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PN-RAX-893
S-7-83

BOTSWANA VILLAGE ENERGY SURVEY REPORT

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Under AID contract number 633-0209-C-00-1024-00.

Date: September, 1983

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PREFACE

The Botswana Renewable Energy Technology (BRET) project (number 633-0209) is jointly funded by the government of Botswana (GOB) and U. S. Agency for International Development (AID). Technical assistance and project management are being provided by Associates in Rural Development, Inc. (ARD) of Burlington, Vermont, under AID contract number 633-0209-C-00-1024-00.

I. INTRODUCTION

A. Background and Purposes of the Survey

The BRET project is a pilot project designed to develop and introduce renewable energy technologies (RETs) in rural villages and institutions. The project's approach requires the active involvement of technology users in identifying energy needs as well as selecting and applying technologies to meet those needs. The initial step in identifying these energy needs was a village energy use survey. This report presents the results of the survey, which was conducted in two very different villages where BRET project activities will be carried out. However, the survey represents only the first step in an ongoing data collection process that will guide the BRET project in selecting, developing and disseminating technologies to meet rural energy needs.

The survey was conducted in Ditshegwane, a small village in the western portion of the Kweneng district, during a three-week period in May and June, 1982, and Shoshong, a medium-sized village in the Central district over a five-week period in October and November, 1982. (See Figure 1.) The findings for both villages are presented in this report to permit comparisons of the results.

The severity of the drought in the western Kweneng area may have had some effect on responses to the survey. As winter set in and the residents of Ditshegwane harvested virtually no crops, they were anxiously awaiting information about the national drought relief scheme. They were reluctant to talk about food production and preparation in specific, current terms and frequently prefaced their responses with "In a good year, we...". It is unlikely that timing or the drought affected responses in Shoshong. In any case, the energy consumption patterns in both villages will be assessed during three seasons as part of the project's ongoing data collection process.

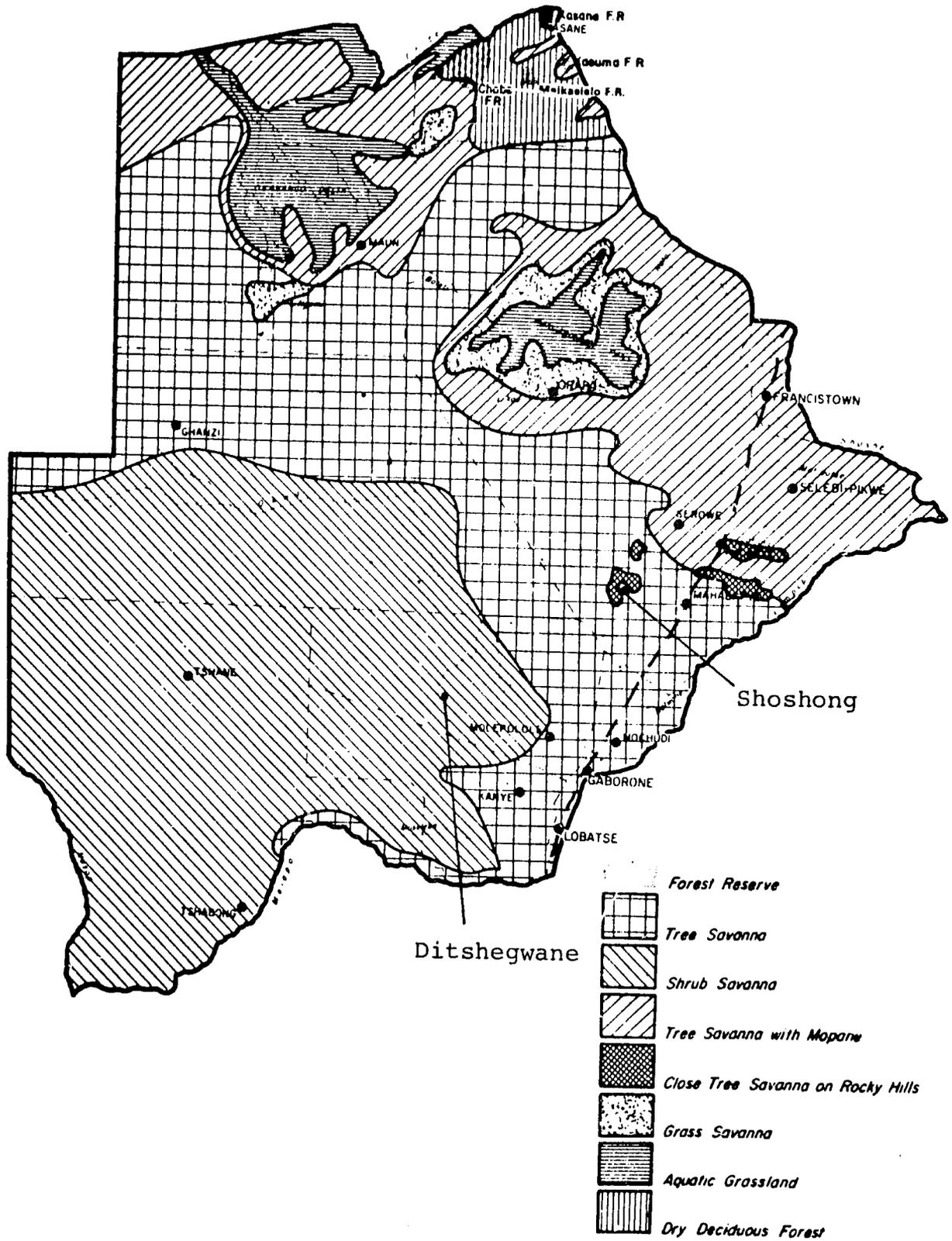
The survey work was conducted by BRET staff members and enumerators trained by the project--villagers selected to assist the BRET staff in gathering data. The enumerators' participation is consistent with the project's commitment to engage villagers, but also provided language support and inside knowledge of each village. The language support was especially critical in Ditshegwane where Sekgalagadi is more commonly spoken than Setswana. In addition, students from the University of Botswana helped in the Ditshegwane survey, as the number of residents who could assist was insufficient.

The survey's purposes were to:

- introduce the project in the villages and initiate discussions with villagers about energy needs;

FIGURE 1

Map of Botswana



- gather detailed data on village energy use; and
- collect information that would assist the BRET project in identifying and prioritizing primary energy needs, matching RETs to village needs and resources, assessing the social and economic feasibility of proposed technologies as well as the social, cultural and economic details relevant to specific RETs, and developing dissemination strategies.

B. General Findings

Firewood and human energy continue to be the most widely used sources of energy in rural areas. Virtually all the domestic, transportation, agricultural and institutional needs in Ditshegwane are met by these two resources. Shoshong residents use firewood primarily for two major domestic activities--cooking and keeping warm. In addition, wood is used by the school feeding programs in both villages, but the clinic in Shoshong relies on bottled gas for its energy requirements.

The major perceived problems in terms of energy supply are the physical work and/or distances involved in gathering firewood. In Ditshegwane, physical strain is the predominant problem, as residents must walk two to five kilometers to collect wood. In Shoshong, villagers walk, or occasionally have transportation or the means to buy wood from people with transport, to obtain wood that is seven to 12 kilometers distant from the village.

The water supply in Ditshegwane is adequate and uses a diesel-powered pump. However, Shoshong's supply is unsatisfactory, particularly on the growing west side of the village. Shoshong may have the potential for wind pumping--a privately owned windmill has been in operation for 20 years.

Ditshegwane's economic resource base is scant--traditional skills are widespread, but residents have little hope of improving their lives. Their stated preferences about ways to perform domestic and agricultural tasks are the same as the manner in which these things are done now. People in Shoshong, on the other hand, have had more exposure to alternatives and their preferences reflect both an awareness of these alternatives and aspirations for acquiring consumer goods.

In Shoshong, the firewood shortage is a stated problem. In addition, there is a strong, interested network of organizations for extension work with RETs.

Activities related to data collection and problem definition need to continue to determine seasonal variations in energy use and consumption patterns.

II. METHODOLOGY

A. Survey Design

The development of the survey design included a review of energy survey methodologies and reports, and identification of the information required for an energy needs assessment and the most suitable means for data collection. The process for identifying and structuring the required data was based primarily on the work of Burrill, Forman and Gomez.*

Detailed data requirements were specified for the following areas:

- demographics,
- social/organizational factors,
- economic indicators,
- geography and climate,
- household energy use patterns,
- agricultural energy use patterns,
- energy use by small shops/businesses,
- energy use for other village activities and institutions (e.g., transportation, school, clinics),
- nonrenewable energy sources,
- renewable energy resources, and
- energy-related problems.

The data presented in this report were gathered through interviews conducted in village households; observations and fuel measurements for selected homes; interviews with community leaders, extension workers and shop owners; existing reports, and district and central government files (especially for demographic, geographic and climatic information); and staff members' observations during the survey.

*Planning Rural Energy Projects: A Rural Energy Survey and Planning Methodology for Bolivia; George Burrill, Sylvia Forman and Enrique Gomez; April 25, 1980; USAID/Bolivia.

After conducting the survey in Ditshegwane, some changes were made in the questionnaire and format for observations and fuel measurements. However, the same basic approach to data collection was used in both villages.

Interviews were conducted using the questionnaires presented in Appendix A, which were designed to be completed in a single session of an hour and a half. Two weeks were required to conduct interviews in Ditshegwane and three and a half weeks in Shoshong. (Shoshong is much larger and the distance between households, greater.)

Household observations and fuel measurements were performed to broaden the information base concerning household energy use patterns and economic levels, and determine actual quantities of fuel used. In Ditshegwane, observations were made only in households which agreed to participate in order to allay fears about strangers and surveys. (Some Ditshegwane residents thought that the purpose of the national census was to select a certain number of people to be killed. This was also a stated concern about the BRET village energy survey.) In Ditshegwane, 39 one-day observations were made. Weekly observations were performed in Shoshong over a four-week period for 32 households. (The observation guide sheet used appears in Appendix B.)

Each survey team included three or four BRET staff members and eight enumerators, all of whom lived in the village for the duration of the survey. This gave them the opportunity to observe general village and household activities, and experience life in each village firsthand. The survey results were enriched by this experience and the survey teams' general observations.

B. Sample Selection Strategies

All the households in Ditshegwane that were occupied at the time of the survey were included in the sample. The village is relatively small--203 dwellings and a total population of 821 (1981 census). It was felt that including all the residents in the survey was logistically feasible and excluding anyone in such a small village might inaccurately convey that project activities are intended for only a select few. Participation was voluntary, and 39 households agreed to be observed.

Shoshong is a much larger village with 733 dwellings and a population of 4,600. The survey sample was selected from the census list using random tables by first generating 200 random numbers. Of these, 165 households were then interviewed; the rest of the numbers represented commercial/community buildings, vacant dwellings or households where all the residents were temporarily absent. In addition, fuel measurements and observations were made for 32 households that volunteered, with

each enumerator observing four households during the four-week period.

C. Data Analysis

The findings presented in this report represent results from the interviews, observations and fuel measurements. The data were compiled and analyzed manually, and the survey team for each village assisted in the frequency tabulations. Tables, statistics and village comparisons were prepared by the BRET staff. The narratives presented here were compiled from information gathered in the background search, observations and staff members' stays in both villages.

III. IMPLEMENTATION

A. Choosing and Entering the Villages Surveyed

The GOB identified the Kweneng and Central districts as the first two areas for BRET project efforts. District involvement was considered important for consistency with the project's community development approach and because the District Extension Teams (DETs) will have a major role in spin-offs of project efforts to other villages in these districts. Several steps were taken to maximize district-level input and support of the project, beginning with selection of the villages to be surveyed.

The village selection process for the two districts was essentially the same:

- preliminary meetings were held with council representatives and/or DETs to share project goals, activities and expectations concerning collaboration;
- BRET staff discussed criteria for the villages to be surveyed with the DETs--these included proximity to district headquarters, BRET activities will not duplicate ongoing projects, local needs are representative of surrounding villages, an interested, well organized Village Development Committee (VDC), an interested, willing Village Extension Team (VET), central location with population of under 1,500 in the Kweneng district and 2,000 to 3,000 in the Central District, limited access to conventional energy sources and space for a village training facility;
- the DETs submitted a list of four or five villages that they felt met the criteria and assisted in drawing up a timetable for village selection visits--in the Kweneng district, the Senior Community Development Officer made all the appointments through his village-based staff, but the size of the Central district precluded this approach, so a DET member was named as the BRET's primary liaison and was informed as appointments and visits were made;
- BRET staff visited the villages to gather information in order to evaluate how well they met the criteria--in each village, interviews were conducted with at least the chief and Assistant Community Development Officer, who then identified other people to interview (to avoid raising false hopes, it was emphasized that the interviews were only exploratory);
- BRET staff then prioritized the villages and wrote to the District Council requesting concurrence regarding the village that was the project's first choice--once written

concurrence was obtained, letters were written to the villages not selected indicating that the project's efforts had the potential for spin-offs throughout the district.

