

COMMUNITY PARTICIPATION IN TACKLING THE
RURAL ENERGY PROBLEM: A CASE STUDY OF
WOODFUEL IN EBUTANYI SUB-LOCATION, VIHIGA
DISTRICT, KENYA.

BY

BEATRICE WAMBOYI B.A (Hons)

University of NAIROBI Library



0356700 5

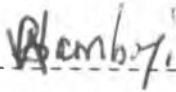
THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR
THE DEGREE OF MASTER OF ARTS (M.A) IN URBAN AND REGIONAL
PLANNING OF THE UNIVERSITY OF NAIROBI.

UNIVERSITY OF NAIROBI
ADD LIBRARY

SEPTEMBER, 1997.

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.



BEATRICE WAMBOYI.

(candidate)

This thesis has been presented for examination with my approval as university supervisor.



DR. SAMUEL OBIERO.

(Supervisor).

DEDICATION

This thesis is dedicated to
the Ang'ang'os' of Owamukhunyi Farm with Grace,
Mercy and Peace through Jesus
Christ our Lord.

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to the Ministry of Lands and Settlement, Department of Physical Planning for offering me the scholarship that enabled me pursue this study.

My sincere thanks go to my supervisor, Dr. Obiero who despite his tight schedule as the Chairman of the Department always found some time to attend to me. His patience, devotion, positive and constant guidance have all enabled this piece of work to be completed. I cannot forget to thank the entire Department of Urban and Regional Planning (DURP), staff and students alike whose very scholarly criticisms of my piece of work lifted it to higher levels.

I am greatly thankful to my parents, brothers and sister who in one way or the other helped me in this study. I can not forget to pay exceptional tribute to first, Dr. Ngau for introducing me to the use of computers, second Ms. Beatrice Ndung'u for the tireless effort and patience she exercised in assisting me in the use of some computer packages like SPSS and Harvard graphics; and finally Mr. Timothy Wasilwa for allowing me do the editing and printing of this work on his pieces of machine.

To all of YOU who participated in making my work successful, I say... MAY GOD BLESS!

ABSTRACT.

The importance of woodfuel as a traditional source of energy and its increasing shortage in terms of supply and demand has made it necessary for a number of scholars to assess the situation in many parts of the world.

Notwithstanding the several studies done and solutions suggested, the problem is still looming high. The central argument, therefore is that a new approach to the fuel wood crisis is urgently needed. This new approach as articulated by, inter alia, Chambers et.al (1989), Hall (1983), Chambers (1988), Hosier (1988) and Soussan (1990) emphasizes that it is imperative to listen to the local people who are the intended beneficiaries of any project and that it is essential for project planners to recognize and understand the methods that local farmers have evolved and adopted for managing rural development including tree planting. It was on the basis of this approach that the study was undertaken to involve the Ebutanyi sub-location community in the identification of viable ways of tackling the wood fuel problem.

The study presupposes that the energy problem in the rural areas can be effectively handled if the people themselves will be involved in identifying viable ways-ways within their reach of tackling the problem first and foremost

before any other step is taken. In essence, the rural energy problem should not be looked at in isolation but as an intricate aspect of rural poverty.

Although the study area lies in a high agricultural potential area, data analysis revealed a weak household economic base that was reflected by low income levels, occupation structures, low energy use technology and the agricultural practises that were in place. This trend has greatly impaired the farm households to ability afford alternative energy sources which has resulted in overdependence on fuelwood. It was on the basis of these weak economic base that the community advocated strongly for the adoption of energy saving technologies and supply enhancing programmes like agro-forestry as not just short term intervention approaches but also the most important step. As a long term measure energy diversification should be encouraged through programmes that will increase income levels of the people hence be able to afford alternatives like solar, biogas or electricity.

Finally, it must be realised that the approach to the alleviation of woodfuel shortage should be a package deal geared at alleviating rural poverty.

TABLE OF CONTENTS.

Contents	Page
Title	i
Declaration	ii
Dedication	iii
Acknowledgement	iv
Abstract	v
Table of Contents	vii
List of Tables and Maps	xi
List of Figures and Plates	xii
CHAPTER 1: INTRODUCTION	
1.1 Background to the Study Problem.	2
1.2 Statement of the Problem	5
1.3 Objectives of the Study	
1.3.1 General objective	12
1.3.2 Specific objectives	12
1.4 Study Assumptions	13
1.5 Justification of the Study	13
1.6 Research Methodology	
1.6.1 Methods of data collection	16
1.6.2 Methods of data analysis	20
1.6.3 Methods of data presentation	20
1.7 Scope and Limitations of the Study	21
1.8 Organization of the Study	24
1.9 Operational definition of terms	25

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK.

2.1	Introduction	27
2:2	Rural Development	
2:2:1	Development defined	28
2:2:2	Concept of Rural Development	30
2:2:3	Kenya's Approach to Rural Development	32
2.3	Community Participation	
2:3:1	Concept of Community Participation	33
2:3:2	Significance of the Approach	38
2:3:3	Kenyan Context	39
2.4	Energy supply and conservation as part of Rural Development	41
2.5	Potential fuelwood production and consumption dynamics	52

CHAPTER 3: THE STUDY AREA

3.1	Overview	63
3:2	Vihiga District, a geo-physical and economic profile.	
3:2:1	The physical background	64
3:2:2	Land use and woody biomass resources	72
3.3	Ebutanyi sub-location in vihiga district.	
3:3:1	Location and size	79
3:3:2	Climate and ecology	80
3:3:3	The woody biomass in the sub-location	81

CHAPTER 4: ENERGY DEMAND AND SUPPLY IN EBUTANYI SUB-LOCATION.

4.1	Overview	83
4.2	The household socio-economic characteristics	83
4.3	Land use patterns.	93
4.4	Energy supply, demand and consumption patterns	
4.4.1	Energy supply patterns	96
4.4.2	Energy consumption patterns	101

CHAPTER 5: COMMUNITY'S PERCEPTION OF THE WOODFUEL INADEQUACY.

5.0	Introduction	106
5.1	Community's definition of the energy problem and its causes.	
5.1.1	Community's definition of the problem	107
5.1.2	Causes of the inadequacy	109
5.2	Level of community participation in tackling the problem	112
5.3	Intervention approaches	
5.3.1	Demand management approaches	114
5.3.2	Supply enhancement approaches	120

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

6.1	Synthesis of major findings	127
6.2	Other emerging issues	131
6.3	Conclusions and recommendations	
6.3.1	Short term intervention approaches	135
6.3.2	Long term intervention approaches	136
6.4	Areas of further research	138

BIBLIOGRAPHY

- APPENDIX I. Household Questionnaire
- APPENDIX II. Focus Group Discussion Interview Guide

LIST OF TABLES AND MAPS

Tables	page
1.1 Demand-supply of wood in Kenya	6
1.2 Projected wood supply and demand	9
3.2.1 Area of the district by division	64
3.2.2 Agro Ecological Zones in the district	72
3.2.3 Agro Ecological Zones by Division	72
3.2.4 District selected land use/cover	74
3.2.5 Forest area and ownership	78
3.3.1 Mean land use/cover type	81
4.1 Age structure	87
4.2 Estimated Household monthly income	90
4.4.1 Type of energy used in cooking	101
5.1 Fuel Preference Matrix	120
 Map	
3.1 Vihiga District: National and Regional setting.	66
3.2 Agro Ecological Zones in Vihiga District	71

LIST OF FIGURES AND PLATES

Figure	page
1.1 Demand-supply of wood in Kenya	7
2.1 Energy consumption relations	47
2.2 (a) Fuelwood supply dynamics	56
2.2 (b) Fuelwood demand dynamics	58
2.2 (c) Fuelwood production and consumption patterns	61
3.1 Mean monthly rainfall (mm)	68
3.2 Mean monthly temperature ($^{\circ}$ C)	69
4.1 Household size	84
4.2 Land owned	89
4.3 Occupation structure	92
4.4.1 Sources of fuelwood	97
5.1.1 Community definition of energy problem	108

Plate

I	A woodlot and fence	100
II	Firewood market	111
III	Tree nursery	124
IV	Tree nursery: a section awaiting transplanting	124

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND TO THE STUDY PROBLEM.

Energy in its various forms plays a very important role in our everyday life including development issues. It is vital for development due to the numerous linkages it has with other sectors of the society in general and the economy in particular.

Kenya, like other developing countries is experiencing increases in her energy consumption. This has been necessitated by expanding developmental needs and the rapidly increasing population. Despite the increases in consumption the country still depends on three major sources of energy:

- i) Petroleum fuels;
- ii) Electricity (conventional); and
- iii) woodfuel (non conventional).

Of the three, woodfuel is the most used in meeting domestic energy requirements. It accounts for approximately 70-80% of the domestic energy needs and will maintain that dominant role in the economy for quite some time (National Development Plan (NDP) 1994 -1995, PS, Ministry of Energy¹).

¹ Note. Permanent Secretary Ministry of Energy, KBC Press Conference on Energy situation in Kenya, 10th Dec 1996.●

In comparison to other forms of energy, woodfuel remains the cheapest in terms of affordability and technique of use. Hence, the high rate of depletion of woody biomass in the country. In view of the current high rate of depletion of wood resources, the overall government policy on wood energy is to ensure adequate supply of wood energy through sustained yield and demand management while protecting the environment (NDP, 1994-96).

To meet the stated objectives, the Government tried to implement measures affecting both the supply and demand of woodfuel. The measures undertaken include among others, encouraging more sustainable production and use of wood energy, promoting widespread adoption of fuel efficient jikos (wood stoves), charcoal kilns and rural electrification programmes. Farmers on the other hand, have through public information and education programmes been encouraged to adopt farm tree planting, increase the supply of tree seedlings and promote agro-forestry.

Despite all the cited programmes, the problem of rural energy inadequacy has never been curbed. The failure of the programmes has been attributed to such constraints as high capital costs, lack of appropriate technology and the

ineffective promotion campaign strategies that have hampered the exploration and utilization of alternative sources of energy available like bio waste, biogas, wind energy and solar power (Economic Survey, 1995).

Another strategy which can enhance rural energy supply and also promote efficient utilization of existing resources is community participation in problem identification, programme planning and implementation. It has been noted, for instance, that community development programmes devoid of sufficient community participation cannot be as successful as would be expected. Ndungu (1989) notes that the success of a community programme is not largely determined by whether or not the community is the one that initiated the programme in question. Rather the crucial factor is whether the local community who are the beneficiaries were involved in the subsequent planning and implementation stages. His research, therefore, attributes the poor performance of development programmes or the refusal to take up suggested solutions to the limited and insufficient involvement of the beneficiaries in the subsequent design, planning and implementation stages. In line with the preceding argument, the Government of Kenya has underscored the need of peoples' participation in the development of their regions. In that connection, it is the

Government's conviction to not only let the local communities benefit from whatever programmes the Government initiates but also involve them in the initiation process (Sessional Paper No.1 of 1986, Development Plan 1979-83; District Focus For Rural Development (DFRD), 1984).

It is the Government's intention to adopt and strengthen policies and programmes for sustainable rural development. In the energy conservation area, the policy is that the government together with the private sector should reduce the cost of using both imported and domestic energy through elimination of wasteful consumption practises and maximization of the efficiency with which energy is used through out all the sectors of the economy. Also the problem of woodfuel scarcity is evidently seen by the commercialization of fuel wood that used to be freely picked in the countryside a decade ago. Secondly, the policy also stresses the fact that domestic generated energy should be substituted for imported energy due to the high cost of importation.

Unlike the previous studies done where solutions have been imposed on the people (Top-Down Approach) leading to minimal success of the programmes, this study seeks to use the Bottom-Up Approach where the community members will be expected to actively participate in finding solutions to the

problem. It is in this vein that the study was undertaken. Therefore, the study aims at achieving this through the use of mainly Focus Group Discussions (FGDs).

1.2 STATEMENT OF THE PROBLEM

In the last two decades, the Government of Kenya has dedicated great attention to rural areas with the hope of alleviating rural underdevelopment and regional disparities. The major concern has been to steer progress in the countryside to keep pace with the modernization process which seems to characterize most urban areas. Among the essential services known to stimulate progress in the rural areas is energy in its various forms. In the case of Kenya, the country experiences a severe woodfuel and related energy problems.

By 1984, woodfuel constituted a critical energy resource in the Kenyan economy. It was established that 75% of the energy resources were from woodfuel as compared to 1.2% from electricity, 21.4% from oil and a mere 0.3% from coal. This pattern was significant in the rural areas where woodfuel constituted 95% of the energy consumption of which 69% was in the form of woodfuel and 29% in the form of burnt charcoal (O'Keefe et.al, 1984). Thirteen years later (1997), woodfuel is still the major source of energy in the country, and

especially for the rural population for whom it provides about 73% of the total energy used (NDP 1997-2001:96-103). The rate of consumption is also expected to increase with the increase in population and the rise in the costs of other fuel substitutes. It is estimated that demand for woodfuel will continue to grow by 4% per annum to accommodate an additional demand for a cheap source of energy (O'keefe et.al, 1984).

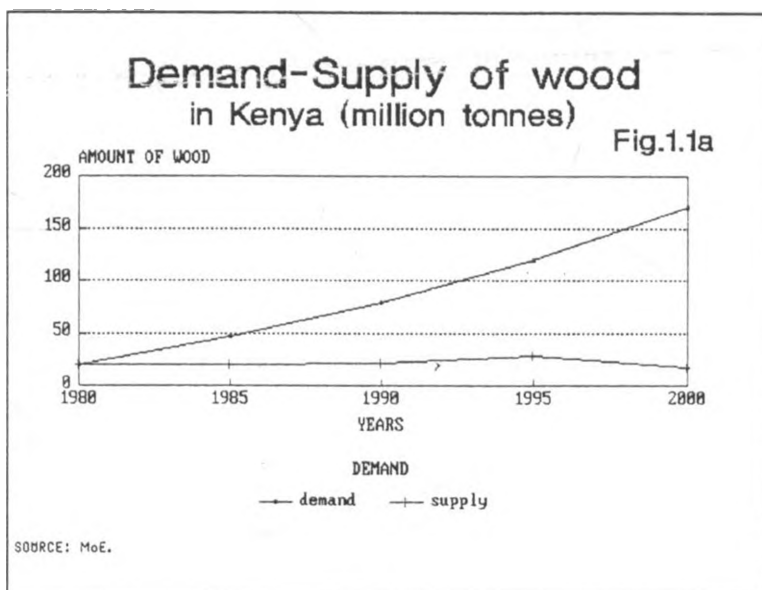
It is further estimated that the demand of wood resources exceeds the supply a situation that is expected to worsen beyond the year 2000 (Table 1.1). The table shows that since 1985 the demand for wood resources has always exceeded the supply with the shortfall increasing annually. This phenomenon is much more serious since the standing stock is also decreasing over the years.

TABLE I.I DEMAND-SUPPLY OF WOOD IN KENYA (million tonnes).

	1980	1985	1990	1995	2000
DEMAND	20.41	26.42	32.37	41.04	49.74
SUPPLY	20.33	20.35	21.57	27.91	17.61
SHORTFALL	0.08	6.07	10.80	13.13	32.13
STANDING STOCK	934.82	885.41	829.36	744.49	674.40

SOURCE: National wood Resource supply- demand relationships in Kenya (million tonnes).

This same scenario can be illustrated well as a compound line graph (Fig.1.1). On the demand side, the figure shows that since 1980 the demand for wood has been increasing steadily a trend that is envisioned to continue beyond the year 2000. While the supply had also been increasing at somewhat slow rate upto 1995 when a sharp decrease was experienced. This downward tendency is also expected to continue beyond the year 2000. Accordingly, the gap between the demand and supply of wood is widening over time. But the question is " How will the country meet that deficit?"



The emerging situation is that the country will be able to meet its wood requirements in the short run although some of the supplies will come from non-sustainable wood supply sources and wood fuel substitutes such as agricultural residues and animal wastes (Table 1.2).

TABLE I.2 PROJECTED WOOD SUPPLY AND DEMANDS 1995-2000 ('000M³).

	1995	2000
W O O D D E M A N D		
Industrial wood	1,058	1,209
Poles and posts	1,219	1,435
Fuelwood	20,107	23,947
TOTAL WOOD DEMAND (1)	22,384	26,591
S U S T A I N A B L E S U P P L Y		
Indigenous forests	1,942	1,905
woodlands&bushlands	11,240	11,157
Farmlands & settlements	7,437	9,373
Forest plantations	2,121	2,494
Total sustainable wood supply 2(a)	22,740	24,929
Non sustainable wood supply 2(b)	283	414
Fuelwood substitutes 2(c)	2,011	2,395
Total wood supply 3=2(a+b+c)	25,034	27,738
Surplus (3-1)	2,650	1,143

Source: National Development Plan 1997 - 2001.

But the main trend is that demand is increasing at a higher rate than supply. Beyond the year 2000, it is expected that the total wood supplies will not be able to keep pace with the wood demand. The deficit will manifest itself in a shortage of fuel wood, leading to, inter alia, the use of industrial wood as fuel wood. With such an ever increasing demand for woodfuel, a study which will lead to the better understanding of the issues and hence finding ways of dealing with them is exceptionally necessary before the last tree is cut. Since it is the government's intention to attain energy self sufficiency further studies are necessary in trying to find out ways and means of attaining that goal.

To ensure sustainable wood supply while at the same time avoiding environmental degradation, on farm wood production is cited as one of the programmes the government is set to achieve in its eighth plan period. The study, therefore, set to find out the feasibility of such a programme given the size of the farms owned by small scale farmers and the increased competition for the use of their parcels of land.

In regard to the national scenario as depicted above the woodfuel scarcity problem is no different at the district level (in this case Vihiga District) where nearly 80% of the population depend on agriculture as the main economic activity. Looking at the household and land holding sizes one realizes that there is

hardly enough land for the growing of food crops as well as woody biomass. As a result, a competition has emerged between the various land uses with woody biomass loosing heavily to agriculture and settlement. Hence, the stock of woody biomass in the area has drastically reduced. Furthermore, the district has only two gazetted forests with restrictions levied on the use of the forests products. In addition, the forests are just pockets in a few areas of the district. Thus on-farm wood production remains the only alternative.

At the divisional level (Luanda Division), the situation is even worse. There are no forests or bushes left. Woody biomass production has remained part of the duty of the farm household. Given the small land sizes and large households it becomes difficult to produce enough wood for domestic use.

In Ebutanyi sub-location, just like most rural areas the symptoms of woodfuel dependence are well seen in the declining woodfuel resources from from the increased cutting of trees. This has been caused by varying degrees of the need for land and wood products. As wood fuel resources in the area decline and recede the cost of obtaining fuel wood whether in cash or the time spent in gathering the wood are imposing severe and increasing strains on the already marginal household survival and production strategies. These impacts are greatest for the poor, women and children who normally bear the greater responsibility for fuel provision and use.

Despite the fact that several studies have been done on the problem of woodfuel scarcity, it is still looming high. The central argument of the study is that a new approach to the fuel wood crisis is needed urgently. The study, therefore drew inspiration for this new approach from the articulations by inter alia; Hall (1983), Chambers (1988), Hosier (1988), Chambers et.al (1989), de Groot and Hall (1989) and Soussan (1990) which emphasized that it is imperative to listen to the local people who are the intended beneficiaries of any project and that it is essential for project planners to recognise and understand the methods that local farmers have evolved and

adopted for managing rural development including tree planting. It was in this vein that the study was undertaken to examine the participation of Ebutanyi community in tackling the woodfuel problem. The study aims at assessing the woodfuel inadequacy situation in the study area first before examining the community's involvement in tackling the problem.

