1. THE CHARCOAL STOVE MARKET IN LUSAKA : the economics of making and selling ordinary mbaulas

1.1 ESTIMATED NUMBER OF HOUSEHOLDS AND NUMBER OF ORDINARY MBAULAS PER HOUSEHOLD IN LUSAKA

Today there are +/- 280 000 households (see updated summary of population and households, section   ) in the greater Lusaka metropole, including a peri-rural zone of +/- 23 000 households, who own and use one or more ordinary charcoal burning mbaula stoves for cooking space heating, water warming, and other domestic tasks,. Survey work by TSA has established that the number of mbaulas owned by households varies from 1 to 3 with an average of 1.5 mbaulas per household across all Market Segments.

1.1.1   Domestic Mbaulas in Use

TSA estimates there are 280 000 housholds X 1.5 mbaulas or +/- 420 000 mbaulas currently in regular domestic use in the Lusaka market. Depending on the material used in making the mbaula and the frequency of its use, an mbaula has a life span of between 6 to 30 months. **From the data generated by the fieldwork, the average life span of an ordinary mbaulas is +/- 15 months.**

1.1.2   Mbaulas in Commercial Use

In addition to domestic use of mbaulas, mbaulas are also extensively used by women who prepare food in markets and restaurants, by women selling maize and other cooked foods on the roadsides, and in work places. TSA's preliminary investigation indicates that the total number of mbaulas in use outside of homes will add between 5% and 7.5% or 20 000 to 30 000 additional mbaulas to the Greater Lusaka stove market.

1.1.3   Total Number of Charcoal Burning Stoves in Use in Greater Lusaka

The TSA baseline survey conservatively estimates a combined total of +/- 440 000 mbaulas of all sizes (small, medium, and large) are presently in use in the homes, resturants, factories, institutions like hospitals, clinics, clinics, orphanages and hospitals, by food vendors in markets and along the streets of the greater Lusaka.

From the data generated by the TSA survey, the average life span of a mbaula is about 15 months. About 1/15th or 6.66% of these mbaulas wear out each month, and as a consequence about 29 300 will be needed every month to replace the old stock of mbaulas as they go out of service. The total estimated demand for replacement mbaulas in Lusaka over a 12 month period comes to about +/- 351 600 (+/- 352 000) new units every year.

1.2 SIZE AND ECONOMIC VALUE OF ORDINARY MBAULAS

1.2.1   Different Sizes of Ordinary Mbaula, Average Retail Prices, Market Share, and Average Cost across All Sizes

The sizes of the ordinary mbaulas very from a diameter of 16 cm up to 50cm. The mbaulas are normally made from scrap metal obtained from junk car bodies, old drums, flattened galvanized roofing sheets, and from salvaged sheet metal off cuts. The prices at which mabualas of the same size vary considerably, depending on the market, how hard the buyer negotiates, and the thickness and quality of the metal used. The survey indicates that about 70 % of the mbaulas on offer in the markets are between 16 and 20 cms in diameter.   The following prices and price ranges were documented for the different sizes of ordinary mbaulas:

Diameter of mbaula	Price range (in Zambian Kwacha)		Estimated average stove price	Est.% stove market	Average stove value
Small (up to 20 cm)	4 000	8 000	K6 000 ($1.50)	70 %	K4 200
Medium (26 to 30 cm)	8 000	16 000	K12 000 ($1.75)	25 %	K3.000
Large (36 to 40 cm)	30 000	40 000	K35 000 ($2.25)	4 %	K1 400
Extra large (+ 50 cm)	40 000	60 000	K50 000 ($12.50)	1 %	K 500
Estimated ordinary mbaula retail price averaged across 4 different sizes					K9 100 ($2.28)

1.3 MATERIAL/LABOUR COST AND GROSS PROFIT FOR ORDINARY MBAULA

A 20 cm ordinary mbaula has the following costs:

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Scrap metal material                                      K2 000  to  K2 500
Labour                          K1 500   to   K2 500
Gross profit                    K   500   to   K3 000
Labour + gross profit                                     K2 000   to   K5 500
Retail price to customer                                  K4 000   to   K8 000

Average retail price to customer                          K6 000 ($1.50)
Average income from labour + gross profit                 K3 750 ($.95)
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It needs to be noted that the gross return - measured as income from labour and profit - on a tinsmith's typically very limited operating capital invested in scrap metal is between 100% and 220%..