After the selection was made, BRET staff members returned to the village chosen for the survey to notify the chief and VDC, arrange a kgotla meeting to introduce the project and survey work to the villagers, and enlist the VDC's assistance in identifying residents who could help with the survey. At the introductory kgotla meeting, the chief introduced the project's representatives who then explained the BRET's purposes and proposed village activities. The survey work and its relationship to the project were discussed in greater detail, and a VDC representative (the chief in Ditshegwane) assumed responsibility for identifying possible enumerators. Thus, the project's commitment to involve village leadership and residents in BRET activities was again underscored.

B. Selecting and Training Enumerators

The BRET extension team spent two to three days in each village selecting enumerators from the pool of individuals identified by the chief and/or VDC representative. One day was spent getting acquainted with the village in general, a second in activities with the candidates, and a third sharing selection decisions with the candidates and VDC. Selection activities were designed to provide candidates with opportunities to demonstrate the following skills:

- ability to read and write in English and Setswana,
- sensitivity to people of all ages,
- ability to understand and articulate the project's goals and purposes of the survey,
- knowledge of the village,
- interviewing and observation skills,
- interest in learning, and
- basic understanding of arithmetic, conversions and measurements (this criterion was added for the second round).

At the end of the day of activities with the candidates, the results were evaluated and final selections made. In Ditshegwane, four villagers were selected as enumerators and in Shoshong, nine. One of the Ditshegwane enumerators also participated in the Shoshong survey. The Ditshegwane survey team

was supplemented by four first-year university students, who were chosen using a similar procedure with a group of first-year students from the Kweneng district.

Training was conducted for each group of enumerators prior to the actual survey work. The Ditshegwane group participated in a five-and-a-half-day workshop conducted at the University of Botswana. Training for the Shoshong group was conducted in the village and expanded to nine days (based on the experience with the Ditshegwane enumerators and revisions of the survey).

Training activities were designed to maximize practice and the participants' involvement. The goals were to:

- learn more about BRET activities and objectives,
- become familiar with the survey instrument,
- practice using the questionnaire,
- identify potential problems in conducting the survey and develop solutions,
- practice fuel measurements for solid, liquid and bulk fuels,
- practice observing household activities, and
- practice recording data.

C. Procedure in the Villages

Prior to beginning the actual survey work, a second kgotla meeting was called to reintroduce project staff, present the enumerators, and review the survey's purpose and timetable. The survey team's first task was to physically locate the households in the sample. Since the entire village of Ditshegwane was to be surveyed, this was primarily a matter of assigning village areas to the teams of enumerators. In Shoshong, on the other hand, this task required almost two full days--the census map helped, but the village is large. Subsequent survey activities also differed for the two villages.

In Ditshegwane, the survey was conducted over a three-week period. The first two weeks were spent in conducting household interviews, where the final question asked if the team could return to observe household activities for a full day. During the third week, the 39 households who responded positively to this question were observed. Observations and interviews were also conducted at the clinic, school, trading store, bus stop and bar/bottle store. Fuel measurements were not taken during the

household interviews; they were done in only four households approximately two months after the survey work was completed.

In Shoshong, the survey was performed over a five-week period. Household interviews and fuel measurements were conducted during the first three weeks, and fuel measurements/ observations continued for an additional two weeks. Shop owners were also interviewed during the last two weeks, while measurements and preliminary data compilation were being carried out.

IV. RESULTS FOR DITSHEGWANE

A. Village Description

1. Physical Characteristics

Ditshegwane is located on the eastern edge of the Kalahari Desert, where rainfall is minimal--204 millimeters per year prior to the severe drought of 1980. The borehole which supplies potable water is 250 feet deep. Agricultural land is located three to seven kilometers from the center of the village. The low-grade, sandy soil supports only shrublike acacias.

The village is 85 kilometers northwest of Molepolole, the headquarters of the Kweneng district. From the junction of the two roads leading into the village (from Letlhakeng to the east and the sand-track from Maboane to the west), the kgotla, borehole, trading store, primary school, health post and bottle store can be seen. These are the centers for most community activities.

Ditshegwane covers three square kilometers and includes 203 compounds. A compound is typically surrounded by a thornbush fence with an entrance through a carved wooden fence. The compounds vary in area as well as the number and quality of structures. Most houses have mud walls and a thatched roof with exterior support posts that hold the roof above the top of the wall. Thatch is scarce and grows far from the village. Because of this, as well as a lack of transportation for large quantities of thatch and the frequent lack of household labor, many roofs are in disrepair. Only four compounds included cement-block/zinc-roofed buildings, and six had rondavels with heavy "Dutch" thatch. Both types of construction indicate relative wealth and prestige.

Near the kgotla, the VDC has built several small huts of mud and thatch and two square houses of cement and zinc for local government employees and village guests. The customary court clerk, two police officers, adult literacy assistant and Assistant Community Development Officer live there. There are two cement-block/zinc-roofed pit latrines in this area as well.

2. Demographics

According to the 1981 census, Ditshegwane has a population of 821. The population is composed of Bakwena and Bakgalagadi, who originally settled in separate parts of the village and were governed by two distinct headmen. The village is presently administered by one subchief.

AS shown in the population pyramid (Figure 2), almost 60 percent of the village's population is under 20. It is notable that 80 percent of those over the age of 20 have never been to school. Of all the men of working age, 17.5 percent are absent.

Table 1 shows that traditional skills are prevalent in the village, while experience with metal, machines and engines is minimal.

Table 1. Village Skills -- Ditshegwane

<u>Skill</u>	<u>No. of Households</u>	<u>Pct. of Total (150)</u>
building with clay	133	89
making clothes	75	50
thatching	65	43
tanning	52	35
woodworking	33	22
painting	14	9
driving motor vehicle	12	8
building with cement	11	7
weaving	11	7
organizing groups	10	7
metalworking	7	5
repairing machines	7	5
making baskets	7	5

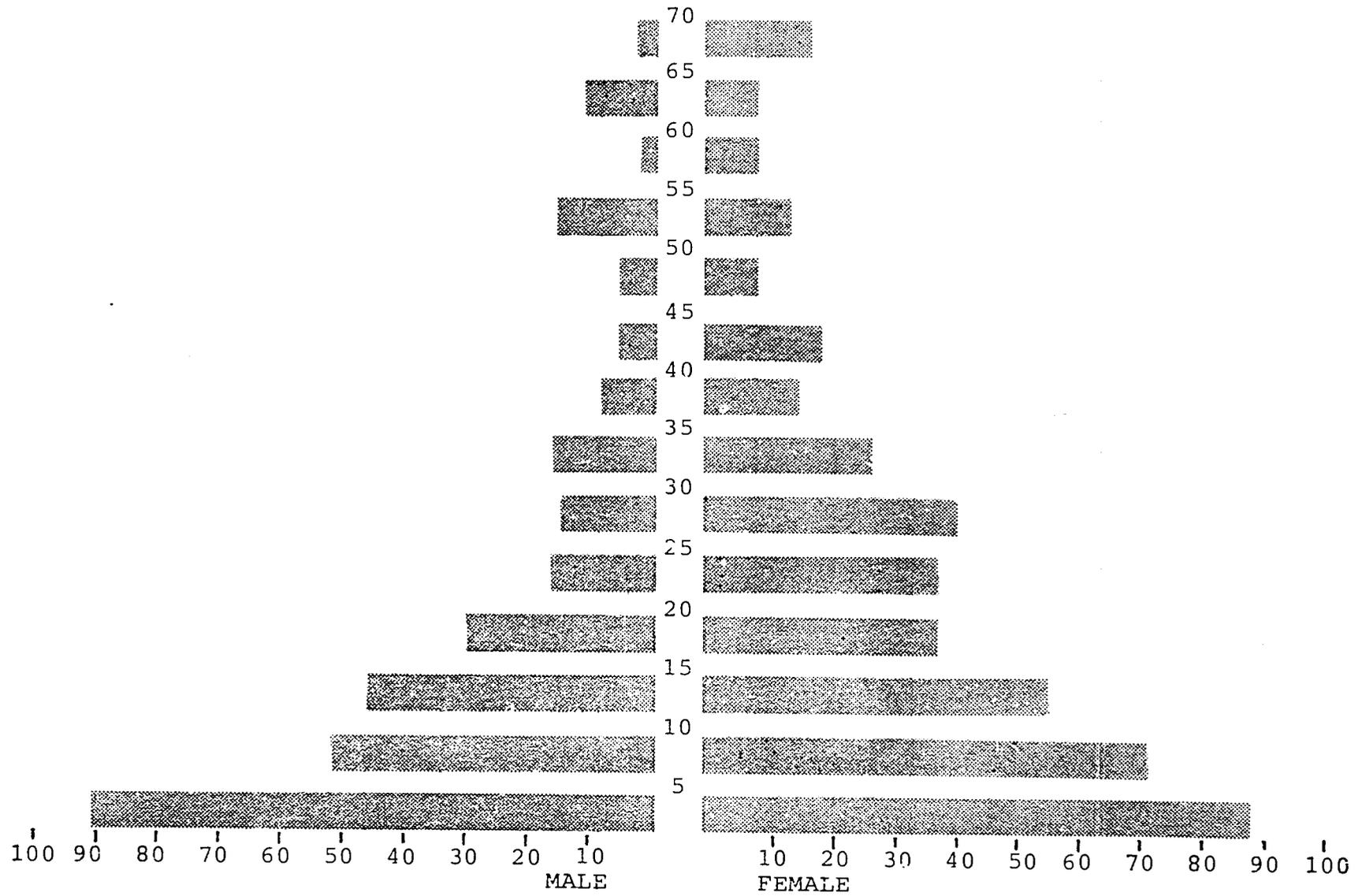
3. Administration/Organizations

The current subchief, Kgosi S. Morwaanare, was installed in 1979, following a central government suggestion that tribal authorities be literate. Having worked for several years in the local trading store, Mr. Morwaanare was the only literate adult male who could take the position. He is relatively young, but administers customary law with the advice of the former chief and assistance from two police officers and the court clerk.

The VDC consists of 12 village representatives, and is responsible for initiating cooperative development projects and working closely with government-sponsored projects and activities. The VDC raised the funds and labor for construction of the school's two original classrooms and several huts near the kgotla. In 1982, it was charged with identifying work projects for participating villagers, who were paid through the Drought Relief Programme. All extension workers in the village and the chief are ex officio members of the VDC. Although the body has an elected chairperson, the subchief functions as the chair and makes most of the decisions about VDC activities.

Other village organizations include a Health Committee chaired by the Family Welfare Educator (FWE), a Farmers'

Figure 2. Population Pyramid -- Ditshegwane



Committee, PTA and 4B. Each group includes two to three people who are also members of the VDC. The membership of all these groups overlaps, due to the village's small size and the relatively few people who actively participate in community activities.

4. Institutions/Social Services

The primary school has been open since 1968. The school compound includes two classroom blocks, four houses for teachers, an outdoor kitchen, two community-built storerooms, two water tanks, a garden and latrines. In 1982, 396 students attended in two sessions because of limited classroom space.

In addition to formal education, school staff members assume responsibility for improving hygiene practices and alleviating malnutrition. Teachers regularly conduct "health inspections" for general cleanliness, lice and manifestations of infectious diseases. Thus, schoolchildren brave the cold of early winter mornings to heat water and scrub thoroughly before going to school. The school feeding program, supplemented by vegetables grown in the school garden, frequently provides the child's only meal during the day. One can easily distinguish schoolchildren, as they are usually more energetic, alert and cleaner than other village children.

At the health post, the FWE has a detailed schedule that includes weight/height measurements at the school each term, weekly weight/height measurements for participants in the malnutrition program, pre- and post-natal classes, and regular hours for consultations and dressings. A nurse and doctor come from Letlhakeng twice a month, and all illnesses that require prescription drugs and/or injections are referred to Letlhakeng, which is 15 kilometers distant. The compound at the health post includes a small, two-room treatment center and office, outdoor kitchen, latrine and one residence.

Although health care is minimal, the water supply in Ditshegwane is potable. The diesel-powered pump at the borehole supplies water for people and cattle. The Department of Water Affairs has installed 10 standpipes throughout the village and construction of a large storage tank will complete the reticulation system for domestic use.

With regard to literacy, a significant proportion of the school-age population is currently enrolled in school, but only 148 women and 53 men participate in the Adult Literacy program. Literacy groups are tutored by village volunteers, who are supervised by the Department of Non-formal Education's Adult Literacy Group Leaders (ALGLs) and use standardized packages.

The trading store stocks food staples, clothes, blankets, cooking utensils, cough mixtures and tonics, sweets and chewing gum. The owners will procure other goods that are specifically requested, if there is space on their regular delivery. The store sits on an enclosed parcel of land of approximately 5,000 square meters, and the owner's residence, workshops, private borehole, generator, kraal and a defunct butchery comprise the compound. (A bar and bottle store was recently opened by the same family on a separate piece of land, southwest of the kgotla.) Although not a service or institution in a strict sense, the trading store has a special role in village life, as it has the only privately owned transportation and supplies diesel fuel for the water pump in an emergency. The store takes in approximately 200 to 300 pula (P) in cash each day, mostly for foodstuffs and draperies, but toward the end of every month, the daily cash intake can be as high as P800.