1.3 OBJECTIVES OF THE STUDY.

1.3.1 General objective.

The general objective of the study was to involve the user community in finding out viable solutions to woodfuel inadequacy in Ebutanyi Sub-location.

1.3.2 Specific objectives.

In line with the general objectives outlined, the specific objectives of the study were:

1. To assess the magnitude, causes and effects of the woodfuel inadequacy in Ebutanyi sub-location.
2. To gain an insight into the local community's perception of the energy inadequacy as a basis of coming up with possible ways of tackling the problem.

3. Based on objective (1) and (2), the study comes up with recommendations for appropriate intervention approaches to alleviate the woodfuel inadequacy.

1.4 STUDY ASSUMPTIONS.

The study was carried out along the following assumptions:

1. That solutions suggested by outsiders have not been able to solve the real community woodfuel needs.
2. That commercialization of woodfuel is not the major cause of the inadequacy.

1.5 JUSTIFICATION OF THE STUDY.

In its different forms energy is a very vital input in fostering economic activities and sustaining development. An adequate and reliable supply of energy is not only a basic prerequisite for the development of the industrial, commercial and agricultural sectors but it is also important for domestic use. Thus, in some sections of Kenya, we cannot think of energy for development since there is still no adequate energy for survival. It is for the sake of the latter reason that this study was undertaken. Presently, major sources of energy in

Kenya are: petroleum fuels, electricity, woodfuel (fuel wood and charcoal) and to a lesser extent solar energy, wind, ethanol, coal and biogas. Other sources of energy also include renewable energy sources like biomass. Although considerable potential also exists for further development of such energy sources like solar, wind and biogas, a greater proportion of Kenyans still depend on biomass fuels.

Bearing in mind the fact that it is the government policy to promote rural development; woodfuel supply is an important aspect of the rural development which deserves further examination to ensure its continual supply. For example, Sunny (1992) notes,

.... energy demands of the third world are likely to increase by more than 50% in the next six years (from 1992) thus increasing their share of global demand from 17% to 24%. Kenya like any other third world country makes substantial use of non-conventional energy sources like woodfuel. Though the share used was expected to decrease as countries developed little has been achieved to that effect.

Thus woodfuel being an indigenous energy source tends to be used a lot more. Hence a study which will contribute to the better understanding of the problem of the inadequacy and finding appropriate solutions to it is highly needed.

Secondly, the area under study lies in a zone of high

agricultural potential but with a high population density of approximately 1000 persons per square kilometre, as a result the average farm holding size lies between 0.5 to 2.0 hectares per person (Luanda Division Report 1996; Vihiga District Development Plan 1996). On average, a family consists of 7-10 members. It is suffice to note that the original vegetation which was moist oriented forest has been replaced by cultivation savanna and human settlements; woody biomass is reducing steadily. Due to the pieces of land holding being very small, agricultural production and livestock keeping has equally declined. From the studies done by inter alia: Mugo (1986); Musoga (1988); Mwenda (1993); Wane (1986) none of the areas studied have such extreme conditions and characters. Hence the findings of this study can be applied to other areas with similar characteristics.

Finally, the study aims at promoting the government's intentions of not only encouraging but also having the people participate actively in rural development issues. As evidenced from the above referenced studies on rural energy problems, solutions suggested by outsiders have not been fully accepted by the intended beneficiaries. This study therefore seeks to adopt a different approach (Bottom-up) through FGDs where the beneficiaries will be expected to identify solutions to the

problem as it best suits their situation.

The study aims at coming up with recommendations for appropriate intervention approaches to alleviate the woodfuel inadequacy that can be applied to other areas with similar characteristics and problems.

1.6 RESEARCH METHODOLOGY.

To be able to achieve the above stated objectives a sample method of inquiry was used. Focus Group Discussions (FGD), Focus Individual Discussions (FID) and the farm household were the major units of investigation.

The following methods of data collection were employed;

1.6.1 Methods of data collection.

a) Documentary sources.

Before the commencement of the fieldwork relevant literature on previous studies both published and unpublished were referred to on such issues as

- i) Natural resources
- ii) Energy in general with special reference to woodfuel

- iii) Kenyan Energy policies
- iv) The role of energy in development.

Documentary research was done in:

- i. Libraries;
- ii. Central and Local Government Authorities like Forestry Department, Ministry of energy, Research stations and other NGOs working on wood fuel production and consumption.

This was particularly so in the course of coming up with a conceptual framework for the study.

b) Primary data.

1. Focus group discussions.

The researcher identified ten (10) registered organizations in the sub-location; four women's groups and six youth groups. From the ten, two groups were randomly chosen from each category for discussion. Then four more discussions were held with unregistered groups which were formed by choosing people randomly in the following order; from St. Phillips Anglican church and African Israel church, professionals in the area and a " merry-go-round " group. For purposes of generating a healthy and manageable discussion a maximum of ten people was allowed with a minimum of six.

2. Focus Individual Discussions.

This method was mainly focused on key informants like village elders, opinion leaders in the area, representatives / officers of various government ministries, religious organizations and local administrators.

3. Household questionnaires.

Household questionnaires were also used to gather information on issues that could not be captured in the FGDs. This entailed issues pertaining to land sizes, incomes, family characteristics among others. A total of 104 questionnaires were administered which constituted about 2% of the total population.

But before administering these questionnaires, a sampling frame was established. This was achieved by first dividing the study area into three clusters. The division of the area into clusters was based on:

- a) the distance from Luanda Township; and
- b) the population density of the area.

Cluster I was the one nearest to Luanda Township with a high population density, while cluster III was the furthest from the town centre with low population density comparatively. From the 104 households, 63.5% were administered to women who are the

major users and collectors of the wood fuel and 36.5% to men.

Systematic random sampling was applied in choosing the households to be interviewed. From each cluster, one household was obtained on a random basis and the additional households were selected by interviewing the tenth household. In cases of failure to get a respondent in the tenth household, the eleventh household was interviewed instead. Cluster I which is nearest to the town with a high population density had 46.2% of the questionnaires administered there, followed by Cluster II with 36.5%, while Cluster III received 17.3% of the questionnaires.

c) Direct observation

Direct observation was also an indispensable tool of data collection in the process of research. It was a very useful method in the research because it helped the researcher to avoid the imposition of her reality on the situation and subject of study. It was used in order to gain knowledge of the salient issues pertaining to the study. These were among others: fuel wood collection methods, the commercialization process, storage and ways of use. These information was then noted down by the researcher This method of data collection was used concurrently with photography.

d) Photography.

The method proved very effective in an attempt to capture some of the salient features of the research as well as in enhancing visual presentation of the situation as it is on the ground.

1.6.2 Methods of data analysis

The data collected from FGDs, FIDs and the questionnaires was organized and subjected to descriptive statistics like frequency counts, averages, percentages and cross tabulations.

1.6.3 Methods of data presentation.

Data collected from the field has been presented using various methods. Thus bar graphs, tables, pie charts, photographs and maps have been used.

1.7 SCOPE AND LIMITATIONS OF THE STUDY.

The study focuses mainly on the analysis of how the community can tackle the energy problem in Ebutanyi sub-location, Luanda Division of Vihiga District with special reference to woodfuel. It came to the analysis after establishing the magnitude of the inadequacy, causes and effects of the same. Thereafter, the study came up with recommendations for appropriate intervention approaches to alleviate the scarcity. In essence the spatial scope of the study was a sub location which is the lowest decision making level in the District Focus for Rural Development strategy. Findings derived here will portray the grassroots perception of the problem under consideration. Due to financial and time constraints, it was not possible to study a large area. In addition, the sub-location under study is only one of the many areas in the district facing the same problem hence ways of handling the problem identified here can be applied in other sub-locations.

Like other studies, this study was not free of limitations. One of the limitations faced in the research was that of scanty records or statistics. Vihiga district being a fairly new district has not come up with its own statistics hence the researcher was on several occasions forced to refer to the data

on the former Kakamega District. Furthermore, Luanda Division is equally a new division which was carved from the greater Emuhaya Division hence it does not have a lot of information documented yet. The researcher was again forced to refer to the Emuhaya records.

Time was another constraint. There was no enough time for the researcher to accomplish all that the methodology demands. In many cases the researcher was forced to work from sun rise to sun set spending days in the community and evening reviewing findings.

The study area was in a rural setting where the majority of the households operate at the level of subsistence economies. It was not ease to get much of the information that entailed the keeping of records ie. amount of money earned per month, fuel wood consumed per unit time or the land size under the different farm uses. Hence the researcher had to do with a lot of fair estimates whenever possible.

The above limitation was also coupled with the general unwillingness of some of the interviewees to offer any information pertaining to their assets. The major cause of the unwillingness was fear and suspicion due to the prevalence of thuggery in the area. Hence 79% of the questions concern with

incomes of the people were never responded to. In an attempt to capture the co-operation of the people the researcher had to spend a lot of time in trying to explain to the respondents the purposes of the study.

One of the methods of data collection employed was a household questionnaire which was administered with the help of research assistants. As scholars observe, the more interviewers there are, the more difficult it is for the researcher to maintain consistency over the research. This was worsen when the interviewer had to use his own knowledge in estimating for example the land size and under different uses. There were high chances of either under or over estimating, and that aspects that required further probing were not captured as effectively as the researcher would have wished.

There was also the problem of increased expectations. It is a well established fact that rural communities suffer from a dependency syndrome which causes them to think that only outsiders can solve their problems. The arrival of a new face and the fact that FGDs required an intensive commitment of the community in terms of time and input made their expectations to exceed reasonable limits.

Finally, the problem of inadequate finance adversely

limited not only the duration of the stay in the field and the spatial scope of the research but also the number of people employed to assist in the research.

1.8 ORGANIZATION OF THE STUDY.

The study is organized into six chapters which are: the Introduction, Literature review and Conceptual framework, The Study Area, Energy supply and demand in Ebutanyi sub-location, The community's perception of the problem and Summary of findings, Conclusions and Recommendations.

Chapter one gives a brief introduction of the study. It addresses issues like the statement of the problem, objectives, assumptions and justification of the study, operational definitions, research methodology, scope and limitations of the study.

Chapter two tries to synthesize the work of various scholars on diverse aspects like rural development, community participation, energy supply and conservation as part of rural development upon which the conceptual framework was derived.

Chapter three deals with the background information of the study area. It deals with a geo-physical and economic profile, land use and woody biomass resources for both the district and

the sub-location consecutively.

Chapter four and five deals with the analysis of the data collected from the field. Whereas the final chapter provides the summary of the findings, the conclusions and recommendations.

1.9 OPERATIONAL DEFINITION OF TERMS.

1. WOODFUEL: fuel wood, firewood or charcoal.

2. COMMUNITY:

Is a group of people who live together within a defined geographic territory so that they have common ties, a high measure of interdependence and social interaction.

3. COMMUNITY PARTICIPATION:

The voluntary and democratic involvement of a people in a given geographic area in the entire process of identification of their needs, conception, planning, decision making, implementation and management of projects. In this research it implies "Action by the people to solve their own problems.

4. SUB-LOCATION: Lowest level of an administration unit within Kenya's administrative structure.

5. HOUSEHOLD: A group of people who live within the same compound, fenced or unfenced, and shares meals, have a common source of major income and have a common provision for other essentials of general livelihood.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK.

2.1 INTRODUCTION

Most people in the Third World are familiar with the on going debate on " fuel wood crisis". The amount of literature on fuel wood is enormous and yet the problem still persists. It has repeatedly been described as a complex problem with no single solution. There have been thousands of solutions tried globally, but none has succeeded in significantly shifting forward our knowledge frontiers. The rural poor are no better off and in some instances these solutions have left them worse off. They are the victims of development efforts that are implemented by development experts. In Kenya, the problem of fuel wood was recognised as early as the 1970s yet two decades later, we are still struggling to define the opportunities and constraints for fuel wood development.

As already stated in Chapter 1, the study looks at the problem of fuel wood in a rural setting where it seeks to involve the user community in identifying viable solutions to the problem. This chapter, therefore, seeks to review issues

relating to rural development in totality with special emphasis on energy supply and conservation. The argument advanced here is that, inter alia, demographic pressures and lack of the community involvement in tackling the energy issue have contributed to the present energy crisis in the form of fuel wood scarcity.

2:2 RURAL DEVELOPMENT

2:2:1 Development defined

The term development has many meanings and is rather obscure and ambiguous. It is derived from the verb "to develop". Oxford English Dictionary defines the verb "to develop" as to change gradually, to progress through a number of stages towards some sort of state of expansion or improvement, thus development means the act of developing and the resultant state. Development is not value free since it has to do with the improvement of peoples' lives. The term can be defined in various ways from different value points, then it is important to observe that whatever definition used, it must take in consideration the following three basic components:

- a) Development involves growth where growth can simply be defined as increase in certain capacities depending on what

is to be developed. Growth can therefore be either qualitative or quantitative or both. In this context, growth can be seen as the change or the switch from firewood which has been discovered to be the fuel of the poor, (O'keefe et al. 1984) to the use of other fuels like kerosene, charcoal, bottled gas and electricity or the use of energy saving devices.

- b) Participation is the generation of this growth. Development can be seen at three main experience levels namely: personal, group and collectively. Each is referred to as a development unit.
- c) The development process is also perceived as the distribution of the consequences of growth; thus this can also be seen at three levels; namely individual/ personal benefits, Benefits to a group for which the individual is a member and benefits to a collectivity. These three aspects have to dovetail into one another to make what will finally be called development.

Development in the study will be gauged upon the ability of the people to undergo an energy transition ie. switch from the use of firewood to the use of better sources of energy like gas

electricity or kerosene and the ability to use energy saving devices.

2:2:2 Concept of rural development

The term rural development has been defined differently by different scholars where each definition has been largely influenced by the parent discipline of the scholar himself. Chambers (1983) observes that to people outside a rural setting rural development would mean desirable change in rural areas which is identified with such economic growth parameters as modernization, increased agricultural production, socialist forms of organization, health, transport and water.

Whereas the World Bank (1975) defines rural development as:

... a strategy designed to improve the economic and social life of a specific group of the people -the rural poor. It involves extending the benefits of development to the poorest among those who seek a livelihood in the rural areas. The group includes small scale farmers, tenants and the landless.

Even though these definitions help as to appreciate and understand the type of change we expect in the rural areas, it suffers from two major drawbacks. First, it shows that development can only be realised when it is given or enabled by

those who have it or own it. To those in power this is their view of development. Secondly, the definition suffers from lack of specificity. It is too general without a clear indication of how development takes place and who are the direct beneficiaries. On the other hand, Chambers (1983:147) makes the following observations:

...Rural Development is a strategy to enable a specific group of people, poor rural women and men to gain for themselves and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of development, the group includes small scale, farmers, tenants and the landless.

The above definition still suffers from the problem of a general assumption as experienced in most literature dealing with rural development. The assumption is that the lifestyles of the rural dwellers can only be improved if and only if development programmes are initiated from above by the government or other development agencies. This view then suggests that the best a rural person can do is to enjoy the fruits of development programmes and since he is already undeveloped he cannot participate in efforts directed at improving the standards of living.

Irrespective of the drawback, Chamber's definition helps to

focus on the rural majority and those in the greatest need to improve their standards of living. He views the need of secure and decent livelihood which can be attained through increased productivity as the primary objective of rural development. This particular view of rural development addresses such issues as poverty, unemployment and inequity inter alia:

UN,ECA (1971:1) sees Rural Development as:

... the outcome of series of quantitative and qualitative changes occurring among a given rural population and whose converging effects indicate, in time, a rise in the way of isolated programmes of community Development agricultural extension, health and nutrition.

It should be noted here that development is not just mere programmes- tangible monumental structures. It includes the real improvement in the welfare of a people.

2:2:3 Kenya's approach to rural development.

Even though actual practise has been to a greater level at variance with the declarations of intent in the Government Development Plan, it has been the government policy to pay special attention to the rural areas. As years went by, the government policy has developed from broad guidelines to more specific and focused action programmes. For instance, the

Decentralized Planning Approach has been elaborated in:

1. Sessional Paper No.10 of 1965
2. The special Rural Development programme (SRDP) and
3. The District Focus for Rural Development strategy (DFRD) (NDP: 1984-88).

A major objective of the DFRD being to increase communication between the local community and government officers working in the districts, divisional, locational and sub-locational development committees to encourage inputs from community members on development opportunities and problems in their local areas and the type of projects to be undertaken.

2.3 COMMUNITY PARTICIPATION

2:3:1 Concept of community participation

Community development programmes devoid of sufficient community participation cannot be as successful as would be expected. Ndungu (1989) observes that the success of a community programme is not largely determined by whether or not the community is the one that initiated the programme in question. Rather, the crucial factor is whether the local community who are the beneficiaries were involved in the subsequent planning and implementation stages. In accordance with the same study,

the poor performance of development programmes in communities is attributed to the limited and insufficient involvement of the community in the subsequent design, planning and implementation stages.

People's participation in development activities is seen as a very important aspect which should not be overlooked by those in positions of authority. Thus, participation should not be restricted merely to consumption of goods and services supplied but should also include direct participation in the initiation and management of development activities.

The term community participation has been defined diversely by different scholars. Various terms have been developed in development circles which have all tended to explain what community participation is all about. In fact, some of these terms have been used interchangeably on the understanding that they all mean the same thing. In the process, the term community participation has either been given a general and vague definition such that it lacks the authentic and meaning as well as the focus it is meant to have. Some of the terms used along side or to explain community participation include citizen participation, democratic approach, bottom up approach, user participation, popular participation and community development.

The United Centre for Human Settlements (UNCHS; 1988:3) though in the context of squatter settlement projects defines the concept of community participation in a more elaborate manner. It defines the concept as:

.... the voluntary and democratic involvement of beneficiaries in contributing to the execution of the project, in sharing the benefits derived therefrom and in making decisions with respect to setting goals, formulating the project, preparing and implementing the plans.

This report explains quite explicitly that for the success of a given project the beneficiaries should be given the opportunity of participating fully in decision making regarding the project in question. Project staff or government officers should not go ahead to execute a project assuming that the beneficiaries are going to accept it. Rather they should be fully incorporated in the planning and development process.

Lisk (1985:15) looks at participation from a rather general point of view without any specificity. In what he calls popular participation in development, he says:

... the active involvement of people in the making and implementation of decisions at all levels and forms of political and socio-economic activities.

and that

... the involvement of the broad mass of the population in the choice, execution and evaluation of programmes and projects designed to bring about a significant upward movement in levels of living.

Popular participation like citizen participation, looks at the general participation of people without being specific on what exactly the people are participating in. Furthermore, this only succeeds in mere involvement of the people on say a development programme without due consideration on whether this includes actual community participation in decision making right from the design stage through the implementation of the development programme in question.

