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RENEWABLE ENERGY TECHNOLOGY PROJECT

Laboratory Testing Report Number 14

Title : Production and Marketing of the RET METAL STOVE (Model 3) - Preliminary Findings.

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Preface

The Lesotho Renewable Energy Technology (RET) Project is part of the Appropriate Technology Section (ATS) of the Ministry of Cooperatives and Rural Development (MINCORUDEV). The Project is funded jointly by the Government of Lesotho (GOL) and the United States Agency for International Development (USAID). Technical assistance is being provided by Associates in Rural Development, Inc (ARD), under USAID contract AFR-0206-C-00-1016-00.

The RET Project began in April 1981. The Project has three primary objectives:

- to develop and introduce renewable energy technologies that help rural people conserve scarce fuel
- to develop and introduce renewable energy technologies that help rural people increase the year-round availability of food
- to develop and have fully operational an Appropriate Technology Section to carry on this effort beyond the completion of this pilot phase

This report is part of a series produced by the Project's Research and Development Laboratory to document the research activities that have taken place. Research centers are located at Malefiloane and Mokhotlong in the highlands and at Butha buthe and Khubetsoana in the lowlands.

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1. Introduction

The RET Project developed a sheet steel stove in 1982 under the direction of Glenn Burket and Margaret Thomas (Stove Consultancy for Lesotho RET Project, Associates in Rural Development, Burlington, Vermont, January, 1983). Based on surveys conducted by the RET Project Staff in the Malefiloane area, criteria for a cooking and heating stove were developed. A stove must:

- remove smoke from the cooking and living area,
- use 3-legged pots as well as aluminium saucepans,
- save fuel compared to traditional practices,
- be inexpensive,
- use locally available fuels,
- have space heating capabilities,
- be able to be produced in Lesotho.

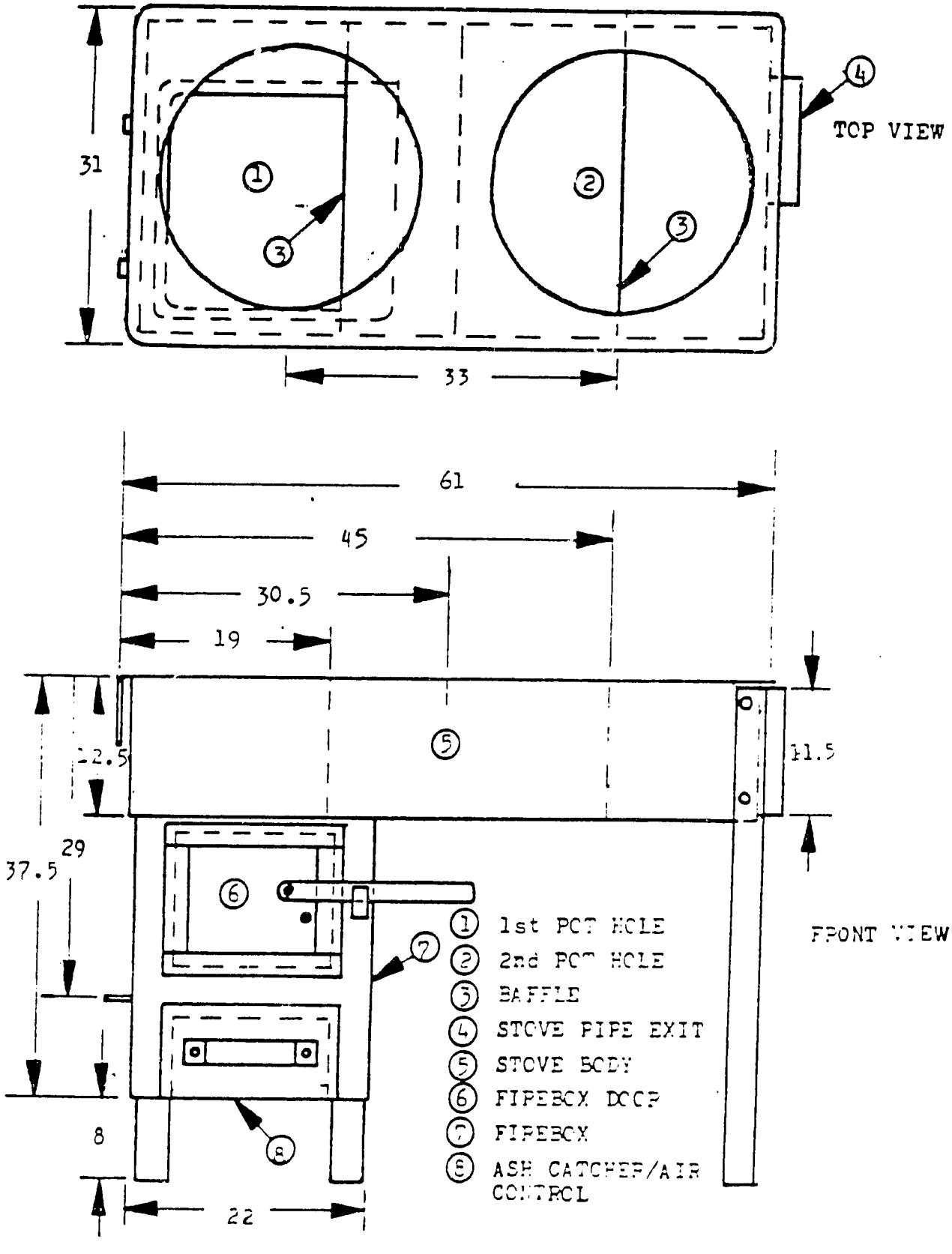
While an earthen stove was developed at the same time, most people preferred the metal stove because they felt it would be a more effective heater during the cold mountain winters. (Thomas and Burket, Ibid.) RET Metal Stoves- Model 3 (See Figure 1) were installed in five homes to evaluate their performance in actual use during the fall of 1983. (Matete, Palasits and Klein, "Results of Kitchen Performance Tests on RET Metal and Earthen Stove in Nine Households in the District of Mokhotlong", RET Project, Ministry of Cooperatives and Rural Development, Lesotho, 1984). This report describes the Project's efforts to produce and determine market acceptance for this new item.

