

# Rufiji Environment Management Project<sup>1</sup>

**Environmental Management and Biodiversity Conservation of Forests,  
Woodlands, and Wetlands of the Rufiji Delta and Floodplain**

## **Fuelwood and Charcoal Uses with Possible Alternative Energy Sources in Ikwiriri Township and Mbunju Mvuleni Village – Rufiji District**

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<sup>1</sup> The Rufiji District Council implements Rufiji Environment Management Project with technical assistance from IUCN – The World Conservation Union, and funding from the Royal Netherlands Embassy.

## **Rufiji Environment Management Project - REMP**

**Project Goal:** To promote the long-term conservation through 'wise use' of the lower Rufiji forests, woodlands and wetlands, such that biodiversity is conserved, critical ecological functions are maintained, renewable natural resources are used sustainably and the livelihoods of the area's inhabitants are secured and enhanced.

### **Objectives**

- To promote the integration of environmental conservation and sustainable development through environmental planning within the Rufiji Delta and Floodplain.
- To promote the sustainable use of natural resources and enhance the livelihoods of local communities by implementing sustainable pilot development activities based on wise use principles.
- To promote awareness of the values of forests, woodlands and wetlands and the importance of wise use at village, district, regional and central government levels, and to influence national policies on natural resource management.

### **Project Area**

The project area is within Rufiji District in the ecosystems affected by the flooding of the river (floodplain and delta), downstream of the Selous Game Reserve and also including several upland forests of special importance.

### **Project Implementation**

The project is run from the district Headquarters in Utete by the Rufiji District Administration through a district Environmental Management Team coordinated by the District Executive Director. The Project Manager is employed by the project and two Technical Advisers are employed by IUCN.

Project partners, particularly NEMC, the Coast Region, RUBADA, The Royal Netherlands Embassy and the Ministry of Natural Resources and Tourism, collaborate formally through their participation in the Project Steering Committee and also informally.

### **Project Outputs**

At the end of the first five –year phase (1998-2003) of the project the expected outputs are:

An Environmental Management Plan: an integrated plan for the management of the ecosystems (forests, woodlands and wetlands) and natural resources of the project area that has been tested and revised so that it can be assured of success - especially through development hand-in-hand with the District council and the people of Rufiji.

Village (or community) Natural Resource Management Plans: These will be produced in pilot villages to facilitate village planning for natural resource management. The project will support the implementation of these plans by researching the legislation, providing training and some support for zoning, mapping and gazettement of reserves.

Established Wise Use Activities: These will consist of the successful sustainable development activities that are being tried and tested with pilot village and communities and are shown to be sustainable

Key forests will be conserved: Forests in Rufiji District that have shown high levels of plant biodiversity, endemism or other valuable biodiversity characteristics will be conserved by gazettement, forest management for conservation, and /or awareness-raising with their traditional owners.

## Executive summary

### Objectives

The two main objectives of this study were to assess the present situation regarding demand for and supply of woody biomass energy (fuelwood and charcoal) in Ikwiriri Township and Mbunju - Mvuleni village, and to make recommendations towards reducing the demand for woody biomass energy in the study area. The field survey was conducted between the 2<sup>nd</sup> and 13<sup>th</sup> May 2000.

### Methodology

The methodology used for the survey included: literature review; use of questionnaires; establishment of temporary sample plots in farmlands to estimate existing number of trees per hectare; visits to forest reserves and meetings with stakeholders. A total of 508 samples were surveyed in 10 villages. The survey sample consisted of 410 households, 83 commercial entities and 15 institutions. Female respondents to the household questionnaires accounted for 88.9 percent for Ikwiriri Township and for 87.8 percent for Mbunju - Mvuleni.

### Findings

The main findings of the study were:

- Season was reported to have no influence on choice of fuelwood by 96.7% of respondents in Ikwiriri and 95.9% of respondents in Mbunju - Mvuleni.
- 42.1% of respondents in Ikwiriri Township and 20.4% in Mbunju - Mvuleni, indicated that the collection of fuelwood was getting harder.
- The main fuel types used in the study area and their average consumption levels per capita per annum for Ikwiriri and Mbunju - Mvuleni (figures in brackets) were: fuelwood, 523kg (600kg); charcoal, 42 kg (32kg); kerosene, 7.7lt (11.8lt).
- Electricity and sawmill residues (sawdust) were also used in Ikwiriri Township but not in Mbunju - Mvuleni. Petrol and diesel are used by the transport sector but they were not covered in this study.
- Contributions of the commonly used energy types to total household energy consumed in Ikwiriri and Mbunju - Mvuleni (figures in brackets) are: Fuelwood 82% (85%); Charcoal 15% (10%); and Kerosene 3% (4%). Households using fuelwood only for cooking were 53% in Ikwiriri and 73% in Mbunju - Mvuleni. Households using charcoal only for cooking were 14% in Ikwiriri and 4% in Mbunju - Mvuleni. Kerosene is the most preferred energy type for lighting. 89% of households in Ikwiriri and 82% in Mbunju - Mvuleni use kerosene for lighting. Fuelwood was used for lighting by 0.3% of households in Ikwiriri and by 4.1% of households in Mbunju - Mvuleni.
- Ikwiriri Township was electrified in 1977 with two diesel generators with a total production capacity of 848 KW. However, by the end of April 2000 consumption of electricity at Ikwiriri was around 422 KW with 10.9% of the total households of Ikwiriri Township supplied with electricity.
- Fuel switch opportunities were analysed based on fuel types and services provided by each energy type. In general, opportunities for fuel switch from the commonly used traditional fuels namely fuelwood and charcoal to commercial energy sources like electricity and kerosene for cooking is almost non-existent due to low income by the majority of households.
- The major commercial energy consuming sectors in Ikwiriri township and Mbunju - Mvuleni village were: food vendors, breweries, hotels, bars, pottery, fish frying/smoking, restaurants and smelting. The commercial sector total annual consumption in the study area was: fuelwood 16 tonnes and charcoal 79 tonnes.

- Farmland trees, woodlands and forest reserves were the main sources of fuelwood and charcoal in the study area. Wood was collected from woodlands and forest reserves without seeking authority. The supply potential of wood from all the resources was declining (difficult to get dry wood for fuelwood), and current efforts to enhance sustainable supply of wood products in the study area are at a low scale.
- 89.1 % and 92.0% of households in Ikwiriri and Mbunju - Mvuleni respectively transport fuelwood manually. 9.7 % and 8% (Ikwiriri and Mbunju - Mvuleni respectively) transport fuelwood by bicycle. 92.3% of households in Ikwiriri transport charcoal manually, 64% in Mbunju - Mvuleni. Those using bicycles to transport charcoal were 7.1% in Ikwiriri and 34% in Mbunju - Mvuleni.
- The demand for fuelwood and charcoal both for Ikwiriri Township and Mbunju - Mvuleni village is increasing in volume. Fuelwood and charcoal are used with low efficiency and there is no defined programme to minimise consumption rates of fuelwood and charcoal through the use of improved wood production and utilisation technologies. Tree cover area in the wood supply sources of Ikwiriri and Mbunju - Mvuleni village are declining rapidly leading to scarcity of fuelwood and charcoal. Recent studies of forest resources in Rufiji District conducted by Sokoine University of Agriculture and REMF have also confirmed the ongoing decline of tree cover in the study area.

### **Problems**

Problems revealed by the study that need to be addressed include:

- Low awareness of environmental conservation strategies.
- Low-availability of technical assistance to promote efficient production and utilisation of fuelwood and charcoal.
- Low-availability of technical assistance to promote community conservation of woodlands surrounding Ikwiriri and Mbunju - Mvuleni.
- Low intensity of tree planting efforts in farmland.
- Increasing fuelwood scarcity with environmental degradation.

### **Recommendations**

To address the identified problems it is proposed to start a programme for improving production and utilisation efficiency of fuelwood and charcoal in the study area. Main objectives of the programme should be to:

- Raise public awareness of environmental conservation and management strategies through local initiative efforts.
- Provide technical assistance on efficient production and utilisation of fuelwood and charcoal.
- Provide technical assistance on woodland conservation strategies through community participation and initiatives.
- Provide technical assistance on effective tree growing in farmlands.

## **Acknowledgements**

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Sawe E.N.

Executive Director TaTEDO

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## Abbreviations

IUCN	The World Conservation Union
REMP	Rufiji Environment Management Project
TEHIP	Tanzania Essential Health Initiative Programme
FDC	Folk Development College
FR	Forest Reserve
Ha	Hectare
HH	Households
KW	Kilowatt
RUBEP	Rufiji Beekeeping Project
SIDO	Small Industries Development Organization
TANESCO	Tanzania Electric Supply Company
TaTEDO	Tanzania Traditional Energy Development and Environment Organization

### Village names abbreviations:

Mg/kus	Mgomba kusini
Mg/kati	Mgomba kati
Mg/kas	Mgomba kaskazini
Ikw/kus	Ikwiriri kusini
Ikw/kati	Ikwiriri kati
Ikw/kas	Ikwiriri kaskazini
Um/kus	Umwe kusini
Um/kati	Umwe kati
Um/kas	Umwe kaskazini
Mbunju	Mbunju - Mvuleni.



## 1 Introduction

### 1.1 Background

The Rufiji Environment Management Project (REMP) based at Utete Town; the headquarters of Rufiji District has identified the increasing demand of fuelwood and charcoal as a threat to the woodlands and forests of the Rufiji floodplains and delta. There are three large settlements in Rufiji district namely Ikwiriri, Utete and Kibiti. Ikwiriri is the largest settlement with an estimated population of 21,669 people (1999) with an average annual growth rate of about 2.3 percent. Fuelwood and charcoal are the main sources of energy for over 96 percent of the population, used mainly for cooking. The estimated average income per capita per annum for Coast region and Rufiji District residents is around Tsh. 29,000 (The Planning Commission 1997). Opportunities for an upward fuel switch from fuelwood to commercial energy sources like electricity for cooking is therefore hindered by low income and it is not expected to take place in the foreseeable future.

Mbunju - Mvuleni village is located close to Ikwiriri, sharing the same natural resources for fuelwood supply and fishing. The main sources of fuelwood and other wood products for Ikwiriri and Mbunju - Mvuleni are surrounding miombo woodlands dominated by *Brachystegia* species and patches of thicket. Currently the miombo woodlands are under great pressure with a pronounced decline of tree cover intensity due to increasing demand of fuelwood and large-scale production of charcoal for sale in Rufiji district and Dar es Salaam.

Inhabitants of Ikwiriri and Mbunju - Mvuleni live for a considerable period in the floodplains, cultivating rice and other food crops. Fuelwood and charcoal used in the floodplains is normally transported from higher grounds. However a small amount of fuelwood and other biomass materials are obtained from the floodplains mainly from a few scattered trees of *Mangifera indica*, *Borassus aethiopicum*, *Hyphaene compressa* and *Phoenix reclinata*.

