

1. Executive Summary of Baseline Study of the Charcoal/Stove Economy of Lusaka

1.1. The Objectives of the Baseline Study

TSA was contracted by ProBEC/North to carry out a field work assessment of the major characteristics and socio-economic dynamics of the charcoal/stove economy of Greater Lusaka City based on a small sample of representative case studies. Therefore, the purpose of the Baseline Study is to approximately describe the size and organization and distinguishing characteristics of the charcoal/stove economy of Greater Lusaka. A second objective is to identify the most critical factors which have impacted, or are likely to impact, past, present and future efforts to permanently establish charcoal conserving stoves in the Lusaka mass market (see Terms of Reference, Appendix No. 1).

The findings of this Baseline Study become useful in so far as they assist ProBEC/North, its collaborators, and other promoters of conservation stoves to design, fabricate and market improved stoves that succeed in taking over a major share of the mass market for charcoal stoves.

In addition to the findings that are generated and reported in the Baseline Study, the Baseline Study aims to arrive at a series of recommendations to ProBEC/North about what needs to be done in order to radically increase the role of more efficient, charcoal (and biomass) saving stoves in the Greater Lusaka.. These recommendations will focus on the following areas of concern:

- Prescription of one or more stove products and production/marketing systems which are most capable of replacing the highly wasteful ordinary mbaula with a conservation stove that uses 50% less charcoal
- Proposals which outline a series of different conservation stove initiatives that respond creatively to the different economic, political, and environmental challenges faced by different Market Segments and stove using constituencies.

1.2 The Methodology

TSA makes use of aggregate data from the

- national census reports from the Central Statistical Office,
- ZESCO on electricity consumption,
- the Living Conditions Monitoring Survey Reports (CSO),
- reports on sustainable biomass yield by forest lands and biomass off take from the Dept of Forestry and consultants,
- reports and interviews about past stove design, fabrication and dissemination programmes (UNZA Dept of Engineering, the Technology Development and Advisory Unit (TDAU), the Dept of Energy, NORAD, CARE, and JICA, and
- interviews of charcoal/stove using households, stove fabricators, charcoal burners, transporters, and vendors.

The methodology used by TSA in the Baseline Study is to combine aggregate data, existing reports and a small sample of case studies to construct an approximate (+/- 5%) model of the overall charcoal/stove economy of the Greater Lusaka.

International donors, NGO's, the University of Zambia, and the government have been experimenting with the development and introduction of conservation charcoal stoves for more than 15 years. Although the TOR do not call for a historical review of why past stove improvement programmes have not succeeded, it is possible to identify several recurring mistakes in the improved stove products offered to the public. These historical and continuing mistakes are noted and inform the recommendations made to ProBEC/North about how to successfully develop and disseminate conservation stoves in Lusaka City.

Early on, the TSA team decided it was necessary to differentiate the Lusaka market into distinctive socio-economic and spatial groups of charcoal/stove consumers and then attempt to describe the charcoal/stove patterns typical of each Market Segment. It was strongly felt that an under-differentiated, 'one-size-fits-all' approach to the Lusaka mass market for charcoal and stoves does not reveal enough of the critical factors which determine the ultimate success or failure of a charcoal stove design and dissemination strategy with respect to each improved stove's (i.) technical performance, (ii.) socio-economic acceptance, (iii.) economic complexity of production, and (iv.) environmental impact and appropriateness.

This Baseline Study has the following underlying logic: it first seeks to understand the socio-economic role played by the low cost and inefficient 'ordinary' mbaula in households within particular Market Segments in order to discover the costs and benefits that shape household patterns of charcoal/stove purchases and use. Any new improved charcoal stove product will have to compete head to head against the ordinary mbaula if it is going to gain a share of the charcoal stove market in Greater Lusaka. The TSA team assumes that an improved stove will have to increase its benefits and lower its costs enough to significantly out perform the 'market standard' set by the ordinary mbaula.

1.3 Major Findings

1.3.1 Summary of the major characteristics of the charcoal/stove economy of Greater Lusaka City

Estimated population of Greater Lusaka City +/- 1 365 417

Average charcoal consumption of Lusaka City residents:

	Est.Avge Charcoal Consumption	Value of Charcoal @K700/kg(\$.175)*	Number of 70 kg bags
Daily per capita charcoal consumption	+/- 326 grams .326 kgs	K228 (\$0.056)	
Daily household charcoal consumption (5 members)	1 630 grams 1.63 kgs	K1 141 (\$.285)	
Monthly household charcoal consumption (30 days)	48.9 kgs	K34 320 (\$8.56)	7 bags
Annual household charcoal consumption	586.6 kgs	K410 760 (\$102.69)	8.38 bags
Est. daily charcoal consumption of Lusaka City (+/-1 365 417)	445 533 kgs	K311 873 000 kgs	6 365 bags
Est. annual charcoal consumption of Lusaka City	162 619 545 kgs	K113 833 680 000 (\$28 458 420)	2 323 136 bags