Wileden (1970) in discussing the democratic approach assumes that the final authority and right to make decisions rests with citizenry and that all sides of every issue are freely discussed. It assumes that different alternatives on proper course of action is debated and vote taken. Thus, although the interest of the majority will be the one to be followed everybody will have had a chance to express their feelings. Note that this approach is very general and does not

tell us specifically where, when and how it can be applied. If it is applied in a rural setting then it brings in a picture of a community which is facing an issue of resolution on whether it is right or wrong to take a certain action regarding their own development. The final decision made may be a majority's view which may not necessarily be the correct one: This approach is very mechanical and lacks that element of spontaneity which is a characteristic of a healthy community.

Armstrong (1987) like Obudho et.al (1988) see the "Bottom Up" or "From Below" development approach as growing in importance in developing countries because of being one of the possible means of achieving more rapid rural transformation. Mbithi (1974) sees local participation as one of the criteria for development from below. To him, this development strategy implies involvement of residents, non officials and low level indigenous government staff in the planning/formulation and implementation stages. He cites Kenya's self help projects (harambee projects) as examples of local participation. From this literature it appears that local participation can be hindered when the bureaucratic arm of the government is allowed to have minimum government intervention as possible and instead involve the users, then there are high chances of success and

acceptability of the programme in question. Even then, the approach may not be desirable for all types of projects or programmes. It can only work well when applied on a community or on a small scale level. It would involve inter alia, rural water projects, rural access roads and farming. But when it comes to large scale projects presumably infrastructural in nature that require large sums of money and wide spread usage it becomes totally impossible.

After going through the various definitions advanced, in the context of this study , the term community participation implies action by the people to solve their own problems. Such actions start with the identification of what actions to take and can be articulated in terms of specific activities which members of a community can undertake with respect to development projects. This actions can be undertaken communally or on individual basis after reaching a consensus on what needs to be done.

2:3:2 Significance of the approach

The Government of Kenya has emphasised the importance of the participation of the local communities in their own development. It is the government's conviction that, local

communities should not merely benefit from whatever programmes the government initiates without their involvement (Sessional paper No. 1 of 1986; NDP 1979-83; DFRD, 1984). Although the policy documents touch on the general participation of the people in development planning, they do not address how the people can be effectively used to find solutions to their problems. On the question of the involvement of the people in Local level development activities the Government has stressed the importance of encouraging people in their own development efforts (Sessional Paper No.1, 1986; Nguthe, 1979). The most important aspect, however is the community participation in deciding what to do regarding the project/problem. Participation, is only part, but an important part of the development process along with growth and distribution.

2:3:3 Kenyan context.

The idea of participation in Kenya started decades ago. So that by 1974 it was already in existence under the guise of harambee movements. The concept of community participation is now one of the current thinking in regard to developing the rural areas in Kenya. In the NDP 1970-74 period the major primary resources of Kenya were identified as land and the

people. The strategy was made clear in Kenya in 1984 through the District Focus for Rural Development Programme. Hence the government strategy to Rural development emphasized on among other factors the promotion of greater participation of the local communities in decision making and implementation of development programmes.

Like Conyers (1982), the Kenyan Government considers it important for the following reasons:

- i) Is a means of obtaining information about local conditions, needs and altitudes without which development programmes and projects are likely to fail.
- ii) People are more likely to be committed to a development if they are involved in its planning and preparation.
- iii) Finally, is a democratic right that people should be involved in their own development, people centred development. Peoples participation in planning at the local level is one of those many phrases that have found their way into the planning vocabulary and are increasingly dominating it. Hence no plan is considered good or effective if the people are not involved in its planning and implementation. It has been argued for instance that when individuals participate in the making of decisions concerning development, it is then expected to mobilize

additional investments from citizens to facilitate implementation. Others argue that popular participation increases administrative efficiency by providing two essential ingredients to success; a continual flow of information and clientele co-operation with programme objectives.

Considerable evidence has also been amassed that local participation in development planning is crucial to acceptance and sustained support for rural development. This strategy has been applied in Kenya through the DFRD Programme as will be elaborated at a later stage. This argument implicitly makes the assumption that participation increases the quality of plan making and plan implementation in the development process. The argument then claims that people in any given locality should be allowed to participate in determining the shape of the development of their own area.

2.4 ENERGY SUPPLY AND CONSERVATION AS PART OF RURAL DEVELOPMENT.

As already indicated in Chapter I, Section 1.5, an adequate and reliable supply of energy is not only a basic pre-requisite for the development of the industrial, commercial and agricultural sector, but it is also important for domestic use. Energy, can therefore, be defined as the ability to do work.

presently, major sources of energy in Kenya are petroleum fuels, electricity, woodfuel (fuel wood and charcoal) and to a lesser extent solar energy, wind, ethanol, coal and biogas. It is notable that woodfuel is currently the major source of energy in the country, especially for the rural population for whom it provides about 73% of the total energy used (NDP 1997-2001:96-103).

Of all issues associated with resource development and exploitation, energy has attracted the most attention in recent years (Soussan,1988). It is also the one about which there are the most preconceptions and misconceptions. Ever since the dramatic increase in the price of oil, there has been widespread discussions of various forms of energy crises and gaps; a debate which reflects the traumatic impact of the oil price rises on the country,s economy.

The problem which confronts Kenya, like any other Less Developed Country (LDCs) concerning energy supplies are diverse and complex. Although there is inevitably a degree of variation in the form they take in different places, there are common difficulties which confront most of the LDCS which are not major oil exporters.Whatever the case, the first dimension of the energy issues is that energy must be considered as a vital input

into the process of production. Thus, fairly rapid increases in available energy supplies are essential inputs into the process of economic development irrespective of the form such development takes.

The second dimension of the energy issue sees energy as an aspect of patterns of consumption. We all need energy and use it on a day to day basis. Energy is a basic need, it's vital for survival yet there is increasing evidence that the ability of many communities to provide the energy for their basic survival needs is seriously under threat. This crisis is closely associated with poverty. It particularly threatens poor people. Soussan (1988) further notes that this issue has only been recently recognised and still receives very little attention. It can be recognized as a crisis of energy for survival. This study, therefore focuses on this second dimension of energy.

As shown in Chapter I Section 1.2 woodfuel crisis is still a hidden energy crisis in Kenya which generally faces significant sections of its population. The welfare of these people is increasingly jeopardized by the difficulty they encounter in catering for their basic energy needs. We all need energy in one form or another daily for either cooking, heating or lighting among other uses. Energy, in essence can be

considered as a basic need along with food, water, shelter and clothing. In comparison to the commercial energy supplies this aspect has received little attention, yet, it is just as critical for the future prospects of this country. Though the fuels used to satisfy these basic needs vary from place to place the main energy source is what is known as biomass or traditional fuel. This is particularly true for cooking which is the largest user of energy for most LDCs. The scale of domestic wood fuel problem is difficult to evaluate partly because they have been ignored for so long. But it also reflects the way in which the problems express themselves for they rarely emerge in the form of an absolute lack of fuel. When wood becomes scarce people are forced to spend more time and to travel long distances to gather it or to switch to less favourable fuels such as agricultural residues or to start buying fuels, when previously they gathered them freely or to adopt a range of other responses to the problem of scarcity. These difficulties rarely affect the entire country and are often not noticed by national governments or powerful commercial interests.

Soussan (1988) notes that few people paid any attention to this problem until the late 1970s. Since then concern has grown not least in major international agencies such as World Bank and

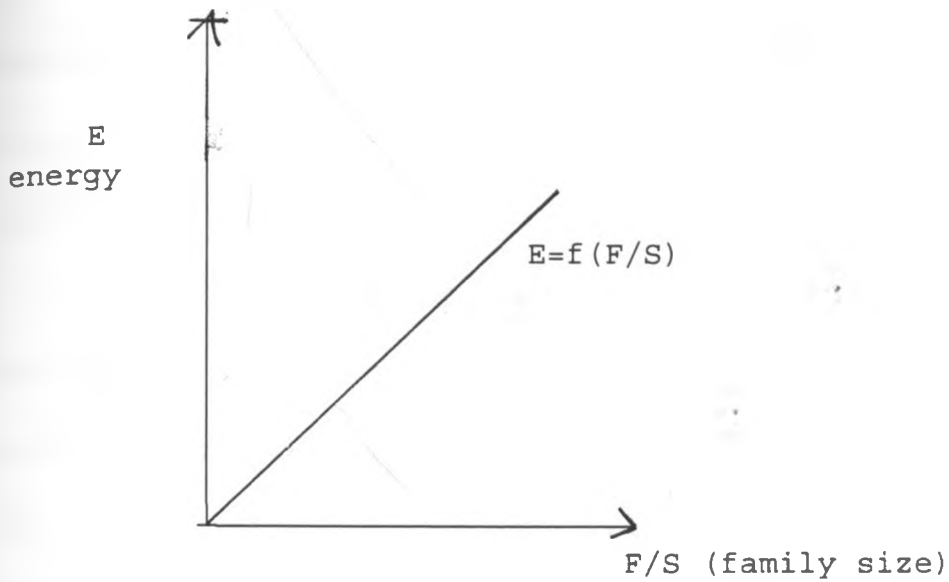
the UN FAO. He observes that the shortage is not of fuel per se but of affordability. Wane (1986) had earlier on cited the same view by saying that the woodfuel crisis is not of energy per se but has its roots in the dynamics of the process of underdevelopment and poverty. He observes that for people with secure and adequate landholding or a reasonable level of income, woodfuel is rarely a serious problem. They can afford to buy or pay for alternatives. It is only the poor and landless who are the greatest sufferers from wood fuel scarcities and it is the poor who can do least about it. No simple technical measure can change this basic fact (Musoga; 1988:6). He notes that poverty is the connecting link between woodcutting and environmental degradation. The landless poor who stripe the woodlands to supply the urban market do so because they see no alternative way of earning a living. The squatter families clearing the trees from mountain slopes are there because they can find nowhere else to farm, their land is eroded and degraded around them because they can not afford the investments needed to protect it and make it productive in the long term.

At times, the woodfuel crisis has been expressed in simple demographic terms. Increasing woodfuel consumption and the pressure on land resources is blamed on rising populations with

implication that stringent birth control measures would make the problem disappear. It is clear however that the woodfuel crisis is much more complex than this. Though population growth is undoubtedly one of the driving forces behind the depletion of tree resources, it is rural poverty, inequality and lack of opportunities that are as much to blame. Until these fundamental problems are tackled, the woodfuel crisis will never be permanently cured.

Ngugi (1990) in line with this thinking concurs with the fact that demographic pressures have contributed to the present energy crisis in the form of fuel wood scarcity. From his research in Mai-ai-ihii village it was revealed that the larger the family size the more the amount of fuel wood needed to satisfy the domestic energy requirements (Fig. 2.1).

Fig.2.1 Energy consumption.



Source: Ngugi (1990:5)

In section 1.2, it was revealed that energy is only one of the needs of the community, thus energy has to compete with other household requirements. As population continues to increase, more sub-division of land will take place diminishing the resource base for supply of fuel wood and other land based family needs. Leach (1988) on one hand, says that most woodfuel supplies arise as a by product of agricultural land clearance. To arrest deforestation one needs to halt the depredations caused by agriculture rather than woodfuel consumption. Measures to reduce woodfuel use become much more a matter of improving

welfare by cutting consumer costs than attempts to save trees. On the other hand, Eckholm (1979) argues that the real issues in deforestation and therefore woodfuel problem are: agricultural stagnation, grossly unequal land tenure, rising unemployment, rapid population growth among other factors.

Foley (1986) extends the argument further to suggest that contrary to the belief that the rural populace or communities' perception of the woodfuel crisis was limited to the extent that they indiscriminately cut down trees and were wasteful in the use of woodfuel; the rural people have actually tried to adjust to the problem in a very rational manner. He argues, for example, that the habit of economizing the use of wood and charcoal has already been institutionalized in the communities where there exists scarcity of woodfuel. The main contributory factor to the woodfuel supply problem, he argues, is the need for additional land for growing food. Due to the rapid population growth and the privatization of the land, people extend farming to lands which were formerly areas where fuel wood was collected; and trees are cut down to make way for cropping and in due course are no longer available for fuel wood supply.

Woodfuel crisis is not limited to the rural areas alone but

it is accelerated by the availability of the urban market for woodfuel. The commercialization of woodfuel means that even if the existing stock of woodfuel would have been sufficient to meet the rural domestic energy needs, there has emerged a competitive demand for it. And since the farmer is striving to generate some income or livelihood he will rise to the occasion and seize the opportunity. This has occurred to the extent that although firewood collection was a reserve of the female, the males are now involved in fuel wood collection for commercial purposes. Foley (1986) concludes by saying that woodfuel problem should not be addressed in isolation but as an integral part of the development process.

Accordingly, Timberlake et.al (1984) see the emergence of the woodfuel crisis in the rural areas as concomitant to the structural changes experienced in the society over time or as part of the societal development process. Thus a society moves from a position of self sufficiency in fuel wood supply to a situation where there is a deficit. First, in a situation where the population densities in a given local area are low, the household fuel wood requirements are met without any damage being caused to the standing stock of trees. While those who own land are able to grow their own trees, but for others, and where

local customs permit, the local people collect from their neighbours' farms where very little time is spent in fuel wood gathering. But as the population in the local community grows, there is a higher demand for fuel wood which cannot be satisfied from the immediate area and as such the fuel wood collection area is extended; a consequence of which is the increased number of hours spent in the said exercise that are not available for other productive work. By and by distance to the source of fuel wood becomes prohibitive and people turn to the standing tree stocks which becomes depleted. There is then a shift to use of inferior alternatives like crop residues, dung and other combustible materials.

Secondly, a set of structural changes and privatization of land ownership restricts the accessibility to traditional communal sources of woodfuel which affects the poor, who are not able to provide for themselves from their farms. And the emergence of commercial wood markets provide an incentive to the people to engage more in wood harvesting either from their own farms or communal areas and nearby forest reserves. The land owners find it more profitable to sell excess wood for money rather than allow the poor to collect it for domestic use.

The energy situation in Kenya can never be conclusively understood without referring to the most critical study done by the Beijer Institute (1981) which intended to contribute to the process of timely energy planning in Kenya and the Kenya Woodfuel Development Project (KWDP) which followed later. The study done by Beijer was at a national level and assessed the current and future commercial and non commercial energy demand and supply situation. The study disclosed the crucial role played by the woodfuel in the economy and that in the absence of appropriate intervention this resource will continue to be depleted as to lead to severe stress on the economy. It came up with recommendations on how to alleviate the energy shortage, some of which are being implemented by the Government (O'keefe, Raskin and Bernow, 1984, Soussan, 1988).

Several other studies have also been carried out at a macro level like: Western, D and Ssemeka, J (1979) carried out a study which examined the consumption of woodfuel in various sectors- large and small firms, rural and urban domestic consumption. The study provided the estimates of the contribution of woodfuel to the total energy consumption in Kenya. He examined consumption patterns by region and came up with projections of demand to the next two decades. Other studies done by such scholars as Arnold

et.al (1962), Chlala (1972), Kabagambe (1976) have tried to evaluate the potential supply and demand of charcoal in Kenya basically in urban areas.

Apart from the macro-level, studies have also been done at the micro-levels. Such studies include those done by: Wanjama (1989) which examined the nature and extent of woodfuel crisis in Kikuyu Division in Kiambu District, Wainaina (1985), Musoga (1988), Mugo, (1989) and Mwenda (1989) among others. This studies identified rapid population growth, deforestation, small land sizes and low energy conservation efficiency methods as the major causes of woodfuel shortages. Whereas solutions are seen as lying in the conservation of energy, diversification of energy and supply enhancement through planting of trees.

2.5 POTENTIAL FUEL WOOD PRODUCTION AND CONSUMPTION DYNAMICS.

Soussan (1988:70) in his work on " The system of fuelwood production and consumption" asserts that the potential of fuelwood production and consumption can be set as a flow diagram. The system he developed assumes that fuelwood supply of an area is a part of the total woody biomass resource, where its availability is limited by competing uses and access constraints. He observes that the demands for fuelwood reflects

the population's energy needs and the availability of alternative sources of energy to meet these needs. The model assumes that the supply of fuelwood depends on the woody biomass available in the community. This author further posits that people play a major role in creating the demand for the fuelwood. But where the supply comes from is not necessarily the domain of the people as they can balance up their needs and priorities with the availability of outside resources (i.e biomass and financial to meet these needs).

Thus he assumes that the whole system of demand and supply lies in a straight line so that in case of a shortfall of supply one can buy from the haves or from the market. Basically, the system works on the assumption that if a people cannot supply for their domestic needs then they can buy from elsewhere. Therefore, the model advanced in this study cites the community as the major actors in determining the supply, the demand and the consumption of woodfuel in their area (Fig 2.2 a,b&c).

Fuelwood supply in any community is governed by and/or will depend on several factors (Fig 2.2(a)). The main factors being:

- i) The government policy on wood fuel specifically and other energy sources in general. In Kenya, for instance, the

policy calls for energy self sufficiency hence the need to plant more trees so as to increase the wood supply.

ii) The competing uses of wood so that the supply of firewood greatly depends on the other uses of the tree products. In areas where other tree products are commercialized what is dedicated to domestic use are the left overs after all other uses have been considered. In essence domestic use is considered subsidiary.