1.4 LABOUR AND GROSS PROFIT RETURNS TO TINSMITHS ON ORDINARY MBAULAS

It takes a skilled tinsmith between 1 and 1.5 hours to make an mbaula. Therefore, in a 9 hour day a tinsmith can fabricate between 6 to 9 mbaulas (average estimated maximum daily production: 8 ordinary mbaulas).

If a tinsmith's average gross income (labour + gross profit) per small mbaula is +/- K3 750 and he manages to fabricate 8 ordinary mbaulas in a day, then his cost, labour income and gross profit from the sale of these mbaulas would be calculated as follows:

Cost/Income Calculations for 20 cm Mbaula

Scrap material	@ K2 250 X 8	=	18 000
Labour	@K2 000 per hour X 9 hrs.	=	18 000
Cost of labour & materials			36 000

Daily income from potential sales:

8 mbaulas @ average price of K6 000		=	48 000
cost of labour + materials			36 000

Estimated gross profit on the daily production of
8 ordinary mbaulas   K12 000

Calculation of Income generated by maximum daily production of 8 ordinary mbaulas:

Direct retail sale value:	48 000	
Cost of materials & labour	36 000	75 %
Gross profit	12 000	25 %
	48 000	100 %
Income from labour	18 000	37.5 %
Gross profit	12 000	25.0 %
Gross profit + labour	30 000	62.5 %
Cost of materials	18 000	37.5 %
	48 000	100 %

Gross profits + income from labour as a return on expenditure on materials:

K30 000 gross profit + labour income (divided by) K18 000 for materials gives the tinsmith +/- 166 % gross return on his materials expenditure.

If a tinsmith were able to make 8 ordinary mbaula every day and sell all 8 stoves on the same day he makes them, then he would only need to have +/- K18 000 set aside for the daily purchase of the materials needed to make another 8 new ordinary mbaulas. Using

this K18 000 to sustain a daily supply of the scrap metal, purchased 'just-in-time' from the nearby scrap metal collector/vendor, the tinsmith is able to fabricate and sell 8 new ordinary mbaulas every day in perpetuity. From this super efficient materials flow created by just K18 000 invested every day to buy more scrap metal, the tinsmith has the potential of earning K30 000 a day on his labour and in the form of gross profit from the sale of these 8 ordinary mbaulas. In the course of a 25 work day month, a tinsmith specializing in the production of 8 ordinary mbaulas a day, if able to sell all 200 mbaula produced in that 25 day period, has the potential of earning a total of K750 00. Amazingly, this super tinsmith would earn this income by daily turning K18 000 worth of scrap metal into 8 ordinary mbaulas and then selling these mbaulas for +/- K48 000 every day, day after day.

On order to generate an average monthly net income of +/- K600 000 ($150.00), above all expenses, a tinsmith specializing in the fabrication and sale of ordinary mbaulas would probably need to turn over about K1 200 000 in stoves. At a cost of K6 000 apiece, that comes to +/- 200 small ordinary mbaulas. If the income from labour and net profit after all expenses comes to 50%, then the tinsmith would earn +/- K600 000 in income for himself and his family. Depending on how quickly a tinsmith is able to sell his stock of stoves, or other sheet metal products, to the public, he probably does not need to keep about K400 000 of his scarce capital permanently invested in scrap and new sheet metal. The funds permanently tied up in materials, either in finished products on hand waiting to be sold or materials waiting to be converted into new products, can be roughly assessed by calculating the value of the stock on display and the value of the sheet metal in stock on hand waiting to be turned into new products.

It is obvious that very small operators, with small inventories of sheet metal products on display, probably have less than K200 000 ($50.00) worth of materials tied up in finished products or scrap/new sheet metal in stock. More prosperous tinsmiths can have between K400 000 to K800 000 worth of materials tied up in finished products or in materials waiting to be converted into products.

1.5 ESTIMATED STOCK/OPERATING CAPITAL OF TYPICAL TINSMITHS

Interviews with tinsmiths repeatedly indicated to the TSA team that this trade group operates with a very small, often insecure, capital base of between K200 000 ($50.00) and K800 000 ($200.00). This relatively small investments in material 'floats' must be turned over as rapidly in order to generate the daily flow of income needed to cover each tinsmith's living expenses as well as enough additional money to pay for the scrap and/or new metal sheet that will sustain each tinsmithing micro-enterprise.

