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LESOTHO VILLAGE ENERGY SURVEY REPORT

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PREFACE

The Lesotho Renewable Energy Technology (RET) project is part of the Appropriate Technology Section (ATS) of the Ministry of Cooperatives and Rural Development (MINRUDEV). The project is jointly funded by the government of Lesotho (GOL) and the 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 AFR-0206-C-00-1016-00.

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ACKNOWLEDGMENTS

The village energy survey research reported here is just one part of the RET project's activities. Thanks are due to all those who made the survey work and data analysis possible.

Mamello Khoboko, the project's senior technical officer, shared in all stages of the work--survey design, training enumerators, conducting the survey and data analysis. All members of the RET staff, particularly Agnes Adontsi and the others at Malefiloane, provided support in its planning and the complex logistics of conducting the survey. The enumerators--'Maphezulu Motsekalle, Nthabiseng Mashalane and Puseletso Nthontho--were dependable, enthusiastic colleagues for the actual interviewing.

The Principal Chief of Mokhotlong, Mathealira Seeiso, and all chiefs of the villages studied, together with local Village Development Committees, gave their fullest cooperation. The District Coordinator's office, MINRUDEV staff and all other government officials in Mokhotlong were generous in sharing office space, and giving advice and support to the survey process. The staff at Maphelaneng High School was also very helpful.

Computer facilities were make available through the Ministry of Finance. The tedious task of initial data entry was undertaken by Masello Matete of the Ministry of Agriculture during hours after work. My husband, John Gay, was indispensable in assisting with computer programming and analysis.

Above all, thanks go to the villagers themselves, who so generously gave of their thoughts, time and hospitality while we lived and worked in their midst. We hope that the survey's results help us listen to their ideas, learn from their experiences and work together with them as the RET project attempts to meet the energy-related needs identified by Lesotho's first village energy survey.

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

The village energy survey is part of the ongoing work of collecting data on present energy use and the potential for energy-related intervention by the Lesotho RET project, operating under the auspices of the Ministry of Cooperatives and Rural Development. This report covers the first stage of the village energy survey, conducted in six villages of the Mokhotlong District between March and May, 1982.

The purposes of the village energy survey are to:

- introduce the RET project to representative communities and explore possibilities for future work with individuals, institutions, groups and/or communities;
- obtain a broad range of geographic, social, institutional and demographic data on communities typical of those in which the RET project will be working;
- gather detailed data on present domestic, agricultural, commercial and institutional energy use and available energy sources;
- elicit opinions from community leaders and individuals regarding general and specific energy-related problems, needs and possible solutions; and
- thus, provide the RET project with information to guide it in:
  --assessing energy-related needs,
  --selecting candidate technologies to match identified needs,
  --assessing the social and economic feasibility of candidate technologies;
  --providing social and economic details relevant to specific technologies being developed,
  --identifying sites and strategies for field tests, and
  --developing and carrying out village-level dissemination activities.

This report presents the results of the first energy survey ever conducted in Lesotho. It provides demographic, social and economic background information, as well as detailed data on energy resources, use patterns and needs for six villages in the Mokhotlong district. The combination of energy-use data, needs assessment and background information on specific villages is basic to the planning of RET project activities. The data are being used to guide technology selection, the design of specific energy-related technologies and dissemination activities in these and similar villages. The survey is the first major step in an ongoing process of trying to understand and analyze energy-related problems in rural Lesotho, and to involve villagers themselves in the process of defining needs and seeking solutions.

1.2 General Findings

Clearly, no single rural development project can meet the whole range of rural needs. Thus, it is necessary to single out particular energy end-uses where the RET project can contribute to meeting some of the perceived and observed needs of villages in Mokhotlong. Further, the work of other projects and government activities designed to meet additional identified needs which may be less directly energy-related can be complemented and encouraged. End uses can be summarized according to the types of energy demands implicit in the analysis of village needs.

Libeso--combustible fuel for cooking, water and space heating--is a high priority along with the human labor required to collect fuel and plant trees, animals which produce dung, and the money to purchase imported fuels and stoves that use paraffin and coal for times when biomass is in short supply.

Animal energy is essential for traction and transportation in this district since the roads are inadequate and slopes, precipitous. Most agricultural traction and hauling rocks for building is done by cattle, while most of the transportation of food, goods and people is provided by horses or donkeys.

Energy for motorized transportation--fuel and vehicles, together with the roads and bridges necessary for access and the human labor required to construct them, are great concerns.

People want vehicles to transport consumer goods, food, building materials, travelers, the sick and the dead.

Solar energy is an important energy source that is already being utilized by people who seek the sun's rays in midwinter to warm themselves, conduct school outdoors rather than sit in dark, frigid classrooms, and orient their rondavels in the traditional way to catch the morning sun through the doorway. The sun is obviously basic to the existing food production system, but fertilizer and/or organic inputs to the soil are needed along with ways to extend the growing season. Solar energy is used by some to dry food for winter use, but far less often and efficiently than it could be.

Clean water in sufficient quantities for agricultural and domestic use is vital. The energy required to move water in the mountains can generally be provided by the effective use of water impoundment and gravity systems, rather than elaborate pumping schemes, although small hydro-rams might help lift water to gardens along streams. Clean, protected water supplies, rain and stream catchments, channeling water to garden areas and perhaps communal solar water heating for laundry would be effective ways of improving village water systems. Despite the hydroelectric potential in the mountains, nowhere in Mokhotlong is water being used to generate electricity or move machinery.

Human energy is the underlying issue in all energy analysis if any energy innovations are to be introduced and

utilized. For human energy to be maintained, adequate food year-round, good nutrition, dependable health care, sanitation, and warm buildings and clothing in winter are essential. Employment opportunities are also needed to provide the means for men and women to use their energy and skills to earn cash, with which they can ease the burdens of bare subsistence living and improve the quality of rural life.

The body of this report contains the detailed results and statistics from which these general findings emerged. What follows is intended to provide the reader with a new perspective on a broad range of development concerns. It is hoped that it will also stimulate the collection of similar data in other parts of Lesotho.

2.0 METHODOLOGY*

2.1 Survey Design

The first step in the survey design process was to identify large data classes and detailed data elements that the RET staff felt would be helpful in the implementation of project goals and activities. A list of desired data was prepared under the following main headings:

- demographic indicators--see section 3.2,
- social and organizational indicators--section 3.1,
- economic indicators--sections 3.1 and 3.3,
- geographic and climatic indicators--section 3.1 and other reports,
- household energy consumption patterns--section 3.4,
- agricultural energy consumption patterns--section 3.5,
- energy consumption in industry, trade, institutions and communication--section 3.7,
- energy use in transportation--3.6,
- electrical energy supply--sections 3.4.11 and 3.8,
- nonrenewable energy sources--section 3.8,
- village renewable energy resources--section 3.8,
- ecological and environmental problems--section 4.0, and
- energy-related needs, problems and plans--section 4.0.

These data classes provide the organizing framework for the survey and this report. Appendix III gives the original

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*See Burrill, Forman and Gomez, Planning Rural Energy Projects: A Rural Energy Survey and Planning Methodology for Bolivia, prepared for USAID/Bolivia, 1980.

version of the detailed data list. Sources besides this survey provided additional information on some other data classes, particularly geographic and climatic indicators, and agricultural energy consumption patterns.

The second step was to develop a strategy for entering each community, establishing a good working relationship with villagers and obtaining the desired information. The village energy survey is only one stage in the ongoing process of involving village people in planning and conducting project activities, and sharing in the design, production and use of energy-related technologies. Thus, the research methodology was planned to provide opportunities for relaxed, informal observation and conversation, as well as structured observation, interviewing and the collection of quantifiable data. This approach involved arranging for the research team--ARD's field supervisor, the project's senior technical officer and three enumerators--to spend four to five days living and working in each of the villages surveyed.

The actual survey instrument was designed with seven separate sections for use in:

- an interview with the village chief,
- interviews with village leaders,
- observations of physical setting, natural resources, buildings and daily activities,
- detailed interviews with individual householders/ farmers,
- interviews with business people, artisans and traders,

- interviews with school teachers, clinic workers and other institutional staff, and
- interviews with owners/drivers of motor vehicles.

Three Basotho enumerators conducted the detailed interviews with individual householders/farmers. ARD's Field Supervisor, a non-Mosotho, was responsible for observations of the physical setting, natural resources, buildings and daily activities. The senior technical officer, a Mosotho, conducted the remaining five parts of the survey. All seven parts of the survey instrument were developed in English, pretested, revised and translated. After back-translating into English, additional pretesting and revision, the final Sesotho version was prepared and printed. (See Appendix IV for the full English text of the survey instrument.)

2.2 Selecting and Training Enumerators

With the help of MINRUDEV officials in Mokhotlong and an RET project staff member in Malefiloane, three local women were recruited, selected and trained to assist in conducting the survey. The selection process involved interviews in both English and Sesotho, tested candidates' abilities to fill out forms and translate, and employed a checklist to objectively compare candidates' qualifications.

The three women chosen were 'Maphezulu Motsekalle, Nthabiseng Mashalane and Puseletso Nthontho. All had 10 years of schooling, but varied greatly in age, family and work experience. Because all were from the Mokhotlong district, they were familiar with many of the villages where the survey would be conducted; two live in villages near Malefiloane. (In addition, the enumerators are available for subsequent data collection and can provide contacts for follow-up project activities in the area.)

The training conducted for three days prior to the survey period included:

- an orientation to the concepts of energy sources, problems, renewable energy technology, the RET project and Ministry of Co-operatives and Rural Development;
- purposes of survey work, reasons for the village energy survey, techniques for conducting interviews, protocol, courtesy, possible interviewing problems and how to overcome them;
- familiarization with the whole survey instrument and detailed study of the part they would be responsible for; and

- three practice interviews, in the group and on the streets of Mokhotlong town, where the training took place.

Much of the training was conducted in Sesotho by Mamello Khoboko, the senior technical officer and an experienced home economics educator, and Agnes Adontsi, an RET staff member who was conducting interviews on energy-related issues in Malefiloane at the time. Their practical experience was invaluable in preparing the enumerators to understand project activities and conduct the village interviews.

FIGURE 2-1

The RET Survey Team

2.3 Sampling Frame

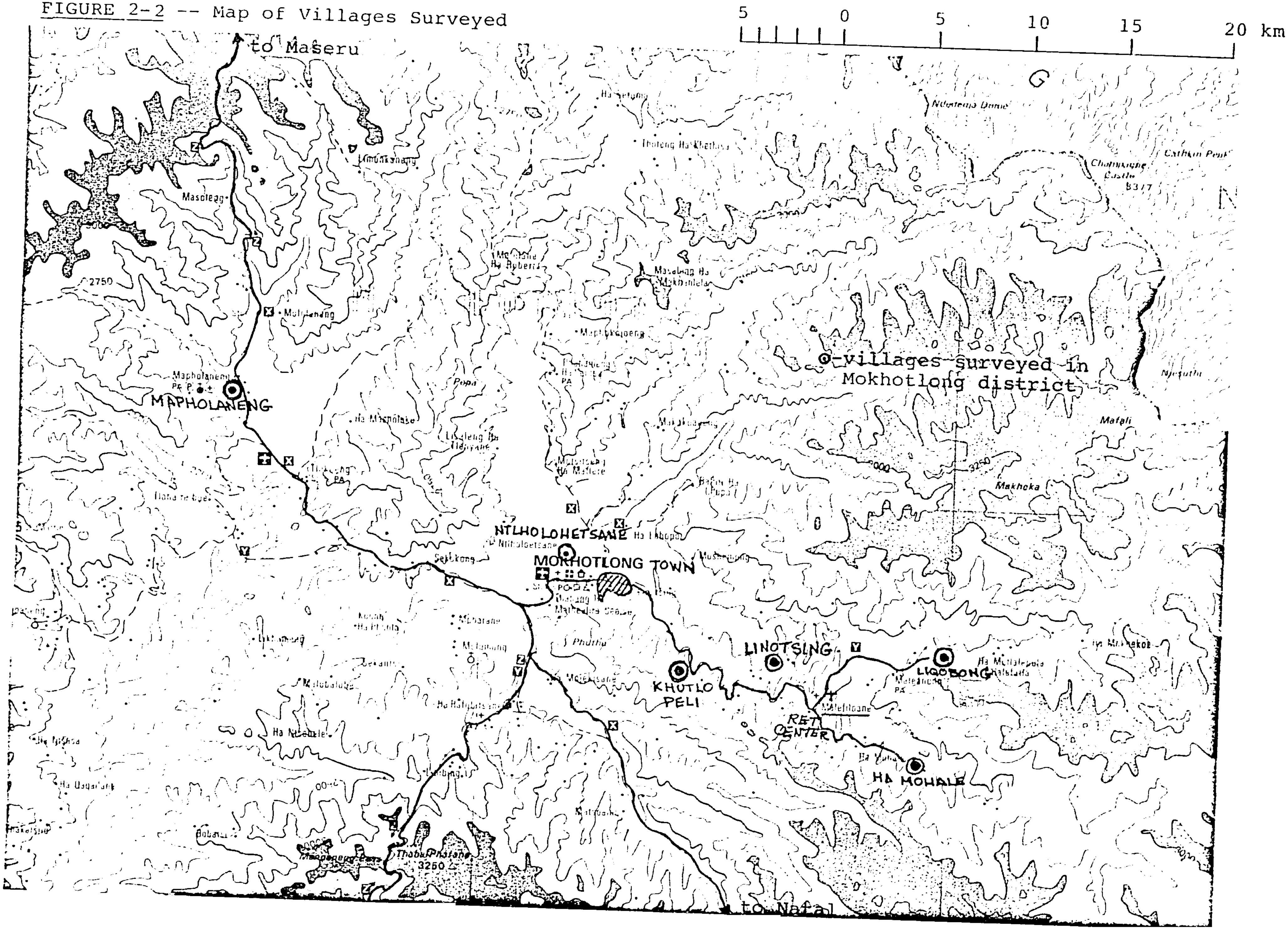
2.3.1 Village Selection

Six villages were selected in order to sample from diverse environmental, social and economic settings. They were not scattered throughout the district, but rather were chosen as communities in which the project could anticipate carrying out follow-up activities if survey results revealed local need(s), interest and the potential for further contact(s). Hence, four villages--Ha Mohale, Liqobong, Linotsing and Khutlo-peli--were within eight kilometers of the project's first regional center at Malefiloane, about 20 kilometers southwest of Mokhotlong town. A fifth, Ntlholohetsane, is a peri-urban village about two kilometers west of the center of Mokhotlong town. Mapholaneng, defined as a district "growth center," is about 35 kilometers northwest of Mokhotlong town on the main road. (See Figure 2-2.) A brief description of each village is given in section 3.1.

2.3.2 Selecting Households within Villages

In order to conduct detailed interviews with individual householders/farmers, it was necessary to select a representative sample of households from each village. However, no village maps or household lists existed before village residence, and in the larger villages, there was no way to obtain a complete list of households. Thus, rather than attempt a rigorous random sample procedure, the following

FIGURE 2-2 -- Map of Villages Surveyed



selection methods were used to provide roughly 20 to 30 interviews per village.

- In the smallest communities, less than 35 households (Ha Mohale, Liqobong and Khutlo-peli), interviews were conducted with all homeowners who could be located during the research period.

- In Linotsing (66 households) and Ntlholohetsane (90 households), each enumerator was assigned to a specific section of the village for the day and asked to interview every third family, trying to obtain a balance of one poor, one medium-income and one prosperous family. Wealth was roughly estimated based on buildings and other visible homestead assets.

- In Mapholaneng, a similar procedure was followed, but approximately every eighth household was interviewed. Again, specific sections of the village were assigned to interviewers for each day.

The survey was designed as an introduction to energy-related issues and possible project activities in the six villages selected, rather than as a rigorous instrument from which district- or nation-wide generalizations might be made. Thus, the informal sampling procedure was felt to be a realistic means of obtaining the largest amount of useful information and establishing fruitful contacts with villagers in the limited amount of time available.

2.3.3 Seasonal Sampling Problem

Because of seasonal variations in fuel and food supplies, agricultural and other activities, and weather conditions, a study such as this would ideally sample different periods throughout the year. However, it was necessary to complete the basic survey as quickly as possible so that the data collected could guide subsequent project activities. There was neither

the time nor the staff to prolong the survey work throughout the year. Thus, the major survey effort occurred during a single time period, which happened to be the harvest season in late autumn/early winter. The data reported must be understood within this necessarily limited time frame.

Brief follow-up interviews of the same households will be carried out for two additional periods--late winter/early spring (August/September) before the growing season has begun and midsummer (December/January) at the height of the rainy growing season. These follow-up interviews will focus on seasonal variations in fuel use, cooking and space heating practices. They will also provide an opportunity to obtain information on a few additional issues that project staff subsequently felt were important.

2.4 Procedure in Villages

Each village chief was contacted before the survey team arrived, and arrangements were made to rent a vacant house for the four- to five-day stay. The team brought its own food, utensils and bedding. The first page of the survey instrument (see Appendix IV) outlines the basic procedure followed by the team during their period of residence in each village.

In each village, the first essential step was to contact the village chief and arrange for a village meeting (pitso) to introduce the team and RET project, explain the team's purpose and ask for cooperation. These meetings proved to be important sources of ideas, questions and information, and provided a way to initiate informal contacts which were pursued throughout the week. The initial contact with the chief also involved employing the first part of the interview schedule to identify village leaders, businesses, local groups and institutions, and obtain a list of all households. This information provided guidance for conducting subsequent interviews.

Following the introductory pitso and interview with the chief, team members split up to carry out their diverse assignments. The three enumerators began individual household interviews, conducting three or four per day. The senior technical officer visited village leaders and business people, schools, shops, clinics and other institutions. The field supervisor drew a village map and recorded observations concerning water supplies, trees, fuel sources, housing, daily

activities, etc. Team members returned to their shared accommodations several times each day, not only to eat and rest, but also to share information and discuss problems that arose in the course of interviewing. The senior technical officer and field supervisor checked over each household survey form as it was brought in, so that any omissions or confusions could be corrected while still in the village.

All team members found opportunities for informal conversations with villagers, as well as observations concerning social, economic, environmental and other aspects of village life. To a degree, all were participants in village life for a brief period and thus, gained an understanding of local problems, such as transportation, food and water supplies, sanitation and space heating needs, an undertanding which non-resident survey teams cannot obtain. Living and working together, we also learned from one another--undoubtedly a very important aspect of the survey process.

Contacts were made with particularly interested individuals, which provided avenues for project follow-up activities long before the survey's results could even be analyzed and reported. This illustrates the important point that the village energy survey is far more than a means to obtain quantifiable factual information, rather it is part of the ongoing process of sharing in analyzing village problems and working together to find solutions.

2.5 Data Analysis

Most of the data derived from the household interviews was coded by project staff in Maseru, entered on the computer at the Ministry of Finance and analyzed using the Statistical Package for the Social Sciences (SPSS). Data derived from all other parts of the survey were coded, hand-tabulated and analyzed at the same time. Notes from observations, pitsos and informal conversations were also utilized in analyzing the data and writing this report. Naturally, only a portion of the results can be presented here. All of the raw data, the computerized data file and analysis notes are available in Maseru so that project staff and others can return to this material for more detailed information as specific questions arise.

3.0 RESULTS

Information from the household level forms the major part of this data presentation, particularly sections 3.2 to 3.6. Data from other survey sections, as well as observations and informal conversations, provide the context for understanding the household-level data, and the basis for section 3.1 which introduces the six villages, section 3.7 on commercial and institutional energy use, and section 3.8 on energy supplies. Open-ended opinion queries concerning local perceptions of needs and problems were put to both individual householders and village leaders. Responses to these questions form the basis of the next section of this report, the energy needs assessment (section 4.0).

3.1 Villages' Geographic, Economic and Organizational Features

3.1.1 Geographical Setting

Mokhotlong district lies in the high Maluti Mountains which dominate the eastern portion of Lesotho. Virtually all the land is above 2,000 meters, and rises to the east to form a summit plateau and the escarpment which rings the northern and eastern borders with Natal. The highest point in southern Africa is Thabana-Ntlenyana (3,482 meters above sea level), about 13 kilometers beyond the first research village, Ha Mohale. The high mountain areas and most remote high valleys serve as summer pastures for Mokhotlong's livestock, and the very limited amount of arable land lies along the major river valleys and nearby plateaus. It can be seen on the map in Figure 2-2 that most of these rivers join the Senqu (Orange) River near Mokhotlong town where Ntlholohetsane, the sixth village, is located. In turn, the Senqu is joined by the more easterly Khubelu River system south of Tloboeng and Mapholaneng, the fifth research village. The Senqu continues to cut south and then west across all of South Africa until it finally reaches the Atlantic Ocean in Namibia.

Most of the rain falls in the summer months (October to April), with the greatest amount along the district's eastern escarpment and western mountains. Much less falls in the sheltered Senqu River valley area. In 1979, at the St. James mission near Mokhotlong, with an elevation comparable to three of the villages surveyed (about 2,500 meters), the mean

temperature was 14.6°C in January and 6.9°C in June. Nighttime temperatures fall below freezing throughout winter in much of the district. Snow is common in the mountains during winter, and frost or snow may occur in any season.

When Basotho settlement began in the district during the 1880s, the area was primarily alpine grassland with a few indigenous willow trees along the rivers, and shrubs in ravines and on sheltered slopes. Human habitation and agricultural activity have pushed farther and farther up the river valleys and onto flat plateaus above the rivers. Over-grazing, cultivation on ever steeper hillsides, and demands for fuel and building materials have contributed to the destruction of vegetation and sheet erosion which are such marked features of the district's central portions.

3.1.2 Villages Studied -- Environment and Economics

The six research villages were selected to represent different ecological settings within this broader landscape. They also have varying degrees of access to the growing, but still rudimentary, road network. No roads in the district are paved, and many are only rocky tracks or impassable mud during rainy periods.

Table 3-1 shows the estimated population of the six villages, as well as the number of households actually interviewed and individuals about whom data were collected from household heads. Ha Mohale and Liqobong are at the highest elevations (2,500 to 2,600 meters). Each is at the extreme

TABLE 3-1

Village and Sample Population Summary

Village	Estimated Number of Households*	Individuals**	Actually Surveyed Hhlds	Indvdls
Ha Mohale	21	124	18	106
Liqobong	24	154	23	148
Lintsing	66	428	23	149
Khutlo-peli	34	172	26	132
Mapholaneng	217	1,270	27	158
Ntlholohetsane	90	607	31	209
total	452	2,755	148	902

*Numbers of households were estimated based on household lists obtained from village chiefs, supplemented with village maps sketched during the research period.