2. Production

Mr. Burket supervised two production runs to evaluate the problems of training metal workers to make the stove and to determine what might be done to streamline the production process. The first run of six stoves (the number of stoves which can be made with minimum waste from two sheets of steel) was made at the workshop in Malefiloane, primarily as a training exercise for two Project staff members. It was found that some of the welds were difficult to make

FIGURE 1

RET METAL STOVE - MODEL 3



but perhaps of greater importance was the observation that cutting the stove parts with an oxyacetylene torch was expensive and time - consuming.

The second run, held in mid-January, 1983, at the Project's workshop in Khubetsoana, was a training session for 3 members of the Thaba Khupa Workshop, a small production and repair facility located about 20 kms east of Maseru. This Workshop had agreed to produce the RET Metal Stove for use in a market test after their staff were shown how to manufacture it by the RET Project. The production process was stream-lined by cutting stove parts with a metal shear. The excellent welding skills of the Thaba Khupa welders also made the process go much more quickly than it had in Malifiloane.

Given Thaba Khupa's committment to produce 12 stoves by the end of February, the Project helped their welders make the jigs used in the manufacturing process. They returned to Thaba Khupa with the jigs and a stove and the Project made plans for a limited market test to begin in May, 1983.

However, Thaba Khupa was not able to deliver any stoves until late March when six stoves were received. The Project evaluated the quality of the stoves, found them lacking - particularly in finish details and understanding of the location of key elements such as the smoke baffles and hinges for the door, and brought the stoves back to Thaba Khupa to have them correct the mistakes. These six stoves plus six others were promised by the end of April, but none arrived until the last week in May.

These delays made it impossible to begin the market test as had been planned. It should be noted that although Thaba Khupa was the only workshop which agreed to produce the stove, two others had also been contacted, BEDCO and SELCO, both in Maseru. Neither was interested even though the Project had guaranteed to purchase up to 50 stoves. Having worked so closely with Thaba Khupa, it was disappointing not to be able to begin the market test early in the heating season. Another production run was organised for early July in Malefiloane so that a total of 18 stoves would be available for the market test, which had been postponed until August. Although not an ideal time, it would still be in the middle of the heating season.