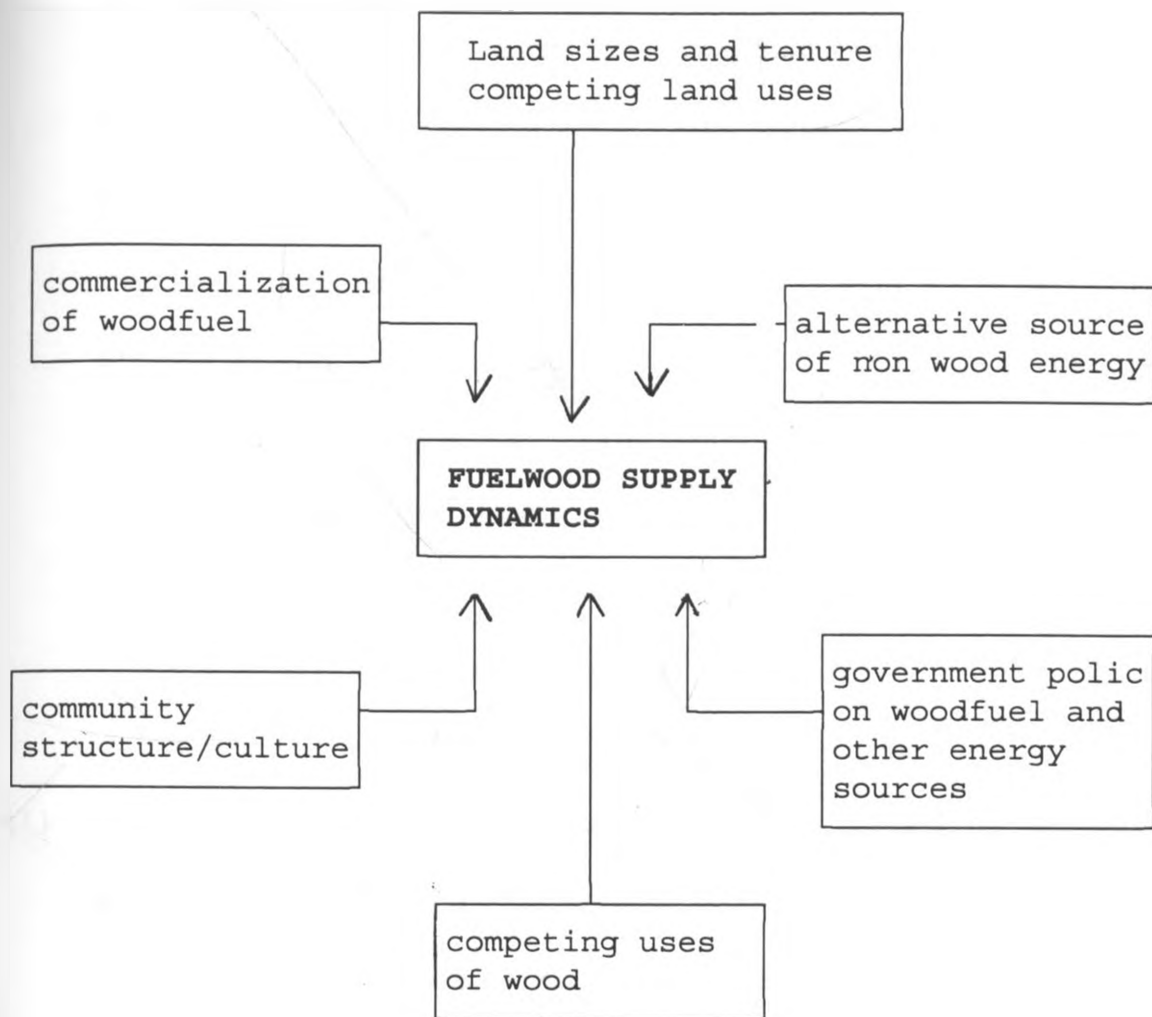
iii) Land sizes, tenure and competing uses of the same also affect the supply of fuel wood. In cases where the land is very small, it becomes difficult to set aside any portion for specifically tree planting. Thus, one has to trade off between tree planting and food crop production. More often than not, trees are planted on hedges leaving the entire piece of land for crop production.

iv) Commercialization of wood will equally affect the supply. In areas where firewood has become a commercial commodity, it is very hard to get any piece of wood lying on the way. The situation is made worse in areas characterized by very

low incomes so that they have to sell any available wood at their disposal so as to get some money for purchasing other necessities of life like food.

- v) Availability of alternative sources of non wood energy like oil, gas, biogas or solar will, also help in decreasing the amount of fuel wood demanded and hence increasing the supply of woodfuel.'
- vi) Community structure or culture in an area is yet another factor that determines the supply of woodfuel or the biomass management system. Thus land management system in an area will reflect the prevailing social structure, local resource management, harvesting techniques and technologies, the range of alternatives non fuel uses to which different species of trees are put and customary rights and obligation concerning the use of and access to biomass resources on communal and in some cases private land. Taken together, the alternative uses of wood and limitations on accessibility will mean that the potential fuelwood resources available to certain households may be severely limited.

Fig.2.2 (a) Fuelwood supply dynamics



source: Author's Perception, 1997.

The demand of fuelwood in any given area is derived from a number of factors. In summary, the demand will basically be determined by the following factors (Fig 2.2 (b));

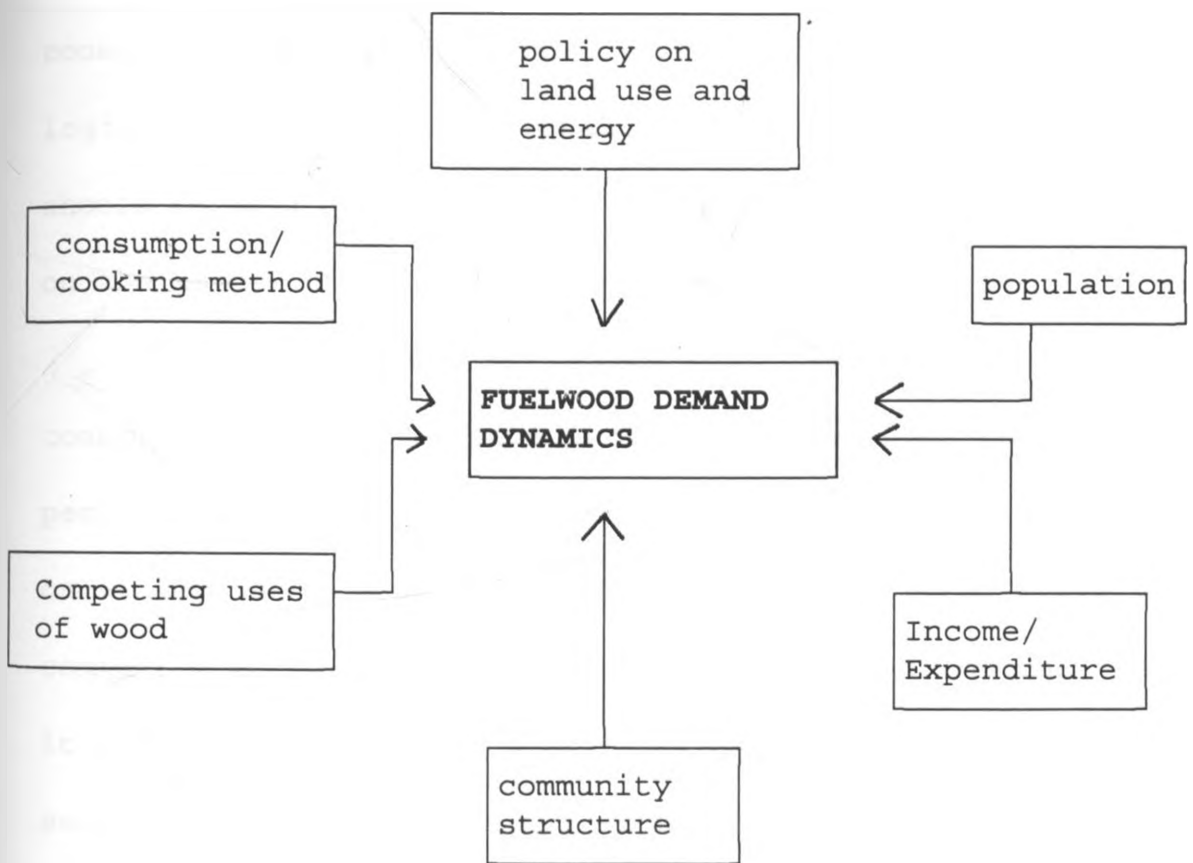
- i) Income levels or expenditure patterns of the people.

Under normal circumstances higher incomes allows one to use modern fuels i.e jump the financial/cost barriers and be able to purchase not just the modern fuels but also the devices for using these fuels. On the contrary, in remote rural areas even high income families typically depend almost entirely on biofuels with perhaps a little kerosene for lighting, kindling the cooking fire or cooking some light meals. Thus in the rural areas high income may not help to reduce the demand of fuelwood as the case may be in urban areas.

- ii) Consumption levels of a people and their cooking methods will equally dictate the energy demand. In cases where a lot of cooking is done on a low energy efficient device like the three stone hearth, more firewood is consumed as compared to a region where there is less cooking on a more energy saving device.
- iii) The number of people living in a given area will also determine the demand of firewood. The more the people, the more the amount of food to be cooked and hence the higher the demand for firewood.
- iv) The community structure or the culture of the people will

also determine the demand of fuelwood. There are certain tribes that are culturally attached to the use of firewood so much so that using any other fuel becomes very difficult in terms of the level of acceptability of the alternative sources of energy.

Figure 2.2 (b) Fuelwood demand dynamics



Source: Authors perception, 1997.

The problem of fuelwood inadequacy is not universal. It is experienced in varying degrees in different places. As a result of these variations, the causes of the problem also differ from one place to another. Due to these differences, fuelwood production and consumption pattern (Fig 2.2 (c)) as advanced in this work suggests that since people in a given community are the central actors in the entire process of production, consumption and creation of the demand for fuelwood, it follows logically that they understand their patterns well and hence should be in a better position to handle any problem that arises on the same.

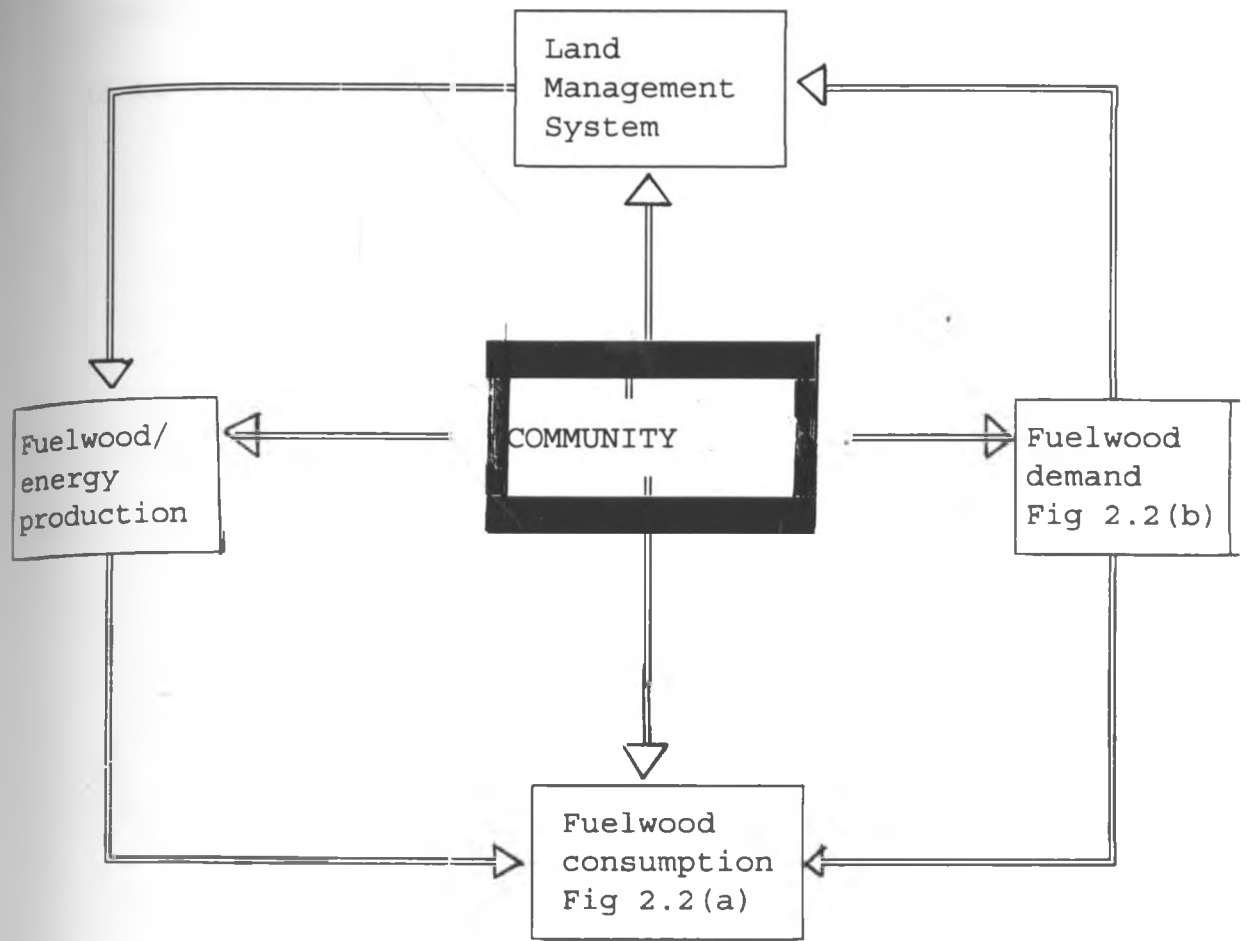
The model, therefore shows that fuelwood production and consumption patterns depend first and foremost on the particular people before any other external forces can come in. Depending on which ever factor influencing the demand (Fig 2.2(b)) the community will determine its level of demand and on the basis of it work out ways and means of managing the land so as to produce enough fuelwood to satisfy their needs. The fuelwood consumption in the area will then depend on the demand and the production mechanism of the community.

Fuelwood production by the community will mainly be determined by inter alia, competing uses of wood, land sizes,

tenure and competing uses of land (Fig 2.2 (a)), whereas the land management system will be dictated by the land policy of the country, land use patterns of the area, land tenure system and the individual household land sizes. Likewise, fuelwood consumption in any given community will depend entirely on the family size. The larger the family, the more the food that has to be cooked and firewood to be used, the cooking technology, the type of food to be cooked and the species of wood in use.

Apart from the internal dynamics of the community, the supply and consumption system will also be affected by external influences i.e the supply of fuelwood can be increased by more tapping from external forests or the neighbourhoods and woodlands whereas the income levels of the people may be raised by transfer payments from other areas and any other income hence making demand for fuelwood to raise.

Fig. 2.2 (c) Fuelwood production and consumption pattern



Source: Author's perception, 1997.

From the model, it should be noted that whenever there is a change in either the demand, production or consumption the community should be able to adjust itself accordingly until it reaches an equilibrium. Hence the fuelwood production and consumption pattern is never static, it keeps changing over time and that is why the model suggests that in trying to

tackle this fuelwood problem, it is only the community in question that can suggest mechanisms of regulating itself so as to satisfy its requirements.

CHAPTER 3: THE STUDY AREA

3.1 OVERVIEW.

This chapter reviews the geographic and the socio-economic background of Vihiga District in general and Ebutany/ sub-location in particular. It is divided into two parts. The first part gives a brief profile of Vihiga District's resource base with special reference to wood fuel.. (Note that the study makes use of data from the entire district instead of being area specific due to lack of data on the smaller units of administration. This lack of area specific data is ascribed to the fact that the district is relatively new and has no data banks for the specific units.) The main aim of this section is to establish the alternative energy source available in the study area. The second part gives a detailed profile of some of the issues in the study area (Ebutany sub-location) that need more emphasis. This chapter therefore, provides a ground on which the superseding discussions, the data analysis and intervention approaches are undertaken.

3:2 VIHIGA DISTRICT. A GEO-PHYSICAL AND ECONOMIC PROFILE.

The following aspects will be considered: the location and size, topography and geology, climate, Agro-Ecological Zones (AGZs), soils and biomass resources of Vihiga District where the study area falls.

3:2:1 The physical background

a) Location and size.

The study was carried out in Vihiga District. A district created in 1992 and is one of the five districts comprising Western province. It borders Kakamega District to the North, Nandi District to the East, Kisumu District to the south and Siaya District to the South West (Map 3.1). It lies between longitude 34° 30' East and 35° E and between latitude 0° and 0° 15' North. The district occupies 613 sq.Km.

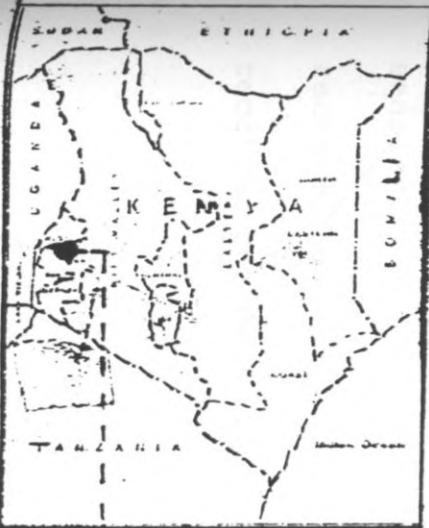
Table 3.2.1 Area of the district by division.

DIVISION	Area in sq.km.
Emuhaya	169.5
Sabatia	110.1
Tiriki	154.7
Vihiga	88.7
Luanda	90.0
TOTAL	613.0

Source: Vihiga District Statistics Office, Vihiga 1993.

b) Topography and geology.

The district is located in the lake basin. It's altitude ranges from 1,300m above sea level in the west to 1,500m in the East. But there are hills which rise above this general level. It has a system of rivers running from North East to South West. River Edzawa is the main river that flows into Yala River, it flows through the upper sections of Tiriki and Sabatia divisions. These two main rivers drain into Lake Victoria. The district is dissected by River Yala in the upper



96



LEGEND

District boundary ———

Divisional " ———

Divisional name LUANDA

Study location

Scale: 1: 320,000

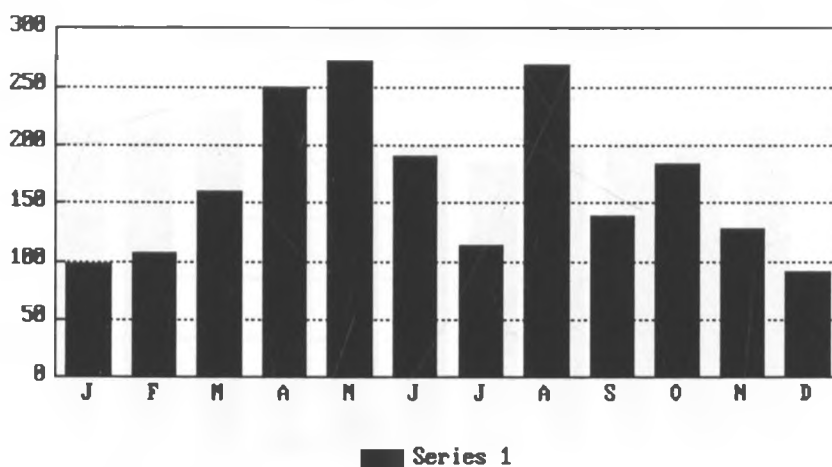
sections of Tiriki and Sabatia. The southern part of the district is dominated by rugged granite tarsus which rise above 1950m above sea level. Some of the notable hills are Maragoli, Bunyore and Nyangori which are remnants of the greater peneplains. The plains are dissected by steep river valleys. The geological formation of the district comprises of the Kavirondo and the Nyanzan rock systems. These rocks are granitic and are commonly found in Tiriki, Emuhaya and Vihiga divisions. They have high potential for the exploitation of building stones and ballast. Some parts of the district comprise the basement system.

c) Climate.

Vihiga District, like other districts in the Lake Basin receives some of the highest amount of rainfall in the country. The region has a bimodal climatic pattern. The districts annual rainfall ranges from 1,800mm to 2,000mm. The rainfall is high, reliable, adequate and well distributed throughout the year. The region experiences two main rainy seasons; thus the long and short rains. The long rains are received between April and May while the short rains are received between September and October. The months of December

to February are characterized by low rainfall. Though the district receives a reasonably high amount of rainfall some parts of Emuhaya receive the lowest amounts of rainfall. Temperatures in the district range from 14°C to 32°C. Variations in the temperatures are generally experienced throughout the year (Fig. 3.1 and Fig. 3.2).