**Estimated numbers of individuals calculated using an average household size based on population actually interviewed in each village.

eastern end of a feeder road, although the road to Ha Mohale stops on a steep slope about half a kilometer from the village. Ha Mohale has a sheltered location facing north, close to the Mokhotlong River. There is good grazing and arable land near the village; thus, rearing livestock and cultivating wheat are the primary economic activities. The indigenous fuel supply--dung and shrubs--is better in Ha Mohale than in any of the other five villages. There is a small Roman Catholic school, but no shops or other institutions in the village. Liqobong is one of several villages in a more densely populated area stretching along the Sanqebethu River to its junction with the Mokhotlong. Maize is grown in fields near the river, and wheat and peas on the higher slopes. There is a large community garden. Sheet erosion is much worse here than in Ha Mohale, and villagers must walk an hour or more to find shrubs for fuel.

Khutlo-peli is situated at about 2,500 meters, on a long plateau that runs southwest, high above the Mokhotlong River from Mokhotlong town to Malefiloane. The access road which follows along this plateau passes right through the village. Maize and peas are the main crops in the fields which curve along the steep slopes above the village and on the plateau where the road runs. Women must climb an hour or more to collect fuel on the mountain tops high above the houses.

Linotsing appears to be the oldest of the four villages in the Malefiloane area. It lies below the road and plateau near

the edge of the Mokhotlong River, at about 2,300 meters. Virtually nothing grows on the barren rocky hillsides which lead down from the road, and it is a hard, 40-minute climb from the village up to the road. Maize and even sorghum can be cultivated in the fields by the river. The village is growing fast, with many new houses on steep, rocky sites where gardening is almost impossible; there are a few good gardens in fenced plots in the center of the village and unfenced plots along the small rivers. Trails near the river lead to Mokhotlong town, less than a two-hour walk away. This village appears to be more oriented toward the town and its commercial activities than the other three villages in the Malefiloane area, with more iron roofing, furniture and consumer goods in evidence and greater use of paraffin. There is a shop owned by one of Mokhotlong's leading trading families, and also a large Roman Catholic school with 226 pupils and five teachers.

Mapholaneng is the largest of the six villages. It is designated as a "growth center" in the district because of its location on the main road, size, and the number of schools, shops and public services, such as a post office, police station, clinic and agricultural extension offices. Mapholaneng is actually two towns--the old town of about one hundred households stretches along the mountain slopes a kilometer or two above the road, while the new town is a rapidly growing string of homes and buildings along the road itself. Young households and newcomers have moved in to take

advantage of the shops, institutions and transportation along the road. The economic life of the two communities is quite different: older villagers are still primarily engaged in cultivation and rearing livestock, while younger roadside households are more interested in education, wage employment and informal income-generating activities, such as brewing, knitting, trading and building. The elevation is only 2,200 to 2,400 meters, so the cultivation of fruit trees and maize, as well as wheat and peas, is possible. Grazing areas and fuel supplies are a considerable distance from the road.

Ntlholohetsane was selected as the sixth village because although it is on the edge of Mokhotlong town, it retains its identity as a cohesive village unit. At a slightly lower elevation than Mapholaneng, maize, fruit trees and vegetable gardening are important agricultural activities. However, rearing livestock is much less common than in any of the other villages because the distance to adequate grazing is so great. The expansion of Mokhotlong town has taken away much of Ntlholohetsane's arable land--a matter of great concern to villagers. The slopes around Mokhotlong town itself are the most barren and eroded of any area surveyed, no doubt because this is the area of oldest settlement, cultivation and grazing. Although the number of shops and institutions in Ntlholohetsane is limited, the village is only a 20-minute walk from town, and hence, it is dependent upon the commercial and public institutions of the district's administrative center. Many

residents have paid employment in town or engage in trading, brewing, sewing, construction and other informal sector activities.

Table 3-2 shows the range of commercial and institutional activities which were identified in each of the six communities. Detailed information on these is in the raw data files and can be extracted for use by the RET project as needed. An inventory of skilled artisans and craftspeople was also compiled for each village. Other general information on economic activities can be found in sections 3.3--economic features, 3.5--agricultural activities and 3.7--small industry, trade and institutions. A detailed breakdown of all data by village is available in the computerized data file and on computer printouts.

3.1.3 Village Organization

The traditional administrative system in Lesotho is based on chieftaincy, although the expansion of central and district-level government structures and civil service activities has grown as a parallel system, particularly since independence in 1966. Each village has a hereditary chief or headman who is part of a hierarchy of chiefs. Village chiefs or headmen are responsible to area chiefs, who are in turn responsible to principal or ward chiefs. There are two principal chiefs in the district--the Tlokoeng Principal Chief, whose home village is a few kilometers south of Mapholaneng, and the Mokhotlong Principal Chief, who lives just west of Ntlholohetsane.

TABLE 3-2

Economic, Commercial and Institutional Village Activities

Activity	Ha Mohale	Liqobong	Linotsing	Khutlo-peli	Mapholaneng	Ntloholohetsane*
small home shops	-	1	-	-	several	several
major shops	-	1	1	-	4	(10+)
clinics**	-	-	-	-	1	(2)
schools	1	-	1	-	2	(4)
post office	-	-	-	-	1	(1)
police station	-	-	-	-	1	(1)
agricultural offices	-	-	-	-	1	(1)
village water supply system	-	-	1	-	1	1
community garden	-	1	-	-	-	1
regular public transportation	no	no	no	no	yes	yes
vehicles	-	1	-	-	3	?(many)

*Activities located in nearby Mokhotlong town have been estimated and are shown in parentheses. All are within easy walking distance of Ntloholohetsane.

**A clinic in Malefiloane serves the first four villages, but is nearly a two-hour walk away.

Village chiefs and their advisors are responsible for the settlement of simple disputes, land allocation, grazing control, referring matters to or from government and law enforcement agencies, holding pitsos, receiving visitors, etc. At the village level, chiefs are now assisted by a variety of committees, the most important being the Village Development Committee. There may also be committees for land allocation, village water supply, community gardens, etc.

Representatives of various government ministries and agencies are located primarily in Mokhotlong town, with some in Mapholaneng and other major district centers. Health workers, agricultural and nutrition extension agents, MINRUDEV staff, police and others visit villages as their work requires. There is a local court in Mapholaneng, but the local courts for the the other five villages are located in the Mokhotlong town area.

Churches play a very important role in Basotho life, particularly because almost all schools are operated by churches. Roman Catholic schools with regular church services exist in Ha Mohale and Linotsing, and near Liqobong and Khutlo-peli. Mapholaneng is a major center of the Lesotho Evangelical Church's (LEC) work. The LEC high school in Mapholaneng is the only school in the district which presently offers studies to the level of the Cambridge Overseas School Certificate (12th grade). Anglican, LEC and Roman Catholic groups are all active in Mokhotlong town, and these involve

Ntlholohetsane residents. Church choirs, youth clubs and women's groups exist in the two peri-urban villages. The balance of power between local chieftancy structures, village committees, central government agencies, and the church and educational institutions varies from community to community.

Voluntary community work occasionally occurs in villages on projects of common interest, such as developing roads, protecting springs and planting trees. Many of these activities, particularly road construction, are subsidized by Food-for-Work programs under the Ministry of Cooperatives and Rural Development. In such programs, certain villagers work for a set period of time (usually three weeks), after which they receive a fixed amount of food from international donor agencies and a small cash incentive of 50 cents a day. Some of those who participate in these programs, especially rural women, have been organized into a national group called Matsolo-a-Iketsetse (Basotho Women in Self-Help). In Khutlo-peli, for example, a branch of this organization is interested in acquiring skills for new income-generating activities, and establishing a market to sell handcrafted goods and home garden produce.

Village health workers have been trained in some of the villages. These are ordinary village women who learn to provide a basic level of medical services, and make referrals to clinics and the hospital. They may also work to encourage improved sanitation, nutrition, gardens, poultry- and pig-

raising, and preschool facilities. For instance, in Ntlholohetsane, the village health workers have voluntarily organized and staffed a school for the youngest village children.

Informal village groups play important roles in local economic activities. Cooperative work groups are basic to providing agricultural labor at peak periods (see section 3.5.1). Women who brew and sell beer regularly often form rotating credit associations or setokofele groups whereby they rotate brewing days and pool their profits so that each member receives a large amount of cash at regular intervals. There are also informal village insurance groups, through which members make small regular contributions to provide for funeral expenses.

3.2 Demographic Features

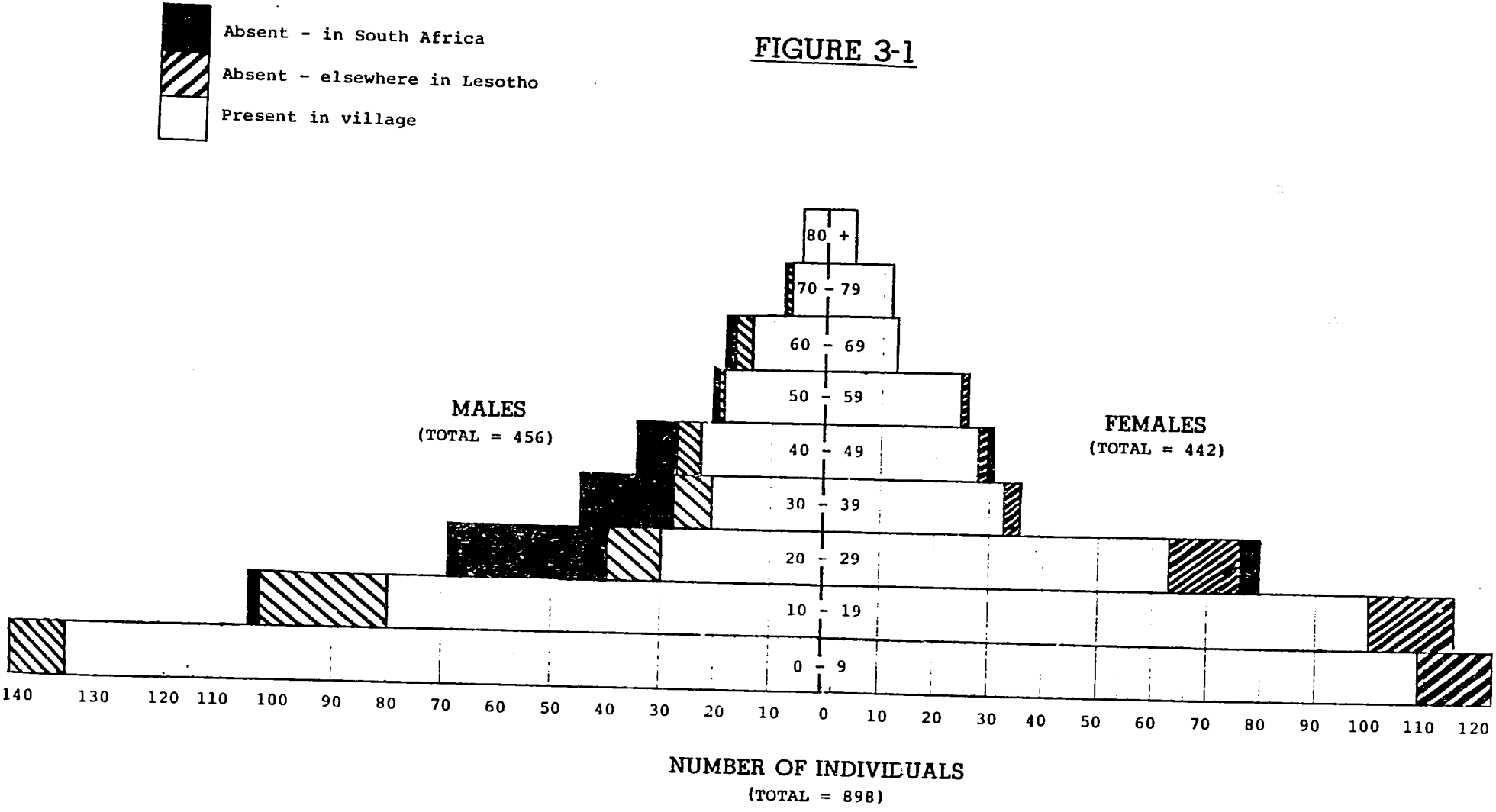
3.2.1 Age, Sex, Residence

The population pyramid in Figure 3-1 illustrates the composition of the households surveyed. (The data for this figure can be found in Appendix I.) The sex distribution shows that men comprise 50.7 percent of the total sample; in 1976, men made up only 48.3 percent of Lesotho's population. The slightly higher proportion of men may be an accident of the small sample size, attributable to the importance of male livestock activities in the mountains, that men in the mountains live in a healthier environment than those in the lowlands and/or that more women move away or die earlier in the highlands.

The age distribution for the study shows that 20.3 percent of the sample is under 10 years of age and 54.9 percent under 20; in the nation as a whole, 49.3 percent were under age 20 in 1976. With Lesotho's high population growth rate--estimated at 2.3 to 2.6--and improvements in child health care, the next national census may indicate a higher proportion under 20.

Because of the high rate of migrancy, both internal and external, it is important to distinguish between *de jure* and *de facto* population figures. The *de facto* population includes only those actually present at the time of enumeration, while the *de jure* population includes all individuals regarded as belonging to a household, even if they are away at work, school or visiting when the census is taken. The population pyramid

FIGURE 3-1



NUMBER OF INDIVIDUALS

IN THE HOUSEHOLDS SURVEYED

BY AGE, SEX AND RESIDENCE

indicates this distinction by dark shading for people in the Republic of South Africa (RSA) and light shading for those temporarily resident elsewhere in Lesotho--at cattle posts, other villages, towns where they may have gone for school or work, or anywhere else in the country. It can be seen that the majority of absent men who are in South Africa are between the ages of 20 and 39 (40.4 percent of this age group). The majority of males who are elsewhere in Lesotho are teenagers (22.8 percent of this age group)--primarily boys who were away at cattle posts at the time of enumeration. Almost all absent women were elsewhere in Lesotho, rather than in South Africa.

Table 3-3 shows the marital status of the population over age 14 by sex. As in the nation as a whole, there are far more women than men who remain widows because of the cultural practice that widowed men remarry whereas widowed women normally do not--they remain as daughters-in-law and mothers in their husbands' families. Similarly, there are more separated or divorced women than men, although such women often go to towns seeking work. Hence, there are a number of households headed by women who have no husbands (21.8 percent of the 148 surveyed). There are also many households which are managed by resident wives in the absence of their migrant husbands, who may be working in South Africa or other parts of Lesotho (28.6 percent of all households). Thus, half the households surveyed actually have female heads for most of each year.

TABLE 3-3

Marital Status by Sex
(over age 14)

Marital Status	Percent Male	Percent Female	Sample Size
married	65.1%	58.2%	308
never married	31.2%	25.1%	140
widowed	2.9%	14.4%	45
separated/divorced	.8%	2.3%	8
sample size	238	263	501

3.2.2 Educational Level

Table 3-4 shows the educational level (total years of schooling) of the sample broken down by sex and village. It can be seen that the average woman has gone farther in school than the average man. This is typical of Lesotho in general because the responsibilities for livestock care during the teenage years and subsequent migration of young men to South Africa make it much more difficult for them to attend school.

The differences between villages are striking. Ha Mohale has more livestock-rearing and is furthest from Mokhotlong town, where there are schools with upper grade levels. It has a low educational level for both sexes. Khutlo-peli, which seems to be the most traditional in its cultural orientation and is also high in livestock-rearing, has the lowest level of male education and a below-average level for females. Mapholaneng, on the other hand, has the highest level of education for both sexes--one of the largest and oldest schools in the district, and the only high school offering up to grade 12, is located here, as well as several new shops and government facilities, which offer limited employment opportunities for more educated people.

Considering only the population over age 14, 60 percent of all males and 76.4 percent of all females have finished three or more years of schooling, and can thus be assumed to have at least a minimal level of literacy. Furthermore, 20.9 percent of all males and 21.2 percent of all females have gone beyond

TABLE 3-4

Mean Educational Level by Sex and Village
(all ages--902 individuals)

Village	Educational Level	
	males	females
Ha Mohale	1.9	2.7
Liqobong	2.1	3.2
Linotsing	2.1	4.2
Khutlo-peli	0.6	2.9
Mapholaneng	4.5	5.1
Ntlholohetsane	3.4	4.0
total population	2.6	3.8

seventh grade. The relative increase of males in the higher grades is probably due to the fact that many children in mountain villages cannot begin school until around age nine or 10, when they are old enough to walk the long distances which are often necessary. Girls may drop out of school if they become pregnant or get married as teenagers, whereas boys in the same age group can continue on to higher levels of schooling, unless herding or migrant work prevent them from doing so.

The fact that such a high percentage of adults have had enough schooling to give them basic literacy is important to the RET project because it means that many people in rural areas can be reached by the printed word. Unlike other parts of Africa, where literacy rates for women are very low, many women in even the most isolated parts of Lesotho will be able to read about new energy-conserving ideas, follow simple printed directions and have some understanding of the scientific concepts involved, if suitable instructional materials are prepared in Sesotho. At present, bibles, hymnals, schoolbooks, mail order catalogs and letters are the principal reading materials available.

3.3 Economic Features of Households

The survey data provide four indicators of economic activity at the household level--sources of income, employment, household assets and agricultural assets. Direct queries about income levels were not asked because questions on this sensitive topic are often met with hostility and/or falsified responses. Instead, a rough estimate of the household's monthly income level was made on the basis of available data. As a result, estimated income level is also discussed in the section on employment. In addition, detailed information was recorded concerning specific types of economic activities and skills in each village--this data will be used in follow-up work in the villages and is not reported here.

3.3.1 Sources of Income

The 148 people interviewed were asked to list the major sources of income that their households depend upon. Table 3-5 shows the frequency with which each source was mentioned. It must be recognized that this frequency listing does not reflect the financial returns of the different types of economic activity, only the number of households reporting each as a source of cash income. Thus, an individual migrant's earnings are far higher than what most women can earn selling beer. Likewise, the table does not show how many individuals actually engaged in a particular activity, only those who chose to report each income source. For example, only 11 households mentioned income derived from Food-for-Work projects (which

TABLE 3-5

Reported Sources of Cash Income
(148 households)

Income Source	Frequency
selling beer	71
migrant earnings -- male	55
wage employment in Lesotho -- male	33
selling wool or mohair	25
selling animals	24
selling knitting, sewing, other handwork	21
wage employment in Lesotho -- female	20
building, thatching, digging rocks	20
selling bundles of shrubs for fuel	19
selling bread or other cooked food	16
selling thatching straw and fodder from fields	15
selling fruit, vegetables, local tobacco	14
selling field crops	13
Food-for-Work payments	11
help given by children	11
herbalist or traditional healer	6
selling chickens and eggs	6
chieftaincy salary	5
village repair work--shoes, carpentry, etc.	4
paid herding	4
selling meat	3
selling imported clothing	3
selling wood from trees owned by family	3
selling instamatic camera photographs	2
migrant earnings -- female	2
cafe or shop	3
other	3

give a cash supplement of 50 cents per day in addition to food payments)--in fact, another question revealed that 24 men and 88 women had engaged in some Food-for-Work activities during the previous year.

Brewing beer tops the list of sources of cash income, with 71 households selling home-brewed or occasionally, imported beer. Another question revealed that 80.7 percent of all households brew and 48.7 percent said they brewed for sale. Brewing is done outdoors in large iron pots or old oil drums, and beer is almost always cooked using biomass fuels--shrubs and dung. Large quantities of water are heated the first day, and the liquid brew is cooked again the second day. The mean quantity brewed is 62.5 liters at a mean frequency of 1.6 times per month, each brew requiring two cooking periods. Some women, particularly those in the two peri-urban villages, brew daily. The women in these two towns also brew large quantities--97.1 liters in contrast to 48.6 liters at a time in the four more remote villages. This is indicative of the shift from brewing for home consumption to brewing as a commercial activity, often in combination with the sale of imported beer and spirits. Brewing clearly constitutes a major energy end-use in fuel-short, peri-urban areas.

Table 3-5 clearly shows that the wage employment of men (88 cases) makes a greater contribution to reported family income than that of women (22 instances). The majority of employed men are migrants to South Africa, whereas most

employed women work in Lesotho. Selling wool, mohair and large animals are primarily the concern of men. Women engage in a range of other types of income-generating activities, above all brewing, in order to obtain a small share of the wage earnings and income from livestock, which are primarily in the hands of men. A survey of Mokhotlong's urban population would undoubtedly find more women employed in shops, government services and education. However, most village women remain at home, engaged in subsistence production, care of children, the ill and elderly, and homestead maintenance.

3.3.2 Employment

Table 3-6 details the number of males and females over age 14 actually engaged in particular types of wage employment or unemployed. The percentage of men who do not have paid employment seems higher here than in other sections of Lesotho, although current data showing growing unemployment throughout the country are not available. In the most remote village, Ha Mohale, where grazing is good and there is much livestock, many men are engaged in livestock and agricultural activities full-time--70.4 percent of the men do not have wage employment. In the two villages near Malefiloane, a much smaller number of men are unemployed--35.3 percent in Liqobong and 44.8 percent in Linotsing. These villages have the highest rates of male migrant work. In Mapholaneng, on the main road in the northwest, 83.9 percent of the men are without regular employment, while in Ntlholohetsane, adjacent to Mokhotlong,

TABLE 3-6

Types of Wage Employment by Sex
(individuals over age 14)

Type of Employment	Males	Females
not employed	104	219
mining in Republic of South Africa	65	1*
mining in Lesotho	4	0
government position	13	4
teaching	4	8
shop clerk	5	15
paid agriculture	6	0
paid herding	17	0
construction	8	0
domestic work	2	8
driver	3	0
hospital or clinic	2	1
chieftaincy	3	1
office work	1	0
hotel	0	2
total	237	259

*A female factory worker.

70.4 percent are unemployed. It is clear that the creation of employment is an urgent need throughout the district, particularly in the growing peri-urban areas where agricultural opportunities are limited.