This last production run in Malefiloane was able to produce stoves for M87.31. Appendix 1 contains a job card from the Malefiloane workshop detailing the costs. Table 1 presents the cost breakdown by category:

TABLE 1

COST OF PRODUCING AN RET METAL STOVE

	Cost	Percent
Materials	M168.85	32.2
Generator Time	225.00	43.0
Labour	65.00	12.4
Shop Time	65.00	12.4
TOTAL FOR 6 STOVES	M523.85	100.0
Cost per stove	87.31	

As can be seen, the single largest item is generator time, 43% of the cost of the stove. By comparison, electricity at Thaba Khupa, supplied from the grid costs M0.06 per Kilowatt hour. Assuming the same number of hours at a demand of 9.0 Kw their cost would be only M24.14, a saving of 89% for this item. It should be noted that the materials costs in Malefiloane include 30% for transport, significantly higher than that paid by Thaba Khupa, which supplied the Project stoves for M65.00 each.

Obviously, if minimum production costs are desired, the stove, as presently designed, should be produced where electricity costs are low. At the present time in Lesotho, this means that production should take place in the Lowlands or in Thaba Tseka. However, for goods produced in the Lowlands, transport costs of the finished product must be added to the stoves if they are to be sold in the mountainous areas for which they were designed. This will add M3.00 to M10.00 per stove depending on method of transport and final selling point.

On the other hand, if a reasonable cost and remote rural employment is the objective then it will be necessary to increase the speed at which each stove is made. Assuming the time can be reduced to 7 hours per stove, or one per day, then all but the materials cost can be reduced by 35.4% or M20.94 per stove. This makes the stove much more competitive but it has not been priced to include a manufacturer's profit as have the stoves

purchased from Thaba Khupa. Unless well-trained welders can be employed and electricity costs reduced still further, it would seem that production of the stove in remote rural workshops does not make sense at this time.

3. Market Test

A. Purpose of the Experiment

This limited market test was designed to indicate the acceptability and potential sales of the RET Metal Stove (Model 3). It also examined the existing market of commercial stoves available in the Mokhotlong area.

B. Experimental Apparatus

The stoves discussed in the previous section were used for this test. Those who purchased stoves were asked to complete a Background Data Sheet, which was used to compare the purchasers with the larger sample interviewed and reported on in 1982 by Dr. Judith Gay and Mamello Khoboko (Village Energy Survey Report, Associates in Rural Development, Burlington, Vermont, 1982). After the stove had been installed and was being used, they were asked for their comments on its performance. These were recorded on a Final Stove User Questionnaire. A sample copy of each form is contained in Appendix 2.

C. Experimental Procedure

The market test was conducted in the Mokhotlong District. Following discussions with the management of several retail stores, two were chosen as retailers for this test. The shops selected were Morojele's general Trading Store, located next to the airport in Mokhotlong camp, with several outlets throughout the District and the Malefiloane Cooperative Store situated next-door to the RET Project's workshop in Malefiloane.

Both stores agreed to stock the stove and to sell them to the general public. The RET Project told each store manager that they would be charged M70.00 for each stove but each store was free to decide on their own retail price. Morojele's store offered the stove for M78.00 and the Co-operative store sold the stove for a

M5.00 profit or M75.00. Both of these prices excluded the price of the chimney system which worked out to be about M15.00. Morojele's store offered customers free installation of the stove but the Cooperative Store charged a M5.00 fee for this service.

As part of the test, the shops agreed to:

- demonstrate the stove to all interested buyers.
- keep a record of the name and address of each person who bought the stove.
- inform the buyer that an RET Project staff member would be visiting them to ask some questions of them and about the stove.

During the third week in August, twelve stoves were placed in the two stores. Eight of these were placed in Morojele's store and the remaining four were placed in the Co-operative store. A few days later, Ntate Morejele moved two stoves to his store in Ha Rafalatsane. This store is located about 20 Km Southwest of camp, next to a Catholic mission. With all prices and conditions set, the market test began on August 19th.

Since the market test was limited to a very small region, no preliminary radio or newspaper advertising was done to familiarize the general public about the stove. Instead, it was decided to hold demonstrations of the stove, at locally pre-announced times, adjacent to Morojele's store. Food was cooked and served to potential customers and the features of the stove were explained. Demonstraitons were held on August 19th and September 12th. No demonstrations were held at the Cooperative Store because RET Project staff felt that most people in the area already knew about the stove since it had been developed and tested right next door.