* Note: the value at which charcoal is sold on the market varies with the seasons. During the rainy and cold seasons the price per kg in big and small plastic bags goes up. During the warmer parts of the dry season the price comes down, particularly when subsistence farmers clear land for agriculture. The average annual price for a +/- 70 kgs bag of charcoal is K40 000 or K571/kg. The average annual price for 1 to 1.4 kg plastic bags of charcoal averages +/- K900/kg. Assuming that 40% of charcoal is sold in small plastic bags and 60% is sold in big 70 kg bags, the average annual price comes to =/- K700/kg.

1.3.2 Stove Ownership & Estimated Monthly and Annual Expenditure on Replacement Stoves

Estimate charcoal stoves in domestic & commercial use		Total Number of Mbaulas
+/- 281 710 households in Lusaka City	X 1.5 ordinary mbaulas/household	422 565
Est charcoal stoves in commercial use: food vendor in mkts, street vendors, resturants, places of work	+/- 6 500 food vendors X 3 mbaulas per vendor	+/- 20 000
Est. total number of ordinary mbaulas in use in Lusaka City		442 565
Total number of ordinary mbaulas replaced per month	15 month average life span	29 333

Total monthly expenditure on replacement mbaulas	Estimated average cost per ordinary mbaulas of K9 000 (\$2.25) X +/- 30 000	K270 000 000 (\$67 500)
Total annual replacement of ordinary mbaulas	12 months X +/- 30 000	+/- 360 000
Total annual expenditure on replacement on ordinary mbaulas	360 000 ordinary mbaulas X K9 000 (\$2.25)	K3 240 000 000 (\$810 000)
Total annual expenditure on replacement improved stoves	360 000 improved stoves X K20 000 (\$5.00)	K7 039 920 000 (\$1 759 980)

1.3.3 Major Characteristics of Stove Fabricators

- Fieldwork in Linda, Mandevu, Kamwala, Bauleni, and Kalingalinga indicate there are +/- 10 full time tinsmiths operating within and around every major market in Lusaka. With a minimum of 50 major markets identified so far, the research team estimates a total of 50 markets x 10 tinsmiths or 500 tinsmiths. In addition, there are additional tinsmiths operating in areas without major markets, in the industrial areas, and in the peri-urban communities. TSA has allowed another 100 full time equivalent tinsmiths operating within Greater Lusaka.
- **Thus, it is estimated there are 600 tinsmiths fabricating ordinary mbaulas to meet the annual demand for replacement mbaulas by the residents of Lusaka City.**
- With an estimated monthly demand of +/- 30 000 for replacement mbaulas, the 600 full time equivalent tinsmiths will each need to fabricate and sell +/- 50 ordinary mbaulas every month (50 mbaulas x 600 tinsmiths = 30 000 replacement mbaulas)
- Over the course of 12 months a typical tinsmith will fabricate 600 ordinary mbaulas
- At an average retail price of K9 000* for ordinary mbaulas, a typical tinsmith will gross +/- 450 000 (\$112.50) a month from the sale of a range of different sized ordinary mbaulas. His net income for his labour and profit will come to about 50% of the retail price, or +/- 225 000 a month (\$56.25).
- If the range of small, medium and large mbaulas average 1.3 kgs of mild thin metal plate, then a total of +/- 468 000 kgs or 468 tons of sheet metal every year – or nearly 40m tons a month – is needed to sustain the existing mbaula industry.

* Note: the average retail price of K9 000 for the range of differently sized and prices mbaulas is derived from the following figures:

small mbaulas	@ K 6 000	X	75%	=	K4 500
medium mbaulas	@ K15 000	X	20%	=	K3 000
large mbaulas	@ K30 000	X	5%	=	<u>K1 500</u>
					K9 000

1.3.4 Strengths and Advantages of the Tinsmith Fabricated Ordinary Mbaula Industry in Lusaka City:

The TSA team identified the following socio-economic strengths as having enabled the network of tinsmith micro-enterprises and the ordinary mbaula – in spite of its low efficiency and relatively short life span – to dominate the Lusaka and Zambian market for charcoal stoves.