Only 55 of the 148 households surveyed reported income derived from migrant earnings, so 62.8 percent have no income from this source. Lesotho's Third Five Year Development Plan (1980-1985)* states that during the period from 1975 to 1980, about 40 percent of all households had no migrant income and predicts this figure is likely to rise to 67 percent between 1980 and 1985. In the Mokhotlong sample interviewed, the percentage of households without migrant income is already higher than this predicted national level. The plan points out that in 1980-1981, the estimated average income for households with a migrant worker was M1,500 per year, in contrast to less than M400 per annum (including subsistence crop consumption) for those without. The poverty line was defined as M1,000 in 1980, so it is clear that a large percentage of households throughout Lesotho, as well as in the sample studied, live under conditions of real poverty, unable to meet the most basic needs. (Lesotho, 1980, page 20.)

A rough estimate of each household's monthly income was made based on estimated salaries for the employment type(s), recorded agricutural yields and assets, and evidence of other

*Kingdom of Lesotho, Third Five Year Development Plan, 1980-1985, The Government Printer, Maseru, Lesotho, 1980.

household assets, building activities, small businesses and number of children attending school. The estimates appear somewhat higher than the national figures mentioned above, partly because livestock is so important in the Mokhotlong district, although cash income derived from this source is difficult to measure. Table 3-7 shows estimates of potential household income levels--"potential" because although a young man may be earning R200 or R300 a month in the mines, only a small portion of that may actually be sent home for use by his dependents, particularly if he is not yet married. There was very little difference between villages in the percentage in each income group. Age and marital status are very important factors, the poorest being small residual households of the elderly, infirm and/or widowed women, who must often care for young children with no family member old enough to seek employment.

3.3.3 Household Assets

Buildings, stone livestock enclosures, energy-related domestic equipment and agricultural assets were recorded in the survey. Table 3-8 shows the distribution of the three basic house types--thatched stone rondavels, thatched rectangular stone houses and rectangular houses made of stone or cement block with corrugated iron roofing (called "zinc" locally). The table also shows ownership of stone-walled livestock enclosures--"kraals." Kraals are the primary source of the most desirable form of dung for burning; hence, households with

TABLE 3-7

Estimated Monthly Income
(148 households)

Estimated Income	Percentage
under M25	8.8%
M25 to M100	33.8%
M100 to M300	49.3%
M300 to M500	7.4%
over M500	.7%

TABLE 3-8

Distribution of Buildings and Kraals
(148 households)

Building Type	Mean Number per Household	Percentage of Households Owning		
		Four Villages Near Malefiloane	Two Villages on Main Road	All Villages
rondavel	1.9	98.9%	86.2%	93.9%
thatched, rectangular house	.2	12.2%	22.4%	16.2%
zinc-roofed house	.3	.03%	51.7%	22.3%
kraal	1.0	72.2%	63.8%	68.9%

livestock and kraals have more adequate and convenient fuel supplies.

The percentage of rondavels is slightly greater in the more isolated villages near Malefiloane, and the mean number owned is also greater--two per household near Malefiloane and 1.6 per household in the road towns. More striking is the difference for rectangular, zinc-roofed houses--over 50 percent of households in the road towns have them. This is partly due to the availability of imported, time- and labor-saving building supplies in these villages, and the lack of traditional building materials. Also, there is prestige and a sense of being modern that goes with cement-block, zinc-roofed houses, despite an awareness that they can be more bitterly cold than thatch-roofed buildings.

A distribution of energy-related domestic equipment, particularly items used for cooking, is shown in Table 3-9. This listing not only provides a picture of typical domestic energy technologies, but also suggests the kinds of material investments being made. Additional details, such as the size and number of cooking utensils, are not presented here, but will be used in the design of improved cooking and heating devices. Obtaining current retail prices for these items will also make it possible to calculate a total household energy technology investment, an example of ongoing research and utilization of this survey data.

TABLE 3-9

Ownership of Energy-Related Domestic Equipment
(148 households)

Item	Mean Number per Household	Percent of Households Owning Item
iron tripod (trifoot)	.6	48.6%
brazier (paola)	.8	71.6%
paraffin pressure stove	1.2	79.6%
paraffin wick stove	.1	8.8%
coal stove	.1	9.5%
paraffin heater	.1	11.5%
flat iron for pressing clothes	1.0	68.9%
three-legged iron pot	2.7	95.9%
flat-bottom iron pot	.6	50.7%
aluminum saucepan	3.1	80.4%
aluminum tea kettle	1.6	85.8%
aluminum frying pan	.4	35.1%
old tin cans (3-3.5 liters)	1.0	85.8%*
half of 200-liter oil drum	.4	27.7%
paraffin lamp	1.3	81.8%**
flashlight	.5	43.0%
radio	.5	43.9%
cassette player	.1	12.0%
hand grinding mill	.5	45.3%

*Round--20.3 percent, rectangular--68.2%.

**With chimney--37.2 percent, without--62.8%.

The first three items are the most common cooking devices in the mountains and, indeed, throughout Lesotho. Trifoots are simply bent iron rods connected with wire or short pieces of pipe, and are used to support a cast iron pot about 10 centimeters above the ground, which permits better combustion than if the pot sat on its three short legs. They are made and sold by inmates of Mokhotlong's prison; recently, some made by the Rural Technology Unit (RTU) at Thaba Tseka became available at Malefiloane's consumer cooperative store.

Paolas are braziers made by filling a leaky bucket or paraffin tin with earth and piercing it to produce many holes on all sides; they are widely used wherever dung is burned. In urban areas, particularly the lowlands, paolas are also used to burn coal. After putting in a few shrubs for kindling, the paola is filled with dung and ignited outdoors so that the large amounts of smoke emitted during the initial stages of combustion will not fill the room, and an ample oxygen supply and breeze are available. Once the dung is burning well, the paola may be brought indoors for nearly an hour of cooking and space heating before it need be taken outdoors to be refilled and lit again, if further heat is desired. A paola will last a year or two, if not left out to rust. Many were observed in very poor condition with pots balanced precariously on crumbling walls. Sometimes a trifoot or second old paola is added to provide support, or allow small water heating tins or odd-sized pots to be used.

Paraffin pressure stoves, usually known by the commonest trade name--"Primus," sell for between M10 and M14 in Mokhotlong. How many of those recorded were actually in working condition is unknown, but malfunction is a big problem. Most small shops carry spare parts, and a few local men or traveling tinkers can make repairs, but not nearly as often or easily as is required. Paraffin wick stoves of the single-burner variety are much less common, although increased marketing by South African firms through shops and mail-order houses may change this. Most of the households owning wick stoves or the much more expensive paraffin heaters (M90 and above) are in the two villages on the road. All the coal stoves reported are also in these two villages, where imported coal can be purchased. Households often make the small investment in paraffin stoves or larger investments in heaters and coal stoves, but then rarely use them because the cost and transportation problems of fuel are so great.

The range of cooking utensils is evident from Table 3-9. Most households own at least two iron pots, one or more aluminum pans and utilize a discarded tin to heat water. The aluminum pans are much more common in the two peri-urban towns on the road, where biomass fuel is scarce and paraffin stoves are used more often. Nearly half the households in the most traditional village, Khutlo-peli, did not own a single aluminum saucepan.

The large drums used to brew beer and cook meat for feasts are fairly evenly distributed in all villages. Generally, they are discarded, 200-litre, oil drums which have been cut in half. They are used outdoors, propped up on three stones over a fire of shrubs, weeds, or dung. Only those who brew and sell beer regularly use them daily, so they are often loaned to relatives and neighbors, as needed.

Most households own one paraffin lamp, most commonly a little, inexpensive, hemispherical lamp with an unprotected wick or string protruding from the top. Many households rarely cook with paraffin, but do use small quantities--less than a liter a month--for lighting. Others use only candles and/or open fires for light. Simple lamps with chimneys (hurricane lamps) are less common. Only one houehold out of 148 owned a much more efficient, brighter, but expensive, paraffin pressure lamp. The only other lighting device is the torch, owned by nearly half of all households and fairly evenly distributed through all the villages. Several homes in the area surveyed, although not the households interviewed, had little battery-operated lights hanging from the rondavel rafters--indicative of a desire for improved electric lighting. Batteries are expensive, however, and these lights were not operating when observed.

The fact that almost half the houses owned radios is significant because it indicates the degree of access to development-oriented programs broadcast over Radio Lesotho, and

consumer-oriented advertising on both Lesotho and South African stations. These radios, as well as less common and more expensive cassette or older record players, are often brought home as gifts and prestige investments by migrant workers.

The presence of large, sturdy, hand-operated grain grinding mills in nearly half the households interviewed was a surprise, because they are almost never seen in the lowlands of Lesotho. Their cost is now between M80 and M100. They are heavy to transport, must be permanently anchored on a wood block in the floor and take up about a square meter of space, plus another square meter for the person who kneels to turn the large flywheel. Some people said their mills had been purchased before they were born--20 to 30 years ago--and were still functioning. Women complained about the backbreaking work of turning the wheel for an hour or two to provide flour for the day's bread or porridge. Others complained about the rough texture of the flour produced and said they would much prefer commercially milled flour, if a diesel mill were located nearby or they could purchase affordable wheat, maize and sorghum flour locally. In all the villages, hand mills, commercial mills and/or ready-milled flours have almost completely replaced the traditional flat grindstones, except for simple tasks like grinding wet dough for sour porridge, peas or lentils. Mills in the more remote villages were bought in Mokhotlong town or Natal, and brought long distances by horse or donkey, demonstrating the successful introduction of

an energy-related device by the South African commercial network. Mills and paraffin stoves are two examples of technological change in domestic energy use and the willingness of even the most isolated villagers to invest in such devices.

3.3.4 Agricultural Assets

Table 3-10 shows the distribution of agricultural land, trees and implements. According to the traditional land tenure system, rights to use fields for cultivation of staple crops--primarily wheat, maize and peas in the mountain areas--are granted to adult male household heads and are retained by widows if the husband dies. Three fields is the norm, with only 12 households reporting more than three. Field size is variable and usually not known in acres or hectares; it was not measured by the survey.

In the nearby Molumong section of Mokhotlong, surveyed by the Farming Systems Research Project, the average number of fields was 2.2 per "farming household" (i.e., field-holding household). The average size of a household's holdings was 2.5 hectares. In the sample surveyed, 16.2 percent of the households reported having no fields. These were primarily young families and newcomers, who must wait for allocations until other field-holders die or move away. The lack of fields is particularly acute in Mapholaneng and Ntlholohetsane--22.2 and 32.3 percent without fields, respectively. This is because there are many newcomers in these peri-urban villages who moved to be on or near the road, shops, schools, clinics and jobs.

TABLE 3-10

Distribution of Agricultural Assets
(148 households)

Asset	Mean Number per Household	Percentage of Households Possessing Asset
fields	2.3	83.8%
community garden plot, fenced	*	25.7%
individual garden, unfenced	*	47.3%
fruit trees	2.3	35.1%
poplar or willow trees	3.6	32.4%
plow	.5	46.6%
planter	.04	4.1%
cultivator	.1	11.5%
harrow or rake	.1	11.5%
ox-drawn cart	.01	1.4%
wooden sledge	.2	22.3%
saddle	.8	54.7%

*Overall means not available.

In addition, prime agricultural land in both areas is being taken over for building sites.

Fields are almost never fenced in Lesotho. Customary law requires livestock owners to keep animals out of fields except for winter grazing. In contrast, successful gardening is largely dependent upon fencing to keep animals out and the availability of water at the start of the growing season. Two of the villages (Liqobong and Ntlholohetsane) have large, fenced, community garden areas, and residents of the other villages mentioned communal gardens as a high-priority need. A few households, particularly in Mapholaneng and Ntlholohetsane, have fenced homesteads, which make gardening much easier. Fencing is expensive and rarely seen in the more remote villages, where small individual garden plots along streambeds or near homes are usually not planted until late spring when the rains have begun and most livestock has been taken to distant mountain grazing areas.

Table 3-11 shows the percentage of households that reported growing various types of field and garden crops during the 1981-82 season, and the total yield in bags (average size of 100 kilograms), if known. Yields for most garden crops were unknown because of continuous harvesting during the growing season. A detailed breakdown by village is available, but is not shown here. It shows that wheat, peas, lentils and potatoes are most common in the three villages at high elevations--Ha Mohale, Liqobong and Khutlo-peli--while maize

TABLE 3-11

Crops Grown and Average Yields in 1981-1982
(148 households)

Crop	Percentage of Households Cultivating Crop	Mean Yield per Household Reporting Crop in Bags
wheat	60.1%	5.9
barley or oats (fodder)	11.5%	2.4*
maize	60.8%	7.2
sorghum	8.8%	3.2
peas	32.4%	2.1
beans	11.5%	1.1
lentils	5.4%	-
potatoes	13.5%	3.3
cabbage	41.2%	-
spinach	15.5%	-
turnips	16.2%	-
beetroot	10.1%	-
carrots	29.1%	-
pumpkins	4.7%	-
onions	2.7%	-
tomatoes	4.7%	-
lettuce	.7%	-

*Entire plant used.

and sorghum are more common field crops in those at lower elevations--Linotsing, Mapholaneng and Ntlholohetsane. Vegetable production is highest in Liqobong and Ntlholohetsane--the two communities which have large, fenced, communal garden areas.

There are very few fruit trees in the villages near Malefiloane, primarily because of the high elevation and strong winds. However, the lack of extension facilities to provide advice and suitable varieties is also a problem. Most fruit trees in the district are peaches, although apples, pears and plums would be more suitable for the elevation. Only 11.1 percent of households in the four villages near Malefiloane own fruit trees, in contrast to 66.6 percent in Mapholaneng and 77.4 in Ntlholohetsane. The combination of lower elevation, access to agricultural services and ease of transportation from tree nurseries in South Africa probably explains the larger number of trees in these villages.

Poplars and willows have been planted by some individual households in all six villages, normally at sites along ravines or rivers. In a few villages, there are also groves which belong to the community as a whole under the chief's administration. There is a high degree of variation within each village--67.6 percent of households have no direct access to trees, while a few individuals, particularly those of older chief families, control groves of poplars and willows. Trees

and/or branches may be sold to others for fuel and building poles.

The distribution of agricultural implements reveals the importance of animal traction and transportation in the Mokhotlong district. Nearly half the households own ox-drawn plows, far more than in the lowlands where tractors are common. However, other than plowing, most agricultural operations are performed by hand, such as broadcasting seed, weeding with hoes or uprooting weeds among wheat plants. Most of the few planters, cultivators and harrows were recorded in the two towns nearest the main road, where maize and sorghum are more common than wheat, and there is more access to agricultural extension advice and transportation routes. Crude little wooden sledges are the most common means of utilizing oxen for transportation. There were just two ox carts (only one of which was functional) among the total population interviewed. Over half the households own saddles, with the highest percentage of saddle and horse owners in the two villages furthest from the main road.

Table 3-12 shows the distribution of animals owned for the households surveyed. Additional information is available that breaks this down by village, and also distinguishes between animals kept in the village year-round and those taken to graze at distant mountain cattle posts during the warmer half of the year.

TABLE 3-12

Distribution of Livestock
(148 households)

Type of Animal	Mean Number Owned	Percentage of Households Owning Animals
cattle	5.8	60.3%
sheep	16.2	15.5%
goats	8.1	15.2%
horses	1.9	49.3%
donkeys	.7	27.0%
pigs	.1	10.2%
chickens	7.8	86.4%

Clearly, cattle are the most common livestock, although about 40 percent of the households surveyed do not own any. There is not a large difference in the mean number owned between the six villages--4.7 in Ntlholohetsane, on the edge of Mokhotlong town at the lowest elevation, and 7.2 in Liqobong at the highest. However, there is a wide range in the number owned by each household and the percentage of households owning cattle. In Liqobong, only 25 percent of the households had no cattle, while in Mapholaneng, 62 percent are without.

Cattle are valued because they provide traction for agriculture and hauling rocks, as well as a regular supply of milk and dung. This value is given ritual recognition in their use as bride-wealth payments and the slaughter of a beast for major family rituals, such as marriages and funerals, where the meat is shared by the entire community. Although the majority of cattle and other stock are taken to cattle posts in the summer, calves and milk-producing cows are kept in the villages throughout the year to provide continuous supplies of dung and milk for their owners. An average of 1.9 cattle per household remained year-round in the six villages, with means of 2.4 for Ha Mohale and 2.6 in Khutlo-peli, the two villages with the best grazing areas nearby and most livestock-oriented cultures. The reported use of dung as a fuel was also highest in these two villages.

Small stock, particularly sheep, are very important to farmers in the Malefiloane area, particularly Ha Mohale and

Liqobong. In these villages, the sale of wool and mohair, to a lesser extent, are important sources of income to the 15 to 20 percent of households owning sheep and/or goats.

Horses are the basic means of transportation for people, grain, staple foods and other consumer goods in the Malefiloane area. In the towns on the road, buses and trucks are now common, although horses and donkeys are still used. Seventy-five percent of the households in Ha Mohale own horses, while less than 40 percent in Ntlholohetsane do.

Pigs are much less common in these mountain villages than other parts of Lesotho. Only 20 of the 148 households reported owning pigs, 10 of these in Linotsing. Several women in Khutlo-peli expressed interest in rearing pigs to supplement their income by selling the meat, but also said they are of much less value than cattle because their dung cannot be burned or used in gardens. Pigs are generally regarded as dirty animals and are sometimes derogatorily referred to as "the cattle of women." This may be because they are kept near the home, particularly by women who brew a lot and feed them beer strainings and household garbage, and also because they may forage in the dongas where people defecate. Modern methods of rearing and marketing pigs are being encouraged by several women's groups, and the number of pigs can be expected to increase throughout the country.

Almost every household owns a few chickens. Women care for chickens close to their homes, sheltering them in rock or

mud enclosures at night, and often utilizing old kraals or crudely fenced areas to protect them from hawks and cold weather.

Animals are valued for both producing income and meeting basic subsistence needs. Wool and mohair are sold. Cattle, small stock and, sometimes, even horses or donkeys may be transferred between households in complex and often protracted bride-wealth exhanges. All may be sold within or between villages and at markets occasionally held in Mokhotlong camp with the encouragement of the Ministry of Agriculture. However, many farmers are very reluctant to sell their animals, preferring to increase their herds as major family assets. Traction, transportation and the production of milk and dung are basic to rural subsistence living--families without these assets are at a great disadvantage compared to livestock-owning neighbors.

Meat is highly valued in Basotho culture. The slaughter of an animal is essential for most ritual occasions, and most animals which die from cold winter weather, heavy snowfalls, illness or age are also consumed. Table 3-13 shows the total number of animals of each type owned by the households surveyed, as well as how many were killed and died during the year. It can be seen that meat from cattle, sheep and chickens forms an important part of the rural diet. Families along the road, particularly in the town nearest Mokhotlong, also buy meat from local butcher shops when they can afford it.

TABLE 3-13

Animals Owned, Killed and Dying in Year Preceding Survey
(148 households)

Animal	Total Number Owned	Number Killed	Number Died
cattle	853	57	200
sheep	2,393	312	324
goats	1,193*	70	129
horses	277	1	55
donkeys	103	1	24
pigs	20	8	10
chickens	1,153	955	576

*The total number of sheep should actually be somewhat higher and goats somewhat lower--a problem caused by computer coding difficulties. However, the combined number of small stock is accurate.

3.4 Household Energy Consumption Patterns

3.4.1 Use of Combustible Fuels

Before examining specific energy uses for major domestic activities, the available data on combustible fuel types, acquisition patterns, cost in time or money, and amounts used will be presented. This introduction is necessary because there is a cluster of related activities which all use the same types of combustible fuels, a single fire often serving a combination of energy end-uses. For example, the same fire may be used to cook food, heat water, warm an iron for pressing clothes, provide indoor lighting and space heating. The verb ho besa means to make a fire, and the derived noun, libeso, refers to any sort of combustible fuel. The principal types of libeso used in the Mokhotlong district are detailed below.

Cow Dung

Three or four times a year, rectangular chunks of dung (lisu) are dug from kraals where cattle are kept at night. Occasionally, dung from sheep and goat enclosures is treated in the same manner. The lisu is then piled neatly on top of the kraal walls, allowed to dry and stored in stockpiles near the house, where it is readily available and can be protected from heavy rain. The average weight of one chunk of lisu was found to be 1.3 kilograms, and a bag weighing about 30 kilograms sells for M2.50. After periods of heavy rain, the very wet dung may be dug out of kraals by men and formed into flat briquettes by women. These briquettes or mapharoa are placed

on grassy slopes, flat stones or kraal walls to dry. Then, like lisu, they are carefully stacked for household use. The average piece weighs .4 kilograms. Both lisu and mapharoa are very concentrated fuels, available year-round to cattle owners, but only occasionally sold to others.

Khapane is dry cattle droppings, gathered from fields where they have been grazing. Since cattle graze on common land, any woman is free to collect khapane regardless of who owns the cattle. However, considerable time and labor is required to travel to areas where cattle graze and pick up the scattered droppings. In addition, khapane is primarily available during winter and early spring, when all the cattle are home from the cattle posts and neither summer rain nor insects have destroyed the droppings. In late winter and early spring, just before the cattle leave the villages, many women from households that do not own cattle go to the fields each day, spending about three hours to walk, collect and return with bags of khapane, weighing an average 20 kilograms each. These, too, are stockpiled for summer use, when dung is difficult to obtain.

Horse and Donkey Dung

Because of differences in their digestive systems, equine dung is much lighter in weight and has more undigested organic matter than cow dung. Bokuluba is regarded as a less desirable type of fuel because it burns faster, produces less heat and gives off more smoke than cow dung. Nevertheless, it is easily

collected wherever horses or donkeys travel or graze during dry periods and hence, is often utilized by those who have no regular supply of cow dung. Some women and children go out twice a day to collect a basin of bokuluba, which is then used to cook or heat water. If fresh, it must be protected from scratching chickens until sufficiently dry. An average bag weighs about 16 kilograms.

Shrubs and Weeds

Patsi is a general term for woody fuel, although it is primarily used to refer to shrubs collected in ravines and the mountains. In Lesotho's lowlands and foothills, there is a wide variety of woody shrubs, some growing taller than a person's head. However, in Mokhotlong's alpine environment, most lowland types of shrubs do not grow. The most common and valuable mountain types of patsi are several species of chrysocoma, called sehalahala. Although rarely more than 50 centimeters tall, some bushes have ring counts showing them to be 20 or more years old. Other shrubs such as Nestlera acerosa (rapeise) and Pentzia cooperi are also used.