A sign was placed outside Morojele's store advertising the stove during the fourth week of the test. This sign was up for only three weeks, at which time a heavy rain storm ripped the paper sign from the wall. No other sign indicating anything about the stove, including price, was ever seen at either store.

TABLE 2

PARAFFIN STOVES IN MOKHOTLONG - SEPTEMBER, 1983

NAME	DESCRIPTION	PRIMARY FUNCTION	NUMBER OF BURNERS	TYPE OF POTS (2)	SMOKE REMOVAL (3)	ACCESSORIES	COST (MALOTI)
Primus	Small, portable pressure stove	Cooking	1	S	NO	-	11.00 - 15.60
Flame	Small, portable wick stove	Cooking	1	S	NO	-	7.50 - 12.25
Blue Flame	Small, portable wick stove	Cooking	1	S	NO	-	6.54 - 7.50
Metalize	Small, portable wick stove	Cooking	1	S	NO	-	12.50
Paraffin Heater	Portable, wick Heater	Heating	(1)	-	NO	-	23.50
NEW RET	Portable, wick heater	Heating	(1)	-	NO	-	105.50
Alladin	Portable, wick heater	Heating	(1)	-	NO	-	98.95

NOTES:

(1) Strictly speaking, the heaters do not have a cooking burner, although people often use the top of the heater to keep a pot warm.

(2) S = Saucepan. If used as cookstoves, the heaters only take saucepans.

(3) Paraffin stoves generate very little smoke, However, ventilation is usually necessary because of the noxious fumes given off when the stoves are in use.

TABLE 3

SOLID FUEL STOVES IN MOKHOTLONG - SEPTEMBER, 1983

NAME	DESCRIPTION	PRIMARY FUNCTION	NUMBER OF BURNERS	TYPE OF POTS (1)	SMOKE REMOVAL (2)	ACCESSORIES	COST (MALOTI)
Steel Stove	Medium size, stationary cylindrical firebox	Cooking	1	S,P	YES	-	70.00
Queen Stove	Small size, stationary cast iron	Cooking	2	S	YES	-	123.00-150.00
Jewel Stove	Large size, stationary cast iron	Cooking	4	S	YES	Water heater, oven, plate warmer	650.00
RET Metal Stove	Medium size, stationary sheet steel	Cooking	2	S,P	YES	Water Heater,	75.00-78.00
Traditional Paola	Small Size, portable, old bucket	Cooking	1	S,P	NO	-	0

NOTES: (1) S = Saucepans, P = 3-legged pots.

(2) Requires installation of a chimney if "yes".

A survey of commercially available stoves and fuel prices in the test market area was made in September in conjunction with the market test. Paraffin stoves are presented in Table 2 and solid fuel stoves in Table 3. Table 4 contains relevant fuel prices taken at the time of the survey.

While the data on available paraffin stoves is interesting, the solid fuel stoves are of more immediate concern. The 'Steel Stove' is similar in size to the RET Metal Stove, but has not sold well - only one in over two years. The 'Jewel Stove' has the largest capacity of those surveyed and while very durable is also very expensive to purchase.

At the other extreme is the traditional paola which is usually made from an old bucket. A very versatile device, but because it has no chimney, it is not as effective an heater as the other solid fuel stoves.

All of the solid fuel stoves are capable of burning wood, dung and coal. The "Queen" and "Jewel" are designed for coal and should last a long time when that fuel is used. The other stoves were intended for use with local shrubs and dung. Although they can be used with coal, their lifetime is reduced with constant use of that fuel.

The initial expense of a many-feature coal stove and the cost of the fuel are probably key in preventing the widespread use of these stoves. A M9.50/bag coal in Mokhotlong is almost twice the price it is in Maseru. (See Table 4). That price does not include transport to the user's home.

TABLE 4

COMMERCIAL FUEL PRICES IN MOKHOTLONG

SEPTEMBER, 1983

Fuel	Quantity	Price (Maloti)
Paraffin	Litre	0.55 - 0.65
Coal	80 Kg	9.50
Wood	40 Kg	4.00 - 5.00

Thus, there seemed to be a market for a many-featured stove designed for local fuels and 3-legged pots as well as aluminium saucepans. It was hoped that the RET Metal Stove (Model 3) would fill that niche.