Fig.3.1 Mean monthly rainfall (MM) For 1989-92



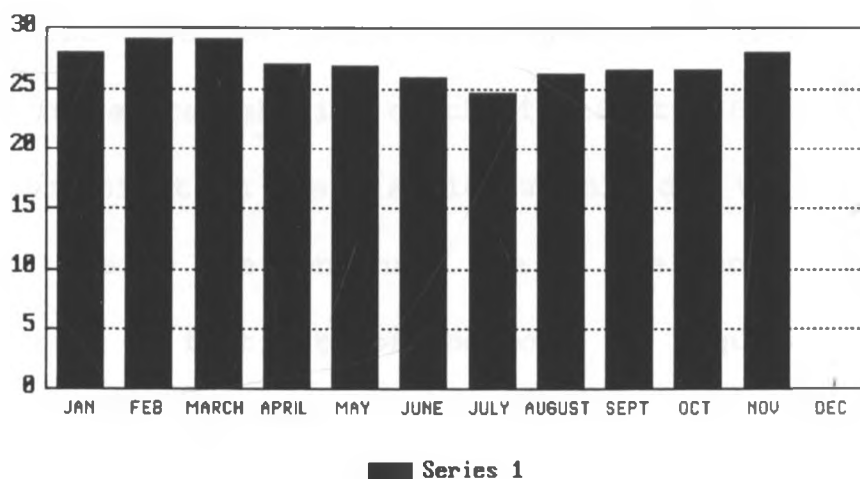
Source:Uihiga district development Plan

d) Soils and agro-ecological zones.

The soils in the district include the well drained dark, red friable soils partly covered with humid top soil derived from both volcanic and basement complex rocks and the yellow red loamy sands derived from both sediments and basement.

Ecologically, the district lies in the high potential agricultural zone. From the many agro-ecological classifications or zones found in Kenya, only two main ones are found in the districts. This may be a useful idea in explaining the pattern of land use and specifically have a bearing in the woody biomass available in the area.

**Fig.3.2 Mean monthly temp.
(degrees centigrade) 1989-1991**



source: Meterological Dept. Kakamega.

These zones are:

i) The Upper Midland Zone (UM₁)

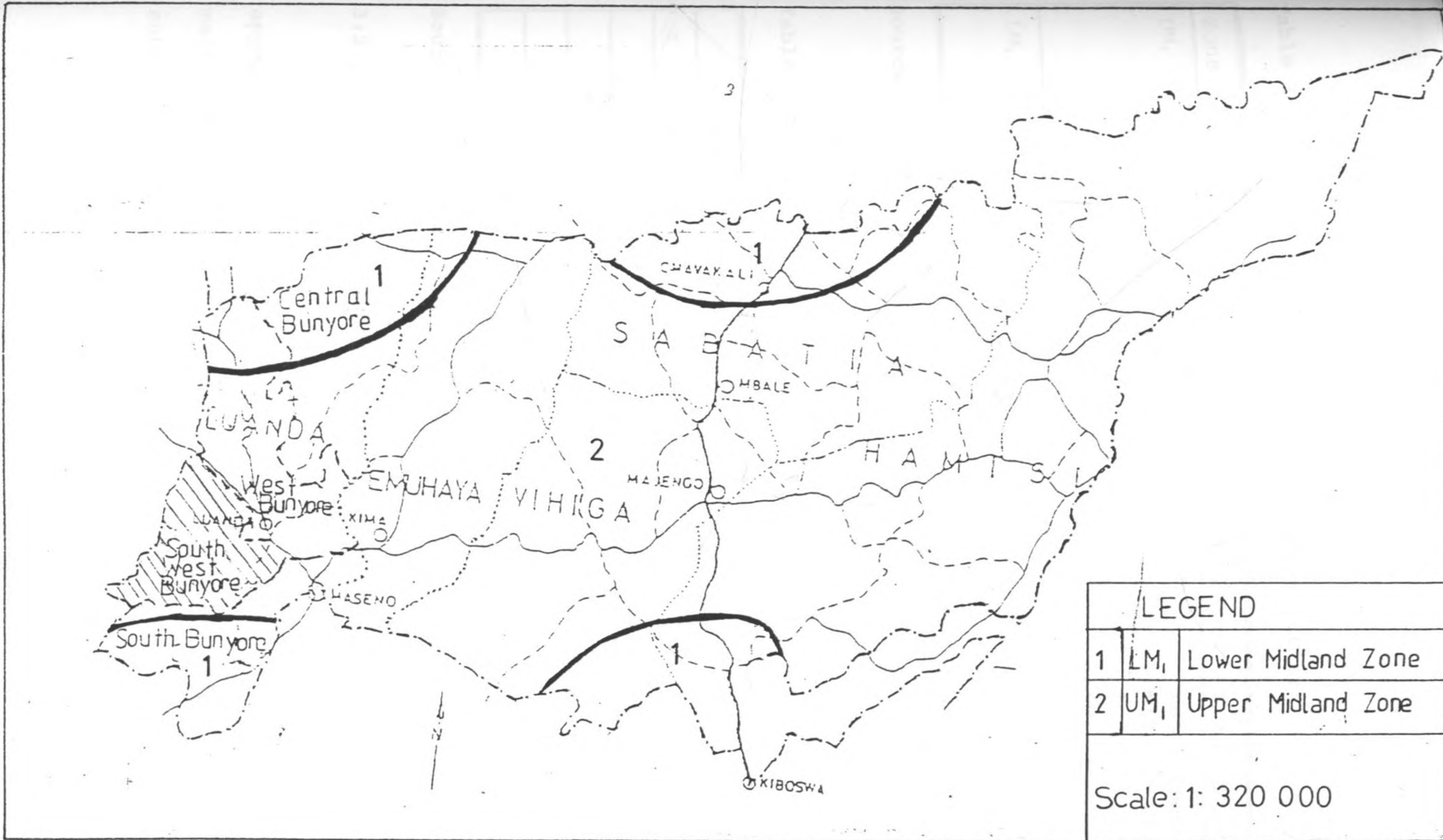
This zone has fertile well drained soils, dark, red soils which support the growing of tea, coffee, finger millet and cassava. The zone covers the western slopes of Nandi

escarpment and parts of Cental Sabatia, Vihiga and Tiriki Divisions. In total the Upper Midland Zone covers 90% of the district.

ii) The Lower Midland Zone (LM₁).

It covers the Western parts of Emuhaya. The soils are red loamy sands which have been derived from sediments and basement rocks. These soils support the growth of such crops as sugar cane, maize, coffee, beans, finger millet and sorghum. It is notable that in both zones, soils are losing fertility through leaching and over cultivation. There is the need for understanding conservation measures for ensuring sustainability of the fertility. Gully erosion is a common sight in the district mainly due to high rainfall. Due to the continued use of the land leading to the reduction in fertility of the soil, it requires the use of fertiliser to maximize production (Map 3.2).

71



LEGEND		
1	LM ₁	Lower Midland Zone
2	UM ₁	Upper Midland Zone
Scale: 1: 320 000		

Table 3:2:2 Agro- Ecological Zones in the district.

Zone	Area (km ²)	Location	classification	crops grown.
UM ₁	429	Central parts in Vihiga, Sabatia, Tiriki divisions	Humid	maize, beans, millet, tea sorghum, coffee, fruits
LM ₁	94	Western parts in Emuhaya.	Humid	maize, millet beans, sugar cane

Source: D.A.O's Office, Vihiga, 1993.

Table 3:2:3 Agro-Ecological Zones by division in sq.km.

Division	UM ₁	LM ₁
Vihiga	80	9
Sabatia	105	6
Tiriki	139	15
Emuhaya/Luanda	105	64
Totals	429	94

Source: Farm Management Handbook, 1983.

3:2:2 Land use and woody biomass resources.

Out of the 613 sq.km occupied by Vihiga District approximately 409 sq.km is arable land. Agriculture is the main land use. The district is heavily dependent on subsistence farming with 88% of the total area under

production and livestock holdings. Agriculture is the main economic activity employing about 80% of the population. The remaining 20% derive their livelihood from other non agricultural economic activities such as commerce and other small scale business ventures. High rainfall, good soils and favourable climate enable the growing of the various food and cash crops in the district (Agatsia, J.L et.al, 1996).

Generally the district is composed of small scale farmers growing food crops for household consumption and the local market. Maize, beans, sorghum, millet are the main staple crops produced in most areas. Other crops are bananas, vegetables, guavas, paw paws and avocados. Cash crops grown are beans, coffee, tea in the Southern parts and central parts of the district. The livestock mainly kept are cattle, poultry, sheep and goats.

Table 3.2.4 District selected land use/land cover for the years 1986 to 1991 for Kakamega District as percentage of total area.

Land use type	86(%)	87(%)	88(%)	89(%)	90(%)	91(%)
s u b s i s t e n c e						
maize	26.4	23.9	23.2	20.2	24.5	22.23
Bananas	0.92	0.84	1.79	1.24	1.47	1.46
W o o d y b i o m a s s ,						
Forest	2.97	6.67	10.18	7.84	6.18	7.39
Bush	3.67	3.15	4.25	3.33	4.14	2.72
Woodlots	3.52	2.54	0.37	3.56	3.23	3.45
Hedges	2.25	2.52	1.73	2.19	1.95	2.30
O t h e r s .						
Bare ground	0.80	1.05	4.25	0.63	1.47	1.46
Pasture	34.91	35.26	31.34	35.33	33.36	31.65

Source: Ministry of Planning and National Development, Technical Report No.145,1996.

It is evident that there is an emerging competition among the various land uses with woody biomass loosing to either agriculture or settlement (Table 3.2.4). For instance, over a span of six years (1986-91), the proportion of land under bushes fell by about 1.0% and that of woodlot fell by about 0.1%. It is necessary to realise that the trend of land uses is rather unpredictable. The different uses go changing in either direction annually. Thus the land under hedges was

2.25% of the total land by 1986, but in 1990 it had reduced to 1.95% of the total land; yet in 1991 it had increased to 2.3%. This unpredictable changes should be appreciated in the light of the dynamics of the man-land resource relationships especially as dictated by increasing population relative to the more or less inelastic supply of land. As seen earlier on, the district is heavily dependent on subsistence agriculture and with the continual increase in population (present growth rate of 2.98% per year), the proportion of land under agriculture will continue reducing. This will emanate from the increased need of land for settlement and crop cultivation. This trend will culminate into rapid land sub-division leading to small uneconomic units.

Presently, the districts 409 sq.km arable land supports approximately 54,000 farm households. The district has a population of about 530,000. It has a population density of approximately 1,015 people per sq.km which is ranked as one of the highest in the country. This has caused continual sub-division of land with an average farm and family size of 0.6 ha and 5.5 per household respectively. It is suffice to note that Vihiga district has the highest incidence of poverty and low incomes per household when characterized among other high

agricultural potential districts in the country. The mean income was Ksh. 1,588 per month as compared to the neighbouring Kakamega District's mean of Ksh. 1,879 and Western province mean of Ksh.2,307 in 1992 (A Household Welfare Monitoring and Evaluation Survey of Vihiga District 1993). These statistics point out to a number of intervention approaches: thus the high population densities and small farm sizes experienced in the area calls, for intensive agriculture and agro-forestry, a practise that should be carried out over and above the family planning efforts.

There is very little expansive capacity a scenario that calls for more trade offs between the land uses. Since subsistence agriculture is the mainstay of the people, the woody biomass (forests, bushes, hedges and woodlot), bare ground and pasture land will be the most targeted. Hence the problem of wood fuel inadequacy as will be elaborated later in the study. In an effort to abate depletion of woody biomass, first, there is need of intervention in terms of provision of alternative energy sources and making the people understand the dangers of clearing the woody biomass. Such dangers would be environmental degradation in terms of soil erosion resulting from the diminishing tree cover.

Secondly, due to the fact that the majority of the people in the district have low incomes per household, the possibility of exploiting self help efforts in the provision of energy in the rural areas should seriously be thought of. This provision strategies should encompass developing more appropriate technologies in energy end use and pooling resources together for making available alternative energy sources. This second alternative should be seen in the light of the point that there is a positive relationship between population density and the level of planted woody biomass. Hence in the densely populated sub-regions of Vihiga and Tiriki the area of woody biomass as a proportion of the total woody biomass cover is very low as compared to areas with low population density (Ambio;1986). This is ascribed to the fact that with diminishing land resources owing to high population increase and the attendant effects, very little land, is left for bushes/forests/woodlot where fuel wood could be collected. As a result most people in the densely populated areas are either forced to turn to on-farm fuel wood sources, buying trees in the neighbourhoods or pieces of wood from the market. As notable from the district the area under planted woodlot and forests actually declines as more land is dedicated to

agricultural production and settlement.

Table 3.2.5 Forest area and ownership.

FOREST	AREA (Ha)	OWNERSHIP	STATUS
Kibiri	3691.3	Government	Indigenous /exotic
Maragoli	469.6	Government	exotic
Total	4160.9		

Source: District Forest Office, Vihiga, 1993.

The apparent competition between the aforementioned land uses and woody biomass is clearly brought out by the fact that the district has only two gazetted forests, thus, Kibiri where both indigenous and exotic trees are grown while in Maragoli only exotic trees are grown. Both forests cover a total of 4160.9 ha which is 7% of the total land area. These forests are not sources of wood fuel for the entire district as, one, they form just a few pockets in some areas of the district such that only those in the neighbourhood can enjoy the use of the wood. Secondly, there are restrictions levied on the use of the forest products i.e. Kibiri forest has some of the indigenous trees that are being preserved from extinction whereas the planted trees in both forests are used for the supply of pulpwood and saw wood. Fuel wood is only a subsidiary product. With the increasing shortage of fuel wood there is need to incorporate the supply of wood fuel in the

planning purposes of forests in Vihiga Districts.

3.3 EBUTANYI SUB-LOCATION IN VIHIGA DISTRICT.

Although much of the issues about the sub-location have already been established in section 3:2, it should be realised that the discussions were a bit too general hence not bringing out clearly the "issues" why the sub-location was chosen for study. This section, therefore, aims at capturing more specific issues on a more localised basis, that will help us appreciate why "community participation " was singled out by the researcher as a better way of tackling the problem of fuel wood scarcity in this area. It should also help us appreciate the fact that the magnitude of fuel wood scarcity can never be the same throughout the district hence fuel wood problems are specific to people in different places as highlighted in Chapter 2.

3:3:1 Location and size.

Ebutanyi Sub-location is one of the four sub-locations that make up South West Bunyore Location; which in turn combines with other three locations to form Luanda Division all in Vihiga District. The sub-location lies between Eshilandumba to the north, Esitsimi to the south, Mwitubwi to

the East and Siaya District to the west. It covers an area of 8 sq.km with a total population of 5,473 people, it had a total of 1132 households with a population density of approximately 684 persons per square kilometre (1989 Population Census Report, Vol.1). Assuming that the population continued to grow at the same rate of 2.89 %, the sub-location has a population of 6701 people to date. Eight years later, the DO's Records show that the area has a population density of 1000 persons per sq.km whereas the family size and average land holding range between 8-10 members and 0.5 -2.0 Ha respectively.

3:3:2: Climate and ecology

The sub-location like the rest of the District has a bimodal type of climate; it is among the areas that receives the highest amount of rainfall in the division. It experiences two rainy seasons thus, the long rains between the months of February and July and the short rains between the months of August and December. It has a moderate temperature of approximately 24°C (Divisional Agricultural Office, 1996). The soils in the area are red loamy soils with a PH of 5.8. It supports the growth of maize, beans, finger millet and sorghum

as the staple crops grown. While others crops like bananas, vegetables, paw paws and mangos are equally grown. In the area, cassava, sweet potatoes and sukuma wiki are the most important crops commonly grown for sell.

3:3:3 The woody biomass in the sub-location.

As stated earlier on, the sub-location lies in the zone that is characterized by very high population densities hence the situation of woody biomass in the area concurs with what Ambio says in the Journal. The proportion of woody biomass in the area is very low. It is noted that until 1990 the area had no forests. But in 1991 some land had been planted covering 0.07 % of the land. The proportion of land accorded to bushes has also reduced from 4.5% to 1.07 % of the total land. A decrease of 3.43% was recorded (Table 3.3.1).

Table 3.3.1 Mean land use/land cover types for the year 1986-1991 in Emuhaya/Luanda Division. (derived from a larger table).

	1986	1987	1988	1989	1990	1991
Bare ground	2.75	2.33	0	1.21	1.08	3.93
Bush	4.50	1.89	0.67	1.71	2.25	1.07
Forest	0	0	0	0	0	0.07
Hedges	4.25	3.89	2.83	3.71	2.63	5.30

Source: Ministry of Planning and National Development, Technical Report No.145.

In as much as the amount of bare ground has equally increased due to increased exploitation of the woody biomass resources, hedges, useful land marks in the area are shown as having increased. This is the aftermath of increased subdivision and privatization of land so that most people are planting the hedges to mark their land. Considering this rate of woody biomass depletion the area seriously needs the introduction of an alternative source of energy. This move would go hand in hand with saving the soil from being left bare to environmental degradation.

CHAPTER 4: ENERGY DEMAND AND SUPPLY IN EBUTANYI SUB-LOCATION.

4.1. OVERVIEW

As indicated in Chapter 1, the main focus of this study is to come up with viable ways of tackling the energy deficit in general and woodfuel inadequacy in particular. But this is inevitably linked to other important factors such as the household socio-economic dynamics, the landuse patterns, the magnitude, causes and effects of the inadequacy, energy supply, demand and consumption patterns. This data analysis section will therefore be divided into two chapters. This Chapter will deal with energy supply and demand dynamics in the study area whereas the proceeding chapter will deal with the community's perception of the problem.

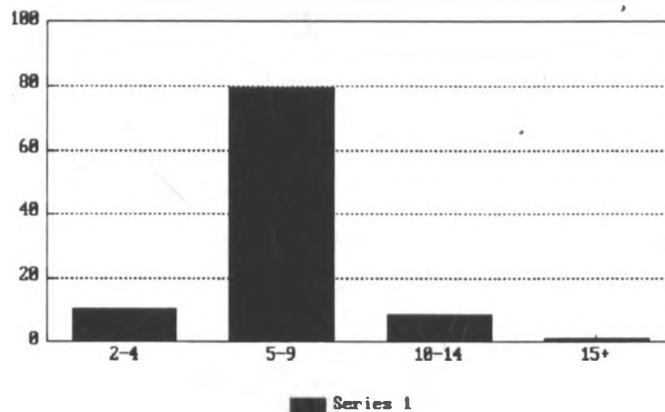
4.2 THE HOUSEHOLD SOCIO-ECONOMIC CHARACTERISTICS/DYNAMICS.

In this section the household characteristics discussed are; household size, age structure, employment patterns, income levels and landuse patterns. These characteristics were considered necessary in an attempt to address the energy demand,

supply and consumption issues in the study area as appreciated in subsequent discussions.

Household size.

Fig.4.1 Household size



source: Field survey,1997

About 80% of the households have 5 to 9 members (Fig 4.1) whereas the average household size was 7 persons. The largest household had 16 persons while the smallest had 2 persons.

Implications of the family size

As already seen in Chapter 2 (Fig.2.1) the larger the family size, the more the amount of fuel wood needed to satisfy the domestic energy requirements. Based on a per capita fuel wood consumption of 1041 kg per annum, the household with 2 to 4 persons will require about 2081 kg to 4164 kg per annum as

compared to the household with 5 to 9 persons which will require approximately 5205 kg to 9369 kg per annum (Statistical Abstract, 1995). In terms of land requirements, if we are to rely on on-farm fuel wood supply, then the households with 2 to 4 persons will require between 0.47 acres and 0.94 acres respectively committed to fuel wood production alone as compared to 1.2 and 2.1 acres of land required for the family category with 5 to 9 persons.