Areas where shrubs can be collected are regulated by the chief, as are grazing lands and other community resources. Slopes immediately adjacent to the village are usually reserved for the extremely aged and infirm, who "have no daughters-in-law to collect fuel for them." Each village has its designated collection area, but for some, it may be two to four kilometers away and several hundred meters up in elevation. In Linotsing,

Mapholaneng and Ntlholohetsane, fuel resources are particularly limited, and many households either buy patsi collected by women in more distant villages or send boys with donkeys to cattle posts to bring it back. Of the households interviewed, 43.2 percent said they sometimes buy patsi, and 10.1 percent purchase dung. Only 13.5 percent reported selling patsi, and 1.4 percent sell dung. Villages which are in a position to supply shrubs and dung are more remote and were not reached by this survey. The average weight for a head-load of patsi is 20 kilograms, and donkeys usually carry two, 10-kilogram loads. A woman may spend four to five hours collecting a head-load and several hours a second day transporting it to town for sale, at M1 in most locations.

In areas where there is little or no sehalahala, annual weeds, such as datura, wild marigold and other small plants, like Arthemisia afra (lenganal) and Athanasia linifolia (lelingoana), are collected in and between the fields. In densely populated villages, like Mapholaneng, school children and women scour the whole area within walking distance, collecting whatever combustible biomass they can find and leaving little but bare earth and rock. The average bundle of lengana weighs 10 kilograms. These are sold by women willing to take the time to collect them, particularly in the Mapholaneng area. The Linotsing chief exerts strict control over the gathering of weeds, as well as other types of patsi. He explained at a village meeting that according to Basotho law

and custom, such annuals should not be collected in autumn until they had scattered their seeds--an example of the extent to which local communities recognize fuel shortages and have developed customary practices for controlled use.

Crop Residues

Wheat straw, maize stalks and cobs, and pea or bean plants may also be used as fuel. However, there are competing demands for crop residues. In the meeting at Linotsing, women complained that the chief's strict regulations left them no choice but to burn crop residues or go without cooked food. The men complained that women should not burn residues which they wanted to feed livestock through the winter or plow into the fields. Women who have straw after threshing must decide whether to burn it, or use or sell it for thatching. Because most women participate in cooperative work groups at harvest time and each is given a bundle of wheat at the end of the day, even those without fields have some access to this resource. However, straw burns very quickly and is messy to use indoors, so its value as a fuel is very limited. Maize cobs can be used in a paola rather like dung, but relatively little maize is grown in the high mountains.

Trees

Families which own willow or poplar trees will occasionally cut down one or two, or trim branches to burn, using oxen to haul large trees up from river bottoms. Others sometimes buy such wood from the owners. However, the number

of trees in the Mokhotlong district is extremely limited and wood is also needed for building, so the amount available for fuel is very limited. Stove-length pieces of wood are imported from Natal for use in government offices and sale in Mokhotlong shops. None was reported in the survey.

Coal

Like stove-wood, coal is imported from Natal and is only used in the towns along the road. A few households in Mapholaneng and Ntlholohetsane reported using coal, mostly civil servants and shopkeepers with access to vehicles and suppliers. A bag of coal weighing 80 kilograms cost M5 to M8 in Mokhotlong, in contrast to M3.4 in Maseru.

Paraffin

There are about a dozen shops in Mokhotlong town which sell paraffin (kerosene)--three in Mapholaneng, one in Malefiloane and several in the Malefiloane area, but no shops in the first four villages surveyed were selling it. Women complained about the difficulty of walking three to six kilometers to buy paraffin and the higher prices charged in these remote areas. A liter could be had for 48 or 50 cents in Mokhotlong town, but cost 60 to 70 cents in the Malefiloane area. Many villages are much further from any road or shop, thus putting paraffin out of the geographic and financial reach of most villagers. Paraffin prices, with comparable urban to rural variation, are similar throughout Lesotho. A national subsidy has checked the price escalation of the 1970s, keeping

prices generally around 50 to 60 cents. Of all the households interviewed, 91.7 percent occasionally use paraffin, but some use less than a liter a month for lighting only.

The reported use of each fuel type for the week immediately preceding the survey is shown in Table 3-14, as well as the percentage of households using each during that period. It must be recognized that these self-reported quantities are much less accurate than if the survey team had performed the measurements. Often, people could not remember or found it difficult to estimate quantities, and indigenous measurements, such as a head-load, full basin, full bag, etc., are not easily translated into standard units. A number of sample measurements were made to find an average weight for common units. The degree of correspondence with autumn fuel use in Malefiloane as measured and reported by Marc Best is reassuring.* Repeated recall surveys at two other seasons of the year are planned, as well as accurate measurements of actual fuel use.

Table 3-15 presents average fuel prices for the Mokhotlong district, but care must be exercised in their interpretation. Dung fuels, such as lisu and khapane, are usually gathered rather than purchased, and lisu requires little time to collect since it is removed from kraals near the home. In addition,

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*Marc Best, The Scarcity of Domestic Energy: A Study in Three Villages, SALDRU Working Paper No. 27, South African Labour and Development Research Unit, Cape Town, 1979, pages 79-83.

TABLE 3-14

Reported Fuel Use per Week in Autumn
(148 households)

Fuel Type	Mean Amount Used per Household	Percentage of Households Using Fuel
lisu (cow dung from kraals)	16.5 kgs	55.4%
mapharoa (cow dung briquettes)	3.3 kgs	25.0%
khapane (cow dung from fields)	5.9 kgs	31.8%
bokuluba (horse/donkey dung)	6.3 kgs	37.2%
all dung	32.1 kgs	not calculated
shrubs	23.0 kgs	81.8%
willow and poplar trees	1.0 kg	7.4%
crop residues	2.5 kgs	10.8%
all woody fuels	26.6 kgs	not calculated
paraffin	2.2 liters	92.6%
coal	1.0 kg	3.4%

TABLE 3-15

Fuel Prices in Mokhotlong

Fuel Type	Selling Price in Maluti	Energy Content	Price per Megajoule
lisu	M2.5 per 30 kgs	14 MJ/kg	M.0060
mapharoa, khapane and bokuluba	rarely sold	--	--
khapane	M.5 per 20 kgs*	13 MJ/kg	M.0019
sehalahala	M1 per 20 kgs	15 MJ/kg*	M.0033
coal	M8.5 per 80 kgs	29.7 MJ/kg	M.0036
paraffin-urban	M.5 per liter	43.9 MJ/l	M.0114
paraffin-rural	M.7 per liter	43.9 MJ/l	M.0159
LP gas	M1 per kilogram**	--	--
gasoline	M.75 per liter	41.9 MJ/l	M.0179

*Estimated figures.
**Unavailable in shops in the Mokhotlong district.

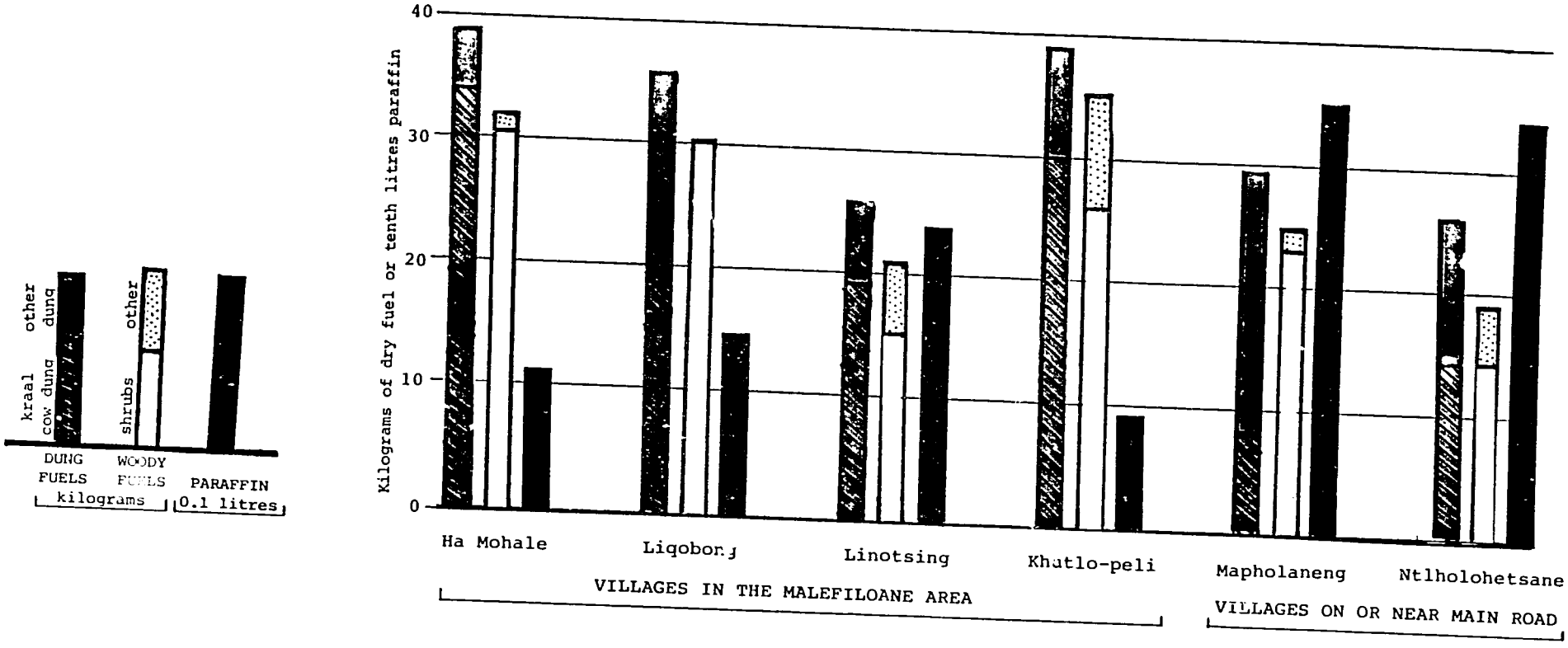
there are no standard measures for fuels that are gathered (dung and sehalahala), which results in some variance in the amount held by a bag or bundle. Petroleum products command higher prices in less accessible areas, but are often unavailable.

A clear inverse correlation between the use of biomass fuels and paraffin is shown in Figure 3-2, which compares mean household use of major fuel types by village. (The data presented in this figure may be found in Appendix II). For comparability, 0.1 liter of paraffin is plotted on the same scale as one kilogram of dung or woody fuel. The graph also distinguishes between the primary biomass fuels (kraal cow dung and shrubs) and less desired types (field cow dung, equine dung and crop residues). In villages where the use of dung and wood is below average--Linotsing, Mapholaneng and Ntlholohetsane, paraffin use is above average. Also, where kraal dung is in short supply, inferior dung fuels are used to a greater extent.

3.4.2 Cooking

Each household was asked to list all foods cooked on the previous day along with the time of day, place and type of cooking device, and fuel type. These data, together with information on household cooking equipment and types of fuel used, provide a picture of present energy use for cooking during autumn. Since there are seasonal variations in the availability of fuel, food and need for space heating, this question will be repeated again in early spring and midsummer.

FIGURE 3-2



COMPARISON OF MEAN WEEKLY USE

OF MAJOR FUEL TYPES BY VILLAGE

Table 3-16 shows the main types of foods, together with the total number of times mentioned and most common time of day each was cooked. The term for midday (motseare) can actually mean anytime from around nine in the morning to two in the afternoon. Afternoon (mants i boea) implies late afternoon to dusk, and night (ka phirimana), any time after sunset.

The importance of papa as the starchy staple and moroho (green leafy vegetables) is obvious. In the lowlands, sorghum (mabele), which was the traditional staple crop of the Basotho, is commonly grown and cooked into a soft porridge, slightly fermented sour porridge, beer, and occasionally, thick porridge and bread. In the mountains, particularly the higher elevations, wheat is the staple crop. Maize and sometimes sorghum are grown along river valleys, but much maize, sorghum and wheat flour are imported from South Africa. Yellow cornmeal and "bulgur wheat" are available through Food-For-Work as well as school and clinic feeding programs. Thus, any of these grains, but above all wheat, may be used in preparing staple foods.

A variety of wild greens are gathered, while cabbage, chard, mustard and beets are commonly cultivated. Imported cabbages are usually sold in shops, particularly in winter when no other greens are available except those which have been sun-dried. After the morning and evening milkings, milk is customarily boiled to sterilize it and is frequently eaten with the daily papa instead of greens. Bread is commonly made with

TABLE 3-16

Types of Food Prepared and Time of Day Most Commonly Cooked (148 households)

Type of Food	Frequency of Preparation	Most Common Time for Preparation and Frequency	
papa (thick maize porridge)	204	morning	109
green leafy vegetables	162	morning	84
tea	58	morning	34
lesheleshele (soft porridge)	50	morning	40
bread	43	afternoon	21
milk	28	afternoon	28
potatoes	15	afternoon	7
meat	14	afternoon	7
motoho (sour porridge)	12	afternoon	6
pumpkin	12	afternoon	7
likhobe (boiled grain)	12	midday	8
peas	4	afternoon	2
beans	4	midday/after.	2/2
eggs	3	morning	2
stamp (maize hominy)	3	afternoon	2
beer	3	midday	3
leftovers	3	midday/aft./night	1/1/1
others	8	---	
total cooking instances	638	morning	316

local wheat or imported flour, by either steaming or baking in flat-bottomed iron pots. Since large quantities of bread are usually prepared at a single time, it is eaten more often than the cooking frequency would seem to indicate. Evidence previously presented concerning the frequency of brewing beer suggests that it is prepared more often than this listing implies. Some women probably did not list it among "foods" prepared the previous day because it is regarded as a rather special category, requiring large quantities of water, two cooking operations plus fermentation and large pots or drums not used for ordinary cooking.

Table 3-17 shows the types of cooking devices used for the 638 cooking and 316 water heating instances reported. Cooking is divided almost equally between the open fire, paola and paraffin stove. A detailed correlation with food types shows that tea, meat and occasional store-bought foods, like rice, tomatoes and soup, are more often prepared on the primus or coal stove. With tea, this is because of the convenience of heating water quickly before people go off to school or work in the morning. In the other cases, it is probably because those who can afford such expensive foods are likely to be able to afford to cook with paraffin and coal, and to live near shops which sell both. This hypothesis is borne out by the correlation of cooking devices with villages, significant at the .0000 level. Between nine and 12 percent of cooking instances in Ha Mohale, Liqobong and Khutlo-peli employed

TABLE 3-17

Use of Various Devices for Cooking and Water Heating

Device	Percentage of Reported Instances	
	Cooking	Water Heating
open fire	36.7%	33.4%
paola	32.8%	37.3%
paraffin pressure stove	29.2%	28.0%
coal stove	1.4%	1.4%

paraffin stoves, compared to 39 percent for Linotsing, 45 percent in Mapholaneng and 50 percent for Ntlholohetsane.

Data show that in autumn and early winter, when the survey was conducted, 85.3 percent of all reported cooking operations occurred indoors, with only 14.7 percent outdoors. The only food prepared outdoors more often than in was beer, again indicative of its special status. Motoho (sour porridge) and likhobe (a general term for the long, slow boiling of grains and legumes) were prepared outdoors 42 percent of the time. The fact that so much food preparation is done indoors, even when open fires or paolas are used, indicates the importance of fire in providing heat, light and a family social center, as well as for cooking. Of course, those who cook on a primus do so indoors, for such stoves are disturbed by the slightest breeze. Heavy winds often forces people to cook indoors, as does rain. At these high elevations, it is almost never too hot to cook indoors, although the desire to avoid smoke often prompts women to cook foods not intended for immediate consumption--beer, sour porridge and bread--outdoors at midday when the weather is favorable.

Information on the types of fuels used for both cooking and water heating is given in Table 3-18. These data and their correlation with villages correspond very closely to the figures on weekly fuel use given in Table 3-14. It will be important to compare the data obtained for different seasons. Interviews and observations indicate that the use of patsi is

TABLE 3-18

Use of Various Types of Fuel for Cooking and Water Heating

Fuel Type	Percentage of Reported Instances	
	Cooking	Water Heating
kraal cow dung (lisu, mapharoa)	28.4%	31.8%
field cow dung (khapane)	2.6%	3.2%
horse dung	2.7%	2.2%
shrubs and weeds	30.4%	28.7%
poplar and willow	2.2%	2.2%
crop residues (primarily straw)	2.2%	3.2%
paraffin	28.5%	27.7%
coal	2.0%	1.0%
total number of instances	638	316

much greater during the summer when cattle are away at the posts and rain makes it easy to uproot shrubs and weeds during their period of maximumm growth. Such fuel is often collected daily in summer and stockpiled for use in autumn during the busy harvest season. Some weeds, like datura and wild marigold, are only dry enough to burn in autumn and early winter after heavy frosts. Dung is the principal biomass fuel during winter and early spring, when the livestock are home and graze in harvested fields near the villages. Clear winter weather and the lack of insects allow the dung to dry quickly and be collected more easily than in summer. Also, the need for space heating makes the longer lasting dung fuels more desirable for indoor cooking and heating.

The relationship between fuel availability and type of food prepared, on the one hand, and cooking frequency, on the other, was mentioned by a number of respondents. Several women said they used to brew beer often, but as fuel had become scarce near the village, they could no longer spend the time required to collect the large amounts needed for brewing, nor could they afford to buy patsi from more distant villages. Some reported they often cook only once a day, eating leftovers at night. Many said they would like to cook more varied, nutritious and/or interesting foods, but did not have the knowledge, food supplies or fuel to do so. The fact that papa and moroho have become the daily diet in most of Lesotho may not be so much a matter of choice as necessity, for neither

takes more than 30 minutes to cook. Peas, beans and lentils are often ground to speed up cooking. These, together with pumpkin, occasional store-bought dehydrated soups and tinned fish, are welcome changes, as are boiled potatoes (which grow well in the high mountains) and roast maize at harvest time.

Meat was mentioned less often in the food listing than might have been expected, given the importance of livestock in the area and number of animals reported to have been killed or died (Table 3-13). However, meat, like beer, is a special category. As in most pastoral societies, the killing of an animal is not an everyday affair--it is usually reserved for ceremonial occasions or the arrival of visitors. Such events are often held on weekends when large numbers of relatives and neighbors can come to share in the food and related activities. Frequently, a hundred or more adults will be fed by one family on a feast day and another family, the next. No such occasions occurred during the mid-week interviews, but the importance of meat to mountain residents should not be underestimated.

In one village, an ox was slaughtered to honor a deceased person the last evening of interviews. Specific portions were roasted over an open fire at that time by the men who did the butchering. Other portions were boiled by the women who cleaned the animal's entrails. On Friday, as the team was leaving, a dozen village women began to cook the meat outdoors in huge pots and brewing drums in preparation for the feast Saturday, when several hundred people gathered for meat, beer,

bread and other food. No doubt the women who remained to clean up, and men who stayed to finish family business and scrape the skin on Monday shared in the remaining portions of meat and beer. In another village, just as interviews were being completed, the culminating ceremonies for the initiation of 34 adolescent girls were held. On this occasion, 34 sheep were slaughtered and great piles of patsi, which had been collected before the initiation period began, were used to cook the meat in four drums and 20 large iron cooking pots, with much meat left over for subsequent ceremonies in individual homes. At such times, the slaughter of animals and brewing of beer are religious acts in honor of ancestors who give the community its cohesion.

Other occasions for communal eating are provided by the round of cooperative work groups held almost daily during the harvest and threshing seasons in wheat growing areas. Several households reported cooking nothing the day before the interview because they had eaten at a neighbor's fields, while others reported cooking unusually large amounts and varieties of food because workers were coming to harvest their fields. Thus, despite the shortage of fuel and food, traditional Basotho society has developed and maintained ways to ensure that community solidarity is maintained, and both rich and poor members of the community have a share in available resources.

3.4.3 Water Heating

In each household, details were requested concerning the amount of water heated, time, fuel type, cooking device and place utilized. As Tables 3-17 and 3-18 show, the distributions for types of devices and fuels used for cooking and water heating are almost identical. This correspondence is explained by the fact that the same fire used for cooking is almost always used to heat water as well, either by placing water in a three- to 3.5-litre tin alongside the fire, or heating water in a pot or kettle just before or after cooking food. Heating water for tea was reported by respondents as a cooking task, not as water heating per se. Water is heated primarily for bathing first thing in the morning, washing hands and face again in the evening, washing dishes a bit later morning or evening, and bathing babies, new mothers and doing infant laundry at midday. The most important information, in terms of RET project activities, concerns the timing and amount of water heating, which is shown in Table 3-19.

Of particular significance is that 51.6 percent of all reported water heating instances and 47.8 percent of the total volume of water heated occurs at times other than first thing in the morning. The importance of this finding derives from the common conclusion that solar water heating would be innappropriate because Basotho mainly want hot water first thing in the morning. The data show that on clear days, about half of all the hot water needed could be provided by solar

TABLE 3-19

Time of Day and Amount of Water Heated

Time	Frequency of Water Heating	Mean Amount of Water Heated	Total Heated by All 148 Households
morning	153	5.3 liters	809.8 liters
midday	40	4.8 liters	191.7 liters
afternoon	99	4.6 liters	448.7 liters
night	24	4.2 liters	100.7 liters
total	316	4.9 liters	1,550.9 liters

energy, rather than combustible fuels, without any change in existing use patterns. The data slso show that relatively small amounts are heated at a time, suggesting that simple batch solar water heaters--perhaps utilizing pairs of readily available 3.5-litre, food-aid oil tins--could meet much of the present demand. Undoubtedly, if more hot water were available during the day, it would be welcome for additional tasks, such as laundry, which are now done in the icy water of mountain streams. Further, some morning tasks might be moved to later in the day, conserving precious fuel for traditional early morning bathing and tea preparation.

3.4.4 Space Heating

Cooking, water heating, space heating, lighting and ironing are interrelated activities--the same combustible fuels and fires often serve all five energy end-uses. Local building styles, seasonal variations, time and weather conditions are important in determining how end-uses are met. In cold rainy weather, early morning and evening almost year-round, and even during the day in winter, cooking and water heating are usually done indoors to provide space heating.

As noted, 85.3 percent of all cooking and 89.2 percent of all water heating instances reported were performed indoors during the autumn and early winter months, when the survey was conducted. There were some very cold rainy days, snow and temperatures below freezing during this period. Many evenings, even after the cooking was done, people would keep a small,

open fire going indoors to provide light and heat until bedtime or would bring a dung fire in a paola indoors just to provide warmth.

