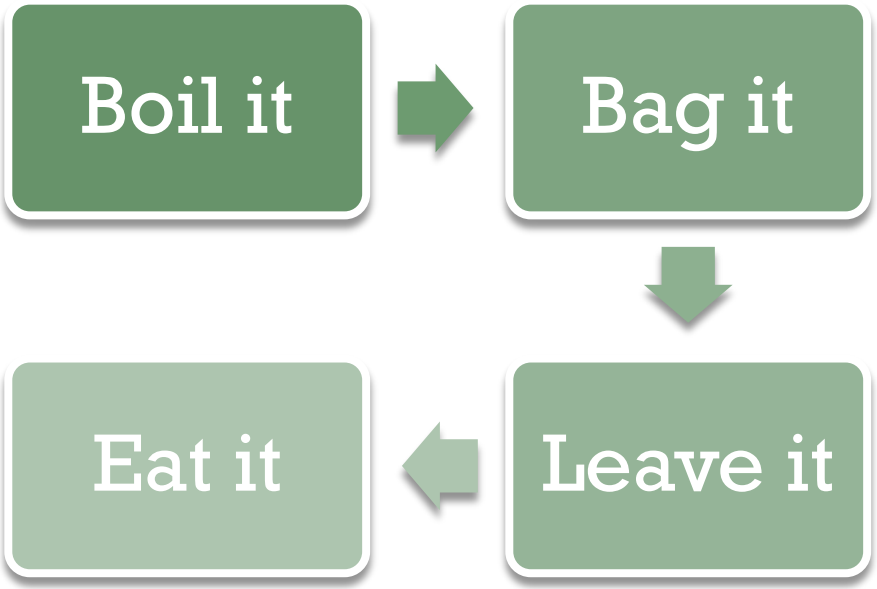
0 minutes	5 minutes	25 minutes
Prep Time	Cook Time	EcoSac Time

Ingredients

250 grams rice

500 ml water

Cooking for Life in 4 Easy Steps



Cooking Tips

Avoid opening the bag as it will release heat, negatively affecting the cooking process.

Beware, chicken, meat, vegetables, etc do not have the same cooking time; guidelines are provided in the recipe page.

Do keep in mind that when in the EcoSac, sauces or liquids do not evaporate or thicken. Therefore, when making a sauce, make sure you get your desired texture before placing your pot in the EcoSac use much less water or whatever liquid you use for the your recipe. However, when making rice, you should use slightly more water as rice absorbs humidity.

The food will continue to cook for an estimated 6 hours, and will maintain heat 10+ hours!

1. Heat oil in a pot over medium-high heat.
2. Toss garlic, cumin powder, ground cumin, and jalapeñ0 peppers for 5 minutes.
3. Add broth, beans and tomatoes.
4. Increase heat and bring to boil.
5. Place covered pot in EcoSac for 1 hour to finish cooking.
6. Serve chilli with sour cream, grated cheddar and cilantro.

Three Bean Vegetarian Chili

5 minutes	15 minutes	1 hours
Prep Time	Cook Time	EcoSac Time

Ingredients

- 1 tablespoon olive oil
- 400 ml vegetable broth
- 2 jalapeño peppers
- 2 tablespoons cumin powder
- 2 tablespoons ground cumin
- 2 garlic cloves, minced
- 2 cans black beans
- 1 can pinto beans
- 1 can kidney beans
- 2 cans diced tomatoes
- salt and pepper
- sour cream, cheddar and cilantro to serve

Cooking Guide

Beware, chicken, meat, vegetables, etc do not have the same cooking time; guidelines are provided below.

	Time on stove	Time in EcoSac
Meat	20 minutes	5 hours
Chicken	15 minutes	3 hours
Vegetables	5 minutes	1 hour
Rice	2 minutes	1 hour

Spiced Carrot and Lentil Soup

10 minutes	10 minutes	2.5 hours
Prep Time	Cook Time	EcoSac Time

Ingredients

- 2 teaspoons cumin seeds
- pinch chilli flakes
- 2 tablespoons olive soil
- 600 grams carrots
- 140 grams split red lentils
- 1 liter vegetable stock
- 125 ml milk
- plain yoghurt and naan to serve

1. Whiz 5 of the tomatoes with ginger and garlic in food processor
2. Heat the oil in a pot and fry the onions over medium heat for 5 minutes.
3. Add the curry paste to the pan for 30 secs.
4. Stir through the tomato mix and remaining tomato wedges.
5. Bubble over high heat while stirring for 5 minutes.
6. Mix in the prawns and peas
7. Place covered pot inside EcoSac for 1.5 hours to finish cooking.
8. Serve with basmati rice.

Prawn, Pea and Tomato Curry

5 minutes	10 minutes	1.5 hours
Prep Time	Cook Time	EcoSac Time

Ingredients

- 1 tablespoon olive oil
- 2 onions, cut into wedges
- 6 tomatoes, chopped
- large knob of ginger, chopped
- 6 garlic cloves
- 3 tablespoons curry paste
- 400 grams king prawns
- 250 grams peas
- small bunch coriander
- basmati rice to serve

1. Heat a large saucepan and dry-fry the cumin seeds and chilli flakes for 1 min, or until they start to jump around the pan and release their aromas.
2. Add the oil, carrot, lentils, stock and milk to the pan and bring to the boil.
3. Cover and place your covered pot in the EcoSac.
4. Rest for 2.5 hours to finish cooking.
5. Whizz the soup with a food processor until smooth.
6. Serve with plain yoghurt and naan.

Bolognese Sauce

10 minutes	20 minutes	2 hours
Prep Time	Cook Time	EcoSac Time

Ingredients

- 3 tablespoons olive oil
- 50 grams butter
- 500 grams minced meat
- 1 medium onion, chopped
- 1 carrot, chopped
- 1 celery, chopped
- 225 ml red wine
- 250 ml meat broth
- 30 grams tomato puree
- salt and pepper
- Spaghetti to serve

1. Heat oil and butter in a pot over low heat.
2. Toss carrot, onion and celery.
3. Sautee minced meat over fire.
4. Add red wine, broth, and tomato puree.
5. Increase heat and bring to boil.
6. Place covered pot in EcoSac for 2 hours to finish cooking.
7. Serve with spaghetti