In terms of food requirements, if we assume that all the food requirements are met from the family farm, then the household in the bracket of 2 to 4 persons will require between 240 to 480 kg of maize per annum as compared to the category of 5 to 9 persons which will require between 600 to 1080 kg of maize per annum. In terms of land requirements, at an average production rate of 540 kg per acre, the household in the category 2 to 4 persons will require 0.4 to 0.89 acres of land to meet their annual maize requirements. This analysis reveals an apparent competition between these land uses with the households having the most number of persons experiencing more land pressure i.e. a household of 9 members require 2.1 acres for fuel wood and 2 acres for maize production; in total 4.1 acres are required. But given an average farm size of 1.83

acres, this household will experience a deficit of 2.27 acres. The agricultural land availability per person will be 0.2 acres per person in a 9 member household as compared to 0.45 acres per person in a 4 member household.

The household size will also determine the level of expenditure given the fact that there are other basic items like food and clothing which compete for the same income. This in part explains why less income is spent on energy needs especially firewood which in the recent past was a non-commodified item. Presently, the tendency is that a lot of time is spent collecting small pieces of dry wood if such can be obtained.

From Table 4.1, it is evident that about 54% of the population in the study area is below 19 years. This group includes the school going age, thus apart from food, clothing and health, school fees is also one of the major income consuming items on the household budget. All these income consuming items have to compete with energy needs for cooking, lighting and specifically boiling water as 27.3% of the people are aged between 0-9 years, an age that requires high standards of primary health care to prevent the occurrence of water born diseases. In actual fact, the majority of people who appeared in

the category under 19 years of age were below 14 years. Conventionally, those are children who may not participate actively in income productive activities and thus constitute a burden on the family income.

Table 4.1 Age structure in the study area.

Age group	No.	Percentages
0-9	195	27.3
10-19	191	26.7
20-29	160	22.4
30-39	87	12.2
40-49	53	7.4
50-59	23	4.0
	715	100.0

Source: Field survey, 1997.

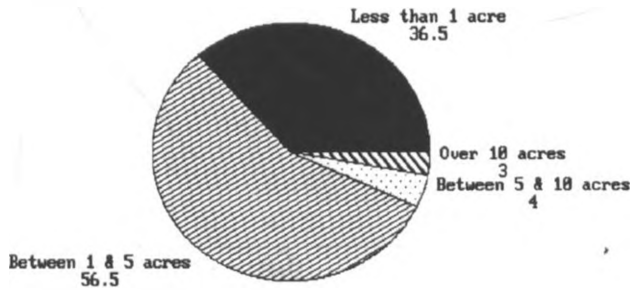
Taking dependency ratio as the number of dependents; that is: persons below and above the working ages per 100 persons in the labour force, the ratio comes to 64.4%.²

It is noticed that 42% of the population in the study area lie between 20 and 49 years. This is taken as the most

$$\text{Dependency ratio} = \frac{(\text{population between } (0 - 14) + (60+) \text{ yrs} \times 100)}{\text{population between } (15 - 60) \text{ yrs}}$$

reproductive age and therefore unless family planning measures are undertaken the population is bound to increase drastically. This increase will then bear heavily on the existing household resources like land. As depicted in Fig. 4.2, the average land size per household in the area is 1.83 acres, where since approximately 40% of the people own land that is less than 1 acre and 57% own land that ranges between 1 and 5 acres. A substantial proportion (36.6%) of the people own half an acre of land. Since 75% of the respondents acquired land through inheritance, the continuation of this trend will lead to further sub-divisions of the land holdings. The land sizes will then become smaller and less economic hence not able to accommodate the various land uses. With such small pieces of land, it is difficult to incorporate adequately the future fuel wood requirement planning in the agricultural land use system.

Fig.4.2 Land owned



source: Field survey, 1997.

Considering the small parcels of land, low incomes and skewed employment patterns in the area, it is evident that the economic base of the area in terms of income generation is weak. This then leads to the question of affordability of alternative sources of domestic energy like charcoal, electricity, kerosene or bottled gas.

Table 4.2: Estimated Household monthly income³

Income bracket	percentage
< 1,000	9.1
1,001-2,000	45.5
3,001-5,000	18.2
5,001-7,000	13.6
7,001-10,000	9.1
>10,000	4.5
	100.0

Source: Field Survey, 1997.

Although the study area lies in a high agricultural potential district it has low income households. From the data collected, the most frequently earned wage was between Ksh.1000 and 2000 per month or more specifically, the income with the highest score was Ksh.1,000 per month (Table 4.2); a sum that is even lower than the mean of Ksh.1,588 per month of the entire district as revealed in the Household Welfare Monitoring and Evaluation Survey of Vihiga District (1993). Information depicted in Table 4.2 caters mainly for the people involved in formal employment and who therefore have regular incomes. These

³ The question on household income had a very high non response rate while those who responded had it difficult in estimating their monthly incomes. Hence the incomes were calculated as a percentage of those who responded to the question. From the 104 cases only 22 responded.

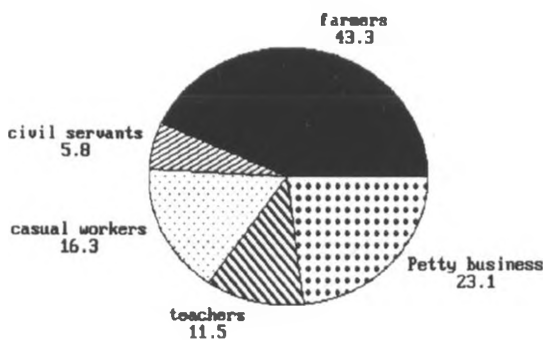
group constituted approximately 20% of the respondents who were teachers and civil servants (Fig.4.3). The majority who constituted approximately 80% operated on a subsistence basis and consequently lacked regular incomes and records to show their earnings. This category comprised of mixed farmers, petty businessmen and casual workers. In fact, if we assume that on average a household consumes firewood worth Ksh.20 per day⁴, the household will spent roughly ksh.600 per month on wood fuel only. Thus for a household earning Ksh.1000 this cost will be 60% of the total income earned monthly. For those households which earn Ksh.4000, the fuel wood cost constitutes 15% of their monthly incomes. This is a relatively high proportion of their monthly income yet, the household has other pertinent requirements. Such a low monthly income trend helps us to understand why approximately 64.4% of the respondents use firewood for cooking. Thus, compared to other sources of energy firewood is cheaper and does not entail incurring other expenses like in buying cooking devices. Thus, 92.3% of the respondents use the traditional and most affordable three stone hearth

In the study area, three (3) pieces of split firewood or a small heap of sticks (Plate II a&b) costs Ksh.10. But on average, a family of six members requires fire wood worth sh.20 to adequately satisfy a day's energy needs.

technique. Due to such limited resources the majority of the people are forced to turn to firewood.

The farm is not only a source of food requirements but also provides income (Fig.4.3). This idea is evidenced by the fact that 43.3% of the households were employed in farming whereas the professionals (teachers and civil servants) constituted 17.3% of the respondents. The lower cadre consisting of casual workers and petty businessmen constitutes 39.4% of the respondents. Of all the farmers, only 13.6% were engaged in growing some crops for sell while all the respondents grew subsistence crops.

Fig.4.3 Occupation structure



source: Field survey, 1997.

In terms of ability to purchase alternative forms of energy, those in the category of subsistence farmers, casual workers and petty businessmen are unlikely to afford hence will continue depending on woodfuel which is a comparatively cheaper option in terms of affordability and technique of use.

Suffice it to say that although no respondent claimed to be openly unemployed, they were several instances of disguised unemployment. Given the seasonality of the farming activities and the tiny pieces of land at each household's disposal, many people remain unemployed after finishing the farm work. For instance in a seven member household, each person has on average 0.26 of an acre to cultivate assuming that each member is able to work and that the pieces of land are approximately 2 acres - the average land size in the area.

4.3 LAND USE PATTERNS.

The economic base of the households in the study area is strongly dependent on the land use patterns as already illustrated in Table 4.3 where 43.3% of the respondents stated that they were farmers. The agricultural practise significantly applied in the area is mixed farming where one is involved in both livestock rearing and crop growing. It was established that

only 13.5% of the farmers grow cash crops, in essence all the farmers grow food crops. Notwithstanding, the level of cash crop planting is very low. The survey revealed that the crops which are commonly sold for cash and therefore considered as cash crops were, kales (2.9%), cassava and potatoes (5.8%) and tomatoes (4.8%). All these were either sold locally in the village or at the local markets (Luanda, Ekwanda and Maseno). The returns are very minimal. The food crops having been planted by virtually all the respondents in different combinations have a wider coverage than the cash crops. Thus; 11.7% of the respondents grow maize, beans and groundnuts; the same number of people also grow maize, beans and bananas, 55.3% grow maize, beans and cassava whereas 21.4% grow maize, beans and vegetables. The most preferred combination in the area was maize, beans and cassava. Even though maize and beans are grown by all the respondents, the harvest is hardly above the subsistence level. The people are often forced to buy more food to supplement what they produce.

Turning to livestock husbandry, roughly 69% of the respondents keep livestock while the rest do not. From those who keep livestock, 21.8% keep exotic or cross breeds, 45.5% keep local breeds, 4.0% keep goats and sheep and 27.7% keep poultry.

In retrospect, using the percentages of the livestock in the area would be misleading, because the livestock numbers are small. The majority of the people (64.4%) keep between one and five animals, 5% keep between 10 and 15 animals whereas 30.7% do not keep any animal on their farms. The relatively high proportion (30.7%) of people who do not keep animals does not limit the possibility of having biogas plants in the area. With a little bit of encouragement there is a likelihood of more people keeping exotic breeds by using zero grazing methods. This may probably be the only way of making maximum use of the small pieces of land they own. Furthermore, some people are already keeping such livestock in the area.

From the data collected, it is evident that 36.5% of the respondents had less than 1 acre of land, 56.5% had between 1 and 5 acres, 4.0% had between 5 and 10 acres and 3% over 10 acres of land (Fig.4.2). Note, however that in as much as the average land size is 1.83 acres, the modal farm size ranges between 1 and 5 acres.

FAO/UNO standards show that the minimum acceptable farm size for subsistence farming is 3.5 acres per household. Going by these standards then it is unmistakable that 87% of the people operate below this desirable minimum. The few number of

livestock kept in the area can be linked to this inadequacy of land so that the people are forced to supplement the animal pasture by either buying animal feeds or grazing their animals on public land i.e school or church compounds and along the roads. Consequently, people practise either tethering, free grazing or both. Besides the crops and livestock, we also had some land being put under trees -woodlot where 17% of the people plant trees. Due to the stiff competition on the uses of land very negligible portions have been set aside for woodlots.

4.4 ENERGY SUPPLY, DEMAND AND CONSUMPTION PATTERNS.

The forerun section has given the socio-economic background against which the current section will be discussed. The most pertinent issue established was that the area has a weak economic base which is bound to be reflected in the supply of woodfuel and may adversely affect the demand and consumption for the same.

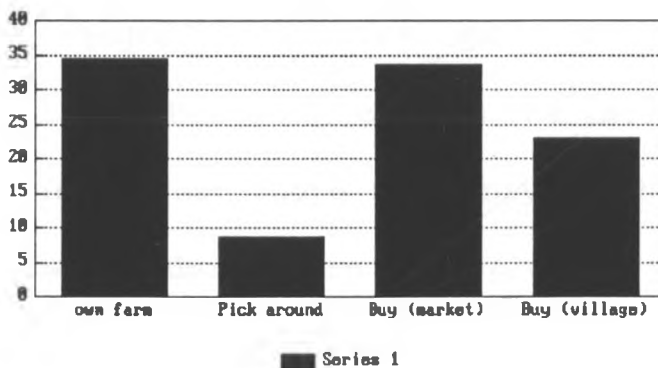
4.4.1 Energy supply patterns

The study disclosed that 56.7% of the households buy fuel wood (Fig.4.3.1). It shows that 23% of the respondents buy from the village, that is someone cuts a tree and locally sells the

firewood to the villagers, while 33.7% of the respondents buy directly from the local markets. As already seen, the category which purchases firewood is over half the cases studied. This should be appreciated in light of the economic base of the households as discussed under section 4.1. It was shown that as many as 72.2% of the households earn less than Ksh.5000 per month with roughly half of them earning between Ksh.1000 and 2000. Since these low incomes do not logically allow the household sufficient purchasing power of all its needs, there has to be trade offs between other household requirements in order to meet the fuel wood needs. The high proportion of households that purchase fuel wood should be seen as an indicator of the complex nature of the energy problem in the rural areas where poverty is the real issue and energy inadequacy

as just a symptom of this underlying poverty.

Fig.4.3.1 Sources of fuelwood



source: Field survey, 1997

The category that has to scavenge around the homes/villages in search of dry twigs which are by all standards inferior in terms of flame power that can be generated from them is the hardest hit. To such groups the chances are that they have to consume semi-cooked food or change completely to foods that require shorter cooking time and less energy. The increase in population coupled by its concomitant problems like the increased subdivision of land and the number of people picking pieces of wood on a daily basis will definitely lead to complete lack of wood to pick if no intervention actions are taken. Hence they might be forced to start purchasing wood. It was revealed that the buying of firewood was prevalent in Cluster I and II which were nearer to the urban area and with high population densities. Whereas picking of the dry pieces of wood was a predominant act in Cluster III which still has a leeway because farm holdings are a little bit bigger.

The other respondents (34.6%) get their fuel needs from their own farms. One should not confuse the idea of on-farm fuel wood supply to imply that there is plenty of the same. Although 81.4% of the cases admitted to have planted trees, they were very few in number as can be deduced from where they have been planted. For instance, out of all the respondents, only 17 % had

set aside at least a very small piece of land for a woodlot whereas 50% did plant the trees on the hedges to couple up as fences. These hedges act as land marks hence the difficulty involved in getting one of them cut down. Generally, trees were grown haphazardly in the homes i.e on cropland and homestead. This marked 29% of where the respondents plant trees.

Unlike the olden days when trees were planted specifically for the provision of firewood and building materials, nowadays they are ranked highest on the list of assets in any given homestead. Their major functions are; inter alia, the provision of building materials both for domestic use and sale and for sale as firewood, while domestic energy provision is just a subsidiary use.

Collecting woodfuel from ones own farm took many forms. In some cases (36.9%) the people simply pick dry fallen pieces of wood from their farms. In very rare cases (8.7%) were trees specifically cut down to provide wood for domestic use. What actually happens is that half of the people who grow trees prune them or cut off branches for domestic use. A negligible proportion (1%) of the respondents use farm residues i.e cow dung, cassava sticks, maize cobs and stalks for cooking. It is important to note here that the low usage of farm waste is not

due to non-preference but its limited supply and competition from other uses of the same i.e animal feeds.



Plate I A woodlot and fence: Notice the size and type of trees grown (Cypress and Eucalyptus)

4.4.2 Energy consumption patterns.

The statistics for domestic energy consumption patterns reveal overdependence on the limited energy-woodfuel. For cooking purposes, fuelwood accounts for over 64% of the energy needs to those who use it alone and over 29% to those who combine it with charcoal. In total it accounts for over 94% of the domestic energy requirements for the purposes of cooking. Despite its limited supply people still strongly prefer it. Paraffin was another source of energy for cooking identified where a mere 5.8% of the respondents occasional use it.

Table 4.4.1: Type of energy used in cooking

Energy	Percentage
Firewood	64.4
Paraffin	5.8
Firewood and charcoal	29.8

source: Field Survey, 1997.

As demonstrated in Section 4.1, if a family uses on a daily basis firewood worth Ksh.20, this would be the equivalent of three of the 2 kg tins of charcoal at Ksh.20 each or a litre of paraffin at Ksh.21. In comparing the three, firewood is the most preferred because:

- a) It is possible to simply buy three pieces of split firewood at Ksh.10 and supplement it with some low quality farm residues like maize cobs, millet and maize stalks during the harvest season or even cow dung.
- b) The cost of the equipment required for use is lowest in the use of firewood than paraffin or charcoal.
- c) The technique of using firewood is very simple i.e only three stones of equal sizes are required and can be adjusted accordingly.
- d) Unlike paraffin, firewood has no effect on the taste of the food.

The low incomes that have led to overdependence on fuel wood has strongly dictated the technology used in cooking. Thus, there are three basic methods or techniques of cooking. The three stone hearth technique (94.2%) is the most commonly used method of cooking, followed by the ordinary metal jiko (40%) and stove (5.8%). It should be realised that apart from the 5.8% of the respondents who use a stove alone, those who use ordinary metal jikos utilise either firewood or charcoal. Hence was just a subset of those who used firewood.

The three stone hearth cooking technology was preferred

first because it is a culturally recognized technique that has been in use from time immemorial. And secondly, for its appropriateness in terms of being flexible enough to accommodate all sizes of cooking pans and pots as need may be. It could also serve several purposes at the same time i.e cooking can go on concurrently with heating and lighting the house, the heat and smoke emitted from the fire help in the preserving of building materials i.e grass roofs. Notwithstanding, the device is also very cheap to make. Inasmuch as other people simply pick three equal sized stones, others simply use soil heaps. Thus the technique involved in setting out the device is "cost less" and virtually anybody can make it.

However, in terms of energy use, it is a highly wasteful technology having a conversion ration of only 10%, the other 90% is wasted. In coming up with intervention approaches, the issue of efficiency of energy use should be considered seriously so as to enhance domestic energy availability by saving on the little that is still available. The same should also be done with the use of the ordinary jiko which has an even lower conversion ratio of about 4.8% (O'Keefe, et.al., ed.,1984)

Lighting was another use of energy in the area where practically 99% of the respondents use kerosene and a negligible

proportion use electricity. It was noted that in the absence of kerosene, fuelwood was used for lighting and heating the houses. Thus the three processes went on simultaneously, no firewood was set aside specifically for lighting or heating purposes.

Although the energy consumption patterns should be appreciated with regard to dietary habits of the community, it was not possible to get the true dietary habits of this community because the research was carried out at a time when drought had been experienced hence famine was looming. Breakfast, which is the first meal of the day was rarely taken. But in case it is taken, tea was the most preferred meal (90%) which has the least fuelwood consumption rates. Regarding lunch meal, ugali was the most preferred meal (40%), followed by porridge (33%), cassava, potatoes and bananas (19%). Githeri (maize and beans) was the least meal taken (4%). Ugali was the most preferred meal for supper (98%) as compared to cassava, potatoes and bananas (2%). The respondents had a liking for ugali, tea and porridge. Although cooking ugali takes a lot of time and firewood, it was preferred since it is the staple food of the people that can sustain someone for a long time. Due to the scarcity of firewood and flour, porridge was opted for as it takes a shorter time to prepare.

Ebutanyi sub-location can therefore be looked at as an area with a weak economic base and depends mainly on woodfuel for its domestic energy requirements.

CHAPTER 5: COMMUNITY'S PERCEPTION OF THE WOODFUEL INADEQUACY.

5.0 INTRODUCTION

In this chapter, special attention will be paid to the community's perception of the woodfuel inadequacy. The issue of perception is by and large an abstract construct and as such not easily quantifiable. By collecting information here and there in bits and pieces but in an systematic manner it becomes easy to draw inferences. It may be subjective but if appreciated within the confines of an established framework or in context, it assumes a significant level of objectivity. It is, therefore, the intention of this work to approach it at three levels; first, give the community's define of the energy problem, gauge the level of community participation in solving the problem and, finally to record how the community has perceived the tackling of the problem.