Table 3-9 shows that only 11.5 percent of the households interviewed own paraffin space heaters, and only 9.5 percent own coal stoves. Many who own these devices do not use them regularly because of the cost and transportation difficulties in obtaining fossil fuels. A paraffin pressure cook stove is also a welcome source of heat in a small room. They are most commonly used by those living in villages nearest the road, particularly in homes with iron roofs. Of the 79.6 percent owning these cook stoves, only a small number use them regularly due to malfunctioning and the high cost or unavailability of paraffin. Most space heating in thatched buildings is provided by either an open fire of dung or shrubs in the center of the floor, or a dung fire in a bucket-type paola.

Most of the houses visited were stone-walled rondavels with either no or very small windows. Such structures are designed to provide shelter and retain heat produced by fires and people, not to utilize the sun for space heating. Only a few rondavels and a larger number of rectangular houses have enough glazing to allow the sun's warming rays to enter. Buildings thatched with wheat straw stay reasonably warm if heat is provided, cracks are sealed and doors closed. However, the customary open door, and cracks and roof which permit smoke

to escape also allow cold winds to penetrate. Homes with galvanized iron roofs are much colder than thatched buildings because of heat lost through the roof and the fact that people rarely start fires for heating in such structures unless they own paraffin or coal stoves. Only two houses had a ceiling under the iron roof, and none had additional insulation.

3.4.5 Lighting

The traditional round hut is usually dark, even during the day, although more modern homes with larger windows allow more natural light to enter. Most domestic activities, and certainly those that require good light like sewing or reading, usually occur outside in the daytime. Survey responses show that artificial light is provided for an average of about three hours per night. Since the typical household has two buildings, most report having two lights each night, about equally divided between candles and small paraffin lamps. A mean of 2.3 candles, costing 12 cents each, were purchased per week per household--75 percent of all households regularly purchase candles. Small paraffin lamps are owned by 81.8 percent of all households.

Like rondavels, most of the schools and shops visited were dark during the day, and most are not illuminated at night. Only Mapholaneng High School, with several hundred boarding students, was able to provide sufficient lighting at night for study purposes. The school has a two-cylinder, Lyster, diesel generator, used three to four hours each night for the sole

purpose of providing light. One private home in Mapholaneng had a bright, paraffin pressure lamp--the other 147 households interviewed had no source of light greater than a single paraffin lamp or candle per room and a simple flashlight for the traveler.

3.4.6 Laundry

Clothes are usually washed in cold water with heavy scrubbing on rocks or in big tubs. It is necessary to have plenty of water to rinse out the soap, particularly when heavy blankets are being washed. Thus, people commonly carry their dry clothes to some place where there is water, rather than hauling water to the house. Women and girls may spend half a day several times a week at the edge of a river or spring washing clothes and spreading them out to dry nearby.

Only three percent of reported instances cited laundry as a reason to heat water, and these few cases were all new mothers with baby clothes and diapers to wash. One other instance was observed for a woman caring for an elderly, incontinent relative, who she said was just like a baby. It is certain that the provision of ample amounts of warm water would improve the quality of rural life by making easier, more sanitary clothing care possible, while also easing the discomfort of carrying laundry to wash in frigid rivers. However, the limited amount of fuel currently available for essential heating and cooking, and the distance to water

supplies make hot water for laundry a luxury that few villagers can hope to enjoy.

Table 3-9 shows that 68.9 percent of households own at least one flat iron for pressing clothes. Households reported ironing clothes an average of 1.4 times per week, usually for over an hour each time. The frequency was greatest in the two villages nearest the road (1.5 and 1.7 times) and least in Khutlo-peli, the village that appears most traditional. Families with schoolchildren, teenagers and employed members press clothes most often. Flat irons are most often heated on a paraffin stove (62.2 percent of all reports). The next most common method is to set the iron flat on its end next to a dung fire, while other cooking, water and/or space heating takes places (23.7 percent of reported instances). Heating irons on a paraffin stove uses quite a bit of fuel for once lit, the stove burns for an hour or two, during which time no other task can be performed but the alternate heating and pressing. An average of one hour and 53 minutes per week was spent pressing clothes.

3.4.7 Water Lifting and Transport

Three of the communities surveyed have gravity-fed water systems which supply clean fresh water from springs above the villages. However, in all three cases, the villages have outgrown the systems--storage tanks cannot hold enough water to provide a constant supply and some broken pipes have not been repaired. In these communities, households which are far from

the taps must use undependable springs or carry water long distances from piped supplies.

In the three communities without systems, clean water is one of the most urgently expressed needs. Animals and people compete for the water that is available from crudely protected springs, which are often near village paths. However, all three have adequate sources of clean water above the village, such that spring protection, storage tanks and simple gravity systems would be serviceable. In most of Mokhotlong's mountain villages, like the ones surveyed, pumping and lifting devices are not needed to meet basic domestic water demands.

A program for community organization, training and technical assistance to maintain existing village water supply systems and establish new ones is urgently needed. Interest and motivation seem very high. Many villagers said they had contributed money for a village water system to the Ministry of Cooperatives and Rural Development, but did not know what to do next. Village water systems are being built in the lowlands where pumping is necessary, but in the mountains, where much simpler gravity systems are possible, there is currently no one to give technical advice and material support to interested communities.

The survey investigated amounts of water drawn and brought to the house for daily domestic use, and found that water was drawn an average of 3.2 times per day. Multiplying by the reported bucket size gives a mean daily use figure of 54.8

liters per household. This does not include water used for most laundry, which is usually done at the river, spring or tap. Nor does it include water used for gardening because first, few people water during autumn, and second, most gardens are located in river bottoms or community garden areas at some distance from homes. Water is also important for livestock, but animals are commonly taken to watering places along rivers, rather than bringing water to the animals. Water is also used in building, as a a few respondents reported. One woman said she drew 18 buckets of water a day for masons who were mixing mortar to build a new house. A businessman in Mapholaneng owns a small diesel pump which he uses for about an hour each day to pump water up from a rivulet to storage drums above his house, for both domestic use and a concrete-block manufacturing operation. (Only his domestic use was included when computing averages.)

In no village did people report times of severe water shortage, nor did the main rivers ever cease to flow. But, people certainly recognize the need for cleaner, closer, domestic water supplies and the agricultural problems faced during droughts. Communities that experience the greatest water shortages in late winter are those located at the edges of the towns along the road, as well as the fringes of Mokhotlong town itself. In these areas, the number of people and homes has outgrown available water supplies, almost all natural vegetation has been gathered for fuel or fodder, and

human habitation and inadequate sanitation have polluted many existing water sources.

3.4.8 Grinding Grain and Related Food Preparation Tasks

Since wheat is the major crop in the Mokhotlong district and many households live too far from Mokhotlong town to buy processed flour, energy use in grinding grain was studied. Information was collected on the amount of time spent processing and grinding grain by the three typical methods--by hand using a flat grindstone and cylindrical stone grinder; with a hand-operated, home, iron grinding mill; and at a commercial diesel mill (one is located in Mokhotlong town and another at Frazer's store in Tlokoeng, about eight kilometers from Mapholaneng). The survey data on commercial grinding were too variable to be analyzed--some respondents included time spent in transportation and waiting, while others reported only the actual milling time. Data for the other two methods, discussions which ensued and observations of daily domestic routines help clarify energy use in food preparation and point up that far more than grinding is involved.

First, it is clear that threshing wheat is a time-consuming task. It is sometimes performed by groups of men, occasionally by animals, but most often by single women who may sit for half a day or more beating the wheat stalks with sticks against flat stone threshing floors to loosen the grains. This careful threshing preserves the wheat straws, which are essential for thatching now that no natural thatching grass

grows in the Mokhotlong mountains as it does in the lowlands. Straw is also used for craft work in some villages and as a fuel. Thus, any technological innovation to ease the burden of threshing wheat must not destroy this vital local resource. Maize is less common in the mountains compared to the lowlands, and most of what is grown is roasted on the ear before the final harvest. There is rarely enough produced for threshing or shelling maize to be considered burdensome.

Sorting wheat is the second, very time-consuming task in food preparation. There is a particularly noxious weed called belete (a type of wild oat) which grows with the wheat in many fields. Its long, black, inedible seeds ripen at the same time as wheat and are extremely difficult to separate from the desired grain. Thus, women often spend as much time picking belete grains out before grinding, as they subsequently spend actually grinding the wheat.

A third, energy-consuming preparatory chore is beating the grains to loosen the husks before grinding--ho tula, to crush, stamp or beat. This is done most often before grinding maize or hard, old wheat from a previous year. The grain is first soaked in water to loosen the husk and then pounded with a stone pestle in an old tin can or a depression in a rock until the husks can be separated from the grains. Although this step is not necessary for every grinding operation, when it must be done, it takes at least as long as the grinding itself.

The survey results indicate the importance of commercially available grinding machinery. Table 3-9 shows that 45.3 percent of all the households interviewed own hand grinding mills. In Ha Mohale, furthest from Mokhotlong town's commercial mill, 77.8 percent of all households own hand mills, whereas in Ntlholohetsane, the village closest to Mokhotlong, only 16.1 percent own them. Clearly, the hand mill is a technology which is recognized as preferable to grindstones, but not as desirable as commercial diesel mills or store-bought flour. In late 1982, a diesel mill may be installed at a new Basotho-owned shop near the Malefiloane clinic and RET project workshop.

At the time the survey was conducted, respondents in the four villages near Malefiloane reported using hand grindstones 1.6 times per week, primarily for short, easy tasks like grinding peas, lentils, malted sorghum or wet dough. They used hand grinding mills 6.1 times per week, spending well over an hour each time on the longer, more difficult tasks of grinding wheat, sorghum and maize. In contrast, those in the two villages nearer the road and commercial mills only used hand mills once a week. A radical decline in the use of hand mills in the Malefiloane area is likely if a commercial mill is installed. Thus, grinding, which is regarded as a very burdensome task, may be performed by a fossil fuel-driven, commercial milling system in the area surveyed, at least for

those who are able to pay the price and can transport their grain to the commercial mill.

3.4.9 Food Preservation

The preservation of food by dehydration, bottling and in storage pits is not new to villagers in Lesotho's mountains, particularly older people and those in remote villages who have not yet become dependent on imported foods. Table 3-20 shows the preservation methods along with the types of food and mean amounts reported by those making use of each method.

The amounts preserved by bottling are quite small--usually only a few jars per household. In addition, bottling is generally restricted to the more affluent households in Mapholaneng and Ntlholohetsane, where peaches and tomatoes are grown and sold. Bottling is an expensive preservation method, which requires a capital investment in bottles, a large cooking pot, paraffin for boiling and sugar to cook with the fruit, but it does have a prestige value. Rows of bottled fruit are decorative items in many Basotho homes where fruit is available, and preserved peaches are a favorite food for feasts and as gifts. Although drying is a common preservation method for fruit in other parts of Lesotho, it is rare in the Mokhotlong district because the number of fruit trees is limited by high altitudes and cold weather.

Dehydration is, however, important for preserving vegetables where imported cabbages cannot be purchased. Many households reported storing several 20-liter tins or 50- to

TABLE 3-20

Amounts Preserved by Method and Food Type

Method	Food Type	Number of Households Reporting	Mean Amount per Report in Liters
Dehydration	cabbage	43	61.9
	wild greens	15	37.0
	unspecified greens	42	76.1
	green peas	4	33.7
	carrots	2	12.5
	pumpkin	2	35.0
	green beans	2	4.0
	onions	1	10.0
	tomatoes	1	5.0
	peaches	1	5.0
	meat	1	?
	total	114	58.9
Bottling	peaches	17	6.0
	tomatoes	4	6.0
	carrots	2	4.5
	green beans	2	6.5
	total	25	5.9
Storage Pits	potatoes	30	86.2
	unspec. root vegtbls.	14	115.7
	carrots	5	37.0
	turnips	2	15.0
	cabbage	1	300.0
	peaches	1	20.0
	total	53	89.4
Total Preservation Reports		192	60.5

100-liter bags of dried green leafy vegetables, such as cabbage and chard from their gardens and wild greens. Drying is simply done on mats laid on the ground or sheets of iron roofing. Wind, rain and dust were mentioned as problems. Meat is occasionally dried by cutting it into thick strips and hanging it in the sun for several days. Dried peas, beans, lentils and grains were not recorded in this category, except where fresh garden produce was specifically indicated, because grains and pulses are usually very dry when harvested and are simply stored in bags after shelling or threshing. Here, rats and insects are much greater post-harvest problems than dampness.

Based on observation, it appears that most vegetable drying does not begin until the very end of the autumn growing season when heavy frost begins to kill the cabbages. Then, there is insufficient time to dry all the produce available. Perhaps improved drying techniques, as well as an emphasis on drying throughout the growing season, would increase the year-round availability of a variety of vegetables. Information should be collected on traditional methods for cooking with dried foods from elderly villagers, who still remember the days before non-nutritive, imported, white cabbage became so common.

3.4.10 Home Construction and Maintenance

It has already been noted that 93.9 percent of the households surveyed have one or more thatched-roof, stone-walled rondavels; 16.2 percent, thatched rectangular houses; and 22.3 percent, rectangular houses with iron roofing (Table

3-8). In the two most remote villages (Ha Mohale and Liqobong) and the most traditional (Khutlo-peli), the majority of new buildings are thatched rondavels, while in the other three, most new buildings are iron-roofed, rectangular structures.

Table 3-21 lists responses to the question, "What would you like to do to renew or improve your household buildings?" It should be noted that some respondents mentioned only one thing, while others described several features of new houses they would like to build or improvements they would like to make. Of particular significance is the number who want to build new buildings with iron roofs, cement walls and floors, ceilings and windows. Interest should be fostered in energy-saving designs for simple rectangular houses, especially those utilizing modern building materials, as well as the more traditional rondavel.

A shortage of building sites in villages near the road and of building materials almost everywhere was mentioned by many village leaders and invididuals. The shortage of thatching straw is a problem which forces people to delay repairs or new construction, or use iron roofing even if they prefer thatch. People said that enough straw to thatch a typical, small rondavel would cost about M40, <u>if</u> it could be purchased from other villagers. Some women thresh wheat carefully and sell the straw to those wishing to thatch in order to earn small incomes. Suitable building stone is also in short supply in some villages, like Ha Mohale and those along the road. Stones

TABLE 3-21

Desired Home Improvements
(148 households)

Type of Improvement	Frequency of Mention
build a house with iron roof	56
build a big new house	42
build more rondavels	35
plant trees	27
buy furniture, dishes or utensils	25
thatch or repair existing building	22
fence the household plot	20
build a latrine	20
put in a cement floor or linoleum	15
plant a garden	13
install fuel-saving stove described by RET project interviewers	11
smear the house with fresh dung	10
raise chickens, pigs, other animals	9
paint or plaster existing walls	8
buy a coal stove	8
build livestock enclosure	8
put ceiling in new or old house	7
build or improve existing shop or bar	6
enlarge existing home	3
put water tap in yard or house	3
improve agriculture	3
put windows in new building	2
other	1

are available in other villages, but require long hours of backbreaking work to dig and move. In the two villages on the road, much new construction is done with cement blocks because they are easier to obtain and use than the hard, volcanic mountain stone. Many masons prefer cement blocks for quick, easy rectangular construction. Other building materials, such as roofing iron, planks, doors, windows, wire, etc., are available from the main shops in Mokhotlong town and Natal. Occasionally, materials can be bought elsewhere or ordered, but usually at exorbitant prices because of the transportation required.

Certainly, obtaining and transporting building materials, either traditional or modern, is a major energy-related problem for most of the district. Even in Mokhotlong town, all imported goods must be trucked over the long, six-hour route from the western lowlands or the precipitous Sani pass, which drops down into Natal. Horses, donkeys and people can be seen carrying heavy roofing materials and planks to villages far from the main road. Herdsmen who wish to roof their summer shelters at cattle posts may have to travel several days with donkeys to haul poles from villages fortunate enough to have trees. Men use ineffective little wooden sledges pulled by oxen to transport building stone, or sometimes, they simply roll the rock down a long hillside above the village, compounding serious sheet erosion problems. Respondents listed

the tasks of digging and hauling stone, building and thatching among the most difficult tasks that men perform.

Thus, energy use problems related to buildings have two aspects:

- design, construction and heating, so buildings are warm and comfortable; and
- obtaining, transporting and building with local or imported materials.

3.4.11 Electricity for Lighting and Communication

One last type of domestic energy investigated was the small amount of electricity provided by batteries. Of the households surveyed, 43 percent own a flashlight; 43.9 percent, a radio; and 12 percent, a cassette or record player. Altogether, 43.9 percent reported the occasional purchase of batteries for these end-uses. The husband of one enumerator even brought a battery-operated television home from the mines, although the wife had neither the large automobile battery nor the antenna required to use the television in the village where she lives. Two homes had small, overhead, hanging lights made from automobile headlamps, designed for use with batteries--neither was operative. Shops and mail-order houses in South Africa, which cater to the rural African market, advertise a variety of battery-operated radios, cassette players and lights, and most shops in the Mokhotlong district sell batteries. In the villages studied, no one had a generator for domestic use; the only one is at Mapholaneng High School, which has already been mentioned in section 3.4.5 on lighting.

3.5 Agricultural Energy Consumption Patterns

The basic distribution of agricultural implements, crops and livestock has already been discussed. In this section, energy utilization in the agricultural process is considered.

3.5.1 Garden and Field Crops

For garden crops, the soil is usually tilled by hand, with small individual and communal plots being turned over with a spade or fork after the spring rains begin. A few households use ox-drawn plows for the initial tilling, if the plot is sufficiently large and accessible. Planting, watering, weeding and harvesting are all performed by hand, customarily by women and children. For field crops, tilling is accomplished by animal traction, with ox-drawn plows. No household interviewed owns a tractor, and only six reported using a tractor to plow. Planting is usually done by hand, broadcasting the seed, followed by the use of a plow, harrow or rake--only six households own planters. No one reported employing horses, mules or donkeys for any field cultivation, despite the large number of these animals in the district.

Twenty-seven households reported paying cash to hire oxen for traction. In the majority of cases, however, traction is provided by the household's own animals and plows, or a variety of traditional arrangements whereby animals, implements and labor are pooled or exchanged. The interrelationship of different forms of energy is well-illustrated in such exchanges. For example, a woman with fields, but no cattle or

male labor, may ask men with cattle and plows to cultivate her fields in exchange for food and beer. The woman's energy is used to grow and collect the necessary grains and vegetables, gather fuel and then, prepare the food by grinding, cooking and brewing. Within Lesotho's traditional agricultural system, such energy exchanges are a basic means of equalizing resources and enabling all community members to participate in food production. Similar labor exchanges are often involved in other cultivation processes and occasionally, other laborious rural tasks. Table 3-22 lists all the kinds of occasions when households reported using cooperative work groups.

Hoeing and weeding, particularly in maize and sorghum fields, are often performed by groups of women who work in one another's fields in exchange for either the labor or food and beer. When harvesting wheat, almost every field is cut by mixed groups of men and women with sickles as their only tools. All receive food and drink, but each woman also gets a bundle of wheat to take home at the end of the day. For some villagers without fields, these cooperative occasions are their only means of obtaining grain and straw. At threshing time, too, labor is exchanged, and small amounts of grain, as well as food and drink, are distributed to workers.

The repair of agricultural implements, particularly plows, is an energy-related problem. When asked about recent repairs, 23 households mentioned broken wooden plow beams; 18, metal plow parts; 10, saddles; and seven, sledges. Because of the

TABLE 3-22

Cooperative Work Groups
(148 households)

Type of Activity	Number of Reports
harvesting wheat	88
threshing wheat	65
hoeing/weeding	43
collecting rocks for building	14
harvesting maize or sorghum	8
digging dung from a kraal	8
collecting firewood (shrubs)	6
building a house or kraal	5
plastering a house	4
clearing stones from a field	3
carrying furniture down steep slope	1
chopping firewood	1

lack of facilities, farmers must attempt their own crude repairs with inadequate materials or simply abandon equipment until they can purchase new parts or tools from distant shops in Mokhotlong or Natal. Technical support of individuals who currently make tool repairs in villages and providing metal repair services in remote areas would improve farmers' ability to utilize existing agricultural equipment.

The use of fertilizer and other means for increasing soil fertility is extremely limited in the area surveyed, as indicated in Table 3-23. The field cropping system, developed as Basotho moved up into the mountains in the late 19th and early 20th centuries, depended on exploiting virgin grassland. No more virgin land is available, and soil depletion as well as sheet erosion are marked features of villages in areas of the oldest cultivation, grazing and human habitation. Because fields must be used for winter grazing, crop residues are carried home for winter fuel and fodder, and dung is also burned, there is little organic matter available to be plowed into fields in the spring. The fact that some households use dung and ash on small garden plots indicates an awareness of the value of such inputs, particularly among women who are responsible for vegetable gardens, and usually control dung and ash supplies. There was no reported or observed attempt to compost other organic material, such as uprooted weeds or straw, and no use of mulch. Although some farmers expressed a desire for improved agricultural methods, there is almost no

TABLE 3-23

Ways Households Use Fertilizer and Organic Agricultural Inputs
(148 households)

Location	Commercial Fertilizer	Dung	Ash
fields	2.7%	3.4%	0.7%
gardens	--	14.9%	10.1%
not used	97.3%	81.8%	89.2%

use of commercial fertilizers in the survey sample, perhaps because of their high cost and transportation difficulties, as well as a lack of agricultural extension services.

Lack of water during the early growing season was mentioned by many households as a serious problem, yet no irrigation or water catchment systems were observed. The three village water supply systems are inadequate to even supply water for domestic needs to all the homes, let alone garden irrigation. Thus, most plots are simply watered by carrying buckets up from springs or streams.

3.5.2 Trees

Many of those interviewed recognized the desirability of trees (both fruit species, and poplar and willow which provide fuel and building poles), yet the absence of trees is one of the most marked features of the Mokhotlong landscape. The area was originally grassland with shrubs and Cape Willows in a few sheltered spots and river bottoms. Some early settlers did plant willows and poplars, and fruit trees have been planted by some households at lower elevations. Individuals continue to make small, successful plantings, but there are few extensive government- and community-supported planting activities, as are common in the lowlands. Table 3-24 shows the mean number of trees planted per household in 1981 for each of the six villages and the mean for the entire group. The means for Khutlo-peli and Mapholaneng are higher than average, largely due to a few industrious planters in those two villages.