REMP provided a one-month consultancy to TaTEDO to assess the situation of fuelwood and charcoal uses in Ikwiriri and Mbunju - Mvuleni village. Results of the study will enhance planning and implementation of REMF objectives which are to:

- Promote the integration of environmental conservation and sustainable development through environmental planning within the Rufiji delta and floodplain.
- Promote the sustainable use of natural resources and enhance the livelihoods of local communities by implementing sustainable pilot development activities based on “wise use” principles.
- Promote awareness of the value of forests, woodlands and wetlands and the importance of “wise use” at village, district, regional and central government levels and influence national policies on natural resource management emphasizing the non-sectoral, multi-biome-integrated approach to the environment.

## **1.2 Terms of Reference (TOR)**

The two main objectives of the consultancy were:

- To assess the present situation regarding demands for and supply of woody biomass energy (fuelwood and charcoal) in Ikwiriri township and Mbunju - Mvuleni village.
- Make recommendations towards reducing the demand for woody biomass energy (fuelwood and charcoal) in both settlements.

Appendix 1 contains the full terms of reference for the consultancy.

## **1.3 Implementation schedule**

The main field survey was conducted between the 2<sup>nd</sup> and 13<sup>th</sup> May 2000. A complementary field survey was conducted between 26<sup>th</sup> and 29<sup>th</sup> May 2000. Data analysis and production of this report was conducted between 30<sup>th</sup> May and 6<sup>th</sup> July 2000.

## **1.4 Composition of field survey team**

The field survey team was composed of experts in various fields to enhance fulfilment of the TOR. The experts involved were:

- Kaale B.K. team leader (Msc. Bsc., Energy/Environment)
- Ndilanha A.E. consultant (Msc. B.Sc., Energy/Stoves)
- Kway S. consultant (Msc. Bsc., Forestry)
- Songela Francis (B.Sc. Engineering/Stoves)
- Hamisi A. (B.Sc. Engineering)
- Kilemwa A. (B,Sc., Forestry/Resource Assessment)
- Scolastica Spendi (B.A Sociology)
- Rose Kachecheba (B.A Business Administration)

In addition, two women and two men from Ikwiriri and Mbunju - Mvuleni assisted in data collection.

## 2 Survey Methodology

### 2.1 Literature review

An intensive literature review was conducted to enhance sharing of existing experiences in the field of energy and environmental conservation.

### 2.2 Field surveys

Questionnaires were prepared, pre-tested and discussed with REMP representatives prior to use. One questionnaire dealt with household energy consumption and others dealt with energy consumption for commercial purposes. To facilitate discussion with local people and to enhance transparency, the questionnaires were both in English and Swahili language. About 10% of all households were surveyed.

Weight measurements (kg) were recorded of the following:

- Fuelwood and charcoal used by sampled households per day.
- Fuelwood bundles collected by women from the woodlands (In the local area called Mzigo).
- Fuelwood bundles collected by women and children from farmland trees (In the local area called Kisomba).
- Fuelwood bundles sold in the market and in households.
- Fuelwood sold by sawmill owners in wheelbarrows (In the local area called Toroli).
- Charcoal in small tins and bags commonly used in the area.

Discussions were held in the field with charcoal producers on their production technologies and possibilities of improving production efficiency of their traditional earth kilns.

Transects and circular sample plots with radius of 15 m (0.071ha) were established in farmlands at an interval of 1km apart, moving from North to South in order to estimate the number of existing trees per hectare in each village.

Field visits were made in the forests to get a view of ongoing human activities and availability of dry wood that could be collected for fuelwood. Appendix 2 contains samples of the questionnaire forms used in the field.

### **3 Results**

#### **3.1 Socio –economic and cultural data of Ikwiriri Township and Mbunju - Mvuleni village**

##### **3.1.1 General**

Socio-economic and cultural data on the study area with relevancy to energy consumption and environmental conservation were collected to enhance planning and implementation of energy and environmental programmes. Issues covered are highlighted and details of findings are presented in Appendix 3.

##### **3.1.2 Respondents sex**

Female respondents to the household questionnaires accounted for 88.9 percent for Ikwiriri Township and for 87.8 percent for Mbunju - Mvuleni. Men accounted for 11.1 percent for Ikwiriri Township and 12.2 percent for Mbunju - Mvuleni village. Women as major collectors and users of fuelwood and charcoal, played a major role in the survey.

##### **3.1.3 Household members' sex**

Females accounted for 54.1 percent of the total household members in Ikwiriri township and for 55.4 percent for Mbunju - Mvuleni. Men accounted for 44.9 percent in Ikwiriri Township and for 44.6 in Mbunju - Mvuleni.

##### **3.1.4 Household members education levels**

Education of household members was assessed in five levels namely: no schooling, attended primary school education, attended secondary school education, attended college education and those with university education. Results were:

Female household members without any schooling accounted for 34.6% for Ikwiriri and 31.3% for Mbunju - Mvuleni. Figures for men were 26.3% for Ikwiriri and 24.1% for Mbunju - Mvuleni.

Female household members with primary school education accounted for 17.9% for Ikwiriri Township and 23.4% for Mbunju - Mvuleni village. Figures for men were 17.7% for Ikwiriri and 20.1% for Mbunju - Mvuleni.

Female household members with secondary school education accounted for 1.6% for Ikwiriri Township and 0.7% for Mbunju - Mvuleni village. Men accounted for 1.8% for Ikwiriri Township and 0.4% for Mbunju - Mvuleni.

For both Ikwiriri Township and Mbunju - Mvuleni village no female household member had attended college education within the surveyed sample. However, 0.1 % of male household members in Ikwiriri Township had attended college education but none in Mbunju - Mvuleni.

With regard to university education, none of the household members surveyed had attained university education.

##### **3.1.5 Purchase of Newspapers**

Households purchasing and reading newspapers were 42.1% in Ikwiriri and 46.9% in Mbunju - Mvuleni. Common newspapers found were: Nipashe, Dimba, Kasheshe and Majira. Households not purchasing or reading newspapers were 57.9% in Ikwiriri and 53.1% in Mbunju - Mvuleni.

### **3.1.6 Own a Radio**

Households with radios were 54.6% in Ikwiriri and 32.7% in Mbunju - Mvuleni. Those without a radio were 45.4% in Ikwiriri and 67.3% in Mbunju - Mvuleni.

### **3.1.7 Income levels**

Households were asked to indicate their income status based on Ikwiriri and Mbunju - Mvuleni socio-economic and cultural living conditions. About 74.5% of Ikwiriri households indicated that they had a low income and for Mbunju - Mvuleni 83.7% of households surveyed indicated that they had a low income. Households that indicated they had a medium income were 25.5% in Ikwiriri and 16.3% in Mbunju - Mvuleni village. None of the households surveyed indicated they had a high income.

### **3.1.8 Choice of fuel types depending on season**

Respondents were requested to indicate if choice of fuel for cooking and other activities was influenced by season, i.e. use of different energy types during the dry and rainy season. Respondents who indicated that season had no influence on choice of fuel types for cooking were 96.7% for Ikwiriri Township and 95.9% for Mbunju - Mvuleni village. Those who indicated season had some influence were 3.3% in Ikwiriri and 4.1% in Mbunju - Mvuleni. They indicated that during the rainy season they were sometimes using charcoal if it was difficult to find dry wood. (It is easy to store charcoal in the house during the rainy season and the energy content of charcoal is higher than that of fuelwood).

### **3.1.9 Selection of fuel types for specific foods**

Most respondents indicated that they had no specific preference of fuel types for cooking specific foods. Those who indicated they had no preference of fuel for any type of food were 95.0% in Ikwiriri and 95.9% in Mbunju - Mvuleni. Those who indicated they had a preferred energy type for cooking specific foods were 5.0% for Ikwiriri and 4.1% for Mbunju - Mvuleni village. The main preference indicated was the use of charcoal for cooking rice.

### **3.1.10 Fuelwood supply problem**

Respondents were asked to indicate if they were experiencing a problem with fuelwood supply or if collection of fuelwood was getting harder as compared to 5 years ago. Respondents who indicated fuelwood supply was a problem were 42.1% for Ikwiriri and 20.4% for Mbunju - Mvuleni. Those who indicated fuelwood supply was not a problem were 57.9% for Ikwiriri and 79.6% for Mbunju - Mvuleni village.

### **3.1.11 Willingness to contribute to solving fuelwood problems**

Respondents were asked to indicate if they were ready to contribute towards ensuring a sustainable fuelwood supply in their local areas. Respondents who indicated they were ready to contribute and participate in ensuring sustainable fuelwood supply in their areas were 36.3% in Ikwiriri and 20.4% in Mbunju - Mvuleni. Those who are not willing to contribute were 63.7% in Ikwiriri and 79.6% in Mbunju - Mvuleni. Follow-up discussions with some of the households who indicated that they were not willing to contribute in enhancing sustainable supply of fuelwood revealed that ignorance on energy and environmental issues was the main underlying factor. With informal discussion of about one hour, most of those who indicated that they were not willing to contribute changed their mind and promised to support and participate effectively in future tree growing and improved stove programmes.

### **3.1.12 Awareness of Energy Options**

Members of households surveyed were asked to indicate if they were aware of other energy options for cooking and lighting besides the ones they were using (mainly fuelwood, charcoal and kerosene). For Ikwiriri Township, 19.4% of the total surveyed households indicated they were aware of energy options, mainly the use of electricity for lighting. However, 80.6% of households in Ikwiriri were not aware of alternative energy options.

6.1 % of Mbunju - Mvuleni households indicated they were aware of other energy options, 93.9% indicated they were not.

### **3.1.13 Who makes decisions on fuel type use?**

Members of households were asked to indicate who decides on what type of fuel to use, covering three categories namely; females, males and all (females and males). Results showed that in Ikwiriri Township, decision of fuel type to use at household level was made mainly by females, accounting for 74.8% of the total households surveyed. Males accounted for 13.3% and decision's by all accounted for 11.9%.

The same trend was observed in Mbunju - Mvuleni village, where females accounted for 69.4% of those making the decision on type of fuel to use in their households. Males accounted for 4.1% and decisions made by both females and males accounted for 26.5%.

### **3.1.14 Plans to change to alternative fuels**

Respondents were asked to indicate if they had plans to change the energy types they were using for cooking and lighting to alternative energy sources. For cooking, the majority indicated they were planning to maintain the current energy mix of fuelwood and charcoal. However, changes were indicated in lighting, where 41.0% of Ikwiriri residents indicated they were planning to use electricity for lighting if their economic situation will improve. In Mbunju – Mvuleni, 18.4% of respondents indicated they had plans to use electricity for lighting if their village was to be electrified. Those who indicated they had no plans to change to an alternative energy source were 59.0% in Ikwiriri Township and 81.6 % in Mbunju - Mvuleni.

## **3.2 Present situation on household energy demand in Ikwiriri Township and Mbunju - Mvuleni village**

### **3.2.1 Fuel types used**

Fuel types commonly used by households in Ikwiriri Township and Mbunju - Mvuleni village are: fuelwood, charcoal, kerosene, electricity and farm residues. Petrol and diesel are used by the transport sector but they were not covered in the study.

### **3.2.2 Average household energy consumption levels**

#### **General**

A total of 508 samples were recorded in 10 villages (of which 9 villages were in Ikwiriri township), in order to estimate the average fuelwood, charcoal and kerosene consumption for households, commercial entities and institutions.