Concerning transportation, there is daily eastbound bus service to Molepolole, where transport to Gaborone is readily available. On Tuesdays and Thursdays, a westbound transport truck passes through Ditshegwane as it makes a loop from Molepolole to Kang and back.

5. Sources of Income

Income sources were not addressed directly by this survey, but according to 1981 Census figures, 10.3 percent of the population was economically active (excluding traditional agriculture). Shop assistants, the two building contractors and their crews, civil servants and teachers are the only residents who earn a regular cash income. Other income is derived from remittances or the sale of khadi/bojalwa and, occasionally, small stock or cattle. Very infrequently, someone will be paid a small sum to gather building poles or thatch, or build mud walls for a hut. It is in this context that the survey results were interpreted.

B. Survey Findings

1. Household Fuel Use by Type

Table 2 shows the number of users by fuel type.

Table 2. Frequency of Fuel Use by Type -- Ditshegwane

<u>Fuel</u>	<u>No. of Households</u>	<u>Pct. of Total (150)</u>
wood	150	100
dung	47	31.3
agricultural residues	18	12
paraffin (kerosene)	79	63.2
batteries	57	38
candles	45	30
gasoline	1	1
diesel fuel	1	1

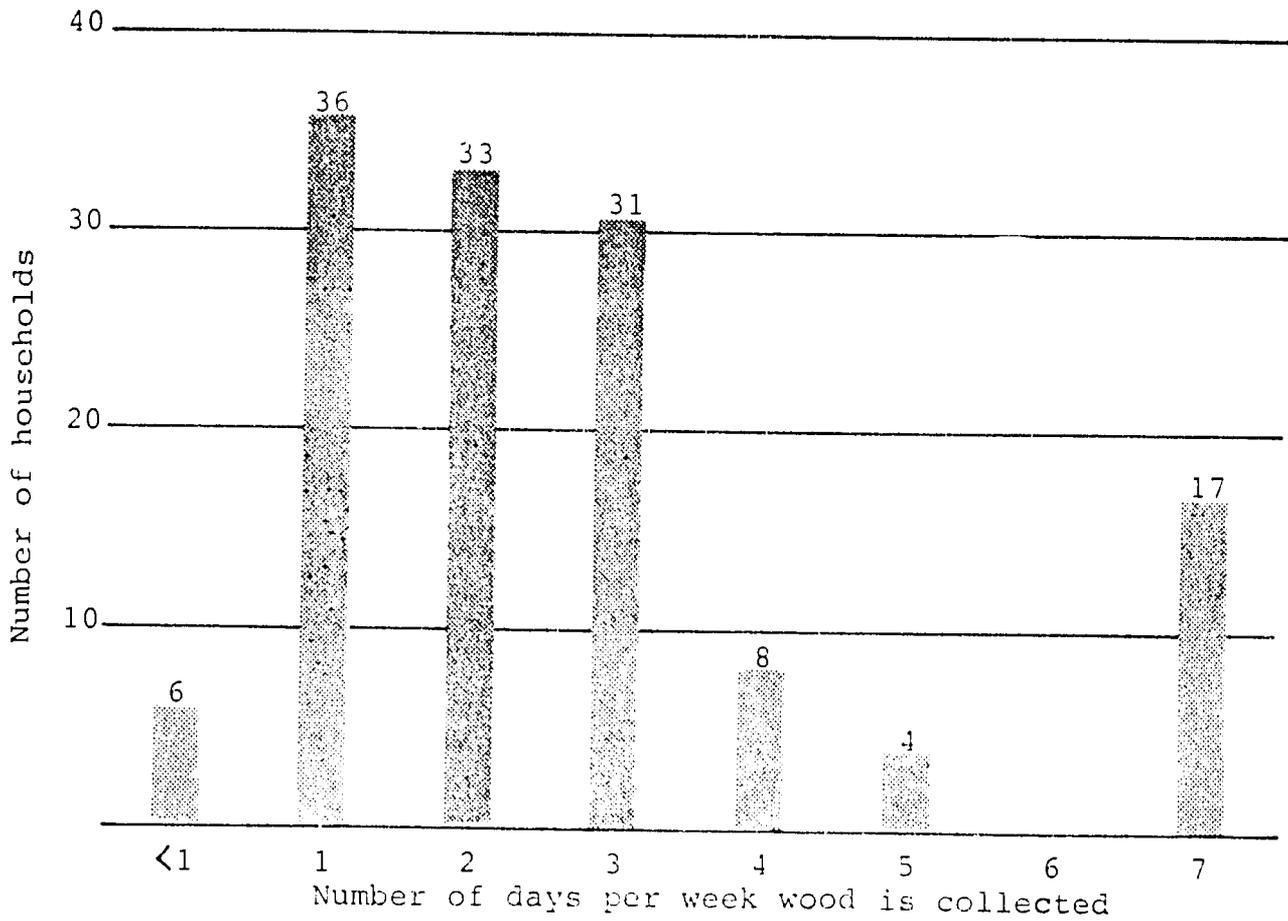
As Table 2 indicates, wood is the most commonly used fuel in Ditshegwane. Other biomass fuels, such as dung and agricultural residues (e.g., stalks and cobs), are used to supplement wood, though primarily at agricultural lands and only infrequently in the villages. Gathering wood is a major household activity and therefore, patterns for this activity deserve some elaboration. A household collects wood an average of 2.7 times per week. It is generally gathered by women and children, and then bundled and transported in head-loads. In the three households where ox wagons or sledges are always used, the men are responsible for collecting the wood. An additional 14 households use ox wagons or sledges occasionally, but everyone else walks two to five kilometers to gather wood. Given the average distance traveled and time required to gather a "standard head-load" (approximately .004 cubic meters),* the average amount of time a household spends collecting wood each week is approximately 27 hours. (See Figure 3.)

Within a two- to five-kilometer radius of the village, residents can still select the type of wood to gather. Preferred woods (listed in Table 3) burn for a long time, make good charcoal, and do not smoke or create much ash.

*A Handbook for Village Woodlot Planning and Management, Village Area Development Project, Hukuntsi, Richard White, May, 1979, Government Printer, Gaborone.

Figure 3

Frequency of Wood Collection -- Ditshegwane



Total number of trips per week - 336

Total number of households - 135

Mean - 2.7

Standard deviation - 1.96

Table 3. Preferred Types of Wood -- Ditshegwane

<u>Species</u>	<u>No. Who Prefer</u>	<u>Pct. of Total (150)</u>
moselesele (Acacia dichrotachys cinerea)*	88	58.7
mongana (Acacia mellifera)*	81	54
motlopi (Boscia albitrunca)**	25	16.7
mogotlho (Acacia erioloba)*	8	5.3
mogonono (Terminalia sericea)**	6	4
others	14	9.3

Conversely, 102 households do not use certain types of wood because they are associated with bad luck. Beliefs about these types of wood (listed in Table 4) include that they attract witches to the household, draw lions to the village and cause people to fall ill.

Table 4. Wood Taboos --Ditshegwane

<u>Species</u>	<u>No. Who do Not Use</u>	<u>Pct. of Total (102)</u>
morobe (Ehretia spp.)**	50	49
mohirikwane	39	38.2
monyeyelele (Ochna spp.)**	29	28.4
moretologa (Ximenia spp.)**	12	11.8
mosetlha (Peltophorum africanum)**	12	11.8
others	7	6.9

Three factors indicate that Ditshegwane does not face an immediate shortage of firewood:

- the radius for collection is less than eight kilometers,
- people are selective about the types of wood they gather, and
- the use of agricultural residues and dung is infrequent.

The labor and time involved in gathering wood are the most notable issues related to the availability of this fuel.

While wood is the major energy source in the village, small quantities of purchased fuels are used for lighting and operating

*Source: Botswana Acacias, John Timberlake, 1980.

**Source: A Vegetative Key to the Woody Plants in Southeastern Botswana, John Wollard.

torches and radios. Table 5 (on the next page) summarizes purchasing patterns in Ditshegwane. Although many households buy fuel, the quantities they use are very small, as open fires are predominantly used for most household activities (e.g., cooking and heating).

2. Energy Use in Domestic Activities

To assist the project in selecting RETs for domestic use, current practices and energy requirements for domestic activities were examined. Table 6 shows fuel use by type for each household activity and clearly indicates that wood is the primary source of energy for domestic activities. The open fire serves many functions in a household--it is used for virtually all activities. The remainder of this section discusses domestic activities, practices and fuel requirements in greater detail.

Table 6. Fuel Use by Domestic Activity -- Ditshegwane

Activity	Wood	Dung*	Agricultural Residues*	Paraffin	Gas	Other
cooking	147 (98%)	47 (31%)	5 (3%)	6 (4%)	1 (<1%)	
baking	126 (84%)	31 (21%)			1 (<1%)	
brewing	103 (69%)	33 (22%)	2 (1.3%)			
lighting	110 (73%)			77 (51%)		81** (54%)
space heating	101 (67%)			5 (3%)		
protection from cold	92 (61%)					

*As a supplement to wood.

**Includes candles (70) and torches (11).

Cooking is traditionally done in three-legged, cast-iron pots over an open fire. A typical meal includes sorghum or maize porridge. Soft porridge is eaten alone, but firm porridge may be accompanied by a vegetable or meat dish. Porridge is usually cooked in a size-three pot, which holds approximately 7.5 liters of water, while the side dish is cooked in a size-one pot that

Table 5. Fuel Purchasing Patterns -- Ditshegwane

Fuel	Retail Price*	Average Amount Spent per Household per Month	Number of Purchasers	Percentage of Total Fuel Purchasers (n=90)	Percentage of Total Households (n=150)
paraffin	P0.60/ liter	P1.75	79	87.7	52.7
batteries		P2.60	56	62.2	37.3
candles	P0.10 each	P1.15	55	61.1	36.7
wood	P4.00/ truck load	P4.00	2	2.2	1.3
diesel fuel		P100.00	1	1.1	1
gas		P9.00	1	1.1	1

*As of May/June, 1982 in local shop.

holds approximately 2.5 liters. The pots are placed directly over the fire, and food aid tins are often put alongside to heat water for washing.

Table 7. Cooking Times During the Day --Ditshegwane

<u>Time</u>	<u>No. of Households</u>	<u>Pct. of Total (150)</u>
morning only	19	12.7
afternoon only	21	14
evening only	48	32
morning and afternoon	3	2
morning and evening	34	22.7
afternoon and evening	0	0
morn., aft. and evening	13	8.7
any one time	12	8

During the survey period in Ditshegwane, residents were cooking infrequently--88 households (58.7 percent) reported cooking only once a day and 37 (24.7 percent) twice daily. The average number of meals cooked by each household per day was 1.45 (standard deviation of 0.66). Given the severity of the drought, resulting poor harvest and general level of poverty, many respondents reported cooking only "when there is food." Thus, the major resource constraint on cooking is the availability of food, not fuel. The physical strain of collecting wood is exacerbated by the villagers' generally weakened condition.

In terms of baking bread, bread is not sold commercially in Ditshegwane, but fuel and the required ingredients are generally available from the trading store. Bread is not a regular item in the diet, rather individual households bake when they have the interest, ingredients and time. In addition, fires are not built exclusively for baking bread as this requires charcoal, which is produced by a fire that has already been used for cooking, making tea or heating water.

Yeast bread is made at least once a month in 81 Ditshegwane households. There are two methods for "baking" once the dough of flour, yeast, salt, sugar and water has risen. In the first, the dough is kneaded, transferred to a three-legged pot, covered and left to rise a second time. Charcoal is then placed under the pot and on the lid, and the bread baked for about 40 minutes to one hour. In the second method, a pot lid is placed on a tripod stand over charcoal. When the lid is hot, four to five small pieces of dough are put on the lid to "bake."

Regarding food preservation, when surplus meat or vegetables are available, they are sun-dried. For example, bean leaves are boiled for a short time and then spread on bags, skins or roofs to dry. Meat is cut into thin strips (approximately four by 20

centimeters), salted and hung up to dry. Eighty-three households (55 percent) reported drying vegetables and 55 (36.6 percent), meat.

In the evening, an open fire serves cooking, lighting and socializing functions. A large number of households also use paraffin lamps for anywhere from one to five hours at a time.

Table 8. Energy Sources for Lighting --Ditshegwane

Method/Fuel	Number of Households Using		Not Used
	Primary	Secondary	
open fire	79	16	40
paraffin lamp	59	17	74
candle	13	45	80
torch	0	1	0
gas lamp	0	0	50

Concerning brewing, two beverages are brewed in Ditshegwane--bojalwa or sorghum beer and khadi, an alcoholic beverage made from wild roots or berries. Bojalwa is brewed in 100-liter drums over a three- to four-day period. Malt is produced from sorghum by soaking the grain in water and allowing it to germinate between two damp sacks. It is then sun-dried and ready to use. One kilogram of raw sorghum yields approximately two kilograms of malt. To brew bojalwa, freshly ground, raw sorghum is cooked in boiling water until thick. Once this mixture cools (approximately 12 hours later), it is thinned with cold water and malt is added. The drum is then covered and allowed to ferment for at least one day. After the first fermentation, the mixture is boiled, cooled and thinned again, if desired. More malt is then added for the second fermentation, after which the mixture is strained and ready to serve. To make 100 liters of bojalwa requires approximately 40 to 50 kilograms of sorghum and at least 100 liters of water.