5.1 COMMUNITY'S DEFINITION OF THE ENERGY PROBLEM AND ITS

CAUSES.

5.1.1 Community's definition of the problem

In response to a question on what problems they encountered in the procurement of fuel wood it was established that all the respondents experienced the problem in one way or another. Thus, the woodfuel problem was described in four different ways. It is crucial to note beforehand that a household could experience the problem in all of the four ways described.

First, the problem was defined in terms of the woodfuel's market price where the cost of firewood is viewed by 74% of the cases as being too expensive. This view was deduced from a comparison made between the prices of other basic needs like food and that of firewood. Taking in considering the fact that initially firewood was a non-commodified item.

Secondly, the group defined the problem in terms of the time expended in the procurement of fuel wood. Thus, 67.7% of the cases viewed the problem in terms of the opportunity cost i.e the many duties they have to forego to search for the firewood. Whether one buys the firewood from the market or among the villagers, the distance to be covered is still long hence a

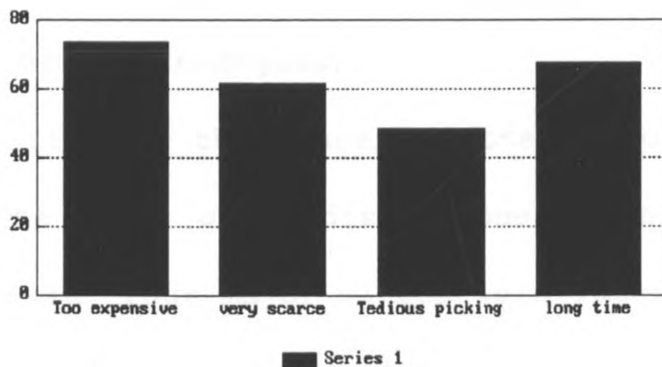
lot of time had to be put in. So much time has to be spent if it meant literally picking the pieces of wood from the farms or around the villages.

Thirdly, 62% of the cases viewed the problem in terms of its scarcity per se. Due to the different uses of wood, it has become difficult to get any piece of wood lying on the way and that picking of firewood is restricted to ones own land. It is due to this problem of scarcity that the costs are high and a lot of time has to be spent in accessing it.

Finally, the problem was defined in terms of the tedious work they have to do in trying to pick up the small pieces of firewood. Over 48% of the cases cited this situation where they have to set aside over four hours a day in order to be able to pick enough

firewood
for a days
cooking
(Fig
5.1.1).

Fig.5.1.1 Community definition of energy problem



source: Field survey,1997.

In terms of the level of perception of the fuel wood problem all the four groups are aware of the seriousness of the problem. Apart from the four ways in which the problem is defined, the same could also be captured in the question that required the respondent to cite whether they had any energy source available in excess annually. Besides one person who talked of using solar energy the rest had no energy source in excess to cite.

5.1.2 Causes of the inadequacy.

The question on the causes of the inadequacy was mainly handled in the focus group discussions where, from the eight discussions held, four major causes were identified. The first cause was identified as, commercialization of wood. Wood can be

sold in many forms, as woodfuel, poles/posts for building or fencing and sewn into timber. Hence whenever a tree is cut, the bigger logs are either sawn into timber or split into poles/post or firewood for sale. The remaining big branches are equally sold, the home where the trees is cut is left with the very small pieces which cannot be offered for sale. In a situation where someone buys the tree, every part of the tree if possible is carried away leaving the seller with nothing. The commercialization of firewood has been aggravated by the increased demand from the institutions in the neighbourhood like schools, hotels and the people living in the urban areas in the neighbourhood. Due to the monetary value attached to trees they are viewed as assets only to be cut with the head of household's consultation and approval.



**Plates II Firewood market: Notice the different sizes
of the firewood on sale.**

Second, the rapid rate of population increase was leading to increased demand of land. Thus land sub-divisions are very frequent leading to very small and uneconomical pieces of land where one can hardly afford to set aside any portion specifically for tree planting. The increased need of land for

settlement implies that there is a rising need of building materials hence trees are also being cleared for the same. The clearing of land for cultivation is another purpose that can not be overlooked.

Third, overdependence on the woodfuel was yet another cause identified. The increased preference of firewood was attributed to the peoples' culture, the comparatively low prices of the woodfuel and the simple technique of use applied.

Fourth, the wasteful technology of cooking applied by the majority of the people has also increased the inadequacy.

Finally, the privatization of land has also contributed to the scarcity. Thus, unlike the olden days, the idea of moving freely on other peoples' land in search of firewood is highly prohibited. Upto date the area has no bushes, thickets or forests.

5.2 LEVEL OF COMMUNITY PARTICIPATION IN TACKLING THE PROBLEM

The problem of woodfuel inadequacy is a long time one in the area. It was on this basis that the study set to find out what the community is doing to alleviate the problem, how the idea was born and how effective the intervention approaches in

progress have been.

To capture this scenario a number of questions were posed. In trying to find out if anything was being done about the problem, the research found out that 48% of the cases were 'doing something' while the rest were not. In fact, those 'doing something' were simply planting trees. A majority of the respondents (77%) observed that the idea of planting trees was their own initiative; while 18.8% had learnt the idea from the chief's barazas and the rest (4.1%) had been advised by extension officers. Asked why they did nothing about the problem when the chief and extension officers advocated for planting of trees, the response was that they had no seedlings and space to plant the trees. If anything they had not been consulted when coming up with that idea. Since more than half of the people had not taken up the idea from the officers then it follows that the idea had failed to be accepted. Note that even the people who were trying to plant trees were doing it entirely out of their own initiative. In this context therefore, where the community got the idea of how to tackle the problem does not matter but what matters is how they are trying to tackle the problem. Given that nearly 48% are involved in planting more trees out of their

own will, then it logically follows that they have a relatively high perception of the problem of woodfuel.

5.3 INTERVENTION APPROACHES

In these approaches suggested, perception is gauged at two levels; one, on demand management: that is the level to which the solutions cited reflect an appreciation of energy conservation in terms of, for example technology used in cooking, and two, the supply enhancement in terms of increasing the amount of energy resources available to the household.

5.3.1 Demand management approaches

From the survey, it was established that 54% of the cases cited the need of introducing fuel wood saving and efficient methods of cooking in the area. This suggestion was arrived at after the realization that the use of firewood is bound to go on for along period of time to come. Compared to other sources of energy, firewood has the following advantages, it cooks faster than either a stove or jiko, has no effect on the taste of the food and that it is possible to adjust the three stones so as to accommodate different sizes of pot desired. The traditional

three stone hearth method has an efficiency of 10% which is absolutely low.

From the discussions held, the people recognized that there was need to apply appropriate technology in coming up with " a modified three stone hearth like cooking device/jiko" that has a higher energy efficiency. This jiko could be the equivalent of the Maendeleo one-pot jiko that has an average heat utilization efficiency of 30% but with proper use, a fuelwood saving efficiency of upto 50% is achieved. From other researches done, it has been established that this type of jiko is particularly suitable for making traditional dishes and operates just like the three stone device hence can easily be adopted by the local people.

The group explored the possibilities of using the locally available resources (manpower and soil) in coming up with such a stove. It was established that such a stove was easy to make and use. To come up with a modern one pot jiko, all one needed was to buy a stove liner which was valued as the equivalent of one chicken or 30 eggs while the other materials would be found locally in the homestead. Such necessary but locally available materials would include anthill soil, flat and round stones,

water or one wheelbarrow load of soft under soil mixed with sand and a basin of fire ash. The tools required are sufurias, debes, panga or shovels. The three stones hearth is replaced with a jiko at exactly the same place. It was ensconced that the stove could be made with or without the liner and' that making the stove was so simply a skill that can be learnt by any interested person. None of the participants knew exactly how the Maendeleo jiko is made. On this basis, it was suggested that inquirers be made from relevant officers and modalities worked out on how the technology can be disseminated to the people.

The efficiency in woodfuel utilization would be increased by either adopting or enhancing some or all of following techniques;

- a) Apply the traditional methods of conserving energy i.e pulling firewood out of the fire after use, putting off the fire when not in use, putting the burning wood under ash and soaking some foods before hand (maize/beans/green grams)
- b) Use a few thinly split fuel sticks
- c) Reduce the fire wood once the cooking dish has come to a boil

- d) Cover the cooking pot with a lid whenever possible and always avoid over cooking
- e) Before cooking some foods i.e arrow roots, cassava and sweet potatoes, chop them into small pieces and
- f) Use dry wood so as to reduce some of the energy used in drying the wet wood first before it burns
- g) Finally it was revealed that proper kitchen management would play a major role in energy saving thus it was imperative to prepare the food to be cooked and arrange all what you need nearby before lighting the fire.

It was necessary to advocate for the proper arrangement of kitchen items in such a way that minimizes the walking distance within the kitchen area hence saves on the time spent looking for an item and consequently the energy that goes to waste in the process of trying to locate an item. With regard to the former, it was suggested that the female folks who are the major users of the firewood should be targeted for the education. This could be carried out in different forums where the women meet for their own functions i.e merry-go-round groups or women's union and even in chief's barazas. In general it was agreed that there was need to strengthen conservation methods in the area by

for example providing additional information and pieces of advice through extension services and demonstrations by the concern ministry.

Although improved efficiency in the use of wood was cited as the most necessary undertaking in an effort to cut on the fuel wood demand, the community recognizes the need of interfuel substitution. This option as it were can only be achieved through switching to other alternatives like paraffin, biogas, solar or electricity. This is a very clear attempt of reducing overdependence on fuel wood. So far some of the people already use paraffin in the preparation of some of the light meals like tea and porridge. Solar energy is also being used specifically for lighting by some few people.

The option of turning to other sources of energy is closely tied up with the question of the level of household resource endowment in terms of income generation, agricultural production (animal husbandry) and land sizes. This option calls for greater participation in the monetary economy such as the purchase of the different cooking gadgets and the associated fuel. The option of fuel switching, therefore, did not hold much water in the approaches suggested because of the low income levels of

the people and the high comparative advantages of the use of firewood over other sources of energy (Table 5.1). In spite of the fact that power grid is within the sub-location, a negligible proportion of the people can afford to install it in their houses which are mostly flimsy and unsafe dwellings to support electric wiring. Even to those who have installed it, Leach's (1988) observation that electricity use by the rural poor, those who have managed to install it, is for lighting and other modern appliances and does not displace biomass fuel is applicable wholesale. Though cooking with other fuels may be cheaper i.e kerosene, the maximum power production may be very little as compared to firewood.

In trying to come up with the most preferred type of fuel, a fuel preference matrix that has a high correspondence to the one of Leach (1988) was developed. The matrix shows that fuel costs plus equipment costs add up to make the cost of switching to other fuels very expensive even before other factors like accessibility to the source are considered. The matrix, therefore reveals that fire wood was the most preferred energy source as the cost of getting the equipment was very minimal or non existence, fuel payment was small and that it was easily

accessible. It was followed by charcoal, kerosene, bottled gas and electricity respectively in preference.

Table 5.1 Fuel preference matrix

Fuel type	Barriers to adoption		
	Equipment cost	Fuel payment	Access
Electricity	very high	high	restricted
Bottled gas	high	high	restricted and bulky to transport
Kerosene	medium high	high	often restricted in low income areas
charcoal	medium high	small	good, dispersed markets & reliable supplies
firewood	low/zero	small	good

Source: Field survey, 1997.

Looking at the different views of the people on how the demand can be managed one is led to conclude that the peoples' perception of the energy problem is rather high. This can be supported by the fact that all the approaches suggested by the people are just within their ability to realise.

5.3.2 Supply enhancement approaches

The discussions held established that the people have a strong attachment to the use of fuelwood and that changing to alternatives may not be that easy. It was on this basis that the

people suggested the need to improve wood production systems in the area. Planting of trees was cited as an inevitable method. Putting in perspective the land sizes and the competing uses of the same, it was decided that the trees to be planted had to be fast growing and have a high fixed carbon content that leads to a high calorific value. The trees to be advocated for should have a very high heat content so that one needs only a few pieces to prepare a day's meal. But the inevitable questions are 'How long will such trees take to mature and hence ready for use? and where will the trees be planted?'

It was the suggestion of the people that they should be encouraged to treat fuelwood like food and grow it like a subsistence crop. This approach was stimulated by the realization that a tree in this community has so many other uses of which the provision of domestic fuel is just but subsidiary. Thus, the tree could be sewn into timber, posts/poles for building purposes or even split into firewood for sale. Remember due to the repeated usage of the small parcels of land (approximately two acres) production of food crops has drastically dropped.

Since the entire division had only one tree nursery at the

Divisional Headquarters (Plates III and IV), it was suggested that the community would request a willing member or members to donate a small piece of land where they would set up a communal tree nursery. Alternatively, they would request the use of public land like schools and church compounds.' It would be the responsibility of every member to collect around seeds for planting. Moreso, they would seek the assistance of the extension officer on the knowledge of setting up and effective management of the tree nurseries of their own. The extension officer would equally be instrumental in advising the community on the best tree species to plant that would satisfy all or most of their needs but more specifically have a high heat content instead of depending on the exotic species which usually have a low heat content.

The other approach cited was that of increasing wood production through agro-forestry. It was observed that some of the people already practise a system of production that would be a classic example of indigenous agro-forestry in which an integration of trees and ground crops permits farmers to maximize the total yield from the small patches of land in an effort to meet their needs for cash income and subsistence. It

was observed that the people should be advised on the modern forms of agro-forestry and that those who are not yet involved in the practise should follow the trend. To achieve this goal the assistance of the agricultural extension officer attached to the area would be intensified. It was also observed that in an attempt to increase the productivity per unit area, extension services related to agro-forestry will have to be intensified in order to disseminate modern agro-forestry practises in the area. Currently, the people were intercropping- food crops with any type of tree without taking in consideration the kind of trees that can be planted in relation to their crops.

Looking at all these options the community did not hesitate to observe that the solutions to the energy problem of such an area must come from the woody biomass cultivated and managed by the farmers themselves. This means that there is hardly any alternative to fuel wood and the only viable source of supply is from the farms.

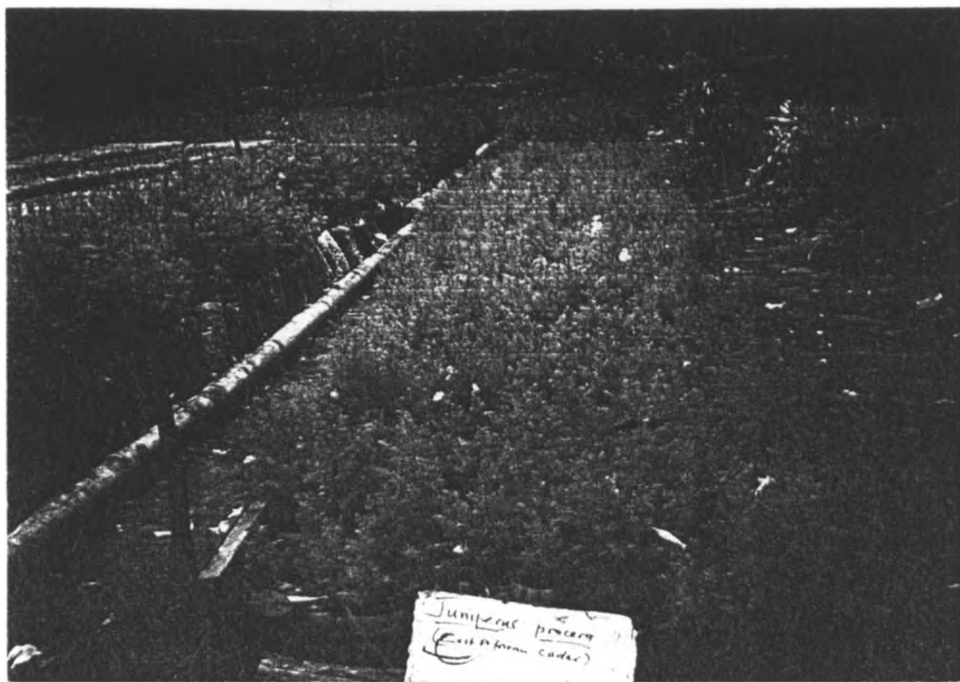


Plate III: A tree nursery at the Divisional headquarters. Notice the exotic trees that are commonly planted (Cypress, Cedar and Eucalyptus).



Plate IV: Section of the tree nursery in readiness for planting.

As such, solutions to rural energy problems must be integrated into local production system. How to do this is the challenge, but such a solution should attack the root cause of the problem poor people face in rural areas as the shortage is not of fuel wood per se but of affordability.

Apart from the management and supply enhancement approaches the community also cited a close link between the fuel wood supply shortage and the high rate of population growth in the area. The group was of the opinion that increased subdivision of the land had caused a decrease in woody biomass in the area and that to curtail further clearing of the woody biomass, population growth rate had to be controlled at whatever cost. Currently, community based health officers have lounded an education campaign aimed at enlightening the people on family planning techniques. Lastly, the people suggested that both urban and rural dwellers should pull resources together for the advancement of energy supply in the area. This intent would be achieved by the urban dwellers forming development associations that would be geared at soliciting for funds from the urban centres towards the same. Notwithstanding, the rural dwellers would equally be expected to do the same.

In conclusion, it is obvious that the community has a high perception of the woodfuel problem and if given the necessary support and motivation they can travel an extra mile in tackling the problem by themselves.

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

6.1 SYNTHESIS OF MAJOR FINDINGS.

The study was aimed at involving the community of Ebutanyi sub-location, Vihiga District in the identification of viable ways of tackling the rural domestic woodfuel inadequacy. This step was taken in an attempt to see to what extent a given group of people can be able to address and/or cite ways of tackling the problem that are within their ability to realise. The extent of woodfuel scarcity as it were differs from one area to another. It follows then that each area will have its own ways of handling the problem depending on the intensity and the alternatives available. On the basis of this preceding idea was the study guided to hypothesizing that it would be more practical to tackle the problem as per a given area instead of generalizing. To achieve this aim, the study rotated along the following objectives;

1. To assess the magnitude, causes and effects of the woodfuel

inadequacy in Ebutanyi sub-location.

2. To gain an insight into the local community's perception of the energy inadequacy as a basis of coming up with possible ways of tackling the problem.
3. Based on objective (1) and (2), the study comes up with recommendations for appropriate intervention approaches to alleviate the woodfuel inadequacy.

In an attempt to meet these objectives, the study was guided by the idea that it is the community that has control over the use and management of their resources i.e pieces of land. The community determines whatever to be produced from the land and generates the demand, first and foremost before any external force can come in play. It follows then, that these particular land owners are the best placed in terms of deciding how to use their land so as to be able to maximize on the production of woody biomass that can meet their domestic wood needs. And at the same time decides on other alternative ways of meeting the deficit.

In chapter 3, it was stated that the study area lies in a high agricultural potential zone that is characterized by high

and reliable rainfall totals. Though the climate of the area is suitable for biomass production, this production ability has been constrained by the high population pressure on the agricultural land. It was established that the proportion of land available for the production of wood is increasingly becoming less. The proportion of woody biomass relative to the total cover has been diminishing over time to the extent that at the district level there are only two gazetted forests covering 7% of the total area of the district. In fact none of the gazetted forest lies near the study area. In essence, the study area has no forest apart from very few individually owned bushes. Instead trees are mainly grown on hedges.