The one and two person tinsmith businesses of Lusaka are typically survival oriented micro-enterprises. They require little in the way of tools and production technology, have negligible overheads for space and utilities, and require a committed float for sheet metal and other materials that is approximately equal to one half of the net income that the owner of a tinsmith enterprise will be able to take out of the business every month. For example, if the tinsmith is earning K600 000 a month, then he probably has about K300. 000 in capital tied up in his material float.

If a tinsmith has +/- K1 000 000 worth of product on display at his workshop/marketing stall, then approximately 1/3rd of this value represents materials which the tinsmith has already paid for, or borrowed, then materials on which he is paying some kind of heavy interest. Thus, the tinsmith's materials float includes +/- 1/3rd the value of the retail prices for all the finished products on display at his stall; it also includes any surplus funds which the tinsmith uses to purchase additional material as needed to fabricate specific products in response to customer demand and also simply to make the best possible use of his labour power and metal working skills.

TSA has the impression that many, perhaps most, tinsmiths do not have a large enough capital float to keep themselves optimally busy through out the month. The TSA team found tinsmiths all over Lusaka who were not making anything because they had run out of materials and money and were forced to wait for customers to buy their finished products, thus re-liquefying their sunken investment in scrap metal.   .

The majority of tinsmiths operate their businesses alone or with one or at most two younger, apprentice type workers. These apprentices move as quickly as possible to open up their own small, parallel enterprises once they have learned enough to become independent and saved their own start up capital.

1.6 ESTIMATED MONTHLY INCOME OF TINSMITHS IN LUSAKA

1.6.1   The monthly income of tinsmiths typically ranges between K400 000 to K800 000 ($100 to $200). TSA estimates the average monthly income of Lusaka tinsmiths at +/- K600 000 ($150), or +/- K24 000 ($6) a day (assuming a month of 25 working days). The income per day ranges from K16 000 to K32 000 ($4 to $8).

1.6.2   Most tinsmiths report they make more money selling and repairing cooking pots than they make fabricating and selling mbaulas. From observing the total value of the inventory on display at the stands of tinsmiths it is possible to conclude that mbaulas constitute about 25% of the stock in hand. The ordinary mbaulas are a relatively high turn over item. However, according to several of the tinsmiths interviewed, cooking pots of all sizes, particularly small cooking pots, are the products with the highest turnover and therefore earn more income for tinsmiths than any other product. TSA was not able to gather any data that would reliably indicate the relative contributions made by the sale of washing tubs and basins, cooking pots, show makers (for warming bath water) in comparison with mbaulas.

1.6.3   By costing the stock on display in a representative cross section of tinsmith's stalls in different markets, TSA estimates that the average investment in materials of tinsmith enterprises varies between K300 000 and K500 000 (average: K400 000). **TSA has discovered that the value of the materials incorporated into a finished sheet metal product typically accounts for +/- 37.5 % of its retail value.** Labour value (about 33.3%) and gross profit (about 29.2 %) together contribute the other 66.7 % of the retail value of a finished metal stove product.

TSA found the retail value of finished products on offer at the stalls of tinsmiths ranges from K500 000 and K1 500 000 with an average value of

+/- K1 000 000. With the cost of raw materials contributing +/- 37.5% of the retail price, a tinsmith with finished products in stock worth of +/-K1 000 000, has tied up approximately K375 000 of his operating funds (capital) in materials.

TSA was not specifically tasked to carry out in depth assessments of the expenditure and income dynamics of tinsmith enterprises. However, the Baseline Survey does indicate that tinsmith enterprises - in common with all healthy businesses - must always keep enough surplus operating funds on hand to be able to positively respond to major changes in vital market conditions. Tinsmiths can be expected to hold between 40% and 50% of the value of their stock of finished products in one of two forms of operating capital, either in the form of cash (+/- 10%) or in the form of materials purchased for incorporation into finished products (+/- 40%). Therefore, a tinsmith with +/- K1 000 000 worth of finished products can be expected to have about K500 000 in operating capital.