Khadi is made by fermenting a desert berry or tuber in sugar and warm water. Water is boiled in a single, size-two, three-legged pot, before adding cold water and sugar. The mixture of warm water and sugar is then poured over crushed berries or roots in a 15- to 20-liter bucket and covered. The bucket is wrapped in old blankets and the mixture allowed to ferment slightly.

Of the 150 households interviewed, 112 (74.7 percent) make bojalwa and/or khadi. Of these, 103 (92 percent) use wood as their source of energy; one uses a combination of wood and dung. Forty-nine respondents make khadi daily, as the berries and tubers are readily available, and 62 brew bojalwa at least once a month.

In addition to providing heat for cooking and light, an open fire is used day and night for protection from the cold. In Ditshegwane, it is virtually the only source of heat.

Table 9. Protection from the Cold -- Ditshegwane

<u>Method</u>	<u>Number Who Use</u>	<u>Percentage of Total</u>
hot drinks	2	1.3
sleep	10	6.7
clothing	48	38.7
bask in the sun	68	45.3
blankets	138	92
open fire	142	94.7

To increase the efficiency of an open fire, 101 households reported building fires indoors during the winter. However, huts in Ditshegwane are built with a 10- to 25-centimeter space between the wall and roof, which lets warm air escape from the dwelling.

Burns are also a hazard. The FWE reported that she treats an average of three burn cases per week during the winter. Usually, these are children who fall into fires while warming themselves or adults whose blankets catch fire while they are asleep. At the time of the survey, one child fell into an open fire and was burned too severely for treatment by the local FWE-- he died by the time he reached the clinic 15 kilometers away.

During the survey, villagers were observed sitting in front of fires, drinking khadi, until it was "warm enough" to start moving around the village or time to report for drought relief work. This could be any time between eight and 10 in the morning. In the evening, people gathered around small fires, again to keep warm.

In summary, the energy source for domestic activities in Ditshegwane is almost exclusively fuelwood. The primary constraint on the domestic energy supply is a lack of food, which limits the amount of human energy available for collecting wood. Burns are a major stated problem. The general level of poverty in Ditshegwane holds little hope for improvement of the villagers' lot.

3. Agricultural Energy Use

Agriculture in Ditshegwane is highly traditional--virtually all tasks are done by hand. The western Kweneng area is semiarid, and the current drought has further discouraged agricultural production. Crop yields are often poor, which

results in a lack of seeds for planting the following year. In Ditshegwane, 40 households (27 percent) do not have agricultural land, and an additional 14 (9.3 percent) do not own or have access to draft animals for plowing. Stated problems included a lack of human and animal power and/or money to hire them, as well as physical strain.

Table 10. Energy Use in Agriculture -- Ditshegwane

Activity	Human Power		Animal Power		Diesel/Gasoline	
	No.	% of 150	No.	% of 150	No.	% of 150
plowing	94	63.6	94	63.6	+2	1.3
sowing	97	64.7	0	0	0	0
weeding	94	63.6	0	0	0	0
harvesting	96	64	0	0	0	0

4. Energy Use In Transportation

The human energy required to gather fuel in Ditshegwane and the strain on this energy source is perhaps even more dramatic when transportation is examined. Residents walk almost everywhere. The village itself is small (three square kilometers) and the cattle are kept nearby, but agricultural lands and wood collection areas are three to seven kilometers from the center of the village. The nearest clinic is in Letlhakeng, 15 kilometers from Ditshegwane, and virtually everyone who goes there walks.

Table 11. Energy Use in Transportation -- Ditshegwane

Activity	Human Power		Animal Power		Diesel/Gasoline*	
	No.	% of 150	No.	% of 150	No.	% of 150
collect wood	143	95.3	16	10.7	0	0
carry water	146	97.3	1	1	0	0
gather thatch	64	42.7	39	26	0	0
get clay	137	91.3	2	1.3	0	0
go to cattle post	49	32.7	2	1.3	2	1.3
go to clinic	131	87.3	1	1	23	15.3

*In addition, 11 respondents reported using lorries when they went shopping--two to Gaborone, five to Letlhakeng and four to Molepolole.

5. Institutional/Commercial Energy Use

Village institutions and businesses also require energy to provide services. In Ditshegwane, this energy requirement is met primarily by firewood.

The school has a feeding program for its pupils, and in 1982, the enrollment was 396. Soft sorghum porridge and beans are cooked over an open fire for all the students each day. Wood is provided by the students, who each contribute a stick approximately 25 centimeters in diameter and 40 centimeters long. For lighting, the teachers use paraffin lanterns and candles for class preparations and other evening activities. The buildings are not heated during the winter.

The health post provides meals once a month to approximately 400 tuberculosis patients, pregnant women and children under five. There is no refrigeration, so the post does not store vaccines. For the occasional evening when someone needs emergency treatment, candles are used.

The water pump receives a 200-liter supply of diesel fuel each month. This is adequate, but the pump's actual monthly consumption was not determined.

In terms of shops and businesses, there is no refrigeration at either the trading store or the small restaurant. The store does not operate after dark and thus, does not require lights. The restaurant occasionally cooks fat-cakes using firewood, and it is open for a few hours in the evening, so about one candle a day is burned for lighting. The bar has a paraffin refrigerator and uses a seven-kilogram gas cylinder for lighting.

C. Conclusions

As already mentioned, the survey was conducted during the winter of a drought year. From the survey team's residence in the village, observations and interviews, it is clear that food and money were the villagers' foremost concerns. Of the most fundamental human needs, shelter is the only one being met in Ditshegwane. Food, in terms of both adequate nutrition and the sustenance of human energy, is the most pressing need in this village. Residents are aware of the need for food and see income as a possible solution. On the other hand, they have little hope of improving their situation alone and thus, look to external assistance to help effect changes.

Firewood is the major source of energy used in Ditshegwane to meet both domestic and institutional requirements. The principal energy-consuming activities are cooking, heating water (including that used for brewing) and keeping warm. The wood used for domestic and institutional activities is collected an

average of 3.66 times per week on foot. Agricultural work is performed manually, and transportation to places as far away as Letlhakeng (15 kilometers) is by foot. Human activity is the most significant energy resource in Ditshegwane--consequently, food is the most important energy source.

Although food production is outside the scope of this project, BRET activities must be selected and developed in ways that will improve and sustain human energy by conserving it and/or generating income. Given the amount of time that villagers spend gathering firewood, technologies that conserve this fuel should be given a high priority.

V. RESULTS FOR SHOSHONG

A. Village Description

1. Physical Characteristics

Shoshong is easily accessible. It is connected with its eastern neighbor, Mahalapye, by 42 kilometers of dirt road. Mahalapye is a major village on the blacktop road between Gaborone and Francistown, just north of the Tropic of Capricorn. Serowe, the headquarters for the Central district, is directly linked to Shoshong by a northbound road that will soon be paved.

Shoshong's natural landscape is dominated by hills rising on the north, south and southwest, and the Shoshong River, which passes through the western side of the village. Tree savannah is the predominant vegetation. Firewood is collected from areas seven to 12 kilometers away and agricultural lands are located up to 20 kilometers from the center of the village.

Man-made additions to the landscape include many interconnecting roads suitable for lorries and donkey carts; a series of telephone poles that carry lines into government offices, schools, the clinic and some shops and private residences; and two large towers which support windmills for pumping water--only one of the mills is operational. In addition, three diesel-powered pumps supply water via a reticulation system that runs throughout the village. The average borehole depth is 55.3 meters, but only two of the three boreholes in use produce potable water.

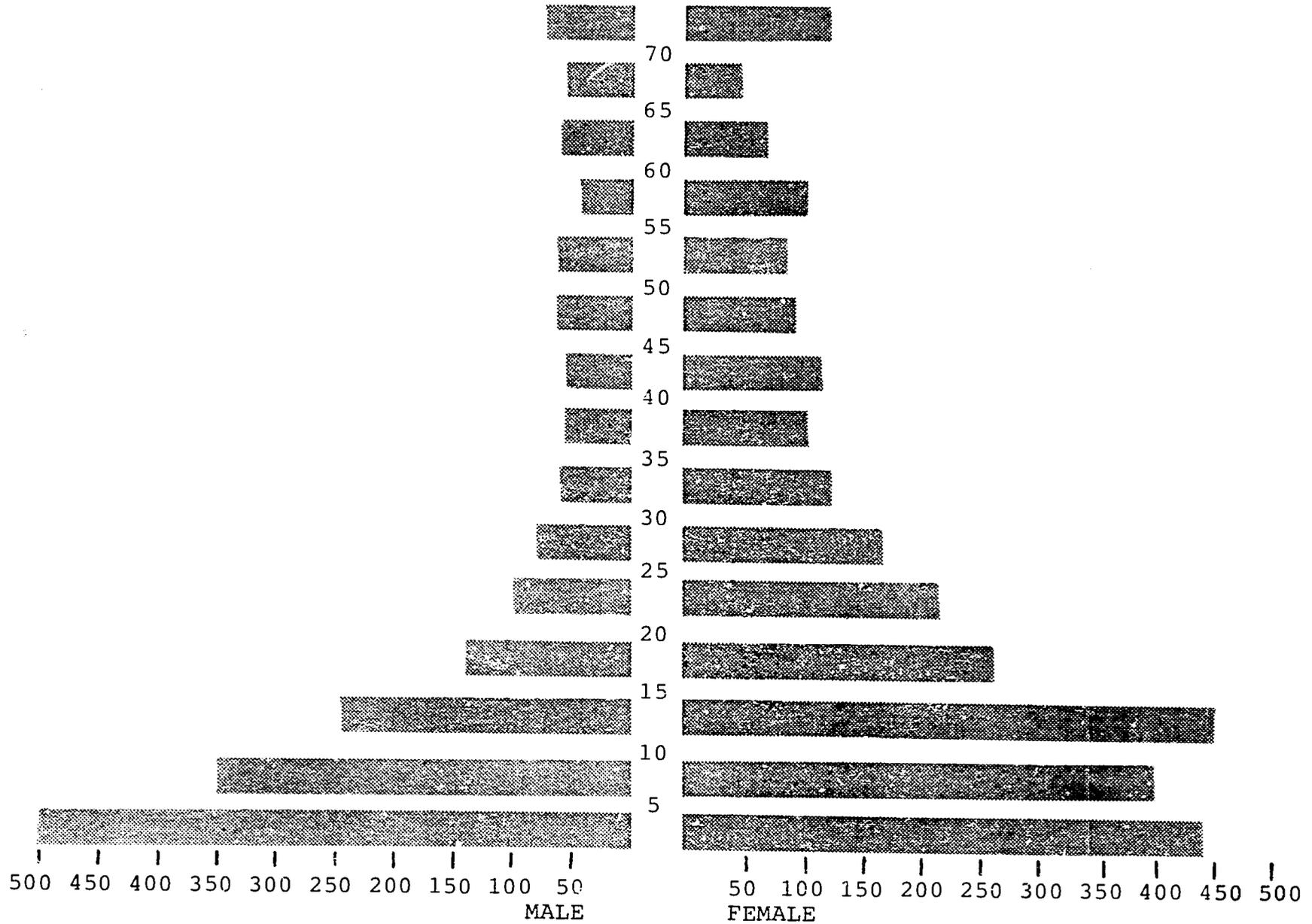
Originally, Shoshong was situated snugly between two hills. Today, the village covers an area of about 17 square kilometers, which stretches far beyond the shadow of these hills. This expansion has taken it across the Shoshong River, where it is now spreading westward into what is called Motseomosha (new village).

There are 787 households in Shoshong, and most are constructed of mud and thatch--693 (88 percent) have thatched roofs and 593 (75.3 percent), mud walls. There are 181 dwellings (23 percent) built of cement block; about half of these have thatched roofs and half, zinc or iron. A brush or shrub fence usually defines the household compound, while a mud-walled lolwapa encloses the outdoor living space and individual buildings.

2. Demographics

The 1981 census enumerated 4,600 Shoshong residents. The population pyramid in Figure 4 shows that 58.2 percent of the

Figure 4. Population Pyramid -- Shoshong



population is female and 61.2 percent, under 20 years of age. Some 63 percent of the population has had some formal schooling. Of the male population between the ages of 25 and 34, 50 percent are absent from the village, working in mines.

People in Shoshong have traditional skills in agriculture and building. They also have experience with more modern machinery, tools and equipment, as Table 12 indicates.

Table 12. Village Skills -- Shoshong

<u>Skill</u>	<u>Number of Households</u>	<u>Percent of Total (165)</u>
building with clay	143	86.7
riding a bicycle	140	84.8
using sewing machine	73	44.2
driving motor vehicle	51	30.9
making baskets	41	24.8
woodworking	38	23
working with cement	36	21.8
metal working	25	15.2
repairing machines	24	14.5
organizing groups	23	13.9

3. Administration/Organizations

Customary law is administered by the chief, Mr. M. Monamodi, his deputy and the headmen of Shoshong's two wards. A Sub-land Board Office handles the allocation of community-held land. A 23-member VDC plans and implements village development projects, and acts as a liaison between the village and the District Council. VDC projects have included planting a village woodlot, organizing resources for a secondary school and construction of a community center, where literacy classes, ballroom dancers and other groups can meet.