Surveyed samples were distributed as follows:

- Households 410 samples
- Commercial entities 83 samples
- Institutions 15 samples

Table 1 provides details of the sample distribution in each village.

Table 1: Summary of surveyed areas Ikwiriri and Mbunju - Mvuleni

Activities	Mgomba Kusini	Mgomba Kati	Mgomba Kaskazini	Ikwiriri Kusini	Ikwiriri Kati	Ikwiriri Kaskazini	Umwe Kusini	Umwe Kati	Umwe Kaskazini	Mbunju - Mvuleni	Total surveyed
<b>Households</b>	54	44	31	71	21	18	36	58	28	49	<b>410</b>
<b>Commercial</b>											
<i>Charcoal</i>	1	5	0	0	0	6	2	2	5	0	21
<i>Fuelwood</i>	1	2	3	0	1	0	2	1	0	0	10
<i>Pottery</i>	0	1	0	0	1	0	0	0	0	1	3
<i>Fish fry/smoke</i>	1	0	1	0	0	0	2	0	0	0	4
<i>Mama Ntilie</i>	1	0	0	4	0	0	0	6	0	4	15
<i>Migahawa</i>	0	0	2	2	0	0	0	1	0	1	6
<i>Hotels</i>	0	0	0	1	0	0	0	0	0	0	1
<i>Brewing</i>	0	0	0	2	0	0	1	0	1	0	4
<i>Weaving</i>	0	0	1	0	0	0	0	0	0	0	1
<i>Smithery</i>	0	0	2	0	1	0	0	0	0	0	3
<i>Bars Nyama choma</i>	0	0	0	0	0	0	0	2	0	0	2
<i>Poles</i>	0	0	0	0	0	0	0	1	0	2	3
<i>Logs</i>	0	0	2	0	0	0	0	0	0	0	2
<i>Milling machines</i>	0	0	0	1	1	0	1	0	1	0	4
<i>Sawmills</i>	1	0	0	0	0	0	0	2	0	0	3
<i>Makuti</i>	0	0	0	0	0	0	0	1	0	0	1
<b>Subtotal</b>											<b>83</b>
<b>Institutions</b>											
<i>Primary schools</i>	0	0	0	0	0	0	0	0	0	2	2
<i>Secondary schools</i>	0	0	1	0	0	0	0	0	0	0	1
<i>Dispensary</i>	0	0	0	1	0	0	0	0	0	1	2
<i>TANESCO</i>	0	0	0	0	1	0	0	0	0	0	1
<i>Post office</i>	0	0	0	1	0	0	0	0	0	0	1
<i>TRC</i>	0	0	0	1	0	0	0	0	0	0	1
<i>FDC</i>	0	0	0	1	0	0	0	0	0	0	1
<i>TEHIP</i>	0	0	0	1	0	0	0	0	0	0	1
<i>Petrol stations</i>	0	0	0	0	1	0	1	0	1	0	3
<i>Carpentry group</i>	0	0	0	0	0	0	0	1	0	0	1
<i>UJENZI</i>	0	0	0	1	0	0	0	0	0	0	1
<b>Subtotal</b>											<b>15</b>
<b>TOTAL</b>											<b>508</b>

Population data and number of households for the surveyed villages are summarized in Table 2 and Figure 1.

Table 2: Ikwiriri and Mbunju - Mvuleni population and household statistics

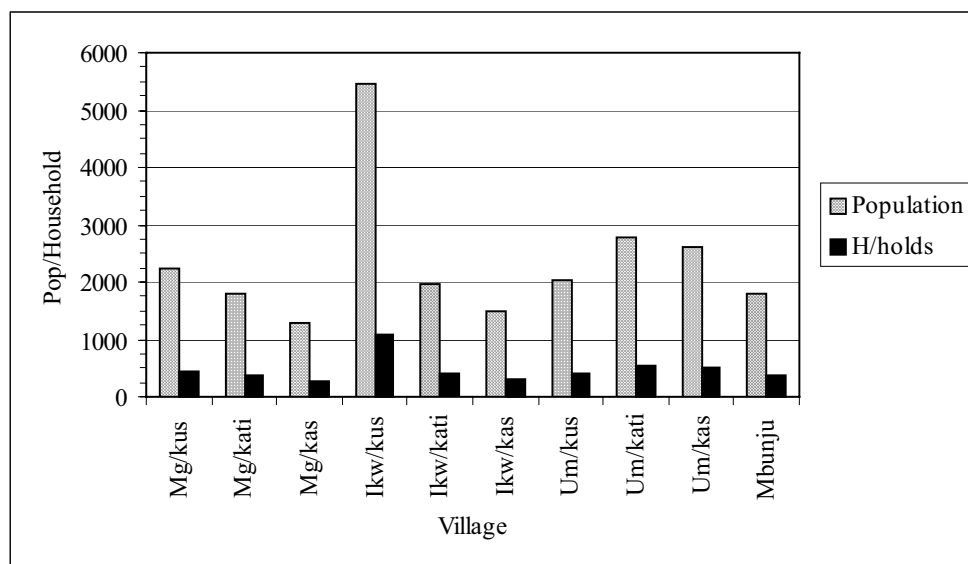
Village	Women	Men	Total 1999	% women	HH size no. people	No. HH	HH surveyed	% surveyed	Pop. growth rate	5yrs	10yrs
										Pop. 2005	Pop. 2010
<b>A. Ikwiriri township.</b>											
Umwe Kusini	1061	964	2025	52	5	405	36	9	2.3	2,269	2,542
Umwe kati	1436	1349	2785	52	5	557	58	10	2.3	3,120	3,496
Umwe Kaskazini	1395	1210	2605	54	5	521	28	5	2.3	2,919	3,270
<b>Sub-total</b>	<b>3892</b>	<b>3523</b>	<b>7415</b>	<b>52</b>		<b>1483</b>	<b>122</b>	<b>8</b>		<b>8,308</b>	<b>9,308</b>
Ikwiriri Kusini	2838	2608	5446	52	5	1089	71	7	2.3	6,102	6,836
Ikwiriri Kati	1070	898	1968	54	5	394	21	5	2.3	2,205	2,470
Ikwiriri Kaskazini	779	728	1507	52	5	301	18	6	2.3	1,688	1,892
<b>Sub-total</b>	<b>4687</b>	<b>4234</b>	<b>8921</b>	<b>53</b>		<b>1784</b>	<b>110</b>	<b>6</b>		<b>9,995</b>	<b>11,199</b>
Mgomba Kusini	1140	1092	2232	51	5	446	54	12	2.3	2,501	2,802
Mgomba Kati	970	837	1807	54	5	361	44	12	2.3	2,025	2,268
Mgomba Kaskazini	661	633	1294	51	5	259	31	12	2.3	1,450	1,624
<b>Sub-total</b>	<b>2771</b>	<b>2562</b>	<b>5333</b>	<b>52</b>		<b>1067</b>	<b>129</b>	<b>12</b>		<b>5,975</b>	<b>6,695</b>
<b>Total</b>	<b>11,350</b>	<b>10,319</b>	<b>21,669</b>	<b>52</b>		<b>4,334</b>	<b>361</b>	<b>8</b>		<b>24,278</b>	<b>27,201</b>

**B. Mbunju - Mvuleni village.**

Mbunju	-	-	-	-	-	-	-	-	-	-	-
Mvuleni	NA	NA	1800		5	360	49	14	2.3	2,017	2,260

Source: TEHIP & REMP 1999 reports

Figure 1: Population and household data for Ikwiriri and Mbunju - Mvuleni



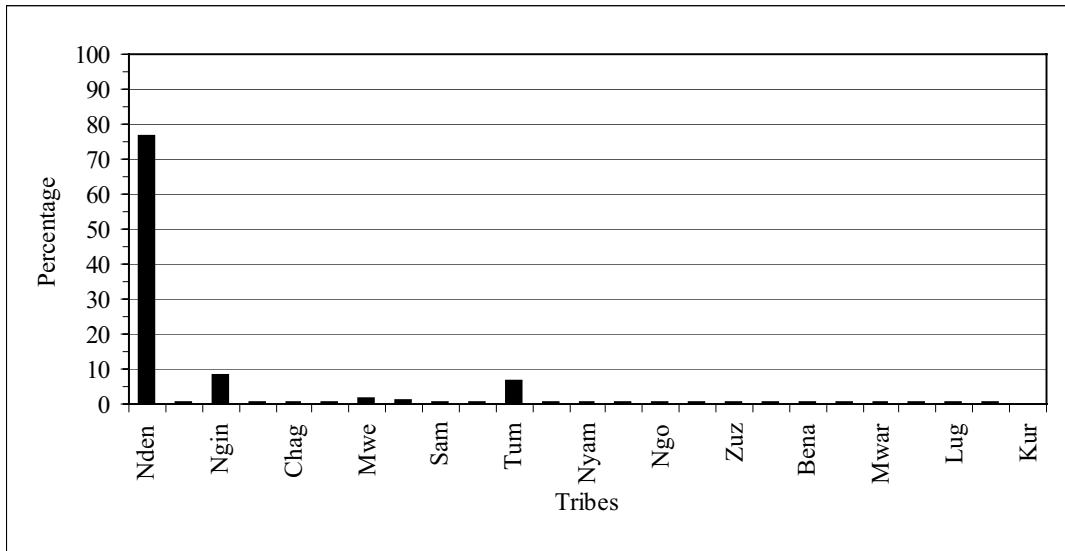
Source: TEHIP & REMP Reports, 1999

Village names abbreviations: Mg/kus - Mgomba kusini, Mg/kati - Mgomba kati, Mg/kas - Mgomba kaskazini, Ikw/kus - Ikwiriri kusini, Ikw/kati - Ikwiriri kati, Ikw/kas - Ikwiriri kaskazini, Um/kus - Umwe kusini, Um/kati - Umwe kati, Um/kas - Umwe kaskazini, Mbunju - Mbunju - Mvuleni.



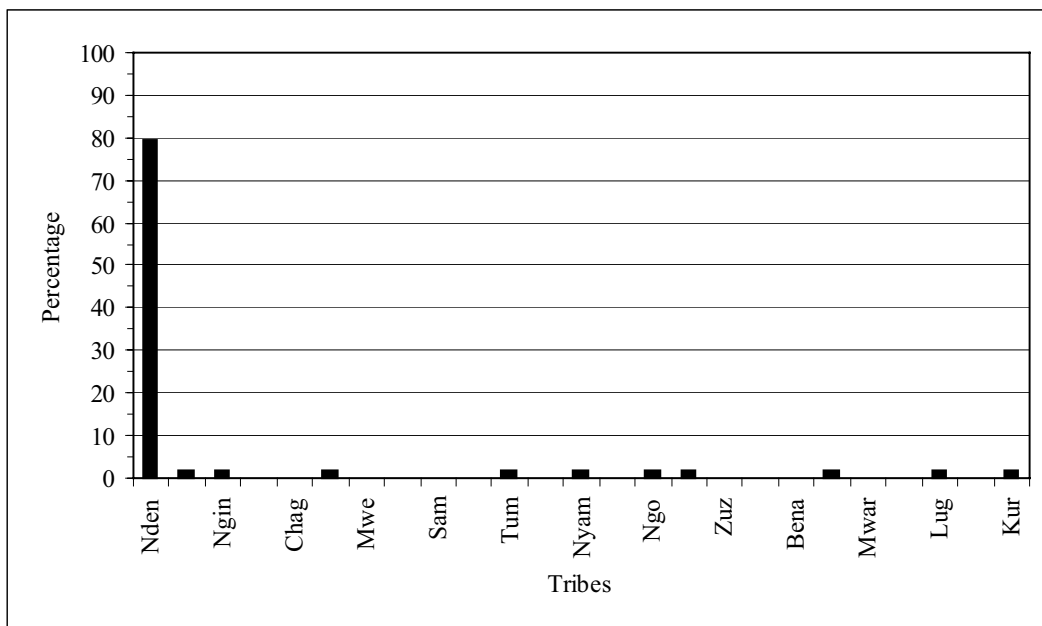
A total of 25 ethnic groups were found in Ikwiriri Township. However three ethnic groups were the most dominant, namely Ndengereko (76.4 percent), Ngindo (8.6 percent) and Matumbi (6.9 percent) (Figure 2 and 3, Appendix 4).