1.6.4 The costings performed in this section of the report have shown that a small ordinary mbaulas fabricated out of scrap metal gives an average return from labour income and gross profit on material investment of +/-167%. If +/- K375 000 is invested in scrap metal, we get the following income from labour and gross profit:

K375 000 (divided by) K2 250 materials budget per stove = 166.7 ordinary mbaulas x K6 000 (average price) = +/- K1 000 000 in retail stove sales

K375 000 (37.5%) of the retail price goes to pay for labour and K250 000 (25%) is left over for gross profit. From the investment of K375 000 in materials, a tinsmith stands to earn a total of K625 000 (62.5%).

A tinsmith would need to sell +/- K1 000 000 worth of stock every month – whether ordinary mbaulas or a combination of metal products - to generate an income of +/-K600 000. To achieve a net income of +/- K600 000 a month, it is necessary for a tinsmith to make and sell an average of K40 000 ($10.00) worth of products and to achieve that same average level of production and sales for 25 work days a month.

25 days x K40 000 = K1 000 000 x 62.5% = K625 000 income from labour and gross profit per month

The tinsmith's labour and gross profit on this daily and monthly turnover will be +/- 62.5%. His daily income on a turnover of K40 000 comes to K25 000 and his monthly income would total +/- K625 000..

1.6.4 If 30% of a tinsmith's business of +/- K40 000 is made up of mbaulas, then the tinsmith will have to make and sell 2 mbaulas a day @ K6 000 = K12 000 in daily retail sales. If the tinsmith achieves this same rate of sales over 25 work days during the month, he will produce and sell +/- 50 ordinary mbaulas a month x K6 000 per mbaula = K300 000 a month from the retailing of mbaulas. The tinsmiths income from labour and gross profit on this K300 000 in retail sales comes to K187 500. Over a 12 month period, this tinsmith would produce and sell +/- 600

stoves and earn an annual income from labour and gross profit of K2 250 000
($562.50)

1.7 ESTIMATED NUMBER OF TINSMITHS IN GREATER LUSAKA

1.7.1   Market Based and Home Based Tinsmiths

TSA identified more than 50 major markets in Lusaka and counted the number of
tinsmiths with stands in and around 5 markets or doing business from their homes in the
compounds. Based on this preliminary research, TSA estimates there are an average of
10 tinsmiths who make mbaulas in and around these 50 markets. In addition to the 500
tinsmiths identified in and around the major markets of Lusaka, an additional +/- 100
independent full and part time tinsmiths are at work producing mbaulas that are sold from
their home workshops or supplied to other market based vendors for resale. Included in
this group of less visible tinsmiths are tinsmiths who reside in villages and settlements
within the many peri-urban communities surrounding Lusaka city.   In total, the TSA
team estimates, there are +/- 600 tinsmiths making stoves for the Lusaka market.

1.7.2   Seasonal Variation in Mbaula Sales

It was not possible to establish any definite patterns for the sale of mbaulas by
observing what was is happening at particular tinsmith's stands. The tinsmiths
is a period of heavy rainfall, or the electricity supply gets interrupted. Some days a
tinsmith will sell no stoves, particularly during the warm, dry spring transition informed
the TSA team that they sold more stoves when it turns very cold, or there during
September, October, November and part of December. During the high demand part of
the year, they can sell 5 or 6 stoves a day.

1.7.3   Working Backward from Estimated Total Demand for Mbaulas to the Annual
            Production per Tinsmith

The TSA estimate that charcoal stove makers serving the Lusaka market produce on
average +/- 600 mbaulas a year can also be arrived at by working backward from the
estimated total number of replacement mbaulas purchased by Lusaka residents in the
course of a year (see section 1.1.4). Starting with a annual demand for +/- 352 000
replacement mbaulas, and then dividing the annual production of 352 000 mbaulas by
600 stove makers we get an annual output per stove makers of +/- 587 mbaulas, or a
monthly output of +/- 49 mbaulas per stove maker.

The TSA team is fairly confident of its conservative estimate of about 600
tinsmiths and stove makers producing mbaulas for sale into the Greater Lusaka
market. We can arrive at the total production of mbaulas by starting with the estimated
average daily output and sale of +/- 2 mbaulas X 25 working days per month which gives
a monthly output of +/- 50 mbaulas and an annual total of +/-600 mbaulas.