The VET is composed of the Senior Assistant Community Development Officer, two Agriculture Demonstrators, two FWEs, the head teachers of the two primary schools and the ALGL. The members of this team administer social services and supply the community with practical education and information. To enhance community participation, the VET has organized specialized committees--the Farmers' Committee, Social Welfare Committee, Health Committee and PTA. These groups assist in assessing community needs and disseminating information. All VET members are ex officio members of the VDC, as is the chief.

There are also a number of active voluntary organizations in Shoshong, including the Botswana Council of Women (BCW), YWCA, 4B, Girl Guides, Boy Scouts, Bible Society and Student Christian Movement. These groups, especially the BCW, YWCA and 4B, provide

additional audiences for practical skills and information-sharing, and organizational projects include sewing classes, gardening and crafts.

In addition to the traditional kgotla system, these organizations and committees are important supplementary avenues for sharing information.

4. Institutions/Social Services

The two primary schools, the Shoshong and Kgamane Primaries, had a combined enrollment of 1,492 for 1982. The schools offer standards (grades) one through seven. However, there is no secondary school in Shoshong, so those who pass the standard 7 examination seek places in secondary schools throughout Botswana. Both schools have gardens, which produce vegetables for sale and the school feeding program.

Literacy instruction is provided to 283 people (151 women and 132 men) enrolled in the Department of Nonformal Education's Adult Literacy program. Standard lessons are taught by 20 Literacy Assistants under the supervision of the ALGL.

In terms of health services, the clinic is staffed by a nurse-midwife, two enrolled nurses, two FWEs and two General Health Assistants. There are two beds for inpatient care and a maternity ward. The clinic is also responsible for distributing food aid to the community's 28 tuberculosis patients, 60 malnourished children under five and 714 malnourished non-scholars under 10. Garden plots at the clinic are shared and maintained by the mothers of malnourished children under five. The FWEs supervise the garden and provide cooking/nutrition demonstrations for the mothers.

Potable water is reticulated to all parts of the village from three boreholes with diesel-powered pumps. Motseomasha has experienced rapid growth during the past two years, and the single standpipe on that side of Shoshong is considered inadequate. There are two private bore-holes in Shoshong--one with a diesel pump and one, a wind pump. The Department of Water Affairs installed a wind pump on a borehole around 1965, but it has been defunct for some time and the water's quality has not been checked since it quit operating.

Shoshong has ready access to Mahalapye, where transportation to the north and south by train and bus is available. There is bus service between Shoshong and Mahalapye three times a day for 65 thebe. Private lorries and other forms of transportation also carry passengers to points outside Shoshong. The post office provides communication services, including mail, telegram and telephone, thus increasing Shoshong's contact with the world at large.

In terms of small shops and businesses, there are nine shops and restaurants in Shoshong which carry a wide range of goods from bicycle parts to bread. There are also three bar/bottle stores and a Chibuku depot--a bottle store that sells only a commercial version of bojalwa. In addition to these private businesses, there are agricultural marketing and consumer food cooperatives.

5. Sources of Income

The businesses described above represent sources of income for a few village households. Other sources are given below in Table 13.

Table 13. Sources of Income -- Shoshong

<u>Source</u>	<u>Number of Households</u>	<u>Percent of Total (165)</u>
<u>Primary:</u>		
sale of cattle	57	34.5
selling beer	28	17
remittances	18	11
work	17	10.3
<u>Secondary:</u>		
selling beer	48	29.1
sale of cattle	21	12.7
remittances	21	12.7
work	5	3

The overall economic status of a household can be difficult to assess. Some major assets--e.g., cattle and agricultural implements--may not be readily apparent at a village household. Cattle are kept at cattle posts, while tractors, plows, cultivators and even draft animals may be at agricultural lands for the duration of the growing season. Remittances from working relatives may fluctuate and a household's crop(s) may be sent to family members working in towns or larger villages. A preliminary economic assessment of Shoshong households is shown in Table 14.

Table 14. Economic Status of Households -- Shoshong

<u>Economic Status</u>	<u>Number of Households</u>	<u>Percent of Total (165)</u>
very poor	20	12.1
poor	37	22.4
middle to poor	57	34.6
middle	42	25.5
rich	7	4.2
very rich	1	.6
undetermined	1	.6

Determination of a household's status was based on subjective criteria, including economic activity, sources of income, ownership of livestock, agricultural implements and household equipment. Seasonal fuel use measurements will be taken for a stratified sample from these categories beginning in July to determine whether there are any differences in fuel consumption patterns related to a household's economic status.

B. Survey Findings

1. Household Fuel Use by Type

Frequencies for household fuel use by type are shown in Table 15.

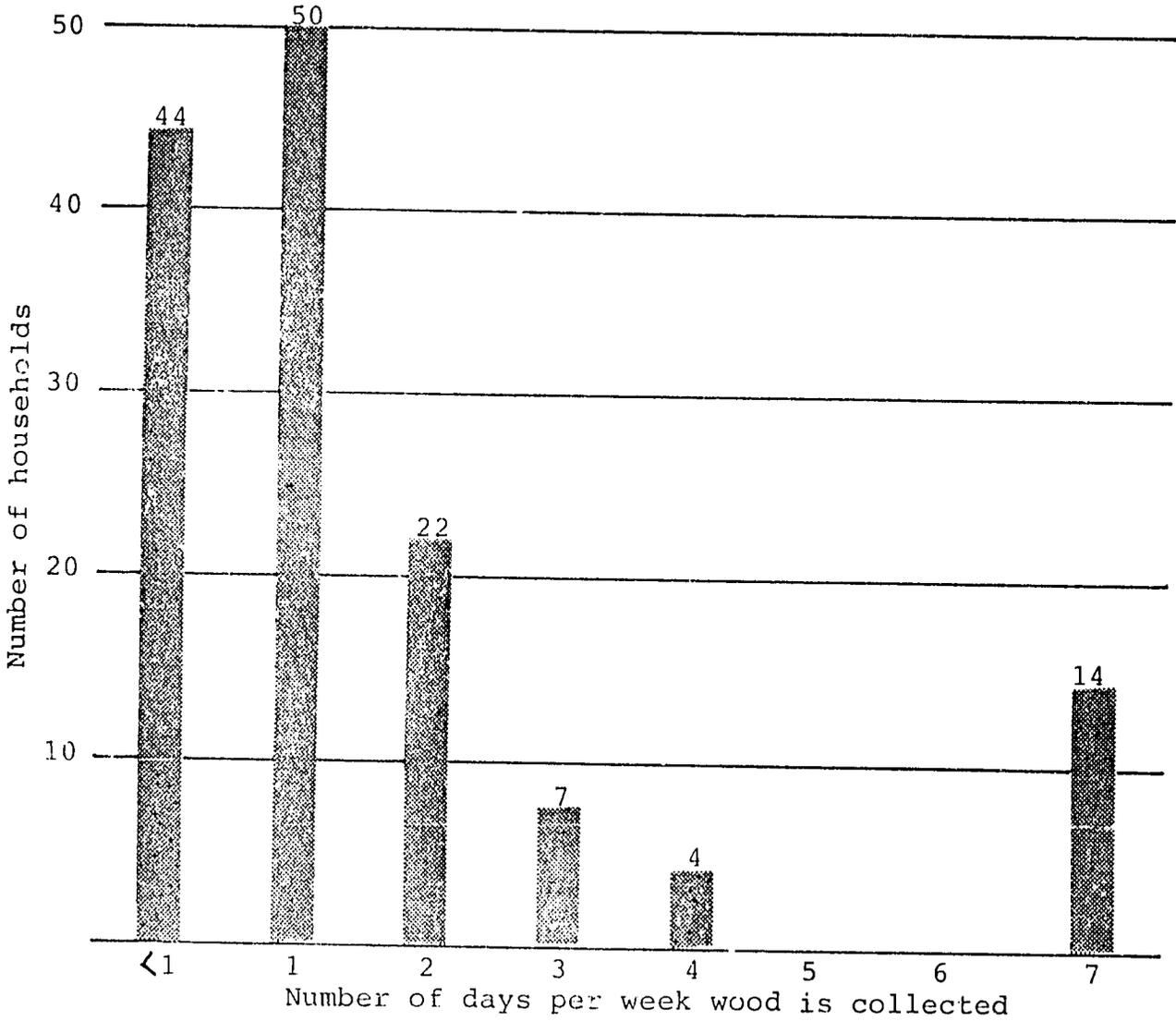
Table 15. Frequency of Fuel Use by Type -- Shoshong

<u>Fuel</u>	<u>No. of Households</u>	<u>Percent of Total (165)</u>
wood	163	99
dung	4	2
agricultural residues	0	0
paraffin	154	93
diesel fuel/gasoline	19	12
gas	9	6

Because wood is used in virtually every household, fuelwood collection patterns deserve some elaboration (see Figure 5). Gathering wood is a daily activity in only 14 (9.2 percent) of the households interviewed. Conversely, in 12 homes (7.8 percent), wood is collected less than once a month. The type of transportation available dictates the distance traveled to collect firewood, and the combination of distance and transportation constrains the number of trips per week. The average distance traveled from the center of the village is 7.5 kilometers, but the range is from five to 15 kilometers.

Figure 5

Frequency of Wood Collection -- Shoshong



Total number of trips per week - 229

Total number of households - 141

Mean - 1.6

Standard deviation - 2.03

Although the distances people travel to collect firewood are great, and villagers state that there are shortages even at such distances, preferences and taboos still affect the types of wood gathered. According to respondents, the preferred woods (listed in Table 16) are those which produce many coals, burn well for a long time and are not smoky.

Table 16. Preferred Types of Wood -- Shoshong

<u>Species</u>	<u>No. Who Prefer</u>	<u>% of Total No. Preferences (134)</u>
mokoba (<i>Acacia nigrescens</i>)	77	58
motswere (<i>Combretum imberbe</i>)	68	51
mohudiri (<i>Combretum apiculatum</i>)	65	49
moloto (<i>Acacia erubescens</i>)	36	27
mosu (<i>Acacia tortilis</i>)	36	27
mongana (<i>Acacia mellifera</i>)	29	22
moselesele (<i>Acacia dichrostachys cinerea</i>)	11	8
other	18	13

In addition, there are some types of wood that are not used in 99 (66 percent) of the households surveyed. Table 17 lists the types of wood associated with taboos, which result in bad luck and ill health for people and cattle.

Table 17. Wood Taboos -- Shoshong

<u>Species</u>	<u>No. of Households</u>	<u>% of Total No. of Stated Taboos (99)</u>
mokgalo (<i>Ziziphus mucronata</i>)	43	43
mosetlha (<i>Peltoporum africanum</i>)	43	43
motopi (<i>Boscia albitrunca</i>)	27	27
morobe (<i>Zimelia</i> spp.)	13	13
other	43	43

The shortage of firewood is perceived as a problem in Shoshong--61 percent of the respondents cited it as the major problem associated with keeping warm in winter, 60 percent for cooking and 44 percent for baking. During the fuel measurement and observation periods, enumerators did report households with no firewood to measure. Thus, although residents do have wood preferences, fuelwood is collected outside an eight-kilometer radius of the village's center and people state that the shortage of firewood, their primary fuel, is a problem.

Of the households surveyed, 94 percent purchased fuels, and paraffin for lighting is the predominant purchased fuel. The use of purchased fuels was examined in the 32 households where fuel measurements were taken. Paraffin was purchased by 94 percent of those households. Table 18 summarizes their fuel purchases. It should be noted that although batteries are in widespread use, their retail price is not given because it varies by size.

Table 18. Purchased Fuels -- Shoshong

Fuel	Average Retail Price (Pula)	No. Households Purchasing	Percent of Total (32)	Pula Spent per Hhld. per Month
paraffin	0.54/750 ml	30	94	1.99
batteries	na	20	63	1.85
diesel	0.592/liter	6	22	35.00
candles	0.11/stick	5	16	0.36
gas	3.65/seven kg	4	13	2.55
gasoline	0.7227/liter	1	3	35.00

2. Energy Use in Domestic Activities

Fuels used for all household activities include wood, dung, paraffin and gas. Domestic activities that require energy are cooking, lighting, baking, brewing beer and space heating. Table 19 summarizes fuel use by type for the various domestic activities in the 165 households surveyed. The remainder of this section describes the energy use patterns for specific household activities in greater detail.

Table 19. Fuel Use by Domestic Activity -- Shoshong

Activity	Wood	Dung	Paraffin	Gas
cooking	160 (97%)	4 (2%)	12 (7%)	9 (5%)
baking	122 (74%)	11 (6.7%)	2 (1%)	4 (2%)
lighting	na	--	154 (93%)	1 (0.6%)
brewing beer	116 (70%)	7 (4%)	--	--
space heating	96 (58%)		2 (1%)	1 (0.6%)

For cooking, wood is used as a fuel in 97 percent of the households interviewed. Only four of these households have wood stoves--the rest cook over an open fire in three-legged, cast-iron pots, which come in standard sizes. Sizes one, two and three are the most prevalent (see Table 20), with either larger or smaller sizes used regularly in fewer than 25 homes. Although 46 households reported owning paraffin stoves, only 12 indicated that they used paraffin regularly as a cooking fuel.