TABLE 3-24

Mean Number of Trees Planted per Household in 1981 by Village

Village	Mean Number of Trees Planted	Total Number of Trees Planted	Number of Interviews
Ha Mohale	2.4	43	18
Liqobong	2.3	53	23
Linotsing	3.0	69	23
Khutlo-peli	6.0	156	26
Mapholaneng	5.0	136	27
Ntlholohetsane	3.0	90	30
total	3.7	547	147

Farmers who had planted trees which subsequently died were asked to explain why they thought their efforts had failed--Table 3-25 lists the reasons given. The two biggest problems are destruction by animals because of inadequate fencing or grazing control and adverse weather conditions, particularly drought. Energy and technical support, in terms of selecting and transporting suitable types of trees, fencing, regular watering, training foresters and agriculturalists, and mobilizing communities to plant and then protect trees, are essential inputs, if much desired increases in fuelwood, building poles and fruit are to be achieved. Meanwhile, the strategies of those few who have managed to successfully grow trees should be investigated, encouraged and disseminated to other concerned individuals.

3.5.3 Livestock Care and Utilization

Livestock can be regarded as one of the most basic energy sources for mountain villagers, along with the human energy required to care for and utilize them, and the land which provides food for both people and animals. Cattle provide almost all of the traction and about a third of the fuel, as well as meat, milk and skins. Sheep and goats are a major source of cash income from the sale of wool and mohair, as well as meat and skins. Horses and donkeys are the basic means of transportation for people and goods. Naturally, animal care demands considerable time and energy. Stone livestock enclosures must be built, maintained and periodically dug out.

TABLE 3-25

Reasons Reported for Death of Newly Planted Trees
(115 interviews)

Reason	Number of Times Reported
eaten by livestock	24
killed by drought or sun	21
do not know	6
killed by frost or cold	5
uprooted by children	4
killed by rats or worms	3
planted in poor locations	3
improperly planted	1

Men or boys must herd animals every day of the year to protect them from theft, assure good grazing and watering, and keep them out of cultivated fields. Some herdboys spend more than half the year living with their animals at distant cattle posts, while other men or boys at home provide daily care for milk cows, horses and donkeys. Many households grow barley for fodder or cut grass and wild oats daily throughout the summer to feed to tethered animals at night. Dipping and shearing small stock, and transporting the fleeces for sale, or taking animals to a wool shed also require labor.

Animals are so central to the life of isolated mountain villages that households without animals and males to provide livestock care become dependent on others for many basic necessities. Alternatively, particularly in areas where roads have penetrated, males may be devoted to wage labor in Lesotho or South Africa so that rural family members can pay cash for the transportation, traction, food and fuel which animals and fields have traditionally provided.

3.6 Energy Use in Transportation

Human and animal energy provide the primary means of transportation in the area surveyed, despite a growing network of roads and increasing number of vehicles. Observations and interviews revealed that women bear the heaviest physical burden in providing transportation. They head-load an average of 55 kilograms of water per day, more if they are brewing or building, and also climb the mountains almost every day to head-load bulky 20-kilogram bundles of brush or bags of dung. Of the people traveling up to 30 kilometers from outlying villages into Mokhotlong town, the majority on foot are women, who then carry their heavy purchases home that evening or the next day. Many women in the district do utilize horses for their trips to clinics and shops, but if goods must be carried by human energy, usually women are expected to do so.

Men and boys probably spend as much time providing transportation as women, but usually do so with the aid of horses, donkeys or oxen. In addition to transporting people, horses and donkeys are used extensively for carrying bags full of grain, flour, maize meal, fodder and many other loads. They are even used for such cumbersome loads as coffins, metal window and door frames, iron roofing and heavy trunks containing the goods of returning migrant workers. Yet, there are very few pack saddles and no open carrying baskets commonly used on donkeys in other African countries. Oxen could be used much more efficiently for transportation, if there were more ox

carts, rather than the crude wooden sledges currently used for hauling rock. Only one functional ox cart was found among the 148 households surveyed, but at the time of survey analysis, ox carts were being stocked and sold for M560 at Co-op Lesotho in Mokhotlong and Mapholaneng--an innovation in the district's transportation system.

The relative importance of different types of transportation and traction is reflected in responses to a question asking for an estimate of how many days per year each type was used (see Table 3-26). The use of horses was highest in the village furthest from Mokhotlong town (89.8 days in Liqobong) and lowest in the village nearest town (14.4 days for Ntlholohetsane). The use of vehicles was highest in Mapholaneng, on the main road from Maseru to Mokhotlong (21 days), and lowest in Khutlo-peli, halfway between Mokhotlong and Malefiloane (2.7 days).

There were only three motor vehicle owners among the 148 households surveyed. One is a young man from Liqobong who had just purchased a truck for use between Mokhotlong and his place of work in South Africa. The other two are shopkeepers in Mapholaneng. One makes purchasing trips in his truck about once a week. The other, who is part of a family with shops throughout the district, owns both a Landrover and a Mercedes-Benz truck, which he uses several times a week to go to Mokhotlong town or South Africa to buy supplies. Mokhotlong town is the only place in the district where petrol and diesel

TABLE 3-26

Use of Various Means of Transportation or Traction
(148 households)

Means	Mean Days of Use per Year per Household
horses	50.4
cattle	27.5
donkeys	16.1
motor vehicles	8.7
airplane	0.6

fuel, as well as rudimentary vehicle maintenance, can be obtained.

The slowly growing network of tracks and feeder roads being built by labor-intensive village work groups is increasing vehicle transportation throughout the district. However, many villages remain far from any road, and few vehicles pass on small roads. In Ha Mohale and Liqobong, both at the extreme end of an existing road, there was only about one vehicle per week at or near the village. The road passing above Linotsing is still a steep, 45-minute scramble up from the village, and efforts to build an access road have failed thus far. Although Khutlo-peli is on the road from Mokhotlong to Malefiloane, the three or four trucks which pass each day have business at the Malefiloane clinic, RET project, or supply goods and building materials to shops further down the road. Few villagers reported any occasion when they were able to travel or transport goods by truck.

Mapholaneng, however, is along the main motor road which was widened in 1982 to allow daily Lesotho National Bus service from the lowlands to Mokhotlong. The institution of this service, as well as another daily bus service, and the passing of many government and private vehicles, have made it possible for people from Mapholaneng and adjacent villages to travel to Mokhotlcng or Tlokoeng for shopping, clinic visits, grain grinding and other business. The improved road and increased public services have also increased the availability of goods

in Mapholaneng shops. Providing more roads, bridges and motor vehicles, together with goods and services they would bring, are high on the list of community improvements desired by the village leaders and individuals interviewed.

The importance of airplane services in this remote district is clear to any observer. Migrant workers regularly travel by air to reach bus or train terminals in South Africa. Government officials, doctors, development workers, school and church personnel, hospital patients and prosperous citizens travel by plane between Mokhotlong and Maseru. There are eight flights per week to Maseru, costing M33 one way, as well as several charter flights per day for migrant workers. Landing fields near Mapholaneng and at Malefiloane allow emergency medical access and scheduled doctors' visits at clinics in these communities. Air postal service between Mokhotlong and Maseru is rapid and dependable, with horse or truck connections to outlying post offices. Some villages, however, such as Ha Mohale, are several hours' walk from the nearest post office and closer postal service was an expressed community need. Although plane service is available to migrant workers, medical emergencies and the affluent, few ordinary villagers have occasion to travel by air and/or can afford it.

3.7 Energy Consumption in Small Industry, Trade and Institutions

Energy use in many small businesses and institutions was investigated by interviewing local business people, shopkeepers, vehicle owners, schoolteachers and other community leaders in the six villages. Many of the energy-related problems discussed are similar to those experienced by individual householders at the domestic level.

3.7.1 Fuel for Cooking and Heating Water

Women who brew beer as a regular business must obtain large amounts of fuel, normally shrubs or wood. Since these commercial brewers are concentrated in peri-urban areas, where traditional fuel supplies are exhausted, most buy sehalahala or similar shrubs from women who carry head-loads to town from villages two to 10 kilometers away. Some buy shrubs carried by donkey or truck from cattle posts up to 30 kilometers away. Only a few brew with dung, imported wood or coal, and apparently none use paraffin. Thus, brewing is a major use of the very limited amounts of local shrubs and wood. Women who cook food, such as bread, fat-cakes and meat, for sale in peri-urban areas usually use paraffin and pressure stoves. They mentioned the high cost of fuel as a problem.

The school program that provides a cooked meal each day is another major consumer of fuelwood. Parents and/or schoolchildren scour the hillsides near a school to gather fuel for cooking the food donated by various programs. At every

school visited, teachers and cooks complained about the time children must spend collecting fuel. They also mentioned the difficulty of cooking outdoors in windy or rainy weather and discomfort of cooking indoors in smoke-filled buildings. The interviewing team also observed the particularly barren hillsides wherever schools had been collecting fuel for a number of years, as in Mapholaneng and Linotsing.

No brewer, school cook or foodseller mentioned water heating as a specific problem. Yet, it was evident that for much of the cooking, as well as sanitary cleansing of utensils, any fuel-saving means of pre-heating quantities of water would ease the pressure of time and/or money now required to obtain fuel.

3.7.2 Water Supply

An adequate supply of water is recognized as a problem by some of the institutions visited. For example, in Ha Mohale, there had been an attempt in 1971 to install a gravity-feed system to provide water for school cooking and the school garden. However, plastic pipes were cut and not repaired, and a small retaining dam was not finished. In Linotsing, village water supply pipes crossing the donga to the school were broken, so water could not reach the far end of town where the school and its gardens were located. In Mapholaneng, there is a good, new water tank at the schools, but a new hotel/ restaurant and shop must cart water uphill for half a kilometer to meet their needs. Women who brew usually carry the 60 to 90

liters of water required by bucket, often from distant springs or taps. Clearly, there are problems with mobilizing communities, as well as providing the technical assistance to repair and extend village water supply systems to meet present and growing institutional, commercial and domestic needs.

3.7.3 Space Heating

As in individual homes, the problem of heating shops, schools and other public buildings is often mentioned by community leaders, shop owners and teachers. Shops are usually built to minimize costs and maximize shelf space along walls, so there is little solar gain from windows, resulting in generally dark and cold interiors. Doors are left open to allow customers and light to enter, so they are extremely cold during the winter. A new shop in Mapholaneng, however, has been built with large fiberglass panels in the roof, creating a much brighter, warmer interior. One shopkeeper in Mapholaneng complained about the large amounts of paraffin required to heat her shop nine hours a day in winter and three hours a day most of the rest of the year. She estimated using over two liters of paraffin a day during the winter and noted that at times, mud or snow cut off the supply completely.

Schoolteachers mentioned the difficulty of trying to teach in unheated buildings during the winter. Most of the schools visited were poorly designed for solar gain, and none had heated classrooms. In many schools, classes are held outdoors

on sunny winter days, while students huddle under blankets trying to keep warm during cloudy, rainy or snowy weather.

The only government buildings for the six villages are in Mapholaneng on the main road. The clinic reported using paraffin heaters in its main building during winter, but said the lack of heaters and funds left other buildings, such as the rondavels where maternity patients stay, with only traditional fuels for heating. Police offices and houses have either paraffin heaters or coal stoves. The main government offices of Mokhotlong camp (observed, but not included in the survey) import large quantities of coal and wood at government expense for heating purposes. Once the winter habit of lighting coal fires is established, these offices are sometimes overheated, with doors and windows thrown open for ventilation by midday.

3.7.4 Refrigeration

Mapholaneng is the only one of the six villages using any energy for refrigeration. There is a propane gas refrigerator for vaccines at the clinic that takes a 45-kilogram gas cylinder, which lasts about eight months. There are two gas freezers at the hotel and one at the newest shop in town, but information on the amount of gas used could not be obtained. Another shop reported a refrigerator that had not been operative for the past two years. Apart from the clinic and these commercial institutions, there does not seem to be a great demand for refrigeration, perhaps because of the cold climate.

3.7.5 Transportation

Transportation problems were frequently mentioned by business people and community leaders, as well as individuals, in all parts of the Mokhotlong district. Parents and teachers in the Malefiloane area noted the long distances children must walk to schools and the difficulty of crossing cold, swollen rivers during rainy periods. Concomitant problems are sickness, absence from class and the inability of young children to start school as early as their parents wish. Most felt the best solution would be a broader distribution of primary schools, particularly for the youngest children.

The difficulties of transporting goods to shops was mentioned by customers and traders alike. The limited road network, poor maintenance of existing roads, scarcity of vehicles, and high cost of motor transportation result in excessively high prices and inadequate supplies of food, building materials and consumer goods in much of the district. Many villagers listed more roads and shops in their area as priority community development needs. Wherever roads have been extended, new shops have been established, but residents of more remote villages remain dependent on human and animal transportation to obtain goods from distant sources. Even where roads exist, shopkeepers noted the high cost of fuel and truck maintenance, and periods when bad weather prevents them from bringing essential goods to customers.

Institutions, such as the clinics at Mapholaneng and Malefiloane, also face transportation, as well as communication, difficulties. They must radio Mokhotlong or Maseru and perhaps wait a day or more when emergency ambulance service by road or air is needed. Thus, dependable radio contact is another essential aspect of providing health services in the district. The police radio system in Mapholaneng was maintained by large storage batteries at the time of the survey, although when the data were analyzed, a single, photovoltaic panel had been installed on the police building. The Malefiloane clinic, which serves the first four villages surveyed, has regular radio contact three times a day with the Lesotho Flying Doctor Service in Maseru and hospital in Mokhotlong town. Its radio batteries are charged by a photovoltaic system.

3.8 Energy Supply

Details of energy supply in the six villages have been discussed throughout the text. This brief section simply summarizes the data and refers to relevant sections.

3.8.1 Electrical Energy

Only the extreme northwest end of the district has access to the major electrical grid, which originates in South Africa and primarily serves lowland towns. It terminates at the Lets'eng-la-Terae diamond mine, 30 kilometers by road from Mapholaneng and 71 kilometers from Mokhotlong town.

The only generator in the six villages is a two-cylinder Lyster at Mapholaneng High School. About 120 liters of diesel fuel are used per month to run the generator three to four hours a night. It provides 15 amps of 220-volt electricity for lighting. There are at least 12 generators in Mokhotlong town, serving the hotel, hospital, police office, bank, Catholic mission and several private shops. The Malefiloane clinic and RET workshop have a small generator, which is used only occasionally for tasks like welding and other machine tool operation. There are several other small generators at isolated missions.

At the time of the survey, a single-panel, photovoltaic system was in place at the Malefiloane clinic, as well as one other clinic in the district. There is now a panel at police headquarters in Mapholaneng and a larger array of four panels at the radio-telephone building in Mokhotlong town. These

installations utilize truck batteries to store electricity. Clinics without photovoltaic systems depend upon truck batteries for their radio communication, which must be carried to Maseru by plane for periodic recharging. As already noted, small batteries are the major source of electrical energy for the average villager--43.9 percent of those interviewed use them. Batteries for radios, cassette players and flashlights are available at many shops in the district, but all are imported from South Africa.

3.8.2 Nonrenewable Energy Sources

Paraffin (kerosene) is the most common nonrenewable energy source used in rural Lesotho. A detailed study of import records at Sani Pass and shopkeepers' purchases would reveal the total amount sold in the district, but such research was outside the scope of this survey, though it should certainly be done. Table 3-14 shows villagers' reported weekly paraffin use, with a mean of 2.2 liters per household. The mean amounts for the two peri-urban villages are well over three liters per week because biomass fuel is scarce and paraffin is locally available.

There was little coal use reported in the villages--only 3.4 percent of the households surveyed utilize it. However, imported coal is an important energy source in Mokhotlong town, and other major communities near the town and on the main road, particularly in government offices, the hospital and largest mission complexes. Some traders in Mokhotlong town and

Mapholaneng import coal and wood for sale to those who can afford it and can provide transportation. As with paraffin, detailed study of shop and import records would reveal the amounts imported and sold.

Candles are used by 75 percent of the households interviewed. Most are imported, but some are made in Lesotho using materials from South Africa.

The clinic, one shop and a hotel/restaurant in Mapholaneng, reported using propane gas for refrigeration. None of the other institutions studied used gas, though some clinics, the main hospital in Mokhotlong and a few individuals (primarily expatriates) use it for refrigeration and/or cooking. All empty bottles must be taken to South Africa or the lowlands for refilling. No shop in the district now sells gas or equipment for its use.

There are two critical problems related to the use of these nonrenewable fossil fuels. First is the difficulty of transporting them into and around the district, the cost of which adds to the retail price. Paraffin generally costs 58 to 60 cents per liter in town, but as high as 70 cents in remote villages. This is considerably higher than the 48 to 50 cents reported for Maseru during the same period. Coal costs about twice as much in Mokhotlong as in South Africa or lowland towns. The second problem is that South Africa is Lesotho's only supplier for all fossil fuels, as well as electricity. Its growing dependence on these energy sources renders Lesotho

ever more vulnerable to political pressure from the country which surrounds it. South Africa has no oil resources and is now producing petroleum products from coal at centers like SASOL, which have already been the target of attacks by South African liberation movements. Increasing international pressure for a complete oil embargo against South Africa and the vulnerability of Lesotho's supplies are factors to be considered in any national energy assessment.

3.8.3 Renewable Energy Sources

Village biomass fuel sources are discussed in section 3.1.2, details of types of dung and woody fuels given in section 3.4.1 and use patterns described throughout section 3. Marc Best has estimated that in the Malefiloane area, the biomass fuel potential in the areas where most women collect shrubs (3.6 kilometers from their homes) was only 546 kilograms per 100-square meters.* Competition for the small amounts of available crop residues to use as fuel, fodder, thatching and fertilizer has been noted. Dung, which is used for fuel and plastering, rarely serves as an agricultural input. Women reported collecting fuel an average of 3.6 times per week, spending nearly three hours each time. In the more remote villages, fuel is gathered almost daily, particularly in the summer, when shrubs are stockpiled, and late winter, when dry

*Marc Best, The Scarcity of Domestic Energy: A Study in Three Villages, SALDRU Working Paper No. 27, South African Labour and Development Research Unit, Cape Town, 1979, page 78.

dung is collected before cattle return to the summer cattle posts. Best reported that Malefiloane women spend an average of 13 hours and 50 minutes a week collecting firewood (Best, 1979, p. 77). Tree crops are possible, but the number of trees in the district is very limited. At present, there are only a few areas where extensive planting efforts have been made, although small individual groves of willows and poplars provide limited amounts of fuel in some villages.

The sun is a major renewable energy source that is not being fully utilized. It is estimated that the sun shines at least six hours a day, 300 days a year in Lesotho. It is particularly strong at the higher elevations and during the cold, but clear and dry, winter months. The amount of sunshine may be somewhat less near the eastern escarpment, where clouds often build up from Natal in the afternoon. Basic meteorological data is regularly collected at Mokhotlong town and is available in Lesotho's meteorological service reports. Water is the other very important, though little used, energy source in the district for most of the country's major water systems originate in here. Plans for hydroelectric generation exist, but none are currently operative anywhere in Lesotho.

4.0 ENERGY NEEDS ASSESSMENT

Energy supplies and technologies are not ends in themselves--they are simply means to accomplish certain specific tasks or end-uses. In turn, such end-uses can make higher level development benefits possible. Thus, a new energy source (the sun, for instance) or a more efficient way of using a traditional source (e.g., more efficient, dung-burning stoves) are applied to an end-use, such as heating water. To continue this example, a larger, more easily obtained supply of hot water can upgrade the quality of rural life by improving household sanitation, and hence health, while also reducing the time and labor required to collect fuel, so other, more productive activities are possible. Any analysis of energy-related needs must take into account evidence pointing to specific energy end-uses, as well as more general perceived needs. The full range of development needs identified during the survey will be examined, followed by a consideration of specific end-uses toward which RET project efforts may be directed.

Although the primary focus of this section is energy-related needs in six rural villages, the larger social, political and economic context of Lesotho's position in relation to South Africa cannot be neglected. It should not be surprising that money and employment are among the most urgently expressed needs, for Basotho have learned that money can buy what human energy must otherwise laboriously produce

from an ever more impoverished environment. They have also learned that by selling their labor, they can earn a small share in the labor-saving commodities of the world which encapsulates them. It must also be recognized that the problems of hunger, sickness and isolation which mountain villagers experience are basic to understanding energy-related needs. Thus, the whole range of expressed household and community needs must be analyzed in order to gauge their energy-related implications.

It must be acknowledged that survey responses may be affected by the agency which interviewers represent--tractors, clinics or schools may be requested, depending on whether interviewers come from the ministry of agriculture, health or education. It is important to accept and record all responses, while recognizing the unavoidable bias created by the identity of those conducting the research. The failure to realize that there can be new solutions to old problems may also influence responses. Villagers who suffer most from energy-related problems may not perceive them as anything other than their normal lot--smoke-filled rondavels, heavy head-loads and long treks to collect fuel may hardly seem worthy of mention. Further, they may think that the only solutions to energy-related problems are out of their economic and/or geographic reach--they know of modern houses with gas stoves, electricity and water systems only in South African towns.

Thus, a variety of questions and observations are necessary to assess energy needs, directly and indirectly. Villagers' opinions concerning needs, problems and difficult tasks form the basis for this energy needs assessment. Observations, implications of energy-use data, and responses to specific questions posed to householders and village leaders are presented in this section.

4.1 Data on Village Needs and Problems

4.1.1 Perceived Household and Community Needs and Problems

Individuals interviewed were asked to list, in order of importance, what they felt were the four biggest household problems or needs. As can be seen in Table 4-1, hunger or the lack of good, nutritious food year-round ranked above all other problems. Many people also mentioned a lack of fields, garden plots and livestock, as well as other agricultural problems, that are related to the difficulty of providing enough food. The next most frequently mentioned problem was sickness, or occasionally, old age or infirmity.

Most directly related to the RET project is the problem in third place--the lack of fuel. People mentioned inadequate supplies of dung or dung-producing animals, shrubs and trees, the difficulty of collecting fuel almost daily from distant mountain slopes or purchasing shrubs from more remote villages, and the high cost or unavailability of paraffin. The fact that 68 people mentioned the lack of libeso (fuel) and ranked it so highly is a clear indication of the level of awareness of an "energy crisis" in Mokhotlong villages.