**Figure 2: Summary of ethnic groups in Ikiwiri Township (by percentage)<sup>2</sup>**



Source: Appendix 4

**Figure 3: Summary of ethnic groups in Mbunju - Mvuleni Village (by percentage)<sup>1</sup>**



Source: Appendix 4

<sup>2</sup> Tribe names abbreviation. Nden - Ndengereko, Pog - Pogoro, Ngin - Ngindo, Nyak - Nyakyusa, Chag - chagga, Mak - Makonde, Mwe - Mwera, Zar - Zaramo, Sam - Sambaa, Nyag - Nyagatwa, Tum - Tumbi, Nyaki - Nyakisoma, Nyam - Nyamwezi, Zig - Zigua, Ngo - Ngoni, Zuz - Zuzuri, Mwa - Mwarabu, Nyas - Nyasa, Lug - Luguru, Kin - Kinga, Kur - Kurya

### 3.2.3 Detailed household data for fuelwood, charcoal and kerosene

Details of individual households' fuelwood, charcoal and kerosene consumption on a daily, weekly, monthly and yearly basis were collected and are summarised in Appendix 5 to 7. Fuelwood and charcoal data were collected in weight (kg), by taking measurements with a spring balance. Kerosene data were collected in volume (ml) by measuring the volume of commonly used units for selling kerosene in Ikwiriri Township and Mbunju - Mvuleni village (commonly called koroboi).

#### Establishing household consumption on common energy units

Data from Appendix 5 to 7 were summarized and converted to a final energy user level in Mega Joules (Mj) (Appendix 8). Conversion factors used based on (FAO 1999) were:

1 kg of dry firewood (about 15% moisture content)	= 13.800 Mj.
1 kg of charcoal	= 30.800 Mj.
1 litre of kerosene	= 35.000 Mj.

### 3.2.4 Average per capita per annum energy consumption levels of fuelwood, charcoal and kerosene in Ikwiriri Township and Mbunju - Mvuleni village

Based on data from Appendix 5 to 7 discussed above, average consumption levels per capita per annum for Ikwiriri Township and Mbunju - Mvuleni village are summarised in Table 3. Average consumption levels in Kg's for fuelwood and charcoal are presented in Figures 4 & 5. Figure 6 presents average consumption levels of kerosene in ml and Figure 7 presents average consumption levels of fuelwood, charcoal and kerosene in Mj.

For Ikwiriri Township, average consumption levels per capita per annum of the surveyed energy types are:

Fuelwood	523 kg (0.75m <sup>3</sup> of solid wood)
Charcoal	42 kg
Kerosene	7.7 litres

For Mbunju - Mvuleni village, average consumption levels per capita per annum of the surveyed energy types are:

Fuelwood	600 kg (0.86 m <sup>3</sup> of solid wood)
Charcoal	32 kg
Kerosene	11.8 litres

In comparison, based on consumption per annum per capita, Mbujumvuleni people have a higher consumption level of fuelwood and kerosene than residents of Ikwiriri Township (Figure 8). The higher consumption of fuelwood is probably due to the easy availability of fuelwood in Mbunju - Mvuleni village. Initially, factors contributing to high kerosene consumption in Mbunju - Mvuleni were not clear. A follow-up field trip was made to Mbunju - Mvuleni to establish the main causes of high kerosene consumption, taking into account kerosene is more expensive in Mbunju - Mvuleni as compared to Ikwiriri. One litre of kerosene at retail shops at Ikwiriri costs Tsh. 622 while at Mbunju - Mvuleni it costs Tsh. 875, an increase of 29 percent. It was discovered that women of Mbunju - Mvuleni use kerosene lamps (koroboi) for making mats at night as an income generation activity.

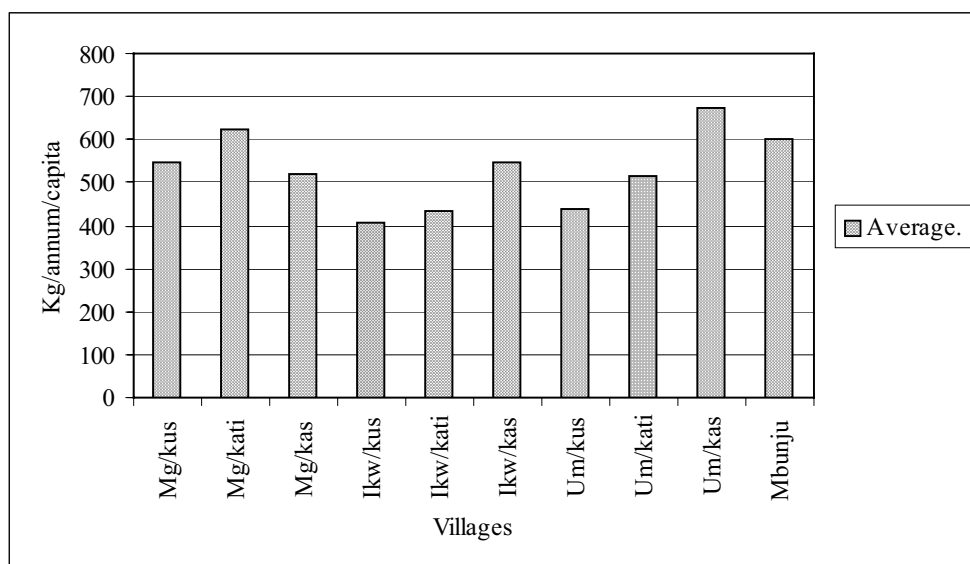
**Table 3: Average per capita per annum and total annual consumption of fuelwood, charcoal and kerosene in Ikwiriri and Mbunju - Mvuleni**

<b>FUELWOOD</b>					
	Pop.	Av. Cons.	Total cons.	Av.cons.	Total cons.
	2000	Mj	Mj	Kg	Kg
Ikwiriri township	21,669	7,217	156,393,841	523	11,332,887
Mbunju - Mvuleni	1,800	8,280	14,904,000	600	1,080,000
<b>Total</b>			<b>171,297,841</b>		<b>12,412,887</b>
<b>CHARCOAL</b>					
	Pop.	Av.Cons.	Total cons	Av.cons	Total cons
	2000	Mj	Mj	Kg	Kg
Ikwiriri township	21,669	1,294	28,031,018	42	910,098
Mbunju - Mvuleni	1,800	986	1,774,080	32	57,600
<b>Total</b>			<b>29,805,098</b>		<b>967,698</b>
<b>KEROSENE</b>					
	Pop.	Av. Cons.	Total cons	Av. Cons.	Total cons
	2000	Mj	Mj	Litres	Litres
Ikwiriri township	21,669	270	5,839,796	7.7	166,851
Mbunju - Mvuleni	1,800	413	743,400	11.8	21,240
<b>Total</b>			<b>6,583,196</b>		<b>188,091</b>

Source: Appendix 8

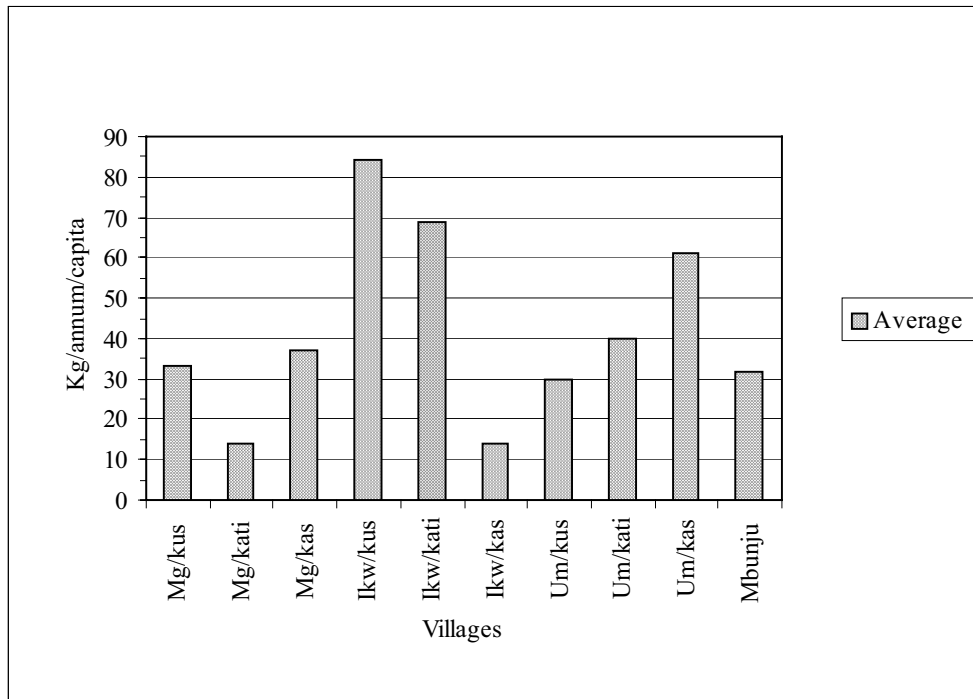
Key: Pop. – Population, Av. Cons - Average consumption, Total cons - Total consumption