Table 20. Frequency of Different Pot Sizes -- Shoshong

<u>Pot Size</u>	<u>Volume (liters)</u>	<u>Number of Households Owning at Least One</u>	<u>Percentage of Total (165)</u>
one	2.5	102	81.8
two	5	85	51.5
three	7.5	69	41.8
four	10	45	27.2

The fuel measurements/observations revealed that an average of 3.4 kilograms of wood is burned in the evening fire, which is primarily used for cooking, but also heats water and provides light.

Table 21. Wood Used for Evening Meal and Activities

<u>Household Size</u>	<u>No. of Households</u>	<u>Pct. of Total (32)</u>	<u>Wood Used</u>
one to three	1	3.12	2.8 kg
four to six	18	56.2	4 kg
seven to 10	8	25	3.8 kg
11 to 15	3	9.3	5.6 kg

Most of the households in Shoshong cook at least twice a day. Soft porridge and tea are the basic menu for breakfast. The midday meal is usually a combination of porridge, samp, rice, meat and vegetables. The evening meal is dominated by porridge, but bread, meat, samp and vegetables may also be served.

Table 22. Frequency of Cooked Meals --Shoshong

<u>Meals Cooked per Day</u>	<u>No. of Households</u>	<u>Pct. of Total (165)</u>
one	15	9
two	38	23
three	105	64
no response	7	4

In terms of baking bread, bread is delivered daily from Mahalapye and sold commercially in Shoshong, but 129 households reported baking at least once a month. An open fire is used by 87 percent of those who bake. Four households use gas ovens and two, wood ovens.

Food preservation is an energy-consuming activity in the three households that own paraffin refrigerators. The rest of

households surveyed preserve meat and vegetables using traditional, sun-drying methods.

Lighting is the major end use of paraffin in Shoshong. Of the households interviewed, 154 (93 percent) reported owning and using paraffin lamps. Paraffin consumption for lighting in the evening by the 32 households where fuel measurements were taken is shown in Table 23. One household used gas for lighting.

Table 23. Paraffin Consumption for Lighting -- Shoshong

<u>Household Size</u>	<u>No. of Households</u>	<u>Avg. Paraffin Consumption</u>
one to three	1	25 ml
four to six	18	106 ml
seven to 10	8	72 ml
11 to 15	3	96 ml
more than 15	1	225 ml

Relative to brewing beer, sorghum beer is made for sale by 111 (67 percent) of the households surveyed. Of these, 71 brew more than 100 liters at a time. Only five households brew khadi.

Concerning protection from the cold, 100 respondents (60.6 percent) heat their homes in winter. Of these, 95 use an open fire; two, wood stoves; two, paraffin heaters; and one, a gas heater. Despite the prevalence of open fires indoors, burns were not mentioned as a problem, and the Shoshong clinic confirmed that burn cases are very rare.

In summary, a lack of fuel was a major concern for 80 of the households interviewed, regardless of fuel type, but the shortage of firewood is a particularly acute problem because 97 percent of the households use it for cooking. The major uses of energy for domestic activities are cooking, lighting and space heating. Firewood is the predominant fuel for cooking and heating and paraffin for lighting. Additional village energy requirements occur in the areas of agriculture, transportation, institutions and small businesses.

3. Agricultural Energy Use

Of the households surveyed, 134 (81 percent) have agricultural lands. Although some use tractors, traditional methods prevail. Twelve of the respondents own tractors and 15, draft animals. Problems associated with agriculture include the physical labor involved and a lack of money to hire tractors or draft animals.

Table 24. Energy Use in Agriculture -- Shoshong

Activity	Human Power		Animal Power		Diesel/Gasoline	
	No.	% of 165	No.	% of 165	No.	% of 165
plowing			113	68.5	17	10.3
sowing	130	78.8	6	3.6	0	0
weeding	147	89.1	0	0	0	0
harvesting	144	87.3	0	0	0	0
threshing	142	86.1	0	0	3	1.8

4. Energy Use in Transportation

In this area, physical effort was the most frequently mentioned problem. The lack of money to purchase diesel fuel or gasoline was also noted occasionally, but did not prevent activities requiring transportation.

Table 25. Energy Use in Transportation -- Shoshong

Activity	Human Power		Animal Power		Diesel/Gasoline	
	No.	% of 165	No.	% of 165	No.	% of 165
collect wood	106	64.2	34	20.6	13	7.9
to cattle post	25	14.2	28	17	46	27.9
to agric. lands	62	37.6	69	41.8	77	46.7
carry water	157	95.2	2	1.2	1	0.6
gather thatch	28	17	39	23.6	75	45.5
collect clay	137	83	1	0.6	0	0

5. Institutional/Commercial Energy Use

Both primary schools have feeding programs. The students provide the fuelwood for cooking, which places an additional burden on the community's wood supply.

The clinic currently uses bottled gas for refrigeration, lighting in the delivery room and its stove. Instruments are sterilized in a small autoclave, using the stove. A detailed assessment of the clinic's energy requirements is being conducted to determine its suitability as a site for one of the BRET project's photovoltaic refrigeration and lighting installations.

Small shops/businesses use and sell fuel. A total of 17 such establishments were interviewed--one marketing cooperative, a garage, a Chibuku depot, two grinding mills, three bar/bottle stores and nine shops/restaurants. Commercial end uses of energy include refrigeration, lighting, cooking and grinding grain.

The three bar/bottle stores have refrigerators--two use paraffin and the third, gas. Three of the shops also have paraffin refrigerators. The gas refrigerator uses approximately three kilograms of fuel per week, while paraffin consumption ranges from eight to 20 liters a week.

Three shops and two bar/bottle stores use gas for lighting, and one shop and the Chibuku depot use paraffin. Five shops and one bottle store do not light their establishments.

Wood is the only fuel used for cooking by the four businesses that do so. Only one has a wood-burning, cast-iron stove.

The grinding mills spend P30 a month on diesel fuel.

Businesses in Shoshong buy stock from Mahalapye. Their fuel costs for transportation range from P20 to P208 per month for the nine establishments that could provide a figure.

All nine shops sell paraffin and candles. The mean price for 750 milliliters of paraffin is P0.54 and for candles, P0.11 per stick. Diesel fuel and gasoline are sold at the cooperative for P0.592 and P0.7227 per liter, respectively. Bottled gas is not available in Shoshong--it must be bought in Mahalapye.

Table 26. Retail Fuel Prices -- Shoshong

<u>Fuel</u>	<u>Mean Price (Pula)</u>	<u>Source</u>
paraffin	0.54 per 750 milliliters	9 shops
candles	0.11 per stick	9 shops
diesel fuel	0.592 per liter	co-op only
gasoline	0.7227 per liter	co-op only

C. Conclusions

Cooking, space heating, water heating and lighting are the major domestic uses of energy in Shoshong. Wood is the predominant energy source--97 percent use firewood for cooking, and 60 percent feel that the shortage of wood is a major problem associated with cooking. Paraffin is the principal fuel used for lighting--it is readily available, as all nine retailers in Shoshong sell it and have easy access to supplies from Mahalapye.

The village water supply is inadequate, particularly for the rapidly expanding area on the western side of Shoshong. Wind power represents a potential renewable energy resource for water pumping. Residents' health needs are being adequately met at this time, but the clinic relies exclusively on bottled gas.

Although Shoshong residents are knowledgeable about technologies that rely on nonrenewable energy sources (e.g., paraffin lamps and stoves, gas cookers and refrigerators), most of their domestic activities rely on firewood, which is becoming scarce. As a result of interest and organizations in the village, a community woodlot for building poles has been established as a partial solution to this problem. BRET activities should build on this interest and supplement this solution by examining the potential for fuelwood development and introducing wood-conserving devices. All the project's activities should be integrated with the work of existing organizations, which are strong and active, especially the VDC, YWCA and BCW.

VI. COMPARATIVE SUMMARY OF RESULTS

The similarities and differences between the survey results for Ditshegwane and Shoshong have implications for the BRET project. The similarities relate to energy use patterns, in terms of both fuels and devices, while the differences pertain to the social and economic features of the two villages. Both actors will combine to determine technology selection and dissemination strategies.

In both Shoshong and Ditshegwane, firewood is used by virtually all (97 percent) households for cooking. It is the predominant cooking fuel, even when families own stoves and have access to reliable supplies of paraffin and/or gas. Firewood is also the primary fuel for space and water heating.

Gathering firewood is a perceived problem in both villages, but for different reasons. In Ditshegwane, villagers consider the distances that must be traveled to collect wood and the consequent physical exertion as the problem. In Shoshong, the difficulty is described as a wood shortage. It is interesting to note that Ditshegwane residents travel up to five kilometers to gather wood, while Shoshong villagers may go as far as 12 kilometers to find wood. However, people in Ditshegwane suffer from food shortages, which increases the physical strain of gathering firewood.

Firewood conservation and easing the burden of collecting wood can be accomplished through the use of wood-conserving stoves and other fuel-efficient cooking devices, solar water heaters and improved building designs. The specific technologies selected, as well as their dissemination and use over the long term, will be affected by other characteristics of the villages and users. Although the wood-conserving devices developed by the project will be generally applicable in both locations, the villages will undoubtedly differ greatly in terms of what is affordable and manageable within the local framework of existing skills and resources.

Residents of Ditshegwane expressed little hope of changing or improving their lot. They perceive themselves as poor, and in fact, almost all the households in Ditshegwane were classified as poor. Furthermore, the villagers expect things to remain as they are--when asked about their preferences for domestic equipment, their responses matched current practices. In Shoshong, on the other hand, only about a third of the households are considered poor. When queried about their preferences for household equipment, the villagers' replies reflected their aspirations and exposure to alternatives.

Traditional skills prevail in most Ditshegwane households. Few people there have experience with metal or machines. The

residents of Shoshong households possess a broad range of traditional and more modern skills.

The membership in organized groups in Ditshegwane is overlapping--a few individuals participate in most of the activities. This fact limits the potential of the different groups to reach the entire village population. In contrast, Shoshong has distinctly different groups of members in several organizations, thus providing ready-made channels for user tests, demonstrations and dissemination.

APPENDIX A

Survey Questionnaires

Ditshewane

**BOTSWANA RENEWABLE ENERGY TECHNOLOGY PROJECT
TIISO LE NTSHAFATSO YA BORANYANE JA MAATLA MO BOTSWANA**

Village Energy Use Survey

Tsheka Tsheko Ya Tiriso Ya Maatla Mo Motseng

The purpose of this survey is to collect information on energy use practices in rural Botswana, to guide the development of the Botswana Renewable Energy Technology Project. Individual responses will be held in confidence and only compiled results will be shared.

Maikaelelo a tshekatsheko e ke go phutaganya dikitso tsa batho ka fa mokgweng o maatla a dirisiwang ka teng mo metseng mo Botswana. Tshekatsheko e e direlwa go thusa Lephata la Tiiso le Ntshafatso ya Boranyane ja Maatla mo Botswana go dira tiro ya lone mo motseng. Dikarabo tsa mongwe le mongwe di tla nna sephiri gare ga moarabi le babereki ba lephata le.

Village

Interviewer

Date

Household No.

Interviewee (optional)

1. How often do you cook ?
Lo apaya dijo ga kae ka letsatsi ?
2. At what time do you usually cook your meals ?
Lo apaya dijo tsa lona ka dinako dife ?
3. How long do your meals usually take to prepare ?
Go apaya dijo go lo tsaya lobaka lo lo kae ?

Morning hours
Mo mosong

Afternoon hours
Motshegare

Evening hours
Maitseboa

4. Which methods do you use for cooking ?
(Rank methods according to which is used most often. Indicate by putting 1 next to the method used most often, 2 next to the method used less often, etc.)

Ke methale efe e lo e dirisang mo go apeeng ?

(Fa methale e dinomoro ka go dira jaana: fa mothale o o dirisiwang thata 1, o o latelang 2, jalo jalo)

Open fire () *Molelo wa leiso*

Wood stove () *Setofo sa dikgong*

Coal stove () *Setofo sa malattha*

Paraffin stove () *Setofo sa parafini*

Gas stove () *Setofo sa gese*

Other (specify) () *Tse Dingwe*

5. If you use open fire for cooking, which fuels do you use? (Rank as in 4.)

Fa lo dirisa molelo wa leiso go apaya, lo dirisa dilo dife tsa molelo ? (Fa dinomoro jaaka mo go 4.)

Wood () *Dikgong*

Dung () *Dibi*

Stalks () *Matlhaka*

Cobs () *Ditlhotlha*

Other (specify) () *Tse Dingwe*

6. If you use a wood stove, which fuels do you use? (Rank as in 4.)
Fa lo dirisa setofo sa dikgong, lo dirisa dilo dife tsa molelo ? (Fa dinomoro jaaka mo go 4.)