From the survey, it was established that the study area has a very weak economic base as depicted in among other things, the employment patterns, low household income levels, the agricultural practises in place and small farm household sizes. The area depends mainly on fuelwood for all its domestic energy requirements especially for cooking. This overdependence on fuel wood arises from the comparative advantages of using it over any other form of energy. Community's perception of woodfuel inadequacy was also gauged at three levels. First, the community

had to give their definition of the problem. It was defined as being very expensive, scarce, in terms of the 'opportunity cost' thus the duties there have to forgo in order to look for firewood and the tedious work of collecting the small pieces of wood until when they fit a day's cooking.

The major causes of the inadequacy cited were, the commercialization of the wood products hence very little wood is dedicated to domestic use; the rapid rate of population increase which has led to increased sub-division of land hence a reduction of woody biomass in the area; overdependence on the woodfuel as the major source of energy for cooking and the use of a simple but very wasteful cooking technology - three stone hearth.

The discussions depicted in Table 5.1 (Energy preference Matrix) uncovered the fact that woodfuel is bound to remain the major source of domestic energy in the area for a better part of the future. Therefore, intervention approaches suggested by the people were geared towards the demand management and supply enhancement of the fuelwood. It was apparent that the community has a very high perception of the energy problem. All they need is to organize themselves so as to tackle the problem 'as a

group.

6.2 OTHER EMERGING ISSUES.

The study having set out to find viable solution to woodfuel inadequacy established that increased farm based supply system of fuelwood was the most attainable alternative suggested. This deduction was arrived at after a critical look at the issue of affordability where it was realised that the majority of the people have meagre incomes and hence a very weak economic base. But considering the average farm size of approximately two acres per household one is left wondering where the trees will be planted in the long run even if it is a species that can be culled for firewood within a short period of time. Remember food crops have also to be planted. It is against this background that the issue of energy diversification though not given alot of emphasis by the community has to come in.

It is only through raising the peoples' income that they can be able to diversify their energy sources. The most welcome alternative source of energy will be that which can go a long way in enhancing the peoples' income levels. Dairy keeping (zero

grazing) would be the most advisable practise as it can be carried out pretty well on the small parcels of land and besides that it is a practise already in place by some of the households. It will require just a little bit of encouragement for more people to take up the practise and make maximum use of the agricultural officers attached to the area. The marketing of the milk may not be so much of a problem as a co-operative already exists in the neighbourhood- Emuhaya. The farm and animal waste produced can be used in the generation of biogas, the growing of food crops and animal feeds i.e Napier grass.

How then will these people acquire these dairy cattle? It is advisable that they form group associations or make use of the existing ones where they may be pulling resources together after a given period of time to buy a dairy cow for each member and assist in the construction of a zero grazing unit.

As concerns the animal feeds they should seek for the guidance of the agricultural officer on how to make maximum use of their pieces of land on the production of animal feeds like napier grass. The issue of agro-forestry should also be enhanced so that the branches of the trees planted should also be used in feeding the animals.

If this practise is well done it will have the effect of a whole package deal. Thus generation of income creation of employment and generation of biogas. This in essence is an area that needs further research.

6.3 CONCLUSIONS AND RECOMMENDATIONS.

Against the scenario set in the preceding sections it is notable that a steady transition from abundance to shortage has occurred and a crisis is at hand, solutions offered must therefore be practical and in conformity with the reality and the needs of the community. Therefore, the Rural Energy Policy in Kenya must focus on the identification of programs that are community based or are area specific to try and alleviate the fuelwood shortage. Note that fuel wood shortage is not universal. These programs/approaches can take the form of enhancing the efficiency of wood use, substituting alternative fuels for wood, improving wood production systems or reforestation. Before any action is called for it must be established from the user community which approach they are willing and able to undertake. Action in this case is called

for, but just what type of action and for whom and by whom? What remedies should be pursued in the short run, medium and long run? Will the people be willing to change their way of life or stick to the old ways. These are the most pertinent questions that should be asked beforehand. Thus to make sure that the above articulations are adhered to, it was the intention of this work to recommend that communities with such a problem should be worked with in coming up with ways of tackling the problem that are within their ability to realise. External forces should only be allowed when the community has completely no way out.

Secondly, from the research findings, woodfuel is cited as the major source of household energy so that any intervention approach that falls short of that consideration miserable misses the mark. Remember also that the mode of cooking is a peoples' way of life hence their culture, and thus it will take a long time to change. In that connection the proceeding section shows the different short term and long term approaches which the study recommended for tackling the problem.

6.3.1. Short term intervention approaches.

a) woodfuel management approaches.

Woodfuel management approaches should be the very first steps to be undertaken by any community faced with the shortage. Thus energy conservation should be encouraged through the promotion of efficient use of woodfuel. This can be attained in two broad ways; namely;

- i) Improvement in the cooking methods and
- ii) Improvement on the cooking stoves.

The three stone hearth mode of cooking should be replaced as cited in Chapter 5 by a stove design that ideally suits existing needs, fits into the existing building structure, suitable for use with local utensils, can be produced cheaply and quickly from the locally available materials, should be locally acceptable and above all its energy saving efficiency should be higher than the former one. The improved jiko, for that matter should be simple to operate, cheap/not too expensive, be fast in cooking and must also fulfil all or some of the roles of the three stone hearth stove i.e be able to heat and light the house concurrently.

b) Woodfuel supply enhancement

The most unavoidable approach is that of increasing the

supply of woodfuel through mainly the process of tree planting.

How then can this be achieved?

- i) Through the help of the agricultural officers attached to their area, the people should be encouraged to plant not just any type of tree, but trees with high percentage of fixed carbon hence high calorific value and avoid those with high percentages of ash and low calorific value. They should be trees with high heat content so that a few split pieces of wood should be able to cater for a day's energy needs.
- ii) Rural modern agro-forestry should be enhanced. People through the help of extension officers attached to their area should be educated on these modern methods inclusive of which are the types of trees that do well when intercropped and take a shorter period to mature like Sesbania, Leucania, Calliandra and Mimosa species. Any wasteland i.e swampy areas should be utilized for the provision of community woodlot. It is therefore the recommendation of this study that various communities should intensify the use of the services of the extension

officers attached to their area instead of waiting for the officers. They should search for them in their offices. Such a calculated move will help save the situation before the last tree is cut.

6.3.2 Long term intervention approaches.

The most crucial long term intervention approach that should be undertaken are those geared towards the diversification of the energy sources. This can be achieved through several factors, inclusive of which are:

- i) Solar energy should be exploited. Apart from the initial cost of installing the solar panels, solar energy is one of the freely God given energy sources that is available in abundance. If harnessed for use, even if it means at day time only, it will go a long way in reducing the woodfuel deficit or demand. With the increased fear of depletion of other sources of energy like fossil fuel reserves and the price increases, solar energy remains the most viable long term solution to the rural energy needs.

- ii) To be able to afford alternative sources of energy, the income level of the people should be raised. This can be achieved through livestock keeping and specifically through zero grazing. Thus the milk produced can be sold whereas the farm waste can be used in the generation of biogas.
- iii) Rural electrification programmes should be enhanced so that those who can afford to pay for the electricity can use it hence lessen the reliance on woodfuel.

6.4 AREAS FOR FURTHER RESEARCH

After going through the study, it was established that further research had to be carried out in the following listed areas in an effort to fully tackle the problem of energy inadequacy in the rural areas. Thus:

1. The possibility of the extensive exploitation of the freely God given solar energy for domestic use in the rural areas.
2. Analysis on how the time spent on woodfuel procurement affects rural development.

3. Effect of woodfuel inadequacy on a peoples' feeding habits hence their health.
4. A research leading to the production of the most energy efficient woodfuel cookstove model that can be universally and easily acceptable due to its being 'cheap, simple to operate, fast in cooking and make use of locally available materials and technology.
5. Possibilities of income diversification i.e zero grazing.

BIBLIOGRAPHY.

- Agatsia, J.L (1996). **Land use trends in Kakamega District 1986-91.** Ministry of Planning and National Development, Technical Report No. 145.
- Aritho, M.L (1995). **The Effects of Household Income and Seasonal Price Changes on Household food expenditure patterns. A case study of Vihiga District.** Report No.57/1995; MPND, African studies centre, Leiden.
- Armstrong, J.K. (1987). **Promoting Bottom Up" Rural Development in a Traditionally Top-Down development Paradigm: The African Dilemma.**" Unpublished PhD Thesis, Nairobi: University of Nairobi.
- Benz L.N (1975). **"Citizen Participation reconsidered."** Social work.
- Bradley, P et.al (1986). **Development Research and Energy Planning in Kenya: Ambio, A Journal of the Human Environment.** Vol.XIV, No.4-5, Pergamon Press.
- Chambers, R (1971). **" Planning for rural areas in East Africa."** Institute for Development Studies, Paper No.119 July, Nairobi: University of Nairobi.
- Chambers, R (1974). **Managing Rural Development: Ideas and Experiences from East Africa.** Scandinavian Institute of African Studies, Uppsala.
- Chambers, R (1984). **Rural Development: Putting the Last First,** Longman, New York.
- Conyers, D (1982). **An Introduction to Social Planning in the Third World,** Institute of Planning Studies: University of Nottingham.
-" Special Report" Daily Nation, 16th July 1995.

- Glass, J.J (1979). **"Citizen Participation in planning, The relationship between objectives and Techniques."** Journal of the American Association, Vol.45, No.2.
- Ghai, D (1988). **"Participatory Development."** Some perspectives from grassroots experiences, Discussion paper UN research Institute for social Development, July.
- Hosier, R (1985). "House energy consumption in Rural Kenya", **A Journal of Human Environment**, Royal Swedish Academy of science Vol.xiv, No.4-5; Pergamon Press.
- Hosier, R (1985) **Energy use in Rural Kenya, Household demand and Rural Transformation;** Beijer Institute, Stockholm and Upsala Sweden.
- Jaetzold, R and Schmidt, H (1982) **Farm management Handbook of Kenya: Natural conditions and Farm Management Information.** Vol.11/A: Ministry of Agriculture, Nairobi: Kenya.
- Kenya, Republic of (1992-96). **Vihiga District Development Plan,** Nairobi, Government Printers.
- Kenya, Republic of, (1979 - 2001). **National Development Plans.** Nairobi: Government printers.
- Kenya, Republic of, (1989). **Population census Report.** Vol.I & II, Nairobi: Government printers.
- Kenya, Republic of, (1986). **Sessional Paper No.1 of 1986 on Economic Management for Renewed Growth.** Nairobi: Government Printers.
- Khasiani, A.K (1992). **Groundwork; African women as Environmental Managers.** ACTS Press.
- Leach, G (1988). **Beyond the woodfuel crisis: People, land and trees in African;** The Guernsey Press.

- Lisk, F (1985). **Role of Popular participation in Basic needs oriented Development Planning:** In Lisk, F(ed.) Popular participation in planning for basic needs, Baltimore Press.
- Luanda Division Reports (1996). DO's Office, Luanda.
- Mbithi, P.M (1974). **Rural sociology and Rural Development: Its application in Kenya.** Nairobi: KLB.
- Muchiri, G (1978). **Rural Energy needs and alternative sources.** Paper presented at energy symposium organised by National Council for science and technology.
- Mugo, F (1989). **A study of wood fuel demand supply in a rural set up: Naitiri Sub-Location Bungoma District, Case study.** Unpublished M.A Thesis, Nairobi: University of Nairobi.
- Musoga, H (1988). **The Rural Energy problem, Woodfuel in Shiswa sub-location Kakamega District, Case study.** Unpublished M.A Thesis, Nairobi: University of Nairobi.
- Mwenda, G.K (1993). **Woodfuel crisis in Rural Kenya: A socio-economic analysis in South Imenti, Meru.** Unpublished M.A Thesis, Nairobi: University of Nairobi.
- Mountjoy, A.B (1978). **The Third World: Problems and Perspectives.** Macmillan Educ. Limited.
- Mideva, R.M (1989). **The Institutional framework and the role of the community in District planning: Kakamega district, Case study.** Unpublished M.A Thesis, Nairobi: University of Nairobi.
- Ngethe, N (1981). **Popular participation and Rural Development.** Proceedings of a conference of the 7th East African social science Research consultative Group held at Westwood Park Hotel, Nairobi, 26th March to 29th March 1978.
- Ngugi, G (1990). **The effects of population growth on the**

environment: The fuelwood crisis in Mai-ai-ihai village- Kiambu District: Paper presented to KENGO'S Environmental 2000 conference, Nairobi. 23rd- 26th Oct,90.

Ndungu, G.A (1989). **The role of community participation in decision making: Kandara community Development centres programmes: Case study.** Unpublished M.A Thesis: Nairobi: University of Nairobi.

Stohr, W (1981). **"Development from Below; the bottom Up and periphery-Inward development paradigm."** In Stohr and Taylor, D(eds) **Development from Below: The delectus of Regional Planning in Developing countries,** John Wiley and sons. Chichester.

Soussan, J (1988). **Primary resources and Energy in the Third World.** Routledge, London.

Ochanda, N (1987). **Land use in Kakamega District,** Ministry of planning and National Development, Kenya, Technical Report No.92, December 87.

Timberlake, et.al.(1984). **Fuelwood: The crisis that won't go away.** International Institute for Environmental and Development Earthseam, London and Washington D.C

Wane, C (1986). **" The woodfuel Challenge; Looking to the future."** **The Courier.** No.95 Jan-Feb 1986:86-88.

Appendix I

COMMUNITY PARTICIPATION IN TACKLING THE RURAL ENERGY PROBLEM: A CASE STUDY OF EBUTANYI SUB-LOCATION, VIHIGA DISTRICT, KENYA.

HOUSEHOLD QUESTIONNAIRE.

General Information

1. Relationship to head of household
1. Household head 2. Spouse 3. Son 4.

Daughter

- 5. others (specify)
- 2. Sex
 - 1. male 2. Female
- 3. Age
- 4. Education level
 - 1. No education 2. Primary 3. Secondary 4. Tertiary
 - 5. Others (specify)
- 5. Occupation of the members
 - 1. Teacher 2. Civil servant 3. Business 4. casual worker
 - 5. Others (specify)
- 6. Place of employment
 - 1. In the village 2. Luanda 3. Maseno 4. Nairobi
 - 5. Others (specify)
- 7. What is your monthly income ?
- 8. What is the household size ?

Land use

- 9. How much land does the family own (acres) ?
- 10. How did you acquire the land ?
 - 1. Bought 2. Rented 3. Inherited 4. Squatters.
- 11. Do you have title deeds for your land 1. yes 2. no
- 12. How do you use your land

	USE	ACREAGE.
1.	CROPS	
2.	PASTURE	
3.	TREE LOT	
4.	AGRO FORESTRY	
5.	OTHERS (SPECIFY)	

13. What are the most important crops on the farm and their annual yields in bags or Ksh.

- a) cash crops.....
- b) subsistence crops

14. Do you intercrop? 1.yes 2. no If yes which crops.....
 ...

15. Do you keep animals on your farm ? 1. yes 2. no

If yes:

Type	No.of animals	No. sold annually
1.Exotic/cross breeds		
2. Local breeds		
3. Goats/sheep		
4. Others (specify)		

16. If yes to (1) above what are the sources of fodder

17. Do you sell animal products? 1. yes 2. no

Animal product.	Freq.of selling.	Price per unit.
milk		
meat		
manure		

18. Where do you graze your livestock 1. Own farm 2. Along t^he road 3. Neighbours farms 4. Any other place specify.

19. Is this where you have always grazed, If no, specify where and reasons for the change of grazing zone

.....
 20. What are the main problems encountered on the farm

- i).....
- ii).....
- iii).....

21. Suggest possible solutions

- i).....
- ii).....
- iii).....

Energy requirements

22. a) What are the main meals eaten and why

- 1. Breakfast.....
- 2. Lunch.....

3. Supper
- b) Which meal takes the longest time to prepare and why.
- c) Which meal is the most preferred, explain why.
23. What do you use for i) cooking.....
- ii) heating.....
- iii) lighting.....
24. How do you cook 1. 3 stone hearth 2.ordinary jiko
3.energy saving jiko 4.stove 5. others' specify.
25. a) Where do you get your firewood ?
1. Own farm
2. Neighbours farm
3. Around the village
4. Buy from market 5. Other means (specify)
- b) If (1) above how do you get it
1. Pick dry branches fallen from trees
2. Cut trees specifically for fuel
3. Use farm waste 4. Others (specify)
- c) If (2) and (3) how much time does it take to collect
 enough firewood for a days
meals?.....
- d) If (4) how much do you spend per day
26. a) Do you grow any trees in the home 1. Yes 2. No
- b) If Yes, where 1. Cropland 2. Hedge 3. Woodlot
4. Round the home 5. Other areas (specify)
- c) What main species are grown and what are their used for

27. i) What problems are encountered in the procurement of
 firewood ? i).....
- ii).....
- iii).....
- ii) Suggest possible solutions

Energy supply.

28. How far from your home is the above source of wood?
29. How adequate is the source ?
30. Approximately how many trees do you have on you farm
- 31.a) What are the trees for?

- b) If for sale what is the price per tree ?
32. How much of the following to you harvest annually
 1. Maize cobs (bags)
 2. Maize stalks (acres)
 3. Any other specify.
 33. Do you have any energy source available in excess on annual basis 1.Yes 2. No If yes, which one
 34. What is your general view of fuel wood availability these days as compared to olden days. Explain. '
 35. If the wood fuel is less, is anything being done 1.Yes
2.no
 36. If yes, how did you get the idea ?
 - 1.From extension officers
 - 2.Chiefs barazas
 - 3.Own ideas
 - 4.Others (specify)
 37. How did you personally participate in coming up with the idea?
 - 1.In giving views/ opinions
 - 2.Learnt of the idea from the extension officers
 - 3.Never participated
 - 4.other ways (specify).
 38. Did the initiators of the idea seek the opinion of the community? 1.Yes 2. No
 39. Has the idea been a failure or a success ?
 - a) If success, why, explain
 - b) If a failure, why, explain
 40. What in your opinion should be done to increase the supply of wood fuel in the area
 41. Solve the energy problem altogether in the area.

- b) If for sale what is the price per tree ?
32. How much of the following to you harvest annually
 1. Maize cobs (bags)
 2. Maize stalks (acres)
 3. Any other specify.
 33. Do you have any energy source available in excess on annual basis 1.Yes 2. No If yes, which one
 34. What is your general view of fuel wood availability these days as compared to olden days. Explain.
 35. If the wood fuel is less, is anything being done 1.Yes
2.no
 36. If yes, how did you get the idea ?
 - 1.From extension officers
 - 2.Chiefs barazas
 - 3.Own ideas
 - 4.Others (specify)
 37. How did you personally participate in coming up with the idea?
 - 1.In giving views/ opinions
 - 2.Learnt of the idea from the extension officers
 - 3.Never participated
 - 4.other ways (specify).
 38. Did the initiators of the idea seek the opinion of the community? 1.Yes 2. No
 39. Has the idea been a failure or a success ?
 - a) If success, why, explain
 - b) If a failure, why, explain
 40. What in your opinion should be done to increase the supply of wood fuel in the area
 41. Solve the energy problem altogether in the area.