D. Results and Observations

Sale of the stoves was slow. All four stoves placed at the Cooperative Store sold. Only one of the eight consigned to Morojele was sold by October 23rd, the date chosen to end the market test. (Soon after the end of the test, the seven remaining stoves were purchased by a local high school for installation in staff members' homes).

The five purchasers were interviewed by RET Project staff using both questionnaires. The Background Data on the five households revealed some differences between this group and the larger population. Categories considered were wealth, sources of income and education.

The most striking aspect of the sample's wealth relative to the larger population was the number of households with zinc - roofed houses. Four of the five households (80%) had zinc-roofed houses compared to 22.3% in the Village Energy Survey. All five families had a source of income other than subsistence farming. Eightypercent received wages (2 miners, 1 government employee and the combined earnings of 1 chief and 1 teacher). The remaining household sold handicrafts. Educational levels for the five households were considerably lower than the wider population studied in the Village Energy Survey. Altough this market test constitutes a very small sample, based on ownership of an expensive house and access to steady sources of income, the purchasers were relatively well-off compared to the general population.

Only two households had had their stoves installed at the time of these interviews. Thus it was not possible to get comments on stove performance from the entire sample. Both women who were using their stoves liked the fact that they could cook two pots at one time,that the stoves saved fuel, that they could use both 3-legged pots and saucepans and that they could adequately heat their house while they were cooking. All households knew others who were interested in buying the stove because of these features.

Not all of the stoves were being used when the households were interviewed because of breakdowns in the process of installation of the stovepipe. Morojele's store had agreed to supply stovepipe for the test, but for many reasons was unable to do so until 6 weeks after the market test began. In the Malefiloane area, the man who was responsbile for installation told the buyers that as soon as the stovepipe was at their homes, he would install the stove. Only two of the four purchasers had acquired the stovepipe at the time of the interviews.

While lack of stovepipe may have discouraged possible buyers, a more important problem seemed to be the separate pricing of the stove, the stove pipe and the installation. A few people arrived at the Cooperative Store with just enough money to purchase the stove, not realizing that stovepipe and installation were additional.

It is likely that two other items contributed to slow sales of the stoves. First, sale of the stoves began in early spring not early winter. This year, August and September were unseasonably warm, so people were probably not thinking about heating, which is one of the major benefits of the stove. Second, lack of effective advertizing in Mokhotlong camp seemed to have an effect on sales. In the Malefiloane area, where people knew about the stoves, no advertizing was done yet four out of four stoves were sold. Although the stove was demonstrated in camp, it is possible that lack of public awareness of the stove contributed to its very slow sales.

4. Conclusions and Recommendations

It is clear that a production process which makes the stove at a low cost, high quality and in a timely fashion, must be worked out before an effective marketing campaign can begin. Since costs of production are less in the lowlands, it is probable that the stoves will be manufactured at a workshop in or near Maseru. This will facilitate the quality control efforts of the Project.

The limited market test indicates that the stove met the needs for which it was designed. It is recommended that an expanded test be

conducted in the winter of 1984. The test should include:

1. A minimum of 50 stoves,
2. One price for the stove, chimney and installation,
3. Begin in early May and run through the end of July,
4. A complete advertising campaign (posters, radio, demonstrations).
5. Follow-up and evaluation of performance by the RET Project on all installations in November, 1984.

Particular attention should be paid to desires for additional features so that they can be incorporated into future stoves. One obvious feature is an oven, something the Project has already begun to investigate.

One final point, Ntate Morojele has expressed interest in more stoves. He is considering financing the production of 50 stoves, which he is prepared to market in Mokhotlong and Butha Buthe. The Project should work closely with Ntate Morojele so that the stoves will be available for the winter of 1984.

APPENDIX 1

JOB CARD

APPENDIX 1

Date July 83

JOB CARD

Customer/Job Type Production Run Worker Korenta Matete, E. Khabisi, N. Kabi, M. Ramaholi

Job Description Making 6 REI metal stoves

Materials:	Unit Cost	Cost
Steel: 3mm Plate 120x240 cm (1 sheet)	R 64.58 per sheet	64-58
1.6 mm Plate 120x240 cm (1 sheet)	R 40.69 per sheet	40-69
5x25x25 mm L 6.36 m	R 1.73 per/m	11-00
25x5 mm — 9 m	R 0.97 per m	8-73
20x5 mm — 11.37 m	R 0.81 per m	9-21
20x5 mm — .72 m	R 0.81 per m	0-58
8 mm Ø 2.65 m	R 0-40 per m	1-06
.5 mm Galvanized sheet metal .39 of 1 sheet	R 7-70 per sheet	3-00
Other: High heat spray paint 5 cans	R 2-80 per can	14-00
Welding Rods — 80 electrodes	R 0-20 each	16-00