Wood () *Dikgong*
Stalks () *Matlhaka*
Cobs () *Ditlhotlha*

Other (specify) () *Tse dingwe*

7. What utensils do you use when you cook on the following:
Lo dirisa dijana dife fa lo apaya ka:

Open fire
Molelo wa leiso _____

Stove
Setofo _____

8. How often do you bake bread ?
Lo apaya borotho ga kae ?

9. Which methods do you use for baking bread ? (Rank as in 4.)
Lo dirisa mothale ofe mo go apeeng borotho ? (Fa dinomoro jaaka mo go 4.)

Open fire () *Molelo wa leiso*

Wood () *Dikgong*

Dung () *Dibi*

Wood oven () *Onto ya dikgong*

Coal oven () *Onto ya malatlha*

Gas oven () *Onto ya gese*

Other (specify) () *Tse Dingwe*

10. What utensils do you use when you bake on the following:
O dirisa dijana dife mo go apeeng borotho fa o apaya ka:

Open fire
Molelo wa leiso _____

Oven
Onto _____

11. If you had your choice, which of the fuels, devices and utensils would you use for cooking ?
Fa o ne o ka fiwa sebaka sa go itlhophela, o ne o ka tlhopa dilo tsa molelo dife, methale ya go apaya efe, le dijana tse di apeelang dife ?

12. Which of the fuels, devices, and utensils would you use for baking bread ?
O ne o ka tlhopa dife go apaya borotho ?
13. How often do you brew beer ?
Lo apaya bojalwa ga kae ?
14. What fuel do you use when brewing beer ?
O dirisa dilo tsa molelo dife mo go apeeng bojalwa ?
15. What methods do you use for lighting ? (Rank as in 4.)
Lo dirisa eng mo go boneseng ? (Fa dinomoro jaaka mo go 4 ko godimo)
- Open fire () *Molelo wa leiso*
- Gas lamp () *Lebone la gese*
- Paraffin lamp () *Lebone la parafini*
- Candle () *Kerese*
- Torch () *Toche*
- Other (specify) () *Tse dingwe*
- _____
- _____
16. How many hours each evening do you use a light ?
Lo bonesa matlo lobaka lo lokae mo maitseboeng ?
17. How often do you press clothes ?
O gatisa diaparo ga kae ?
18. What fuel do you use for heating the iron ?
O dirisa eng go thutafatsa kgatiso ?
19. What type of device do you use to press clothes ?
O dirisa kgatiso e e ntseng jang ?
20. What kinds of pedal or treadle driven machines have you had experience operating ?
Ke mefuta efe ya mechine e e tsamaisiwang ka maoto e o kgonang go e dirisa ?
21. What kinds of hand driven machines have you had experience operating ?
Ke mefuta efe ya mechine e e tsamaisiwang ka mabogo e o kgonang go e dirisa ?

22. Are there wood taboos
A go na le meila ya dikgong ?

Yes
Ee

No
Nyaa

(a) If yes, what are they ?,
Fa e le teng, ke efe ?

(b) Why would this wood not be used ?
Ke ka go reng fa dikgong tse di sa ka ke tsa dirisiwa ?

23. Are there wood preferences ?
*A go na le mofuta mengwe ya dikgong
e o e ratang thata ?*

Yes
Ee

No
Nyaa

(a) If yes, what are they ?
Fa e le teng, ke efe ?

(b) Why do you prefer using this type of wood ?
Ke eng o rata go dirisa mofuta o wa dikgong ?

24. During the winter, what do you do to keep yourself warm ?
Mo marigeng o dira jang go ithutafatsa ?

25. How do you keep your houses warm ?
Lo thutafatsa matlo a lona jang ?

26. What materials do you use for building houses ?
Lo dirisa eng go aga matlo ?

27. Which material do you prefer to use for building walls ?
O rata go dirisa eng mo go ageng mabotlana ?

28. Which material do you prefer for roofing ?
O rata go dirisa eng mo ditlhomesong le dirulelo ?

29. Which type of house do you prefer, round or rectangular ?
O rata moago wa mofuta ofe, rantafole, gaisi, kana polata ?

30. Why do you prefer this shape ?
O rata moago o ka go reng ?

31. What skills do the members of this household have ?
Batho ba lwapa le ba na le boitseanape mo go eng ?

Thatching roofs () *Go rulela*

Working with wood () *Go betla*

Building/working with clay/soil () *Go aga/bopa Ka mmu)mmopa*

Building with cement/concrete () *Go aga ka semente/konkreiti*

Painting () *Go penta*

Working with metal () *Go dirisa ditshipi*

Repairing machines () *Go baakanya mechine*

Repairing engines () *Go baakanya diengine*

Driving motor vehicles () *Go kgoetsa*

Making baskets () *Go dira ditlatlana*

Weaving cloth () *Go loga matsela*

Tanning and sewing leather () *Go suga le go roka matlalo*

Making clothes () *Go roka*

Organizing group activities () *Go goga Mekgatlo*

Other (specify) () *Tse dingwe*

32. Would you allow me to spend a day observing your routine?
A o ka ntetlelela go tla go go lebelela o dira ditiro tsa gago tsa mo lwapeng go tswa mosong go tsema maitseboa ?

Yes
Ee

No
Nyaa

FUEL USE

FUELS <i>Dilo tse di dirisiwang mo go apeeng le mo go boneseng</i>	Types <i>Mehuta</i>	Amount used per week <i>Selekanyo se se dirisiwang ka beke</i>		Months used <i>Dikgwedi tse dilo tse di dirisiwang</i>	Place where fuel is obtained <i>Ko di rwalelwang/ rekiwang teng</i>	How often it is collected per week <i>Di rwalelwa/rekiwa ga kae ka beke</i>	Time it takes to collect <i>Nako e tsewang go rwalela</i>	Distance <i>Sekgala</i>
Wood <i>Dikgong</i>								
Dung <i>Dibi</i>								
Stalks <i>Matlhaka</i>								
Cobs <i>Ditlhatlha</i>								
Other (specify) <i>Tse dingwe</i>								
Purchased fuels <i>Tse di rekiwang</i>		Amount used per week <i>Selekanyo ka beke</i>	Amount spent for fuel per week <i>Madi a a duelwang ka beke</i>					
Batteries <i>Dibetiri</i>								
Wood <i>Digkong</i>								
Paraffin <i>Parafini</i>								
Coal <i>Malatlha</i>								
Gas <i>Gese</i>								
Candles <i>Dikerese</i>								
Diesel <i>Disele</i>								
Other (specify) <i>Tse dingwe</i>								

Activity <i>Tiro</i>	Methods used <i>Methale e e dirisiwang</i>	Who does this activity? <i>Ke mang yo o dirang tiro e ?</i>	What are your problems related to this activity ? <i>Ke mathata afe a o lebaganang le one go dira tiro e ?</i>
Ploughing <i>Go Lema</i>			
Fertilizing <i>Go dira motshothelo</i>			
Sowing <i>Go Jala</i>			
Weeding <i>Go Tlhagola</i>			
Harvesting <i>Go Roba</i>			
Storing Harvest <i>Go Boloka Thobo</i>			
Drying vegetables and meat <i>Go Omisa merogo le nama</i>			
Keeping food fresh <i>Go dira gore dijo di seka tsa senyega</i>			
Keeping water cool <i>Go tsidifatsa metsi</i>			
Keeping milk fresh <i>Go dira gore mashi a seka a rema</i>			
Making sour milk <i>Go dira madila</i>			
Grinding grain <i>Go thuga</i> <i>Go sila (mabele)</i>			

Shoshong

**BOTSWANA RENEWABLE ENERGY TECHNOLOGY PROJECT
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Village Interviewer

Date Household No.

Interviewee (optional)

No. in Household present

..... absent

1. Which devices do you use for cooking ?
Lo dirisa methale efe ya go apaya ?

2. If you use open fire, which fuels do you use ?
Fa lo dirisa molelo wa leiso, lo dirisa dilo dife tsa molelo ?

3. If you use a stove, which fuels do you use ?
 (Enumerator note: Describe the stove)
Fa lo dirisa setofo, lo dirisa dilo dife tsa molelo ?

4. What things does the family have for cooking, baking, keeping warm and other household activities ?
 (Write the number and size)
Batho ba lolwapa le ba dirisa dilo dife mo go apeeng, go itshereletsa mo serameng, jalo, jalo ?
(Kwala palo le selekanyo)

.....	Tripod stand <i>Letshego</i>	.....	Gas cooker <i>Setofo sa kese</i>
.....	Primus stove (working/not working) <i>Setofo sa parafini</i>		
.....	3 legged pots <i>Pitsa tsa maotwana</i>	.....	Wood stove /oven <i>Setofo/onto ya dikgong</i>
.....	Size		
.....	Size .....	.....	Mortar and Pestle <i>Kika le Motshe</i>
.....	Size .....	.....	Paraffin heater <i>Hitara ya parafini</i>
.....	Size		
.....	Tea kettle <i>Ketele ya tee</i>	.....	Paraffin lamps <i>Mabone a parafini</i>
.....	Flat saucepans <i>Dipane</i>	.....	Hand grinding mill <i>Tshilo va diatla</i>
.....	Water tins <i>Moteme/Mmolopita</i>	.....	Refrigerator (paraffin/gas) <i>Setsidifitse sa (parafini/kese)</i>

5. Do you cook everyday
A lo apaya malatsi otlhe

If no, how often do you cook
Fa lo sa apeye malatsi otlhe, lo apaya ga kae

6. At what times do you cook ?
Lo apaya dijo ka dinako dife ?

7. How many people do you cook for ?
Lo apeela batho ba le kae mo lwapeng ?

in morning
mo mosong

afternoon
motshegare

evening :
maitseboa

8. What foods do you usually cook ?
Lo apaya dijo tsa mohuta ofe ?

in morning
mo mosong

afternoon
motshegare

evening
maitseboa

9. How long does it take to prepare meals ?
Go apaya dijo go lo tsaya lobaka lo lo kae ?

in morning
mo mosong

afternoon
motshegare

evening
maitsebo

10. What problems do you have related to cooking ?
Ke mathata afe a lo lebaganang le one mo go apeena ?

11. If you had a choice, which of the fuels, devices and utensils would you use for cooking ?
Fa o ne o ka fiwa sebaka sa go itlhophele, o ne o ka tlhopha dilo dife tsa molelo, methale efe ya go apaya, le dijana dife tse di apeelang ?

Fuels
Dilo tsa molelo

Utensils
Dijana tse di apeelang

Devices
Methale ya go apaya

12. Other than for cooking, what do you heat water for
Kwa ntle ga go apaya, lo thutafatsa metsi go dirisa mo go eng

13. At what times do you heat water ?
Lo thutafatsa metsi ka dinako dife ?

14. Do you ever make a fire just for heating water
A lo atle lo gotsi molelo fela go thutafatsa metsi

15. How much water do you heat each day ? Pot size
Lo thutafatsa metsi a le kana kang ka letsatsi ? Ka selwana se se kae

16. How many buckets of water does your family use each day ?
Lo dirisa dikgamelo tsa metsi di le kae ka letsatsi ?

17. Do you bake bread ?
A lo a tle lo bese/beike borotho

Yes No
Ee Nyaa

How often
Ga kae

18. What method do you use for baking (if an oven is used, describe the oven)
Lo dirisa methale efe ya go besa/beika borotho

What fuels do you use
Lo dirisa dilo tsa molelo dife

19. What problems do you have related to baking ?
Ke mathata afe a lo lebagang le one mo go beikeng borotho ?

20. If you had your choice, which of the fuels, devices and utensils would you use to bake bread ?
Fa o ne o ka fiwa sebaka sa go itlhophela, o ne o ka tlhophela dilo dife tsa molelo, methale efe ya go beika, le dijana dife tse di beikelang ?

Fuels
Dilo tsa molelo

Utensils
Dijana

Devices
Methale

21. How often do you make khadi ?
Lo bidisa khadi ga kae ?

Estimate how many litres ?
Selekanyo se se bidisiwang ?

Is this for home use or for sale ?
A lo bidisetsa go nwa mo gae kana go rekisa ?

What fuels do you use ?
Lo dirisa dilo tsa molelo dife go bidisa ?

22. How often do you brew bojalwa ?
Lo apaya bojalwa ga kae ?

Estimate how many litres
Selekanyo se se apewang

Is this for home use or for sale or both
A lo bidisetsa go nwa mo gae kana go rekisa kana tsothe ka bobedi

What fuels do you use ?
Lo dirisa dilo tsa molelo dife ?

23. Do you use a radio ?
A lo dirisa seromamowa/wayelese

Yes No
Ee Nyaa

At what times of day do you use a radio
Lo dirisa seromamowa ka dinako dife

24. How do you keep your houses warm in winter ?
Lo thutafatsa matlo a lona jang mo marigeng ?

What kind of fuel do you use ?
Lo dirisa dilo dife tsa molelo ?

At what time(s) of day ?
Dinako dife tsa letsatsi ?

How long ?
Lobaka lo lo kae ?

25. What problems do you have related to this ?
Ke mathata afe a lo lebaganang le one mo go thutafatseng matlo ?

26. How do you keep your houses cool in summer ?
Lo tsidifatsa matlo a lona jang mo selemong ?

27. What problems do you have related to this ?
Mathata a lo lebaganang le one mo go tsidifatseng matlo a lona ke afe ?

28. What materials do you use for building walls ?
Lo dirisa eng mo go ageng mabotana ?

29. What materials do you use for roofing ?
Lo dirisa eng mo ditlhomesong le mo dirulelong ?

30. How often is household maintenance done ? How long does it take ?
Lo ntshafatsa matlo a lona ga kae ? Go lo tsaya nako e e kana kang ?