1.7.4   Tinsmith's Who specialize in Mbaula Production

There are some tinsmiths who specialize in making large quantities of low priced
mbaulas for agents – such as charcoal sellers - who then resell the stoves at a 25% to

30% mark up. These more specialized stove makers – when they have an order – will produce as many as 6 to 8 mbaula a day (150 to 200 stoves a month).

1.8 ESTIMATED VALUE OF ORDINARY MBAULA SALES NEEDED TO MEET THE DEMAND OF THE LUSAKA MARKET

Given an average retail price for all the mbaulas sold in Lusaka of +/- K7 500 (or $1.75) per stove, the estimated total value of the annual output of +/- 350 000 mbaulas purchased over 12 months by the residents of Lusaka comes to K2 625 000 000 (nearly K 2.6 billion) or $612 500.

The potential value of the present annual demand for +/- 350 000 ordinary mbaulas is shown below at different average prices for mbaulas:

Average mbaula unit price in Kwatcha & $		Number of mbaulas	Kwatcha value	Dollar value
K7 500	**($1.75)**	**350 000**	**2 625 000 000**	**612 500**
K12 000	($3.00)	350 000	4 200 000 000	1 050 000
K20 000	($5.00)	350 000	7 000 000 000	1 750 000
K30 000	($7 50)	350 000	10 500 000 000	2 625 000
K35 000	($8.75)	350 000	12 250 000 000	2 062 500
K50 000	($12.50)	350 000	17 500 000 000	4 375 000

1.9 ESTIMATED VALUE OF TOTAL POSSIBLE VALUE OF IMPROVED MBAULAS NEEDED TO MEET THE PRESENT DEMAND OF THE LUSAKA MARKET

It is not possible to exactly predict the price at which a more costly, charcoal conserving 'improved' mbaula will become serious competition for the presently dominant 'ordinary' mbaula fabricated by the distributed network of small scale, low overhead tinsmiths who produce and directly sell their own stoves.

It seems reasonable to suppose that an improved mbaula – one that reduces a family's or enterprise's charcoal consumption by 50% while continuing to offer the same convenience as the standard ordinary mbaula – would be very competitive if it retails for between K12 000 ($3.00) and K16 000 ($4.00). If we assume a retail price of K14 000 ($3.50) for an 18 to 20 cm improved mbaula, then there is a potential annual market of +/- K4 900 000 000 ($1 225 000) for replacement stoves.

If the improved mbaulas took over 100% of the Greater Lusaka market, the monthly total retail expenditure for improved mbaulas would come to approximately K408 000 000 or +/- $100 000. A total of slightly more than 29 000 improved mbaulas would need to be produced every month to meet this potential demand.

If these improved mbaulas were fabricated by the existing network of 600 tinsmiths in the Greater Lusaka and they continue to earn +/- 24% gross profit on their direct retail sales

of the stoves, then on average each stove fabricator would earn about K163 000 a month (nearly $41) from the sale of improved mbaulas. At the present moment, stove makers are earning a gross profit of +/- 87 500 a month from the production of ordinary mbaulas, and they would be almost doubling their gross profit from the direct sale of more expensive improved mbaulas to the public.   .

2. THE ECONOMICS OF JIKO/ZIKO STOVES

2.1 Present Supply and Pricing of Jiko/Ziko Stoves on the Lusaka Stove Market

- At the present time (December 2006), Jiko/Zikos stoves are typicaaly sold for beween K25 000 and K50 000 ($6.25 to $12.50). Between September and December of 2006 while the baseline study was underway, there was no identifiable production of Jiko/Ziko stoves.

- In September, an expatriate Lebanese entrepreneur purchased several hundred complete Jiko stoves and one to two thousand Ziko stove metal bodies, which had been sold to FredJoe's by Care Zambia. These improved charcoal stoves and metal casings were left over from Care's Ziko Stove Project which ended in 2003 when its funding from USAID ran out. According to the new owner owner, the complete Jikos were sold – with some difficulty - at about K30 000 through market outlets near to the Soweto market. The exterior casings are now storted stored at NISIR ceramics laboratory with the intention of fitting them with the ceramic liners produced by NISIR for sale to the public.