**Figure 4: Average per capita per annum fuelwood consumption in kg**



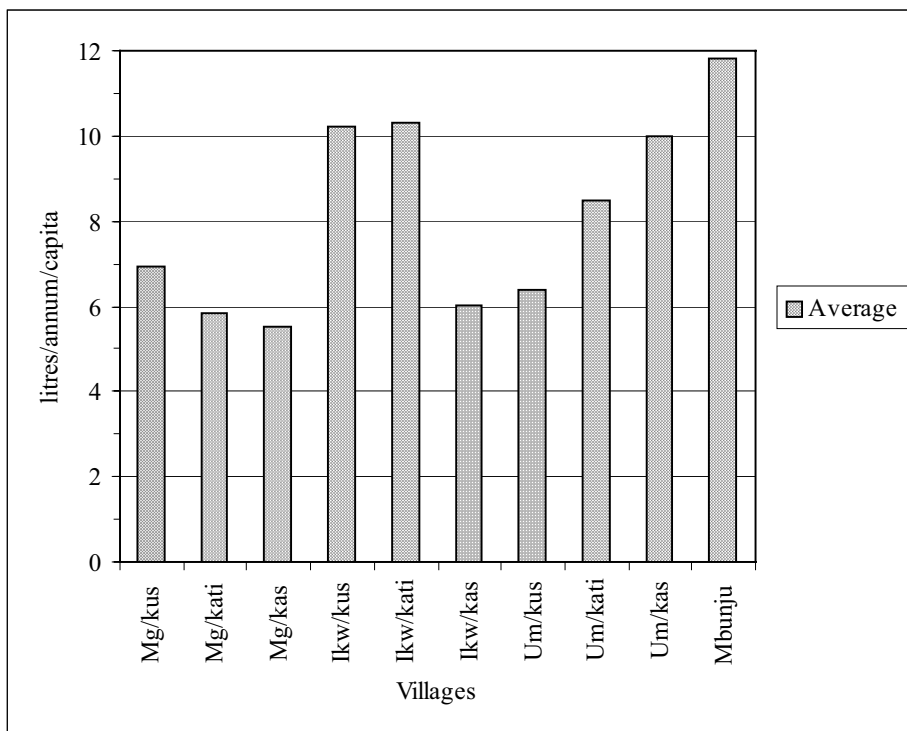
Source: Appendix 5 & 8

Figure 5: Average per capita per annum charcoal consumption in kg



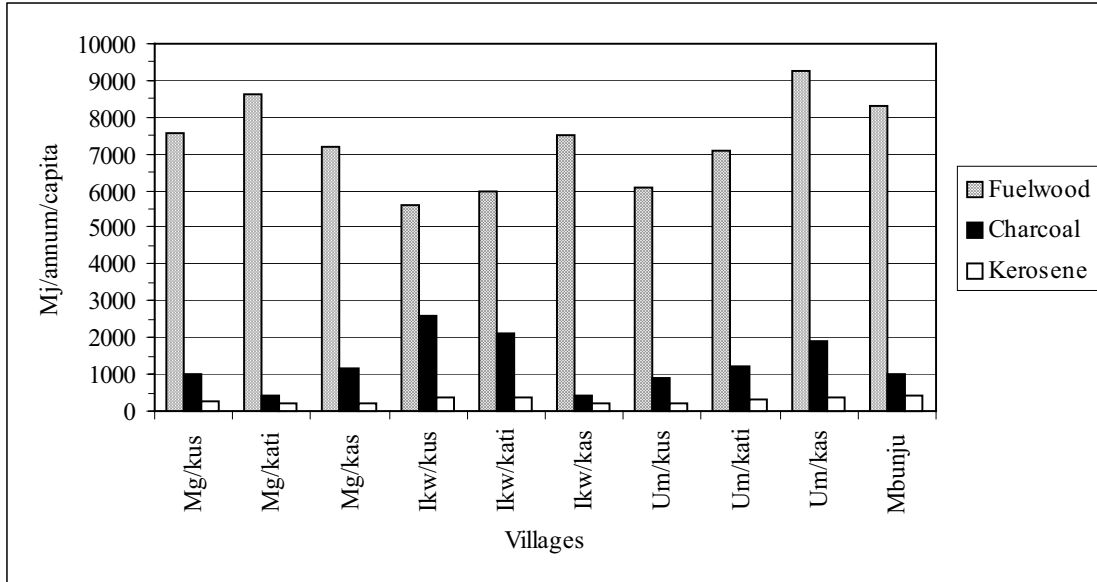
Source: Appendix 6 & 8

Figure 6: Average per capita per annum kerosene consumption in litres



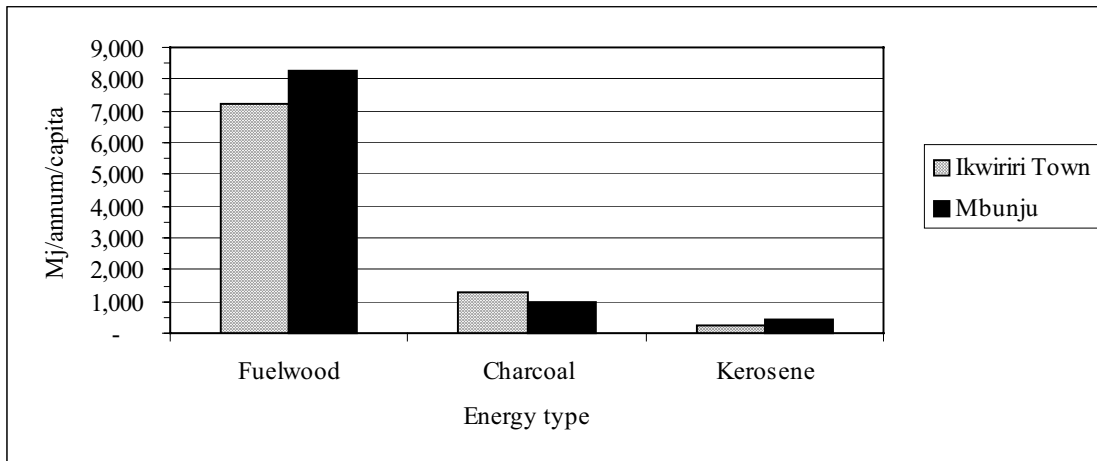
Source: Appendix 7 & 8

**Figure 7: Average per capita per annum consumption for fuelwood, charcoal and kerosene in Mj for villages of Ikwiriri**



Source: Appendix 8.

**Figure 8: Comparison of average per capita per annum energy consumption of fuelwood, charcoal and kerosene for Ikwiriri Township and Mbunju - Mvuleni in MJ**



Source: Appendix 8

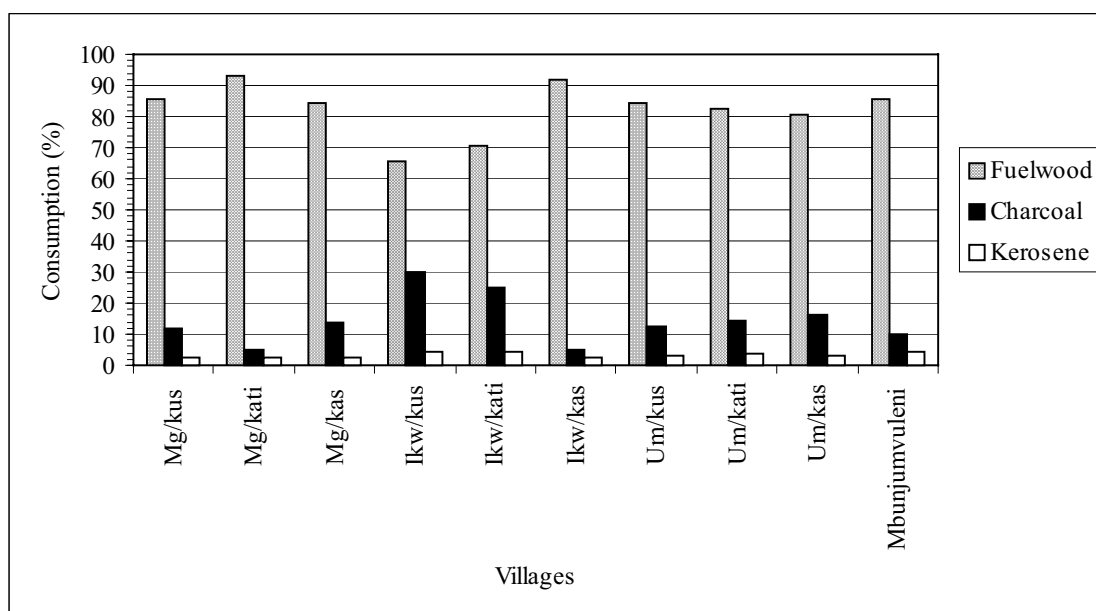
### 3.2.5 Contributions of fuelwood, charcoal and kerosene to total energy consumed

Fuelwood accounts for 82% of the total household energy consumed in Ikwiriri Township and for 85% in Mbunju - Mvuleni village. Contributions of charcoal to the total energy consumed are 15% for Ikwiriri and 10% for Mbunju - Mvuleni. Kerosene contributions are 3% for Ikwiriri and 4% for Mbunju - Mvuleni (Table 4 and Figure 9).

**Table 4: Percentage Fuelwood, charcoal and kerosene consumption in Ikwiriri Township and Mbunju - Mvuleni Village**

	Village	Fuelwood	Charcoal	Kerosene	Total
Ikwiriri Township	Mg/kus	7578	1024	243	<b>8845</b>
	%	85.7	11.6	2.7	
	Mg/kati	8631	439	204	<b>9274</b>
	%	93.1	4.7	2.2	
	Mg/kas	7198	1152	193	<b>8543</b>
	%	84.3	13.5	2.3	
	Ikw/kus	5632	2590	357	<b>8579</b>
	%	65.6	30.2	4.2	
	Ikw/kati	5974	2134	361	<b>8469</b>
	%	70.5	25.2	4.3	
	Ikw/kas	7536	430	212	<b>8178</b>
	%	92.1	5.3	2.6	
	Um/kus	6069	921	223	<b>7213</b>
	%	84.1	12.8	3.1	
	Um/kati	7103	1236	298	<b>8637</b>
	%	82.2	14.3	3.5	
	Um/kas	9267	1892	350	<b>11509</b>
	%	80.5	16.4	3.0	
	<b>Subtotal Ikiwiri</b>	<b>64979</b>	<b>11818</b>	<b>2441</b>	<b>79238</b>
	Average	7,220	1,313	271	
	%	82	15	3	
Mbunju - Mvuleni	Total	8282	979	413	<b>9674</b>
	%	85.6	10.1	4.3	

**Figure 9: Fuelwood, charcoal, kerosene consumption as a percentage of per capita energy consumption**



Source: Table 4

### 3.2.6 Electricity

Ikwiriri Township was electrified in 1977. There are two diesel generators with a total production capacity of 848 kW (Capacity of each generator is 424 kW).

By May 2000 consumption of electricity at Ikwiriri was around 422 kW. Due to low demand only one of the generators was fully utilised.

Reports from TANESCO office at Ikwiriri indicated that between 1977 and 1994 (December 1994) a total of 244 households were supplied with electricity. Between January 1995 to April 2000 an additional 229 households were supplied with electricity. By the end of April 2000 Ikwiriri Township had a total of 4,334 households of which 473 were electrified - equivalent to 10.9 percent. However, by 11 May 2000, when we visited the Ikwiriri TANESCO office, they did not have a single application from a household for electricity connection.

Main consumers of electricity in Ikwiriri Township are:

- Bridge construction company (paying around Tsh. 1,000,000 per month).
- Three timber sawmills (paying around Tsh. 200,000 each per month).
- Eleven flour milling machines (Paying around Tsh. 50,000 each per month but with seasonal variation based on agricultural production).
- A small welding workshop (paying around Tsh 40,000 per month on average).
- Individual households. Consumption of electricity by individual households is low. On average each pays around Tsh 1,500 per month and lighting is the main use of electricity at household level.