Poverty, unemployment, high expenses and other money problems also ranked high. These concerns were often instrumentally linked with other basic needs discussed here. People commented on their inability to buy food, pay for medical care, clothe their families, obtain building materials and purchase fuel, if they lived in areas where traditional

TABLE 4-1

Major Household Problems Perceived and Ranked by 148 Individuals

Need/Problem	Ranking Score*
hunger, lack of good food	251
sickness or infirmity	175
lack of fuel	172
poverty, expenses, unemployement	171
lack of clothing and blankets	90
lack of fields or garden plots	80
livestock problems, lack, loss	69
lack of family members, herdboy, other labor	64
building problems, sites, materials	40
schools and school fees	38
agriculture problems	35
village water supply and latrines	19
having to work far from home	18
shops, consumer goods, roads, transportation	14
other	12

*The ranking score is a sum based on a scale which assigns a value of four to the greatest problem, three to the next greatest problem, two to the next greatest problem and one to the least important problem.

supplies are depleted. In fifth place was a lack of clothing and also, implied by the Sesotho word used, blankets with which to keep warm during the long, cold winters. Another definite problem is the lack of a husband, wife, children, or other laborers and helpers, for without sufficient labor, people cannot easily obtain food, fuel, clothing, housing or money. Problems mentioned relating to providing shelter included wanting a site, building materials, money and/or the opportunity to build or improve housing. A frequent concern about schools is the distance young children must walk in the mountains and the resulting delay in starting school, with more schools, more offering upper grades and lower fees being desired.

4.1.2 Hardest Work for Women and Men

To provide another perspective on individual problems and focus more directly on energy use, each informant was asked to rank the three most difficult, burdensome or heavy tasks that men and women perform. (See Tables 4-2 and 4-3.) It is significant that collecting traditional fuel (ho roalla) was mentioned by 87 people and ranked more difficult than any other female task. This confirms that supplying fuel is regarded as a major household problem. The survey data show that women collect dung or shrubs an average of 3.6 times per week, spending about three hours each time and transporting it by head-load. Thus, women spent an average of almost 11 hours a week gathering fuel during the busy harvest season, when the

TABLE 4-2

Hardest Work for Women
(148 individuals)

Type of Work	Ranking Score*
collecting fuel	199
agricultural work	142
smearing floors	55
grinding	54
laundry and carrying water	16
livestock care when men are away	13
cooking and brewing beer	9
getting rocks for building	8
head-loading heavy things	6
other	9

TABLE 4-3

Hardest Work for Men
(148 individuals)

Type of Work	Ranking Score*
agricultural work	151
collecting rocks, building, thatching	148
working in South Africa far from home	74
carrying grain, etc. with horses or donkeys	19
money problems and unemployment	14
other	15

*The ranking score is a sum based on a scale that assigns a value of three to the task ranked hardest, two to the next hardest task and one to the next hardest task.

interviews were conducted. The number of trips per week was highest in the villages far from towns (6.9 in Liqobong) and lowest near towns where paraffin is often used (2.1 in Ntlholohetasane). Seasonal variation will be investigated, as reports suggest even more frequent fuel gathering during the cold winter months.

Agricultural work, particularly hoeing, was considered the second most difficult task for women, with the household maintenance task of smearing floors with soil and fresh dung in third place, though much lower than the first two. Women reported smearing floors an average of only 1.7 times a month. Grinding was also regarded as a hard task, particularly in the villages farthest from commercial diesel mills and shops which sell flour. Village women reported spending an average of only 45 minutes per week using hand grindstones, primarily for tasks like grinding wet dough to make sour porridge and peas. Such grindstones, as well as commercial mills, are much more common in the lowlands, where iron hand mills are rarely seen. Women spent an average of four hours and 45 minutes a week using iron hand mills--seven to nine hours weekly in the more remote villages--mainly for grinding wheat, maize and sorghum. Flour from commercial mills or in packages is preferred for both its convenience and fine texture. Certainly, grinding is a laborious chore which must be performed almost daily in the more remote villages, but it does not take as much time as collecting fuel. Drawing water is not regarded as a

particularly difficult task, even though there is much concern about the need for clean, improved village water supplies for drinking, cooking, laundry, bathing and gardening.

Agricultural work was regarded as the hardest labor for men, especially ploughing. In the Malefiloane area, all fields are ploughed by cattle and male labor. Fields are weeded, harvested and threshed by human labor, usually through cooperative work groups. Even in Mapholaneng and Ntlholohetsane, which are near or on the road, most fields are still ploughed with oxen for tractors are only rarely available. The second most difficult male task involves building houses and kraals, including digging and hauling rock with crude little wooden sledges, building and thatching.

In third place was migrant work in South Africa. Some respondents mentioned the hard physical labor in the mines, but others spoke of the more abstract burden of working for long periods away from their homes and families, which drains emotional as well as physical energy from both the migrant men and the women left behind. Yet, with the very limited opportunities for employment in rural Lesotho, most young men feel they must seek work elsewhere to earn the money deemed necessary to meet basic household needs. Transportation problems make Mokhotlong the most remote district, so most migrants travel by horse, then air and finally, train or bus to get to the mines. For this reason, visits home are much less frequent than for lowland migrants. The task of transporting

agricultural produce, food and other supplies by horse or donkey was also regarded as laborious, along with the year-round tasks of livestock care.

4.1.3 Natural Resources

Village leaders were asked to assess the availability of natural resources in their area. Lack of trees, shrubs for fuel and building materials--rocks, poles and thatching straw--were the most frequently mentioned problems. Agricultural and grazing lands were considered particularly inadequate in the two rapidly growing villages along the main road. Observations by the survey team confirmed these assessments. In addition, interviewers noted general problems of environmental degradation, lack of vegetation and sheet erosion, particularly in the oldest and most heavily settled areas in river valleys that are low enough for maize cultivation, along the main road and near Mokhotlong town.

4.1.4 Community Development Problems

Village/community development problems and needs, as perceived by both individual householders and village leaders, are presented in Tables 4-4 and 4-5. Village water supply, fuel, trees, community gardens, roads and transportation are high on both lists. It should be remembered that the survey team represented the Ministry of Cooperatives and Rural Development, which is already known for its activities in village water supply, road and bridge construction, and community garden programs. Further, the RET project was

TABLE 4-4

Village Development Needs and Problems
Perceived and Ranked by 148 Individuals

Village Need/Problem	Ranking Score*
village water supply	239
lack of fuel and trees	138
community garden or better garden plots	103
roads and transportation	99
latrines	38
market	32
agricultural needs	23
schools close to home	11
shops and/or grinding mill	11
building materials and home improvement	11
livestock, poultry and pigs	10
other	22

TABLE 4-5

Village Development Needs and Problems
Perceived and Ranked by 47 Village Leaders

Village Need/Problem	Ranking Score**
fuel supply	123
poor water supply	105
roads and transportation	67
poverty and expenses	53
hunger, poor or insufficient food	39
latrines	28
unemployment	26
market for handicrafts and agricultural products	25
government facilities like post office	23
poor agriculture	18
improved clinic and health services	14
ill health	14
more animals	7
plant trees	6
other	22

*A sum based on a scale assigning a value of three to the problem ranked greatest, two to the one ranked next and one to the problem ranked next.
**Sum based on scale used to rank problems, which assigned values from five for those of highest importance to one for those of lowest priority.

introduced as being primarily concerned with fuel-related problems. Thus, it is not surprising that these four items were mentioned so often, but it is no reason to disregard villagers' prioritization of needs. Problems of poverty, expenses and unemployment; desire for markets to sell agricultural produce and handicrafts; need for latrines, better, closer schools, health and postal services, and assistance in improving agriculture and livestock were also mentioned.

4.1.5 Suggested Solutions

Finally, respondents were asked for possible solutions to household and community problems. The answers reflect sources from which help can be expected, such as the government, community, individual initiative, etc. Among the suggested solutions to household problems (Table 4-6), employment or other income-generating opportunities are mentioned most frequently, especially by those in the villages nearest the road and town. The solution offered next most frequently, particularly in the more distant villages, is improvement of agriculture, livestock and marketing, which are seen as ways to meet many basic needs, especially for food and money. It is significant that tree planting coupled with adequate grazing control, is regarded as the principal way to solve the fuel shortage, although some respondents also mentioned increasing the number of dung-producing animals. Medical care, adequate rain, village water system construction and maintenance, and

TABLE 4-6

Suggested Solutions to Household Problems
(148 individuals)

Suggested Solution	Frequency of Mention
no solution	86
get a job, especially near home	60
use good agricultural practices and get good results from agriculture	43
plant trees	36
get medical care and healing	32
get money or higher salary	27
ask people or government for help and advice	27
ask chief for a field and get it	19
build or get RET stoves described by interviewers	18
get, buy or recover animals	14
rain	7
install or repair village water supply	7

TABLE 4-7

Solutions to Village Development Needs
Suggested by 148 Individuals

Suggested Solution	Frequency of Mention
ask government to help	83
people should work together	57
people should collect money together	42
plant trees	42
ask chief for land for gardens, fields, tree planting, building	23
no solution	23
ask people with knowledge, ability or capital to help or advise	22
individuals should do it for themselves	21
roads, transportation, water supply, school, clinic	10
other suggestions	11

TABLE 4-8

Solution to Village Development Needs
Suggested by 47 Village Leaders

Suggested Solution	Frequency of Mention
improve agriculture, production, inputs, soil	27
plant trees for more fuel	23
create employment and other income generation	23
improve water supply or repair system	17
improve roads, build bridges	13
improve livestock and grazing control	12
seek government help to accomplish improvements	12
build or improve clinic, market, shops	11
work together with good village leadership	6
build latrines	6

improved roads and transportation were mentioned frequently as well. The solutions proferred most frequently for specific problems are illuminating (Table 4-9).

TABLE 4-9

Solutions Mentioned Most Frequently for Specific Problems

Problem	Suggested Solution	Frequency of Mention by Individuals
Household Problems		
hunger	plant well, get good yields	27
	get a field	11
	adequate rain	6
fuel	plant trees	35
	follow RET project stove suggestions	18
sickness	get medical care, healing	31
poverty	get employment	22
clothing	get employment	16
	get money	9
Village Problems		
water supply	ask for government help	30
	collect money	27
	people work together	11
community garden	people work together	14
	ask chief for a site	13
	collect money	8
	ask for government help	7
trees	plant trees	25
	ask chief for a site	4
	individuals do it	4
	people work together	3
roads	ask for government help	22
	people work together	14
fuel	plant trees	12
latrines	individuals do it	12
market	people work together	6
	ask people to help	6

4.2 Summary

Considering all the data discussed, the following basic needs appear to be of most concern to those interviewed:

- food,
- fuel,
- clothing,
- shelter,
- water,
- health, and
- education.

The means for meeting these needs that were mentioned most frequently include:

- money from employment, the sale of agricultural produce or other income-generating activities;
- food production and arable land;
- tree planting;
- livestock;
- roads, bridges and transportation;
- building and building supplies;
- shops where food, paraffin, clothing, building supplies, etc. can be purchased;
- village water supply systems;
- latrines;
- health services;
- schools;
- government services--postal, agriculture, etc.; and
- individual and community effort.

APPENDIX I

Number of Individuals in Households Surveyed
by Age, Sex and Residence
(data for population pyramid, Figure 3-1)

Age	Male	Female	Total	Males by Residence			Females by Residence		
				home	Lesotho	RSA	home	Lesotho	RSA
80-99	5	5	10	5	0	0	5	0	0
70-79	8	12	20	7	1	0	12	0	0
60-69	19	13	32	14	3	2	13	0	0
50-59	21	26	47	19	1	1	25	1	0
40-49	35	31	66	23	5	7	28	2	1
30-39	45	36	81	21	7	17	33	3	0
20-29	69	80	149	30	10	29	63	14	3
10-19	105	116	221	30	24	1	100	16	0
0-9	149	123	272	138	11	0	109	14	0
total	456	442	898*	337	62	58	388	50	4

*Plus four missing age or sex information.

APPENDIX II

Mean Weekly Household Use of Major Fuel Types by Village
(data presented in Figure 3-2)

Village	Dung (kgs)	Wood (kgs)	Paraffin (liters)
Ha Mohale	38.6	32.4	1.11
Liqobong	36.8	20.2	1.40
Lintosing	26.6	20.3	2.45
Khutlo-peli	38.3	35.8	.90
Mapholaneng	29.7	24.4	3.39
Ntlholohetsane	26.1	18.8	3.30
total mean	32.1	26.6	2.21

APPENDIX III

Village Energy Data List
December, 1981

The village energy data list was the first step in designing the village energy survey. The data list approach is based on Planning Rural Energy Projects: A Rural Energy Survey and Planning Methodology for Bolivia, prepared for USAID/Bolivia by Burrill, Forman and Gomez, 1980.

In October and November, 1981, RET staff members were asked to suggest types of information that they felt were necessary to design and carry out the project's activities. This detailed data list was then developed to reflect Lesotho's particular information needs.

Questions on most of the data elements were included in the village energy survey schedules. Other data were already available or could be obtained from other sources, including:

- geographic and climatic information from GOL meteorological and hydrological studies, and Thaba Tseka RTU reports;
- agricultural information from reports prepared by many other agencies, such as the GOL Bureau of Statistics, Farming Systems Research Project, and Basic Agrical Services Program (BASP); and
- fuel use and environmental features of the Malefiloane area from a master's thesis and briefer report written by Marc Best in 1978-1979 (see The Scarcity of Domestic Energy: A Study in Three Villages, SALDRU, 1979).

		HOUSEHOLD	VILLAGE
I. Demographic Indicators	1. Demographic	a. Number of household members by sex, age, marital status etc. b. Educational levels. c. Place of residence. d. Off-farm employment.	a. Village population profile. b. School attendance and literary levels. c. Percent migrants. d. Percent employed.
II. Social and Organizational Indicators	1. Social and organizational structure and effectiveness	a. Membership in community groups. b. Religious affiliation. c. Participation in food-for-work and other development activities.	a. List of village organizations and church groups. b. Size and representativeness of groups. c. Leadership. d. Group purposes and activities. e. Group history, accomplishments and problems. f. Communal labor patterns. g. Access to transportation and external contacts.
III. Economic Indicators	1. Economic activities and skills	a. Productive and income-generating activities and skills.	a. List of activities and skills in community.
	2. Income	a. Estimated income levels.	a. Percent at various income levels. b. Local wage levels. c. Sale prices for locally produced goods.
	3. Assets, investments, and consumption patterns	a. Key household assets as wealth indicators. b. Energy-related possessions.	a. Number and type of buildings under construction. b. Land tenure system.

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		HOUSEHOLD	VILLAGE
IV. Geographic and Climate Indicators	1. Local climatic conditions with daily and seasonal variations	---	a. Wind speeds. b. Solar radiation. c. Rainfall. d. Temperatures.
	2. Geographic conditions	---	a. General topography. b. Vegetation. c. Rivers: location and seasonal variations in flow. d. Level of water table or availability of springs.
V. Household Energy-Consumption Patterns	1. Cooking and water heating	a. Cooking methods, places and devices. b. Types of fuel used. c. Amounts of fuel used. d. Where and how fuel is obtained, by whom? e. Fuel costs in time or money. f. Types and numbers of cooking utensils. g. Length of time and time of day spent cooking, by whom. h. Amounts of water heated for non-cooking purposes.	a. Note any communal cooking occasions, such as feasts, school meals, etc.

DATA CLASS	DATA CATEGORY	DATA ELEMENT: HOUSEHOLD	DATA ELEMENT: VILLAGE
CONTINUED: V. Household Energy-Consumption Patterns	2. Lighting	a. Means used for lighting. b. Type, amount and cost of fuel. c. Time lighting is used.	---
	3. Space heating	a. Principal source of space heating. b. Are there any devices. explicitly for heating? c. Type, amount and cost of fuel other than for cooking fires. d. Times of day and seasons when heating is used.	---
	4. Laundry	a. Is water heated for washing clothes? b. Where is laundry done, and how many hours? c. How are pressing irons heated and how many? d. How often and for how long are irons heated? e. Estimated amount and cost of fuel for pressing.	a. Is there any community laundry facility or location commonly used?
	5. Water supply, lifting and transport	a. Where is water obtained? b. Distance and time to collect. c. Number of collections daily. d. Volume collected each time and total used per day. e. Who collects water?	a. Dependability, accessibility and quality of water supply. b. Control, ownership or administration of water supplied. c. How is water lifted and transported?

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		HOUSEHOLD	VILLAGE
CONTINUED: V. Household Energy-Consumption Patterns	6. Food grinding	a. Devices owned and used to grind different types of food. b. Time spent grinding or transporting grain to a commercial mill. c. Who grinds or transports?	a. Availability of mechanized grinding. b. Ownership, costs and use patterns of grinding machines or commercial mills. c. Type and amounts of fuel used.
	7. Food preservation and processing	a. Types and amounts of foods dried, preserved or processed and how.	a. Methods used for different types of food. b. Type, amount and cost of energy or fuel used. c. Time required for process.
	8. House construction and maintenance	a. Time, labor and source of supplies used in building homes and animal enclosures. b. Time, labor and source of materials used in home maintenance.	a. Village resources for construction and repair such as wood, stone, grass, straw, dung, soil, etc.

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		HOUSEHOLD	VILLAGE
VI. Village Energy Consumption in Industry, Trade, Government Institutions and Communications	1. Industry, manufacturing and services	---	For each artisan, producer, miller or repairer, give energy profile including: a. Type, amount and cost of fuel or energy. b. Processing technology. c. Type, quantity and price of goods produced or services rendered. d. Ownership of energy source and other means of production.
	2. Commercial sales and restaurants	---	For each shop, cafe, trader vendor or restaurant. energy profile including: a. Type, amount and cost of fuel or energy. b. Time of day and production activities and energy needs. c. Ownership of shop, utensils or capital invested. d. Overall value of sales per unit of time.
	3. Government and institutional buildings	---	For each office or institution give an energy profile including: a. Type, amount and cost of energy inputs. b. Seasonal variations. c. Note special equipment such as clinic refrigerators, school cooking devices, etc.
	4. Communication systems	a. Number of private radios and record players.	a. Number and type of communication systems and owners. b. Energy supply patterns

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		HOUSEHOLD	VILLAGE
VII. Energy Consumption in Agriculture	1. Crops and agricultural labor patterns	a. Type of crops and cropping patterns for fields and gardens. b. Number and size of household fields and garden plots. c. Time spent in various agricultural tasks. d. Distance from water to garden plots.	a. Calendar of agricultural tasks by crop and by sex. b. Community garden, size, participants, organization.
	2. Motive power: animal and mechanical	a. Type and amount of animal and mechanical energy utilized in agricultural tasks. b. Ownership of implements. c. Cost or other means of obtaining traction.	a. Numbers of plowing teams and tractors available.
	3. Fertilizer: chemical and biological	a. Type and quantity of fertilizer used for what crops, when.	a. Costs and availability.
	4. Irrigation	---	a. Area of land under irrigation. b. Pumping and irrigation methods. c. Water supply and land suitable for irrigation.
	5. Livestock and other animals	a. Type and numbers owned and where they are kept. b. Uses made of each. c. Who herds or feeds them?	a. Seasonal movement patterns. b. Maintenance, control and burning of grazing lands.

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		HOUSEHOLD	VILLAGE
VIII. Energy Use in Transportation	1. Human transport	a. Distance, time and frequency of trips for various purposes. b. Typical loads carried.	---
	2. Animal transport	a. Distance, time and frequency of trips for various purposes.	a. Number of saddles, carts, sleds, etc. available.
	3. Motorized transport	a. Distance and frequency of use of motorized transport by villagers.	a. Number and type of vehicles in village. b. Frequency, purpose and distance of trips. c. Fuel use, cost and where obtained.
XI. Electrical Energy Supply	1. Electricity production	a. Number of batteries used.	a. Number and ownership of generators. b. Fuel use, cost and availability.
	2. Electricity distribution	---	a. Number of households with access to electricity and costs. b. Trends.
X. Nonrenewable Energy Sources	1. Coal, paraffin and propane	a. Number of users with what type of devices.	For each type fuel or energy describe: a. Source, availability and distribution patterns. b. Present uses and trends. c. Prices.
	2. Petrol and diesel fuel	---	a. Source, availability and distribution patterns. b. Prices.

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		HOUSEHOLD	VILLAGE
XI. Village Renewable Energy Resources	1. Identify and quantify energy and fuel types such as wood, dung, agricultural wastes, potential biofuel crops	---	For each type of fuel give: a. Seasonal availability: amount and locations. b. Ownership and distribution of exchange patterns. c. Prices or time required to collect or prepare. d. Typical uses at present. e. Social control and attitudes toward natural resources. f. Historical trends and development plans.
XII. Ecological and nvironmental roblems	1. Identify local ecological and environmental problems both as expressed by villagers and as observed by researchers	---	Describe each problem as quantitatively as possible.
XIII. Energy- elated eeds, roblems and lans	1. Identify energy-related needs, problems and plans, both expressed and observed	---	For each need describe: a. Social and cultural context. b. Economic elements. c. Environmental elements. d. Local conceptions of problems and plans for solutions. e. Researchers' ideas for solutions.

APPENDIX IV

Survey Instrument in English

VILLAGE ENERGY SURVEY - RET PROJECT - 1982

PART ONE - VILLAGE CHIEF

Visit the chief ahead of the actual interview time. Explain the purpose of the project, the work plan of the survey, and the hopes for ongoing association between the village and the project.

If the chief agrees, ask him or her to arrange for a meeting with the Village Development Committee and perhaps with other interested villagers so that you can explain the purpose and introduce the survey team. Arrange housing so that the interviewers can spend about four days in the village, allowing enough time for interviews and observations. Decide if the interviewers may go about the village alone or if a representative of the chief will show them around.

Ask the chief to help by answering the questions in Part One. Explain that this is to help the RET project become acquainted with the village and know whom they should interview in the following parts. If the chief can provide the information, also ask him to list the names of all household heads.

PART TWO - VILLAGE LEADERS

Interview at least six of the village leaders mentioned in Part One, including the chief. Be sure to get a balance of sex, age, education etc. Explain that the purpose of the interviews is to ask important people to tell you about the community and about the problems which people face.

PART THREE - OBSERVATIONS

Ask if one of the leaders interviewed, or perhaps the chief, can walk about the village with you, introduce you to other adults, and help you to obtain the information required for the observation worksheet. Much of the information, however, can be obtained by walking about the village, observing from a hillside, and walking to places where water is drawn, fuel is collected, etc.

PART FOUR - HOUSEHOLDS

Interview a sample of half of the village households (50%). There should be at least 10, but no more than 20 households in any village. Use the household list prepared in Part Three. Interview every other household on the list.