- (i.) The low price of the ordinary mbaula which can be afforded by more than 90% of the households in Lusaka City; the average cost of K6 000 for a small mbaula, used by +/- 75% of the households, compares with K24 000 to K36 000 for improved stoves such as the Jiko/Ziko and the all metal Yomba type improved mbaula, when they can be found.
- (ii.) The quick turn over time between purchasing material and selling the finished product which gives survival oriented tinsmiths with very little operating capital the rapid returns they need to earn a decent monthly income.
- (iii.) The well distributed omnipresence of tinsmiths in the markets selling the well known ordinary mbaula. Also, since the fabricator is normally also the stove vendor, there is no need for additional mark ups
- (iv.) The design, although very poor in efficiently converting the heat energy of charcoal into cooked food, does allow for repair of the high wear perforated fire grate.
- (v.) The ordinary mbaula is made from only one material – mostly recycled scrap sheet metal - and therefore requires only the skills and basic tools of the tinsmith trade to fabricate (in contrast to the Jiko/Ziko stoves which require ceramic knowhow, a supply of clay, a kiln, firewood, and transportation in order to produce a stove product ready for sale).
- (vi.) The ordinary mbaula requires minimum technology to produce: a few hand tools, an anvil made from a length of train track, and a small space in the market or under a tree along the street, etc. Therefore, the total capital required to start up a one or two person tinsmith enterprise is minimal.
- (vii.) There is a ready supply of low priced scrap sheet metal from junk cars, drums, roof cut offs, abandoned metal buildings, junk appliances such as refrigerators and stoves, etc

1.3.5 Need to Appreciate the Dominant Role of the Ordinary Mbaula in the Charcoal/Stove Economy and the Primacy of Price in Determining Product Viability and Market Share

It is TSA's view that previous stove improvement projects and interventions did not fully appreciate how firmly entrenched the ordinary mbaula is at the center of the Lusaka charcoal economy. With a retail price of between K4 000 to K8 000, and an average price of K6 000, for the small 18 to 20 cm stove the ordinary mbaula simply cannot be beaten on price. It is the 'industry standard' against which all other charcoal stoves will be compared on price, durability, convenience, fuel use/expense, and cooking performance.

The improved mbaula of Professor Yomba, the artisan made Jiko stoves promoted early on by the Dept of Energy, the subsequent slightly modified Ziko stove, the Jiko and Ziko stoves promoted by Care Zambia, and the all ceramic and later clay lined Ziko stoves promoted by the Japanese International Cooperation Agency (JICA) have all failed to establish a

permanent market share for themselves among the charcoal using households and businesses of Lusaka City. It must be appreciated that several millions of dollars of donor and government funds have been invested over a period of nearly 20 years without significantly reducing the dominant hold of the low priced, inefficient ordinary mbaula that is fabricated at a rate of between 2 to 6 units a day by informal tinsmiths.

There are a number of different factors which contributed to the failure of particular improved stoves. Price is probably the most powerful factor in determining the acceptance or rejection of a competing charcoal stove. The TSA team has concluded that it will be extremely difficult, perhaps impossible, for an improved mbaula costing more than K12 000 (\$3.00) to permanently take over a major share of the charcoal stove mass market in Lusaka. According to TSA's findings, reported in Table No. ???, an improved charcoal saving stove costing K12 000 is potentially within the reach of about 60% of the charcoal using households in the city and can reach up to 60% of the charcoal economy.

In addition to the obstacle posed by a high retail price, TSA has found the following additional obstacles which have historically interfered with the establishment of improved charcoal stoves in the Lusaka market:

- (i.) **Increased Complexity and High Cost of Production Obstacles:**
The true cost of production of the improved stoves brought to market to date has exceeded the income that could be generated on a sustainable (unsubsidised) basis from sales. The improved stoves introduced into the Lusaka market have all been loss making because the mass market refused to purchase these new stove products at a price that was high enough to cover the cost of production and also give a reasonable profit on capital.
- (ii.) **Capacity, Technology and Capital Gap Obstacles:**
The improved stoves with clay liners required materials (clay), equipment (kilns), inputs (firewood and transportation), technical know-how, start up capital, and marketing and management capacities not controlled by the network of existing tinsmith, nor by the community organizations and aspiring small scale entrepreneurs.
- (iii.) **Competing Interests and Agendas:**
The improved stove projects have all tended to be dominated by the priorities of NGO personnel and ideology, expatriate expertise, and donor funding. The conflict between charcoal conservation, community involvement, informal artisan promotion, and strengthening small formal sector manufacturers – rather than designing, producing and selling a new stove that would be viable in the existing market - interfered with programme agents ability to come to terms with the social and economic dynamics of the existing charcoal/stove economy. Over the last two decades of effort to introduce improved charcoal stoves in Zambia, there has been a failure to appreciate the dominant position of the ordinary mbaula at the center of this economy.