Data on electricity production costs and revenue collected per month by Ikwiriri TANESCO office was collected in order to get a rough idea of the economic viability of electrifying Ikwiriri Township.

#### Costs

Fuel consumption per month is around 48,000 lts	Tsh. 22,000,000
Oil per month	Tsh 100,000
Salaries to 27 workers are around	Tsh. 10,000,000
<b>Sub total direct costs</b>	<b>Tsh. 32,100,000</b>

#### Revenues

Average revenue collection per month is around	Tsh. 3,000,000
--	----------------

Even without considering depreciation and other operational costs, TANESCO is currently making a monthly loss of over Tsh. 29 million for supplying electricity to Ikwiriri Township. Despite this, the majority of households interviewed complained bitterly that electricity was expensive and hence they were unable to afford electricity for cooking and ironing. Low income for the majority of the households is therefore a hindering factor to wider use of electricity for cooking in Ikwiriri.

### 3.2.7 Sawmill residues

Residues from three sawmills in the form of sawdust, slabs and off-cuts are contributing to fuelwood and charcoal production in Ikwiriri Township (see section 4.5.5).

### 3.3 Preferences for different energy types

A mixture of energy types are used for different activities. Results show that fuelwood is the most preferred energy type for cooking. 53 percent of households in Ikwiriri use fuelwood only for cooking, and 73 percent in Mbunju - Mvuleni. 14 percent of households in Ikwiriri use charcoal only for cooking and 4 percent in Mbunju - Mvuleni.

Kerosene is the most preferred energy type for lighting. Households using kerosene were 89 percent in Ikwiriri and 82 percent in Mbunju - Mvuleni. However, electricity for lighting was used by 10 percent of Ikwiriri households. Fuelwood was used for lighting by 0.3 percent of households in Ikwiriri and by 4.1 percent of households in Mbunju - Mvuleni. Table 5 and Appendix 9 provide a detailed summary of energy type preference in the study area.

**Table 5: Percent of Households Preference to Different Energy Types**

Village Name	Activities	ENERGY TYPE						Total
		Fuelwood	Charcoal	Fuelwood And Charcoal	Kerosene	Elec.	None **	
Ikwiriri Township	Cooking	53.0	14.0	33.0	0.0	0.0	0.0	100.0
	Lighting	0.3	0.0	0.0	89.2	10.5	0.0	100.0
	Ironing	1.0	27.1	0.0	0.0	4.7	67.2	100.0
	Heating	3.0	1.1	0.0	0.0	0.0	95.9	100.0
	Fish Smk /Frying	5.0	3.6	0.0	0.0	0.0	91.4	100.0
Mbunju Mvuleni	Cooking	73.4	4.1	18.4	4.1	0.0	0.0	100.0
	Lighting	4.1	0.0	0.0	81.6	0.0	14.3	100.0
	Ironing	6.1	18.4	0.0	0.0	0.0	75.5	100.0
	Heating	6.1	4.1	0.0	0.0	0.0	89.8	100.0
	Fish Smk / Frying	14.3	0.0	0.0	0.0	0.0	85.7	100.0
	Brewing	2.0	0.0			0.0	98.0	100.0

\*\* None implies the household is not dealing with the indicated activity. For example in Mbunju - Mvuleni, 75.5% of households are not ironing their clothes.

### 3.4 Costs of individual fuels

A survey of prices of individual fuels was undertaken in both Ikwiriri Township and Mbunju - Mvuleni village. Weight units (kg) were used for fuelwood and charcoal, while volume unit was used for kerosene (ml). To enhance comparison of fuel types in common energy contents, both the weight and



volume units were converted to Mj. Costs of individual fuels based on common market units and on energy contents are summarized in Table 6. The table shows that purchase of fuelwood in small quantities at 6.2 kg bundles in Ikwiriri Township is expensive, costing Tsh 1.17 per Mj. However, the average cost of fuelwood bundles of 38 to 76 kg's costs about Tsh. 0.38 per MJ a reduction of about 68 percent compared to those purchasing fuelwood bundles of 6.2 kg. Nonetheless, purchase of small quantities of charcoal (1Kg) in Mbunju - Mvuleni is cheaper (Tsh. 2.27) than in Ikwiriri Township where 1kg of charcoal costs Tsh. 3.25. The same trend of higher costs per energy content was observed for consumers purchasing very small quantities of charcoal and kerosene.

**Table 6: Individual Fuel Costs Based on Weight/volume and Energy Content in Mj.**

Village name	Fuel type	Quantity	Price (Tshs)	Equivalent Energy contents (Mj)	Price of unit energy content (Tsh)
Ikwiriri Township	Fuelwood	6.2kg	100.00	85.6	1.17
		38kg	200.00	524.4	0.38
		40kg	200.00	552.0	0.36
		76kg	400.00	1,048.8	0.38
	Charcoal	1kg	100.00	30.8	3.25
		37kg	1200-1500	1,139.6	1.05-1.32
	Kerosene	50ml	30.00	1.8	17.14
		80ml	50.00	2.8	17.89
		250ml	120.00	8.8	13.70
		1000ml	440.00	35.0	12.57
Mbunju - Mvuleni	Charcoal	1kg	70.00	30.8	2.27
		37kg	1200-1500	1,139.6	1.05-1.32
	Kerosene	80ml	60-70	2.8	21.40 - 25

### 3.5 Fuel switch opportunities

Fuelwood switch opportunities were analysed based on fuel types and services provided by each energy type. In general, opportunities for fuel switch from the commonly used traditional fuels namely fuelwood and charcoal to commercial energy sources like electricity and kerosene for cooking is almost non-existent due to low incomes of the majority of households. Studies on fuel switch opportunities in Tanzania with similar economic and energy types to those of Ikwiriri and Mbunju - Mvuleni have concluded the same (Hifab & TaTEDO 1998, Kaale 1985, FAO 1884, Sawe & Leach 1989). To enhance sustainable energy supply for cooking in the study area, efforts are required to increase wise use of existing natural resources accompanied by an increase of supply potential through management of existing woodlands and farmland tree planting.

It should however be noted that fuel switch is taking place within the users of fuelwood, switching from use of desired high quality fuelwood species to lower quality fuelwood species (Leach & Mearns 1988). In the floodplains, some fuelwood consumers were supplementing fuelwood with agricultural residues mainly rice straw but in small quantities. However, use of agricultural residues will increase over time if the present trend of fuelwood supply decline will continue (Barnard & Kristoferson 1985, FAO 1999, ETC Foundation 1987). It is estimated that around 1-2 tonnes of residues can be obtained from one tonne of rice produced.

For lighting, the majority of households will continue to depend on kerosene, in particular at Mbunju - Mvuleni as it is not yet electrified. The use of electricity for lighting in Ikwiriri is expected to increase but on a small scale. For example the average number of households connected with electricity between 1977 and 2000 were 21 per annum.

## **4 Present situation on commercial energy demand in Ikwiriri Township and Mbunju - Mvuleni Village**

### **4.1 Main energy consuming commercial sectors**

The field survey identified nine main energy consuming commercial sectors in Ikwiriri Township and Mbunju - Mvuleni village. These are:

- Food vendors,
- Local brewing,
- Hotels,
- Bars,
- Pottery,
- Fish frying,
- Fish smoking,
- Restaurants and
- Smelting.

Major activities consuming fuelwood in all nine sectors are cooking, smelting, pottery and fish smoking. Based on the responses, cooking is consuming about 87% of the total energy consumed in the commercial sector, smelting 8.3%, pottery 1.8% while the remaining 2.2% is consumed by fish smoking activities. Fishing activities are carried out mainly at three places that are equally accessible to Ikwiriri Township and Mbunju-mvuleni village residents. These places include:

- Uba Lake, which is located in the North of Ikwiriri Township.
- Ruwe Lake, located in the south of Ikwiriri Township.
- River Rufiji, which flows south of Ikwiriri Township and Mbunju - Mvuleni village.

Based on discussions with respondents, it was noted that there is a serious problem of lack of fish in the lakes. This problem has reduced the rate of smoking activity and made it seasonally dependent compared to the situation five years ago (1995).

### **4.2 Average consumption levels**

Average consumption levels for individual owners on the commercial sectors surveyed are summarised in Table 7. Total annual fuelwood consumption for Ikwiriri Township is around 80 tonnes (115 m<sup>3</sup>) and for charcoal around 79 tonnes. In Mbunju - Mvuleni, total annual fuelwood consumption by the commercial sector is around 36 tonnes (51m<sup>3</sup>) and for charcoal around 0.6 tonnes (Table 7). It was encouraging to note all consumers use dry fuelwood. (Appendix 10 provides details of commercial business sector fuelwood/charcoal consumption rates). Appendix 11 provides names of business people surveyed. Appendix 12 provides names of dealers in commercial business's related to fuelwood, charcoal and other wood products – as provided by Ikwiriri Township government leaders. (List for wood related commercial dealers in Mbunju - Mvuleni village was not available from village government leaders; but few dealers were surveyed as indicated in Table 7).

Table 7: Commercial sector consumption levels for fuelwood and charcoal

Village name	Commercial sector activity	FUELWOOD			CHARCOAL		
		Average f/wood cons. per capita per annum per individual business owner (kg)	Total no. of business owners reported	Total cons. per annum	Average charcoal cons. per capita per annum per individual business owner (kg)	Total no. of business owners reported	Total cons. per annum (kg)
Ikwiriri Township	Food vendors	2,232.0	7	15,624.0	1,318.8	29	38,245.2
	Local brewing	4,531.2	2	9,062.4	1,026.0	2	2,052.0
	Hotels	0.0	0	0.0	6,660.0	1	6,660.0
	Bars	0.0	0	0.0	3,552.0	2	7,104.0
	Pottery	912.0	15	13,680.0	0.0	0	0.0
	Fish frying	5,607.6	3	16,822.8	0.0	0	0.0
	Fish smoking	1,104.0	1	1,104.0	0.0	0	0.0
	Restaurants	12,000.0	2	24,000.0	2,031.6	2	4,063.2
	Smelting	0.0	0	0.0	1,880.4	11	20,684.4
<b>TOTAL CONSUMPTION</b>				<b>80,293.2</b>			<b>78,808.8</b>
Mbunju-mvuleni	Food vendors	6,727.6	4	26,910.4	0.0	0	0.0
	Pottery	1,824.0	1	1,824.0	0.0	0	0.0
	Restaurants	6,840.0	1	6,840.0	634.8	1	634.8
<b>TOTAL CONSUMPTION</b>				<b>35,574.4</b>			<b>634.8</b>

### 4.3 Present chain of actors

Fuelwood availability from the primary producer up to the end user in both places is facilitated through the following chain of actors:

#### Those who collect fuelwood, transport and use it themselves.

At the time of the field survey, these constituted about 52% of the households in Ikwiriri township and 93% of the households in Mbunju - Mvuleni village. Almost 100% of the actors in this chain are women. In the commercial sector 16% in Ikwiriri and 50% in Mbunju - Mvuleni collect fuelwood themselves. The majority of actors are also women.

#### Those who only buy fuelwood/charcoal and use it.

In the household sector 48% of respondents in Ikwiriri Township were purchasing fuelwood/charcoal while the figure for Mbunju - Mvuleni was 7%. In the commercial sector 84% of respondents in Ikwiriri Township were purchasing fuelwood/charcoal while the figure for Mbunju - Mvuleni was 50%.