There are four sections of Part Four. They should all be answered by people from the same household. You may have to visit the family several times to get answers to all the questions. The sections are:

4.A Household Energy Use (an adult woman should be interviewed)
4.B Household Data
4.C Agricultural Energy Use (an adult family member who is actively involved in agriculture)
4.D Needs and Problems (try to discuss with several adult family members)

PART FIVE - LOCAL BUSINESSMEN AND CRAFTSMEN

PART SIX - OFFICES AND INSTITUTIONS

PART SEVEN - MOTOR VEHICLES

VILLAGE ENERGY SURVEY

BET PROJECT - 1982

Village _____
Date _____
Interviewer _____

PART ONE - VILLAGE CHIEF

1.1 Name and position _____

1.2 Sex (Male/female)

1.3 Who is senior chief for this area? _____

1.4 Where does he live? _____

1.5 Number of households in this village? _____

1.6 Explain if there are subsections of the village. _____

_____

1.7 Important people in the village:

NAMES	ROLE OR STATUS	SEX

1.8 Village Development Committee members

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

1.9 Community Garden Committee members

1.10 School: Location _____ What grades? _____

Which church? _____ Number of pupils? _____

Names of teachers living in the village:

1.11 Church groups

WHICH CHURCH	LOCATION OF CHURCH	LOCAL VILLAGE LEADERS

1.12 Other community organizations or leaders:

1.13 Local businessmen or businesswomen:

1.14 Is there a local court, a post office, or other official buildings in the village or nearby?

VILLAGE ENERGY SURVEY
RET PROJECT - 1982

Village _____
Date _____
Interviewer _____

PART TWO - VILLAGE LEADERS

2.1. Name _____ 2.2. Sex _____ 2.3. Age _____

2.4. Position in village _____

2.5. List all the village organizations and institutions with as much detail about each as the informant can give:

NAME OF EACH ORGANIZATION	NUMBER OF MEMBERS	NAMES OF LEADERS	STATED PURPOSE	ACTUAL ACHIEVEMENTS	EQUIPMENT OR ASSETS

2.6. List the types of jobs held by villagers

TYPE OF JOB	TYPICAL WAGE PER MONTH	LOCATION OF SUCH WORK	NUMBERS IN THIS WORK	
			MALES	FEMALES

2.7. List agricultural and animal products produced in the village for sale.

TYPE OF PRODUCT	WHERE IT IS SOLD	TYPICAL UNIT PRICE

8.8. List other local products which are sold, such as cooked food, beer, handicrafts etc

TYPE OF PRODUCT	WHERE IT IS SOLD	TYPICAL UNIT PRICE

8.9. List the names of villagers with special skills such as:

Carpenters: _____

Stone masons: _____

Thatchers: _____

Sheet-metal workers _____

Potters: _____

Leather workers, saddlemakers, shoe-repairers: _____

Tailors or seamstresses: _____

Healers: (traditional Sesotho): _____

Village Health Workers: _____

Taxi or truck owners/drivers: _____

English speakers with at least 7 years of schooling: ___

Other: _____

8.10. Community resources: For each of the following types of land or other community resources, indicate whether you feel the amount available for your village is (1) insufficient, (2) just adequate, or (3) More than enough. Comment or explain as necessary, and note seasonal variations:

Residential sites _____

Fields _____

Garden plots _____

Grazing near the village _____

Grazing at the cattle posts _____

Thatching grass and reeds _____

Trees (poplar, willow, etc) _____

Shrubs (sehalahala and other natsi) _____

water supply _____

Other _____

2.11. List types of community work projects undertaken in the past year:

TYPE OF WORK	LOCATION	HOW IT WAS ORGANIZED OR PAID, BY WHOM	NUMBER OF WORKERS		DAYS WORKED
			MALE	FEMALE	

2.12. List the most urgent community needs or problems.
Rank them in order of importance.
Tell if there are any plans or projects to help solve these problems.
If there are no plans, explain what you think could be done, by whom, to help solve them.

NEED OR PROBLEM	RANK	PRESENT PLANS TO SOLVE THEM	IDEAS FOR WHAT COULD BE DONE

2.13. List additional problems which are specifically related to fuel or cooking, if they have not been mentioned in question 12.

NEED OR PROBLEM	IDEAS FOR HOW THEY COULD BE SOLVED

Village _____

VILLAGE ENERGY SURVEY - RET PROJECT
MINISTRY OF CO-OPERATIVES AND RURAL DEVELOPMENT

Administered 1982

STAGE THREE - OBSERVATION WORKSHEET

With the help of one of the village leaders or some other person designated by the chief, obtain the following information necessary to understand the village layout, population and resources:

Household list

3.1 List each household by number and give the name of its head.

3.2 Indicate the work and sex of each household head by the following key:
- M-M Male, migrant
- M-R Male, resident
- F-R Female, resident
- 0 Other (give an explanation)

3.3 Indicate the number of employed persons for each household, according to whether they work in South Africa, in other places in Lesotho, or are working locally.

3.4 Indicate the number of buildings and number of cattle kraals for each household.

Village map

3.5 Draw a rough sketch-map of the village, numbering households to correspond with the household list.

3.6 Draw schools, churches, office buildings, shops and community garden.

3.7 Mark S to indicate all village water supply sources (Seliba). If there are several, mark them as S_1 S_2 etc. Then comment about the type, cleanliness and adequacy of each.

3.8 Mark all groves of trees on the map in the following way. Then write what you see or learn about the owners, and the type, age and size of each grove of trees.

3.9 Mark the places where people usually go to gather sehalahala or other types of fuel. During the week visit each place and record the length of time to walk each way and the distance according to the big map.

3.10 Mark rivers, indicating the location, flow, seasonal variation and potential for mini-hydroelectric use. Also note if there are any irrigated areas or the potential for irrigation.

3.11 Make a note of new buildings or buildings under construction. List their shape and the type of materials being used. Also note any unused walls of old buildings.

3.12 Record the distance to important public services.

3.13 Identify and describe local ecological and environmental problems you observe.

Household plans

3.14 Draw the plans for the inside of several houses showing how the space is used and belongings arranged.

Village _____

Notes to accompany village map (Use back of page for accitional comments)

3.7 Village water supplies

	TYPE	CLEANLINESS	YEAR ROUND ADEQUACY
W_1			
W_2			
W_3			
W_4			

3.8 Trees

	OWNER	LOCATION	TYPE OF TREE	DATE PLANTED	SIZE OF GROVE
T_1					
T_2					
T_3					
T_4					

3.9 Usual sources of fuel

	TYPE OF PLACE	TYPE OF FUEL	DISTANCE	TIME TO WALK ONE WAY
1				
2				
3				
4				

3.10 Rivers with water all year round

NAME	LOCATION IN RELATION TO THE VILLAGE	WIDTH DURING DRY TIMES	WIDTH DURING RAINY TIMES	MINI-HYDRO POTENTIAL

3.11 Number of new buildings under construction or just completed

	NUMBER	MATERIAL OF WALLS	MATERIAL OF ROOFS
ROUND			
RECTANGULAR			

Number of unused walls of rondavels or houses in village _____

3.12 Record the distance to the nearest:

clinic _____

school _____

post office _____

shop which sells paraffin _____

access road _____

(On average, how many vehicles past on that road each day?

3.13 Comment on the local ecological and environmental problems which you observe.

3.14 Draw the plans for the inside of several houses showing how the space is used and belongings arranged.

Village

3.1 - 3.4 OBSERVATION WORKSHEET - HOUSEHOLDS

NUMBER	NAMES OF HOUSEHOLD HEADS	TYPE (MM,MR,FR)	NUMBER EMPLOYED IN RSA	FAR	LES	LOCAL	NUMBER BLDS	KRAALS	Here	Away
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										

VILLAGE ENERGY SURVEY

RET PROJECT - 1982

Household number _____
Village _____
Date _____
Interviewer _____

4-A HOUSEHOLD ENERGY USE

4.1 Name of household head _____

4.2 Name of person being interviewed _____

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

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

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

4.5 Yesterday what foods did you cook, at what time of day, with what fuel, what kind of stove, and was it indoors or outdoors?

TIME	FOOD	FUEL	STOVE	PLACE
Morning				
Midmorning, Midday				
Afternoon				
Night				

4.6 How many buckets of water does the household use per day_____?

What size are the buckets _____(litres) or are they (small/medium/large)?

4.7 How much water does your household heat per day, for what purposes, with what fuel, in what stove, and is it indoors or outdoors?

TIME	PURPOSE	AMOUNT	FUEL	STOVE	PLACE
Morning					
Midday					
Afternoon					
Night					

4.8 How many times per week do you iron clothes?_____ How long each time?_____
With what fuel and stove do you heat the iron?_____

4.9 At night, how many hours do you light the house?_____
On a typical night, how many candles are lit?_____How many lamps?_____

4.10 How often do you brew beer per month? _____

4.11 How often per month is it for the family only?_____ and how often for sale?_____

4.12 What amount do you usually brew? _____(number of tins) _____(n litres)

4.13 Record fuel which is normally used, exact amounts used last week, and details of the way each type of fuel is collected or purchased.

CHECK IF EVER USED	TYPE OF FUEL	AMOUNT USED LAST WEEK	IF IT IS COLLECTED			IF IT IS PURCHASED		
			DISTANCE	TIME	FREQ.	PLACE	DISTANCE	PRICE
	lisu							
	mapharoa							
	khapane							
	bokuluba							
	sehalahale							
	other shrubs							
	local trees							
	Natal trees							
	crop stalks							
	maize cobs							
	other							
	paraffin							
	coal							
	propane gas							
	candles							
	batteries							

4.14 How does the use of fuel differ at different seasons of the year? _____

_____

_____

4.15 Who usually collects patsi (shrubs)? _____

Who usually collects dry cow dung? _____

4.16 Do you ever buy shrubs? _____ Or buy dung? _____ From whom? _____

Do you ever sell shrubs? _____ Or sell dung? _____ Where? _____

4.17 Explain how you grind the following foods, or other foods:

FOOD	DO YOU BUY READY GROUND FLOUR	WHAT KIND OF GRINDER?			HOW OFTEN DO YOU GRIND PER WEEK?	HOW MANY HOURS EACH TIME ?	STONE POUNDING
		STONES	HAND IRON	COMMERCIAL			
wheat							
Maize							
sorghum							
'mela							
motoho							
peas, beans							

4.18 Who usually grinds? _____

4.19 Explain how you preserve food for future use:

	TYPE OF FOOD	HOW MUCH THIS YEAR	WITH WHAT FUEL USE
By drying			
In bottles			
In holes			

4.20 How often per month do you smear the floors? _____

When you smeak, how much dung do you use? _____

4.21 How often do you smear or plaster the walls per year? _____

How much dung do you use each time? _____

4.22 What things would you like to do to improve or renew your buildings?

_____

_____

_____

_____

4-B HOUSEHOLD DATA

4.23 Number of household members: present _____, absent_____, total_____.

4.24 Number of

rondavels

thatched rectangular houses

houses with iron roofs

cattle kraals

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

(1) _____

(2) _____

(3) _____

(4) _____

4.26 Which members of the family have participated in Food-for-work programs during the past year, and for how many working periods (of 15 days each?)

(1) _____

(2) _____

(3) _____

(4) _____

4.27 List all members of the household on the following chart. Include members who are absent if they come home regularly and give support to, or are supported by, the household. Be sure to list the household head first. Indicate how other members are related to the household head, and give other information asked for on the chart.

Motse _____

Hld number _____

4. 27 Lenane la batho ba lelapa

LIST MEMBERS OF THE HOUSEHOLD

(VILLAGE) Motse _____ Hld number _____

	NAMES MABITSO	SEX M/P	RELATION TO HLD HEAD KAMANO	MARITAL STATUS BOEMO BA LENYALONG	AGE LILEMO	EDUC THUTO	EMPLOYMENT (CHELETE) MOSEBETSI	OTHER ACTIVITIES O ETSANG HAPE	VILLAGE STATUS BOEMO BA MOTSE	RESIDENCE O LULA KAE
1.			Hld head							
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										
14.										

RSA, Lesotho (far) Mokhotlong, home

any special work or leadership position

school, herding or any other major activity

work for money

give highest grade reached in total years

un=unmarried
M=married
W=widowed
s/d=separated or divorced

W=wife
S=son
D=daughter

4-C AGRICULTURAL ENERGY USE

4.28 Name of person being interviewed?_____

4.29 Household agricultural possessions:

- ☐ fields
- ☐ garden plot, individual (is it fenced?_____)
- ☐ garden plot, in communal garden (is it fenced?_____)
- ☐ fruit trees, number (type _____)
- ☐ other trees, for wood etc. (type _____)
- ☐ plough
- ☐ planter (type_____)
- ☐ cultivator
- ☐ rake
- ☐ cart
- ☐ sledge
- ☐ sad

4.30 Explain if you have had repair problems with agricultural equipment:

TYPE OF EQUIPMENT	PROBLEM	HOW WAS IT SOLVED?

4.31 Number of domestic animals owned by the household:

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

4.32 In what ways and how often does the household make use of: horses, donkeys, motor vehicles, and airplanes?

TYPE OF TRANSPORT	PURPOSES	DESTINATIONS	DAYS PER YEAR
horses			
donkeys			
vehicles			
airplanes			

4.33 In what ways, and how often, does the family use cattle?

PURPOSES	DAYS PER YEAR
to plough	
to plant	
to weed or cultivate	
to thresh	
to haul (what is hauled?)	
to provide milk	
to provide dung	

4.34 How many animals did you kill for meat last year?
Did you eat any others which had died? How many?

	CATTLE	SHEEP	GOATS	HORSES	DONKEYS	PIGS	CHICKENS
Slaughtered							
Died naturally							

4.35 How many trees, of what type, have you planted in the past year?

_____

_____

4.36 If you ever planted trees which did not live, explain what type you planted, in what kind of place, and why you think they died.

_____

_____

_____

_____

4.37 If you invite people outside the household to help you in the fields, explain what work they do. Do you give them food or anything else for helping? If you give them money, how much money do you pay per day?

WHAT WORK IS DONE?	HOW MANY PEOPLE?	WHAT DO THEY RECEIVE?

4.38 If you ever invite teams of oxen or a tractor to help you, explain what work they do, and what do they receive as pay for their work?

WHAT WORK IS DONE?	CATTLE/TRACTOR	WHAT DO THEY RECEIVE?

4.39 If you ever use fertilizer, manure or ash on your crops, explain:

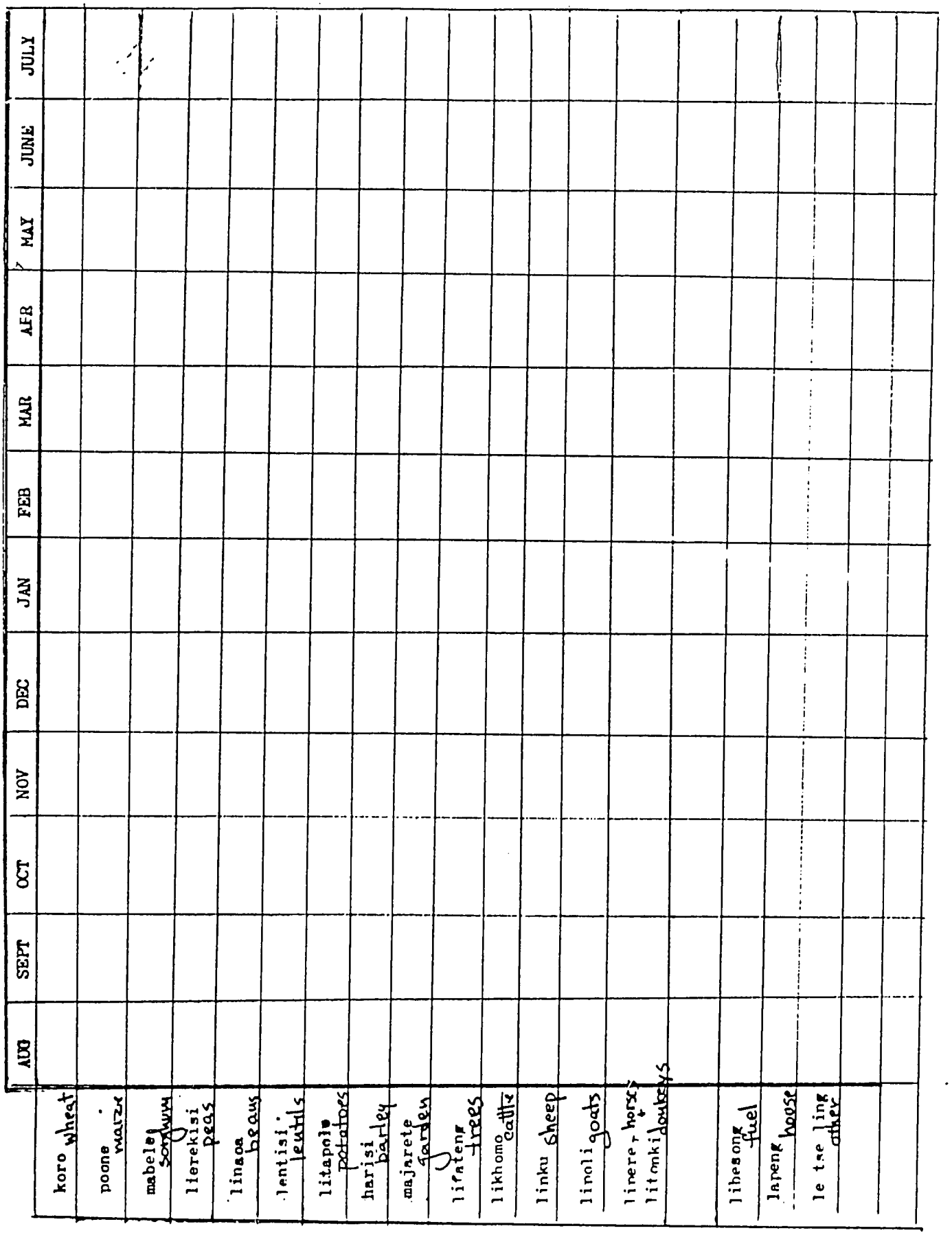
TYPE OF FERTILIZER	TYPE OF CROPS	WHERE IS THE FERTILIZER OBTAINED?	AMOUNT	PRICE
commercial				
manure				
ashes				

4.40 What crops did you plant this year; where did you get the seeds; what was the yield?

PLACE	TYPE OF CROP	SOURCE OF SEEDS	1981 YIELD
first field			
second field			
third field			
fourth field			
your own garden			
community garden			

CALENDAR EA MOSEBETSI (CALENDAR OF WORK) Hld Number _____

4.41 List the main work which you have done, or will be doing, during the year. For example: plow, plant, weed, harvest, thresh, plant a garden, dry food, move animals to cattle posts, hut wool, dip sheep and goats, collect fuel, dip dung from kraals, etc.



4-D NEEDS AND PROBLEMS

4.42 List the most important needs and problems of your household.
Rank these according to importance.
What do you think should be done to solve each problem you mention?

NEED OR PROBLEM	RANK	POSSIBLE SOLUTION

4.43 What things do you think would make this community or village to be a better place?
Rank them according to importance.
How could these changes be made?

IMPROVEMENT	RANK	MEANS TO ACHIEVE CHANGE

4.44 Which work that women usually do is the most burdensome (heaviest)? Rank them.

1) _____ 2) _____ 3) _____

4.45 Which work that men usually do is the most burdensome (heaviest)? Rank them.

1) _____ 2) _____ 3) _____

VILLAGE ENERGY SURVEY
RET PROJECT-1982

Village _____
Date _____
Interviewer _____

PART FIVE - BUSINESSMEN AND CRAFTSMEN

5.1 Type of business _____

5.2 Who is the owner? _____

5.3 Who is being interviewed and what is his/her work?

5.4 What type of goods are made or sold? Give typical prices:

5.5 What type of tools, equipment, technology are involved in making things?

5.6 Estimated gross monthly receipts: _____

5.7 What type of building is used,: How many square meters floor space?

5.8 For how many hours per day_____ and days per week____ is it used?

5.9 How many people are employed, for what jobs? _____

5.10 What means of transport is used (Animal or vehicle) for what purposes, how often?

5.11 What kinds of energy are used for cooking, heating, lighting, transport or other work which is necessary for the business?

TYPE OF ENERGY OR FUEL	USES	AMOUNT PER MONTH	WHERE ITS OBTAINED	COST PER MONTH

5.12 What needs or problems do you have concerning energy and fuel use?

VILLAGE ENERGY SURVEY

RET PROJECT - 1982

Village _____
Date _____
Interviewer _____

PART SIX - OFFICES AND INSTITUTIONS

6.1 Type of office or institution _____

6.2 Type of building and square meters of floor space:

_____

6.3 During which hours of the day _____ and days per week _____ is the building used?

6.4 How many people are employed, for what jobs? _____

_____

6.5 How many people use the building every working day? _____

6.6 Institutional energy use for cooking, heating, lighting, transport etc.

TYPE OF ENERGY OR FUEL	USES	AMOUNT PER MONTH	WHERE ITS OBTAINED	COST PER MONTH

6.7 What means of transport is used (animal or vehicle) for what purposes, and how often?

_____

_____

_____

6.8 Describe any equipment which requires large or regular amounts of energy such as a refrigerator, radio etc. _____

_____

6.9 Describe any special means of producing energy such as a generator, photovoltaic cells etc.

_____

_____

6.10 Do you have any special needs or problems concerning energy fuel or heat?

_____

_____

_____

VILLAGE ENERGY SURVEY

RET PROJECT - 1982

Village _____
Date _____
Interviewer _____

PART SEVEN - MOTOR VEHICLES

7.1 Who is the owner? _____

7.2 Who is the regular driver? _____

7.3 Who is being interviewed? _____

7.4 What type of vehicle is it? _____

7.5 Trips:

WHERE DOES THE VEHICLE USUALLY TRAVEL?	FOR WHAT PURPOSES?	HOW MANY TRIPS PER WEEK?

7.6 Fuel

Is it diesel or petrol? _____

Where do you usually buy it? _____

About how much is used in a week? _____

About how much money does it cost per week? _____

7.7 Do you ever carry fuel for other people? If so, explain:

TYPE OF FUEL	FROM WHERE	TO WHERE	HOW OFTEN	HOW MUCH DO YOU CHARGE
Coal				
Paraffin				
Wood (logs)				
Sebalabala				
Other				