			Materials Cost	R168.85
Generator time	45 hrs	Unit Cost R 5.00 per/hr	Cost	R225-00
Labour Time	65 hrs	Unit Cost R.100 per/hr.	Cost	R65-00
Shop Time	65 hrs	Unit Cost R1.00 per/hr	Cost	R65-00
			Total Cost	R523.85

Cost Per Stove : R87.31

APPENDIX 2

SAMPLE QUESTIONAIRES

BACKGROUND DATA FOR COOKING FUEL USE TESTS

Village _____
Date _____
Interviewer _____
Stove type _____
Date installed _____

4.1 Name of household head _____ - _____

4.2 Name of person being interviewed _____

4.3 Number of household possessions used for cooking, heating, lighting etc.

- [ ] iron tripod
- [ ] mpnola (bucket__/ old 20 lt tin__/)
- [ ] paraffin pressure stove
- [ ] paraffin wick stove
- [ ] coal stove
- [ ] gas stove
- [ ] paraffin heater
- [ ] flat iron for pressing clothes
- [ ] radio
- [ ] cassette player
- [ ] iron pots with legs (sizes_____)
- [ ] flat iron pots (sizes _____)
- [ ] kettle
- [ ] saucepans (small__/medium__/large__/)
- [ ] frying pan
- [ ] empty tins (round__/ square__/)
- [ ] big drum for cooking beer
- [ ] hand grinding mill, of iron
- [ ] paraffin lamp (glass__/ no glass__/)
- [ ] flashlight or torch

4.4 For how many people do you cook each day ____?

4.31 Number of domestic animals owned by the household:

TYPE OF ANIMAL	THOSE STAYING HOME ALL YEAR LONG	THOSE AT CATTLE POST DURING SUMMER	TOTAL
cattle			
sheep			
goats			
horses			
donkeys			
mige			
chickens			
others			

Number of household members: present ____, absent____, total____.

Number of
- ____ rondavels
- ____ thatched rectangular houses
- ____ houses with iron roofs
- ____ cattle kraals

In what kind of house is your new stove? _____

What are the main sources of household income, listed in order of importance?

(1) _____

(2) _____

(3) _____

(4) _____

List all members of your household. Include both those present and those who are absent.

NAMES MAHITSO	SEX M/F	RELATION TO HOUSEHOLD HEAD KAMANO	MARITAL STATUS	AGE LILEMO	EDUC LEVEL THUTO	EMPLOYMENT HERDING OR SCHOOLING	ACTUAL RESIDENCE
1.		His head					
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

21

FINAL STOVE USER QUESTIONNAIRE

Village _____
Date _____
Interviewer _____
Stove type _____

1. Name of cook _____
2. Does the stove cook well the foods that you normally prepare? Yes_____ No_____
3. If no, which foods do not cook well on the stove, and why?

_____

_____

4. Does the stove heat your house well? Yes _____ No _____
5. If no, why? _____

_____

6. Do you think the stove uses more fuel,___ or less fuel_____than your other method of cooking?
7. What do you like about the way this stove works? (List as many specific points as the owner can think of, but do not suggest answers.)

_____

_____

_____

_____

_____

_____

8. Do you have problems using the stove? Yes _____ No _____
If yes, what kind of problems? (Check those mentioned, and add others not listed.)

__ Not enough heat
__ Too much heat
__ Didn't cook second pot
__ Pots didn't fit well
__ Hard to control fire
__ Hard to add fuel
__ Didn't Burn fuel well
__ Smoke escaping into the room
__ Hard to clean out
__ Difficulties with front door
__ Difficulties with ash catcher/air control
__ Difficulties with chimney
__ People getting burned

Other _____

_____

_____

9. What do your friends say about the stove?

_____

_____

10. Do you know other people who want a stove like this one? Yes_____ No _____

If yes, please give their names and where they live. (write on back of page)

PURCHASE MADE: DATE_____ AMOUNT PAID_____ or STOVE REMOVED: DATE _____