#### Those who collect fuelwood/make charcoal transport and sell to users themselves in the market.

A total of 21 people out of a list of 52 charcoal sellers in Ikwiriri Township provided by REMP and Ward authorities were interviewed during the field survey. About 50% of those interviewed were women. In the area of selling fuelwood, a total of 10 people were interviewed out of a list of 38 fuelwood sellers provided. Around 60% of interviewees were women.

#### Those who collect fuelwood / make charcoal in the forests in great quantities and sell to others on wholesale basis.

It was learned that, these actors are subcontracted to produce large quantities of fuelwood / charcoal for markets outside Ikwiriri Township and Mbunju - Mvuleni village.

### **Transporters.**

These transport logs, poles, fuelwood and charcoal from the primary source to the markets and are not involved in selling it to users. Transporters were all men.

### **Medium scale industries involved in production of wood products.**

At the time of the field survey three wood product-processing industries were operating. These were:

- Badr E.A. Enterprises - processing timber,
- Portfolio Investment Company Ltd. – processing timber, and
- Mahmood International Ltd. – processing Mpingo for export only.

All the owners of the saw- mills are men originating outside Coast region.

## **4.4 Utilisation efficiency of fuelwood and charcoal in the commercial sector**

### **4.4.1 General**

The fuelwood energy transformation process from the primary energy source to the end product required (i.e. cooked food, fired pots, knives, etc) involves many energy conversion systems and management of operations. Efficiency of energy demanding operations depend on the energy conversion devices that are used to extract energy from the fuel, management of the operations and the energy demand required to process the product. Based on the interviews conducted in Ikwiriri Township and Mbunju - Mvuleni village, energy conversion operations are carried out using traditional methods.

### **4.4.2 Cooking**

Over 90 percent of the total energy in Ikwiriri Township and Mbunju - Mvuleni village is used for cooking operations. Cooking operations include boiling, frying/roasting and simmering. The types of food cooked in the areas are cassava, maize, rice, sorghum, fish, beans and meat. Almost all respondents interviewed were using three stone woodstoves or cylindrical traditional metal charcoal stoves. According to various studies carried out (Hifab & TaTEDO 1998, Ruth & Cornelia 1985), the efficiencies of such stoves range between 10 - 15% for three stone woodstoves and 15 – 26% for cylindrical metal charcoal stoves. These efficiencies are considered on the low side compared to new technologies with efficiencies ranging from 30 – 44% (Anja 1995, GATE 1984, Ruth & Cornelia 1985). Wide use of improved fuelwood and charcoal stoves could reduce fuelwood and charcoal consumption in the commercial sector.

### **4.4.3 Smelting**

Based on data from interviewees, smelting activities consume about 8% of the total energy consumed by the commercial sectors. Smelting is mainly carried out on a small-scale basis only in Ikwiriri Township. The processes comprise smelting of scrap metals to produce hoes, axes and knives for local use. The methods used include hand driven air blower stoves (at SIDO) and simple traditional methods whereby fuel is fired on top of the metal until it starts melting. The average efficiency of both methods was not estimated as no smelting activity was in the process during the field survey. However, the method used by SIDO has higher efficiency than the traditional method. With the exception of SIDO, none of the remaining commercial sectors interviewed was using improved efficiency technologies. Based on the data provided by one of the smelters using traditional method 37 kg of charcoal (equivalent to 1 bag of charcoal) melts enough metal to produce 400 knives or 40 hoes of normal sizes. Neither hoes nor knives were available for weighing during the survey.

### **4.4.4 Fish smoking**

Fishing activities in Ikwiriri Township and Mbunju - Mvuleni village are undertaken on a household basis mainly to bridge the income gap. Rectangular racks (0.5 m high) with meshed, small pieces of

wood on top are used as smoking devices. Based on the information provided by a single fish smoking respondent, the average consumption is 23 kg for smoking 50 – 100 fishes of normal sizes depending on the type of fish and moisture content of wood. In the absence of smoked fish during the field survey, the weights were not estimated. According to existing practices, about 1m<sup>3</sup> of solid wood is used to smoke 1 tonne of fish (ESMAP 1988, Mbise et al. 1994).

#### 4.4.5 Pottery

The field survey revealed that pottery in both places is a specialised activity. It is carried out by a few women over 45 years of age on a part time basis during dry seasons. From respondents' view, young women are reluctant to involve themselves in pottery activities. One of the respondents indicated an average consumption of 76kg of wood to fire 20 pots with an average diameter of 25cm each.

### 4.5 Geographical sources of fuelwood and charcoal and their supply potential

#### 4.5.1 General

Main sources of fuelwood and charcoal for Ikwiriri Township are:

- Farmland trees in all the nine villages of Ikwiriri.
- Woodlands surrounding Ikwiriri Township namely: Msimo, Mara, Segeni and Roja. Most villagers simply call the woodlands "Mapori".
- Forest reserves (FR) namely: Nyumburuni FR, Ruhoi River FR and Ngulakula FR.
- Residues from 3 sawmills in Ikwiriri Township.

Main sources of fuelwood and charcoal for Mbunju - Mvuleni village are:

- Farmland trees within the village.
- Woodlands surrounding the village (Mapori).
- Ruhoi River Forest Reserve.

With the exception of fuelwood collected from farmland trees, villagers from Mgomba Ward in Ikwiriri Township and those of Mbunju - Mvuleni collect fuelwood and charcoal from the same wood resources.

#### 4.5.2 Wood supply potential from farmlands

A total of 22 temporary plots with an area of 0.071ha were established to estimate the existing number of trees in farmland. A total of 15 plots were established in Ikwiriri (Table 8) and 7 plots in Mbunju - Mvuleni (Table 9). Results showed that the average number of trees in farmlands per ha in Ikwiriri is about 61 trees and in Mbunju - Mvuleni it is about 52 trees (Table 10). Twelve different tree species were found in the farmlands of Ikwiriri (Table 8) of which *Anacardium occidentale* (Cashew) trees accounted for 45 percent of the total trees counted and *Mangifera indica* (Mango) accounted for 23 percent. Contributions of other species ranged from 2 – 5 percent.

A total of 10 different tree species were found in the farmlands of Mbunju - Mvuleni (Table 9). *Anacardium occidentale* trees accounted for 23 percent of the total trees counted. Contributions of the other tree species ranged from 15 to 8 percent. Compared to Ikwiriri, Mbunju - Mvuleni had a more balanced distribution of tree species in farmland.

Dry twigs and branches from farmland trees are collected for fuelwood as soon as they are available. Pruned branches from *Anacardium occidentale* and *Mangifera indica* trees are also used for fuelwood. Data on quantities of fuelwood obtained from farmland trees were difficult to get due to un-systematic collection patterns. Villagers call collection of fuelwood from farmland "kuokoteza"- complimentary fuelwood, which is collected whenever available to compliment collected fuelwood bundles from the woodlands.

Discussions and data obtained from measurements of sample fuelwood used by households per day for cooking, showed that about 40-50% of used fuelwood was from farmland, composed mainly of *Anacardium occidentale* and *Mangifera indica*. Around 90 percent of women interviewed, indicated that the use of farmland trees for fuelwood supply was increasing rapidly due to difficulties of getting dry fuelwood from the surrounding woodlands.

In spite of the increasing trend of fuelwood supply from farmlands, villagers were not active in tree planting. Uncontrolled roaming goats in the study area were eating and destroying young trees. The roaming goats were reported to be the main limiting factor to tree planting. Proper pollarding of mango trees, and pruning of cashew trees could enhance supply of fuelwood in the study area. Compared to other parts of Tanzania, the intensity of around 60 trees per ha in farmlands of the study area could be satisfactory if continuous tree planting to replace old trees takes place. For example the intensity of farmland trees in the floodplains (wetland areas) of Tabora region is reported to be around 15 trees per ha (DANIDA 1999).

#### 4.5.3 Woodlands

Woodlands surrounding Ikwiriri Township and Mbunju - Mvuleni village are mainly secondary regeneration with dense growth of shrubs and small trees. The woodlands are not managed and people are allowed to use them as they wish without any restrictions. Fuelwood collection was intensive within a distance of 3-4 km from the village boundaries. However, availability of dry wood for fuelwood was small. Women interviewed indicated that in the past it was easy to get dry fuelwood from logging residues. Currently logging is very low in the woodlands due to the unavailability of timber saw-log size (Malimbwi 2000, Herlocker 1999, Graham et al. 2000). The estimated standing volume of trees and shrubs in the open woodlands was around 49 tonnes (70m<sup>3</sup>) per ha with a mean annual increment of around 1.4 tonnes (2 m<sup>3</sup>) per ha. (Chidumayo 1997, Malimbwi, 2000, Kaale & Temu 1985). Observations showed that intensive harvesting of poles (rafters) and withies for house construction, were taking place in the open woodlands. In general tree intensity in the woodlands within 4-5 km from the vicinity of Ikwiriri and Mbunju - Mvuleni was declining rapidly.

#### 4.5.4 Forest reserves

Boundaries of Forest Reserves surrounding Ikwiriri and Mbunju - Mvuleni are not demarcated on the ground, hence villagers do not differentiate between public land and forest reserves with regard to their utilisation freedom. Public lands and forest reserves are all called "Mapori" by villagers. Visits were made to Nyumburuni FR and Ruhoi River FR. Very few timber species with suitable timber logs were observed in the forest. Malimbwi (2000) estimated that allowable harvesting from the forest reserves visited should be between 1-2 trees per ha with an average of 1.4 tonnes (2 m<sup>3</sup>) per ha per annum. Discussions were held with 15 villagers (all men) found collecting poles from Nyumburuni FR. The villagers indicated that it is getting increasingly difficult to find quality poles of desired species. Reasons for the unavailability of quality poles from the forest were stated to include:

- Increase of poles harvesting from the FR without control.
- Decline of logging residues some of which were used for poles production.

Based on Malimbwi (2000) the estimated total standing volume of trees per ha with diameter at breast height above 1 cm in the miombo woodlands and forest reserves surrounding Mbunju - Mvuleni village and Ikwiriri Township is about 83 tonnes (118 m<sup>3</sup>) and average volume increment per annum per ha is between 1.4 – 2.1 tonnes (2-3 m<sup>3</sup>). Sustainability of wood products from the forest reserves needs to take into account the multiple uses of the forest reserves and woodlands which include supply of: fuelwood, wood for charcoal production, poles, timber and other forest products like mushrooms, ropes, beekeeping etc.