1.3.6 Overview of Charcoal/Stove Economy of Greater Lusaka

The Lusaka City charcoal/stove economy becomes easier to understand when it is divided into six (6) different socio-economic and geographical zones or Market Segments:

Mkt Segts		% of HH	% Char. Consmpt	Share of HH Income	20% Avge Weekly HH income	Range of 20% of Weekly HH Income
MS 1	High income/ low density	7.6 %	1.5 %	+/- 57%	K122 000	K72 000 to K122 000
MS 2	Mixed high/ mid income & low/mid density	5.9 %	2 %		K87 000	Average Income K100 000
MS 3	Mid income /moderate density	4.2 %	4.5 %		K72 000	
MS 4	Mixed middle & low income/med & high density	29.6 %	38 %	+/- 32 %	K37 000	K25 000 to K54 500
MS 5	Low income/high density	45.6 %	52 %	+/- 10 %	K6 800	K1 000 to K14 000
MS 6	Peri-urban/low income & mixed densities	7 %	2 %	+/- 1 %	K1 000	K000 to K1 000
	Totals	100 %	100 %	100 %		

Referring to the above Table No. 1 and the Master Model of the Lusaka Charcoal Economy (see Table No.), it becomes clear that:

- Upper Income Households (Market Segments Nos. 1, 2, & 3)

These higher income households constitute about +/- 18% of the total households in Greater Lusaka. They are responsible for only about +/- 8% of the City's charcoal consumption. Collectively they earn almost 60% of the total income generated within the city. Twenty percent (20%) of their average weekly household income comes to an average for all three Market Segments of about K100 000 or \$25.00. The range of this 20% of weekly income runs from K72 000 (\$18.00) to K122 000 (\$30.50). Using 20 % of weekly household income as the upper limit on how much money a household can save in a week in order to purchase a replacement stove, these upper income Lusaka households would be capable of paying as much as K72 000 to K122 000.to purchase a new stove.

- Intermediate Income Households (Market Segment No. 4)

The Intermediate Income Households constitute +/- 30% of the households and are responsible for +/- 38 % of Lusaka City's charcoal consumption. These intermediate income households can afford to spend between K25 000 up to K50 000 to purchase a replacement stove; the average figure which households within this market Segment are able to spend is K37 000 or slightly more than \$9.00. About half of these households could theoretically afford to purchase an improved stove for K36 000.

- Lower Income Households (Market Segments Nos. 5 & 6)

The Lower Income Household Segment constitutes about 53% of the households in Greater Lusaka, who altogether are responsible for +/- 54 % of Lusaka's charcoal consumption. Collectively these lower income households earn about 11% of the income generated by the economy of the households residing in Lusaka City. Using 20% of the average weekly income as the limit on how much households in this Market Segment are willing and able to spend on a replacement charcoal stove, the households in the Low Income Market Segment on average are able to spend +/- K7 000 (\$1.75), with a range from a low of K1 000 to a high of K14 000 (\$3.50).

Table No. ??? roughly predicts the effect of stove price on affordability and also its potential effect on charcoal consumption (see page ??).

- (i.) An ordinary mbaula retailing for +/- K8 000 (\$2.00) will reach about 70% of stove buyers and impacts upon +/- 70% of the charcoal market.
- (ii.) An improved stove retailing for +/- K16 000 (\$4.00) to K20 000 (\$5.00) can be afforded by +/- 50% of the charcoal using households and will impact upon +/- 44% of the charcoal market.
- (iii.) Higher priced improved charcoal stoves costing up to K36 000 (\$9.00) are potentially affordable by no more than 30% of the high income earning households in Lusaka City who are responsible for only about 12% of the city's total charcoal consumption.

- 1.3.7 Charcoal stove development has been primarily technology centered and the socio-economic performance of improved stove models has been consistently neglected by previous stove improvement projects.
- 1.3.8 Although impossible to know for certain, the TSA team has been unable to discover any serious attempts to carry out a baseline survey of the charcoal/stove economy of Lusaka and Zambia that penetrated down to the critical socio-economic interests and values (variables) that determine a household's preference for a particular charcoal cooking stove. Therefore, for more than 15 years new 'improved' stoves were developed and presented to charcoal consuming households without understanding the cost/benefit dynamics of the ordinary mbaula which in one form or other has dominated the stove market for +/- 30 years. The primary focus of previous stove improvement projects was to maximize biomass conservation rather than to design a conservation stove, including a production and marketing process, that could deliver an improved product capable of winning market share from the ordinary mbaula without a continuing donor subsidy and public sector encouragement

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