- In October 2006 NISIR still had a few hundred previously produced ceramic liners on hand that were being sold for R4 000**. According to NISIR informants in the ceramics laboratory, if there was a small team of about three technicians dedicated to the manufacture of ceramic liners for Jiko/Ziko stoves, it would be able to produce between 900 and 1000 liners a month or +/- 12 000 liners a year with its existing electric kiln capacity, supply of moulds, mixing equipment, and ability to purchase and transport the necessary raw material.** This potential output of ceramic liners would only be capable of meeting about 3.5% of the estimated annual replacement demand for +/- 350 000 improved charcoal stoves during the accelerated conversion phase when an improved, charcoal conserving stove rapidly displaces the ordinary mbaula with an estimated life span of +/- 15 months. During this first phase, it will be necessary to produce around 30 000 improved mbaulas a month for a period of about two years during which the improved stoves are gradually replacing the ordinary mbaulas. Assuming that the life span of the new improved mbaula will double from 15 to 30 months, once most of the households and charcoal using businesses have converted to the improved mbaula, the demand for replacement stoves will predictably drop to about 15 000 units a month. At this lower level of demand, the present liner production capacity of NISIR could meet approximately 6.7% of the demand for replacement stoves in Lusaka.

- Careful investigations, with a small sample of Lusaka tinsmiths, into the costs involved in fabricating Jiko/Ziko Stoves brought to light the following facts about

the costs of materials, labour, profit, and returns on scarce labour and operating capital:

Material, labour input, and gross profit costing of standard Ziko Stove about which there is broad consensus among tinsmiths who have made Jiko's and Zikos in the recent past.

Materials	Mostly used/scrap		Totally new	
Metal sheet	+/- 4 000		+/- 8 000	
Metal rod for pot rests	1 000		1 500	
Strap handle	500		1 000	
Rivets	500		500	
Liner	4 000		4 000	
Subtotal:	10 000	10 000	15 000	15 000
Labour time				
Obtaining materials	¼ hours			
Cutting	½ hours			
Fabrication & assembly	2 ½ hours			
Fitting liner	¼ hours			
Subtotal	4 hours			
Labour value (@K2 500 per hour)	10 000	10 000	10 000	10 000
Total cost of production		20 000		25 000
Estimated gross profit of 25%		5 000		6 250
Ex Factory Price		25 000		31 250

2.2 Comparison of the Economics of the Jiko/Ziko and the Ordinary Mbaula

- The ordinary mbaula completely dominates the charcoal stove market in Lusaka and Zambia. It has become the de facto standard of the charcoal stove industry in terms of price, convenience in lighting and use, rate of charcoal consumption, durability, universal availability in all nearby markets. In spite of its very poor therdynamic performance and relatively short life span, the ordinary Zambian mbaula has easily defeated a series of competing charcoal saving stoves brought onto the Lusaka market over the last 20 years by the government departments, the university, parastatals and NGO agents with the benefit of substantial donor funding.

- Further research and documentation is needed to identify and weight the role of different socio-economic, organizational and programmatic factors responsible for the failure of the Unza improved mbaula stove design, the Care Zambia promoted Jiko stove, the JICA all clay stove and the JICA promoted Ziko stove (a modified

Jiko) to permanently gain a share of the Lusaka charcoal stove market. At demonstrated in section …… of this report, one of the biggest causes of the failure of these higher performance stoves to establish themselves on the market is due to their high price, relative to the daily and weekly cash flow of the lower income majority - the 60 to 80% of the Lusaka market at the "bottom of the pyramid". If the purchase price exceeds the capacity of potential low income buyers to save the cash required to purchase a replacement stove, over a period of 5 to 7 days, then it becomes highly unlikely they will choose to make the sacrifices needed to buy an improved stove when it costs 4 to 5 times more than the their old friend, the ordinary mbaula.

- The biggest obstacle to widespread consumer acceptance of higher performance charcoal conserving stoves has been the selling price, which has always been between 4 and 10 times higher than the ordinary mbaula. The next biggest obstacle, discovered by the TSA baseline study, is the tendency for past donor funded projects to disproportionately focus on improving the efficiency of charcoal stoves and also actively promoting their use by low income households in the high density compounds of Lusaka. As a consequence, these donor funded initiatives did not give enough attention to how to make the necessary transition from highly subsidized donor dominated economics to the highly competitive, low operating capital economics that dominates the day to day business activities of the hundreds of tinsmiths who collectively are the de facto controllers of the Lusaka mbaula stove market.