Job
Tiro

How often ?
Ga kae

How long does it take ?
Go tsaya lobaka lo lo kae ?

31. What problems do you have repairing buildings, furniture or household equipment and how do you solve them ?

*Mathata a lo lebaganang le one mo go ntshafatseng matlo a lona le go baakanya dilwana tsa ntlo ke afe?
Lo a kgona jang ?*

Equipment
Didirisiwa

Problem
Mathata

Solution
A kgonwa jang

32. What materials would you prefer to use for building walls
O ne o ka rata go dirisa eng mo go ageng mabotana

Why do you prefer these ?
Ke eng o rata dilo tse ?

What materials would you prefer to use for roofing
O ne o ka rata go dirisa eng mo dirulelong le mo ditlhomesong

Why do you prefer these ?
Ka go reng ?

33. Which type of house would you prefer, round or rectangular
O ne o ka rata mohuta o fe wa ntlo, ee lesakana kana e e dikhutlo tse nne

Why do you prefer this shape ?
Ke eng o rata moago o ?

34. Are there wood taboos ?
A go na le meila ya dikgong ?

Yes No
Ee Nyaa

- a) if yes, what are they ?
Fa e le teng, ke efe ?

- b) why would this wood not be used ?
Ke eng mohuta o wa dikgong o sa dirisiwe ?

35. Are there wood preferences ?
A go na le mehuta wa dikgong o le o ratang thata ?

Yes No
Ee Nyaa

- a) if yes, what are they ?
Fa e le teng, ke efe ?

- b) Why do you prefer using this type of wood ?
Ke eng o rata mohuta o wa dikgong ?

AGRICULTURE TEMO

36. What agricultural things does this household own ? Write the number of each:
Ke dilo dife tsa temo tse batho ba lulwapa le be nang le tsone

Lands	<i>Masimo</i>
Vegetable garden (fenced/unfenced)	<i>Tshingwana ya merogo (E ageletswe/ga e e agelelwa)</i>
Community garden	<i>Tshingwana ya merogo ya morafe</i>
Plough	<i>Mogoma o o lemang</i>
Tractor	<i>Terekere</i>
(Type)	<i>(mohuta)</i>
Planter	<i>Polantiri</i>
Cultivator	<i>Sekofole</i>
Hoe	<i>Mogoma o o thagolang</i>
Cart (oxen/donkey)	<i>Sekotshikara (sa dikgomo/ditonki)</i>
Sledge	<i>Selei</i>

- 37 What kinds of problems have you had with repair of equipment ?
 How and where was it solved ?
Ke mathata afe a lo lebanang le one mo go baakanyeng dilo tsa lolwapa ?
Mathata a le a kgor : jang ?

Equipment <i>Sedirisiwa</i>	Problem <i>Mathata</i>	how solved? <i>A kgonwa jang ?</i>

38. Number and location of domestic animals
Palo ya diruiwa le ko diruiwa di nnang teng

In the village All year <i>Mo motseng</i> <i>Ngwaga otlhe</i>	At cattle posts In summer <i>Ko morakeng selemo</i>	Total <i>Tsotlhe</i>
Cattle <i>Dikgomo</i>		
Sheep <i>Dinku</i>		
Goats <i>Dipudi</i>		
Donkeys <i>Ditonki</i>		
Mules <i>Dimoulo</i>		
Pigs <i>Dikolobe</i>		
Ducks <i>Dipidipidi</i>		
Chickens <i>Dikoko</i>		

39. If you ever use fertilizer on your fields or garden, explain:
Fa lo a tle lo dirise monontshane mo masimong kana mo tshingwaneng ya merogo, tthalosa fa tlase.

Type of Fertilizer <i>Mohuta wa monontshane</i>	Where obtained or purchased <i>o rekwa kae</i>	Cost <i>o ja bokae</i>	Amount Used at lands <i>Selekanyo se se dirisiwang ko masimong</i>	Amount used on garden <i>Selekanyo se se dirisiwang mo tshingwaneng ya merogo</i>

40. What crops are you planting this year
Lo tsile go jala dijalo dife ngwaga ono,

Crops /Vegetables
Dijalo/Merogo

Lands/Garden
Masimo/Tshingwana ya merogo

41. What skills do the members of this household have ?
Batho ba lwapa le ba ne le boitseanape mo go eng ?

- | | | |
|-------------------------------------|-----|---|
| Thatching roofs | () | <i>Go rulela</i> |
| Working with wood | () | <i>Go betla</i> |
| Building/working with clay/soil | () | <i>Go aga/bopa Ka mmu</i> |
| Building with cement/concrete | () | <i>Go aga ka semente/konkreiti</i> |
| Painting | () | <i>Go penta</i> |
| Working with metal | () | <i>Go dirisa ditshipi</i> |
| Repairing Machines | () | <i>Go baakanya mechine</i> |
| Repairing engines | () | <i>Go baakanya dienjine</i> |
| Driving motor vehicles | () | <i>Go kgwetsa</i> |
| Making baskets | () | <i>Go dira ditlatlana</i> |
| Weaving cloth | () | <i>Go loga matsela</i> |
| Tanning leather | () | <i>Go suga</i> |
| Sewing leather | () | <i>Go roka matlalo</i> |
| Making clothes | () | <i>Go roka</i> |
| Organizing group activities | () | <i>Go goga Mekgatlo</i> |
| Riding bicycle | () | <i>Go palama baisekele</i> |
| Sewing by machine
(hand/treadle) | () | <i>Go roka ka machine wa diatla/maoto</i> |
| Using hand grinder | () | <i>Go sila ka tshilo ya mabogo</i> |
| Other (specify) | () | <i>Tse dingwe</i> |

42. What are your major sources of income?
Lo itshidisa ka eng mo lwapeng?

*Amount
 Selekanyo*

- Cattle Sale _____ *Thekiso ya dikgomo*
- Renting Draught Animals _____ *Go adima dikgomo tse di lemanng, jalo, jalo*
- Renting Equipment _____ *Go adima dilwana tse temo jalo, jalo*
- Brewing Beer _____ *Go apaya bojalwa*
- Grinding Grain _____ *Go sila mabele*
- Business _____ *Kgwebo*
- Work _____ *Tiro*
- Income from working relative(s) _____ *Madi a a tswang ko babereking*
- relatives) _____ *Tse dingwe*
- Other _____

AGRICULTURE

Activity <i>Tiro</i>	Methods used <i>Methale e e Dirisiwang</i>	Who does this activity ? <i>Ke mang yo o dirang tiro e ?</i>	What are your problems related to this activity ? <i>Ke mathata afe a o lebaganang le one go dira tiro e ?</i>
Ploughing <i>Go lema</i>			
Weeding <i>Go tthagola</i>			
Harvesting <i>Go roba</i>			
Threshing <i>Go phota</i>			
Storing Harvest <i>Go Boloka Thobo</i>			

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Activity <i>Tiro</i>	Methods used <i>Methale e e dirisiwang</i>	Who does this activity ? <i>Ke mang yo o dirang tiro e ?</i>	What are your problems related to this activity ? <i>Ke mathata afe a o lebaganang le one go dira tiro e ?</i>
Drying vegetables <i>Go Omisa merogo</i>			
Drying meat <i>Go Omisa Nama</i>			
Keeping water cool <i>Go tsidifatsa metsi</i>			
Keeping milk fresh <i>Gc dira gore mashi a seka a rema</i>			
Making sour miik <i>Go dira madila</i>			
Grinding grain <i>Go thuga</i> <i>Go sila</i>			
<i>Mabele/sorghum</i>			
<i>Maize/mmidi</i>			

TRANSPORTATION

Activity <i>Tiro</i>	Where do you go to collect? <i>Go rwalelwa kae?</i>	Type of transport used to collect <i>Mofuta wa sepalamo se se dirisiwang</i>	Is this transport owned or hired? <i>A sepalamo se ka sa lona kana se a hirwa?</i>	How often do you go to collect? <i>Go tsamaiwa ga kae?</i>	What are your problems related to transporting <i>Mathata di lo lebaganang le one ka sepalamo se ke afe</i>	What transport do you prefer to do this activity? <i>O rata go dirisa sepalamo sefe</i>
Collecting Wood <i>Go rwalela dikgong</i>						
Collecting water <i>Go rwalela metsi</i>						
Collecting Thatch <i>Go rwalela boiang</i>						
Collecting Clay <i>Go rwalela mmu</i>						

Activity <i>Tiro</i>	Where is ... <i>Ko kae ...</i>	Type of transport used? <i>Mohuta wa sepalamo se se dirisiwang</i>	Is this transport owned or hired <i>Ke sepalamo sa lona kana ke se se hiriwang</i>	How often do you travel or transport goods to <i>Lo ya ga kae</i>	What are your problems related to travelling and transporting goods to <i>Mathata a lo lebaganang le one ka sepalamo se ke afe</i>	What transport do you prefer to do this <i>O rata go dirisa sepalamo sefe ...</i>
Going to the lands <i>Go ya masimong</i>						
Transporting goods to/from lands <i>Go rwalela dilo ko masimong</i>						
Going to the cattle post <i>Go ya marakeng</i>						
Going to the clinic or health post <i>Go ya bongakeng</i>						
Going to work <i>Go ya Tirong</i>						
Going to school <i>Go ya sekoleng</i>						
Going to the shops <i>Go ya mabentleng</i>						

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SMALL SHOP OWNERS/BUSINESSMEN: ENERGY USE QUESTIONNAIRE

BA KWAIBO E NNYE: TECHIKA-TSHEKO YA LITSILO YA BORANYANI

Village

Interviewer

Date

Interviewee

Business or
Shop Name

Job

Employer

What type of business is this?

Kgwabo e ke ya mofuta ofe?

What are the hours of operation? How many days per week?

Lo bula lenq lo bo lo tswala lenq? Lo bula malatsi a le kae mo bekeng?

What kinds of things are sold here? Give typical prices.

Go rekisiva dilwana tsa mofuta ofe fa? Ditlhwatlhwa di ntse jang?

What things which are sold here are also made here?

Ke dife dilo tsaedi rekiswang fa tse di diriwang lenq fa?

What type of equipment and fuel, if any is used for making these items?

Go dirisiva mofuta ope, le dilo tse di ntsewang jang go dirwa dilwana tse?

Does this business have a refrigerator?

Yes

No

A kgwabo e e na le setsidifatsi?

Ee

Nnyaa

If yes, what kind?

Fa ele ee, sa mofuta ofe?

How much fuel does it use per week?

Se dirisa mafura a selekanyo se se kae ka beke?

Does this business cook food to sell?

Yes

No

A kgwabo e apaya dijo go di rekisa?

Ee

Nnyaa

If yes, what kinds?

Fa e le ee, tsa mofuta ofe?

What method is used for cooking?

Go dirisiva mofuta ofe wa go apaya?

How much fuel do you use per week for cooking?

Lo dirisa mafura a selekanyo se se kae, ka beke mo go apeng?

7. What do you use for lighting your shop?

Lo dirisa eng go tshuba mo kgwebong?

How many hours per day do you light it?

Lo tshuba mo kgwebong dioura tse kae ka letsatsi?

How much fuel do you use per week for lighting?

Lo dirisa selekanyo se se kae sa mafura mo go tshubeng ka beke?

8. Do you grind grain as part of your business?

Yes
Ee

No
Nnyaa

A lo sila mabele/mmidi mo kgwebong e?

How do you grind grain?

Lo sila jang?

What do you charge? (per kg)

Lo duedisa jang?

9. Do you heat this building in winter?

Yes
Ee

No
Nnyaa

A lo thuthafatsa ntlo ya kgwebo mo marigeng?

How?

Jang?

10. What kind of transport do you use for your business?

Lo dirisa ditsamaiso dife mo kgwebong e? (diphologolo/dikoloi)

For what purposes?

Go dira eng?

How often?

Go kae ka beke, kgwedi, jalo jalo?

If you use a motor vehicle, how much fuel do you use per month?

Fa lo dirisa koloi kana kara, lo dirisa mafura a selekanyo se se kae ka kgwedi?

11. If business owner generates his/her own electricity, does he/she also use it at his/her home?

Fa e le gore mong wa kgwebo o itirela motlakase, a o dirisa motlakase

gape kwa ntlong ya gagwe ya honno?

Yes
Ee

No
Nnyaa

APPENDIX B

Observation Guide Sheet

APPENDIX C

Survey Teams

Ditshegwane

Kegakgametse Bathobasele
Brigid Kenosi
Maipelo Kgomotso
Kemofitlhele Montsholobe
Baile Mosotho
Mogapi Raloka
Phuralalo Tshipane
Batho Tshoso

Shoshong

Gothusamang Badubi
Kegakgametse Bathobasele
Cecil Lecoge
Gabosenkwe Mogatle
Motlhagodi Motshwarakgole
Baikanne Mphoyakgosi
Patrinah Sereetsi
Sefetoleng Setso

BRET Extension Trainers

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