- In retrospect, the main mistake made by all of these earlier donor funded stove improvement projects was to largely ignore the established and highly competitive economics of the pre-existing and still dominant network of +/- 600 tinsmiths, geographically distributed throughout all the major compounds of the city, who have been successfully fabricating and selling the ordinary mbaula for the past 30 to 40 years. In addition, these tinsmiths also fabricate (and repair) and sell cooking pots, water heating basins (show makers), washing tubs, chicken feeders, storage lockers and containers, etc.

- Specifically, past donor funded projects appear to have failed to understand just how price sensitive the demand for charcoal stoves is among households that survive on less than K450 000 per month (about K15 000 per day). It needs to be appreciated that it is not uncommon for a large low income household with 6 to 8 members to spend K60 000 a month for charcoal. Two K1000 plastic bags of charcoal, weighing 1 to 1.5 kgs (total: 2 kgs to 3 kgs), are purchased every day from a nearby charcoal vendor (K1000 X 2 bags/day X 30 days = K60 000 per month).

From the process history available about previous stove improvement projects, these programmes simply assumed widespread market acceptance would take place once a radically more efficient stove was launched that reduced charcoal consumption by 50%. It was believed that a monthly savings of +/- K30 000 on charcoal expenditure would somehow help to 'finance' the purchase of a much more expensive improved mbaula. The idea was that such a charcoal saving stove

would prove to be an irresistible 'value proposition' to most low income families in their struggle to survive on daily incomes of K10 000 to K20 000. Although the purchase of an improved charcoal could save +/- K30 000 a month on a large family's charcoal expenditure, and that daily savings could add up by the end of the month to 10% of the family's total income, such low income families have a difficult time accumulating the K30 000 needed to purchase an improved stove from their meagre daily cash flow.

Contrary to a middle income perception of what constitutes economic rationality, the lower income households, that make up the lower 60% to 70% of the economy of Lusaka, are primarily focused on optimising the use of any surplus funds that come to hand within a very short term framework of one to two days up to a maximum period of one week. Therefore it is **NOT** at all 'rational' for them to radically reduce their daily consumption of essentials by 30%, at a rate of saving of between K4000 to K5000 a day over a period of – say - 7 days, in order to accumulate the K30 000 to K35 000 required to buy an improved stove IN SPITE OF THE FACT that such a stove may save the family K1000 a day on their charcoal bill for the life of the stove.

Middle income rationality perceives the long term benefit of saving K30 000 a month on charcoal by spending an additional K30 000 up front to purchase c charcoal saving stove that will continue working and saving K30 000 s month for the life of the stove. There is a general understanding that K1000 saved is the same as earning an extra K1000 every day. Thus, a household that manages to save K30 000 a month by purchasing and using a charcoal saving stove, will save a total of K360 000 in the course of a year. A family that saves K360 000 in the course of a year because it 'invested' K30 000 in a charcoal saving stove, will earn a return on that original investment of +/- 100 % a month and 1 200 % a year.

In sharp contrasts, low income urban households in Lusaka use very short time frames – often little more than one or two days - to arrive at their own 'rational' decisions on how to use their small day to day flows of income. Therefore, as a rule, low income households tend to minimize costs and maximize benefits within a narrow time frame of a few days. Middle and upper income households tend to make use of much longer time frames to in figuring out how to minimize their costs and maximize their benefits. It appears that the survivalist master strategy of many, perhaps most, low income households is to minimize their day to day expenditures and then skilfully managing their scarce income and resources so as to meet as many of the competing socio-economic needs as possible within a short time frame of a few days to perhaps a week.

The pressure created by a backlog of unmet current social and economic needs in low income households means that it is extremely difficult to divert enough money from a small daily flow of income to accumulate a lump sum of K30 000 with which to purchase an improved stove. The perspective of low income households with many competing, time and cash flow sensitive demands on their limited income, particularly when dealing with a lump sum 'windfall' of

K30 000, is in sharp contrast to the long term middle income approach to economic rationality. When discussing the saving up K30 000 from daily cash flow for the purchase of a charcoal saving stove, informants in the low income compounds repeatedly emphasized that if they had an extra K30 000 they would prefer to use that money to meet other needs such as: to purchase a bag of charcoal or veggies and fruits for resale, medicines, air time, transport, school supplies, or pay off loans, etc. They agreed that they would not waste such a windfall of saved money on purchasing an expensive charcoal saving improved mbaula.

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