Table 8: Temporary plots established in Ikwiriri township farmlands and GPS readings

Plots measured	Species		Uses		Number of trees found in each plot												Percent of each species to total
	Local name	Botanical name	Fruits	Income	Fuelwood	Poles	Mgomba kusini	Mgomba Kati	Mgomba Kask	Ikwiriri kusini	Ikwiriri Kati	Ikwiriri Kask	Umwe kusini	Umwe Kati	Umwe Kask	Total surveyed	
							1	0	4	5	0	0	3	1	1	15	
							6		8	1			4	5	5	29	
Mkorosho		Anacardium occidentale	X	X	X												
Mzambarau		Syzygium jambolana	X	X	X							2				2	
Mwembe		Mangifera indica	X	X	X			7		8						15	
Mkangwa		Acacia tortilis			X	X							1			1	
Mkayu		Ficus sycamoros			X					1						1	
		Sorindeai															
Mpilipili		madagascariensis			X	X				1						1	
Mjohoro		Senna siamea			X	X				3						3	
Mwegea		Kigelia africana			X	X				1			2			3	
Mtumba		Lannea shweiuifurthii			X	X										3	
Mtopetope		Anona senegalensis			X											3	
Mfuru		Vitex doniana			X	X							3			3	
Mkauruti					X	X				1						1	
<b>Total trees measured</b>							<b>6</b>		<b>21</b>	<b>16</b>			<b>12</b>	<b>5</b>	<b>5</b>	<b>65</b>	

Village	Plot No.	GPS Readings		Village	Plot No.	GPS Readings	
		North	East			South	East
Mgomba kaskazini	1	497290	9122856	Umwe kusini	8	7 59.845	38 58.115
Mgomba kaskazini	2	496786	9121998	Umwe kusini	9	7 58.139	38 59.475
				Umwe kati	10	7 56.981	38 59.423
				Ikwiriri kusini	11	8 00.288	38 57.813
Mgomba kaskazini	3	7 57.018	38 56.690	Ikwiriri kusini	12	7 59.325	38 58.369
Mgomba kaskazini	4	7 57.178	38 56.953	Ikwiriri kusini	13	7 58.665	38 59.259
Mgomba kusini	5	7 57.228	38 58.336	Ikwiriri kusini	14	7 59.010	38 58.807
Umwe kaskazini	6	7 56.277	38 59.166	Ikwiriri kusini	15	8 01.302	39 00.541

**Table 9: Temporary plots established in farmlands of Mbunju - Mvuleni and GPS readings**

Number of plots measured	7
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Species		Uses					Trees found	Percent to total
Local name	Botanical name	Fruits	Income	Fuelwood	Poles	Timber		
<i>Mkorosho</i>	<i>Anacardium occidentale</i>	X	X	X			6	23
<i>Mvumo</i>	<i>Borassus aethiopium</i>	X			X		3	12
<i>Mzambarau</i>	<i>Syzygium jambolana</i>	X	X	X			3	12
<i>Mwembe</i>	<i>Mangifera indica</i>	X	X	X			2	8
<i>Mkangwa</i>	<i>Acacia tortilis</i>			X	X		4	15
<i>Mkuyu</i>	<i>Ficus sycomorus</i>			X			1	4
<i>Mpakasa</i>	<i>Deinbolia borbonica</i>			X	X		1	4
<i>Mwegea</i>	<i>Kigelia africana</i>			X			1	4
<i>Myembayemba</i>	<i>Antidesma vernosum</i>			X	X		2	8
<i>Mnyamwea</i>	<i>Lonchocarpus capassa</i>			X	X	X	3	12
<b>Total trees measured</b>							<b>26</b>	<b>100</b>

Village	Plot No.	GPS Reading	
		South	East
Mbunju - Mvuleni	1	7 55.727	38 52.272
Mbunju - Mvuleni	2	7 55.543	38 52.024
Mbunju - Mvuleni	3	7 55.310	38 51.792
Mbunju - Mvuleni	4	7 55.238	38 51.458
Mbunju - Mvuleni	5	7 56.560	38 55.647
Mbunju - Mvuleni	6	7 56.737	38 55.903
Mbunju - Mvuleni	7	7 56.206	38 53.662



Table 10: Estimated number of trees per ha in farmlands of Ikwiriri and Mbunju - Mvuleni

IKWIRIRI					
Villages	Plot No.	Plot Radius (m)	Plot Area (ha)	Number of trees counted	Estimated number of trees per Ha.
Mgomba Kas	1	15	0.071	7	99
Mgomba Kas	2	15	0.071	7	99
Mgomba Kas	3	15	0.071	5	70
Mgomba Kas	4	15	0.071	2	28
Mgomba Kusini	5	15	0.071	6	85
Umwe Kas	6	15	0.071	5	70
Umwe Kusini	7	15	0.071	5	70
Umwe Kusini	8	15	0.071	4	56
Umwe Kusini	9	15	0.071	3	42
Umwe Kati	10	15	0.071	5	70
Ikwiriri Kusini	11	15	0.071	5	70
Ikwiriri Kusini	12	15	0.071	3	42
Ikwiriri Kusini	13	15	0.071	4	56
Ikwiriri Kusini	14	15	0.071	0	0
Ikwiriri Kusini	15	15	0.071	4	56
<b>Total</b>				<b>65</b>	<b>915</b>
<b>Average number of trees per Ha</b>					<b>61</b>

MBUNJU - MVULENI					
Villages	Plot No.	Plot Radius (m)	Plot Area (ha)	Number of trees counted	Estimated number of trees per Ha.
Mvuleni	1	15	0.071	3	42
Mvuleni	2	15	0.071	4	56
Mvuleni	3	15	0.071	4	56
Mvuleni	4	15	0.071	1	14
Mbunju	5	15	0.071	8	113
Mbunju	6	15	0.071	3	42
Mbunju	7	15	0.071	3	42
<b>Total</b>				<b>26</b>	<b>366</b>
<b>Average number of trees per Ha</b>					<b>52</b>

**4.5.5 Residue from sawmills and carpentry workshops**

Residue from three sawmills at Ikwiriri are contributing about 612 tonnes (874m<sup>3</sup>) of fuelwood and about 1,193 tonnes of charcoal to the local market. Sawmill waste included sawdust, slabs and off-cuts. Most of the sawdust is burned within the sawmill compounds. However, it was reported that seven households in the study area were using sawdust as a source of energy for cooking. Sawdust could therefore be a potential alternative source of energy in Ikwiriri Township. Names of the sawmills and their estimated contribution of fuelwood and charcoal per annum are summarised in Table 11. Appendix 13 provides details of the individual sawmills with regards to the main tree species used, log inputs and amount of sawmill residue produced.

Observations in the study area showed that people were collecting wood shavings and small pieces of wood from carpentry workshops for lighting charcoal and fuelwood. However, quantities of residue from carpentry workshops in the study area were very small.

**Table 11: Quantities of sawmill residues produced and used for fuelwood and charcoal at Ikwiriri per annum**

<b>Name of sawmill</b>	<b>Estimated residue in m<sup>3</sup></b>	<b>Estimated amount of residues used for charcoal production m<sup>3</sup></b>	<b>Estimated amount of residues used for fuelwood m<sup>3</sup></b>
Badr E.A Enterprise Ltd.	750	600	150
Portfolio Investment Company Ltd.	1380	1104	276
Mahmood International Ltd.	449	0	449
<b>Total in m<sup>3</sup></b>	<b>2579</b>	<b>1704</b>	<b>875</b>
Weight in tonnes with wood density of 0.7 per m <sup>3</sup> of solid wood	<b>1805.3</b>	<b>1192.8</b>	<b>612.5</b>

#### 4.6 Profitability in fuelwood and charcoal business

Fuelwood and charcoal production/selling provide an alternative source of income besides agriculture to residents of Ikwiriri Township and Mbunju - Mvuleni village. However, the survey showed that profitability in fuelwood and charcoal business based on Ikwiriri and Mbunju - Mvuleni consumers was very low. Profit per month excluding labour charges of selling and handling fuelwood was around Tsh. 4,176 for women purchasing and selling fuelwood. For women collecting free fuelwood from the forest and selling it, their average profit per month excluding labour charges was around Tsh. 18,174 (Table 12). Observations also showed that, the average income status of the majority of fuelwood and charcoal sellers at a retail level was very low. However, it is recommended to conduct more detailed studies on the profitability of fuelwood and charcoal in the study area as data presented in Table 12 was based on respondent responses. In most cases, business people tend to report lower income and profit levels.

The profit margin for charcoal sellers was also very low. For people producing and selling their charcoal themselves, average monthly profit excluding their labour cost was around Tsh. 62,077. For those buying charcoal and selling in retail, their average monthly profit excluding labour was Tsh 15,286 (Table 12).

Fuelwood and charcoal business in Ikwiriri Township and Mbunju - Mvuleni is on a small scale due to the low population and low purchasing power of the majority of households. Despite this, fuelwood and charcoal business is providing some income to people with few other alternative sources of income.

Sale of charcoal to Dar es Salaam on a large scale was reported by village leaders to be a profitable activity. However, large-scale charcoal dealers in the study area ran away from the survey team. Village leaders indicated that some of the reasons which made the large scale charcoal dealers avoid the study team were:

They do not pay forest fees for making and selling charcoal on a commercial basis.

They do not have a business license.

They do not pay District Taxes or VAT.

Large-scale charcoal producers can cause severe deforestation, hence their operations should be studied in the future through indirect methods.

Table 12: Profitability table

A) Fuelwood Profitability

No	Purchasing Price (Tsh) per bundle	Total sold bundles per day	Unit	Selling price (Tshs)	Unit	Total collec. per day (Tsh)	Trans. cost per bundle (Tsh)	Trans. cost per day (Tshs)	Labor (Tshs) (opp. cost)	Tools (Tshs)	Total prod. Cost (Tshs)	Profit per day (Tshs)	Profit per month (Tshs)
1	0.00	4	Bundle	200	Bundle	800	0.0	0.0	0	2.19	2.19	797.81	23,934.30
2	400.00	10	Bundle	70	Bundle	700	200.0	166.7	0	0	533.33	166.67	5,000.10
3	400.00	10	Bundle	60	Bundle	600	200.0	166.7	0	0	533.33	66.67	2,000.10
4	400.00	5	Bundle	100	Bundle	500	200.0	66.7	0	0	333.30	166.70	5,001.00
5	300.00	6	Bundle	100	Bundle	600	400.0	133.3	0	0	500.00	100.00	3,000.00
6	0.00	6	Bundle	100	Bundle	600	0.0	0.0	0	2.19	2.19	597.81	17,934.30
7	0.00	10	Bundle	100	Bundle	1000	0.0	0.0	0	2.19	2.19	997.81	29,934.30
8	0.00	5	Bundle	100	Bundle	500	0.0	0.0	0	2.19	2.19	497.81	14,934.30
9	0.00	2	Bundle	70	Bundle	140	0.0	0.0	0	2.19	2.19	137.81	4,134.30
10	800.00	8	bundle	70	Bundle	560	300.0	24.0	0	0	364.00	196.00	5,880.00
<b>Average profit for fuelwood producers/sellers</b>												<b>18,174.30</b>	
<b>Average profit for fuelwood sellers</b>												<b>4,176.24</b>	

Table 12 continued: B) Charcoal Profitability

No	Purchasing Price (Tsh) per bundle	Total sold bundles per day	Unit	Selling price (Tshs)	Unit	Total collec. per day (Tsh)	Trans. cost per bundle (Tsh)	Trans. cost per day (Tshs)	Labor (Tshs) (opp. cost)	Tools (Tshs)	Total prod. Cost (Tshs)	Profit per day (Tshs)	Profit per month (Tshs)
1	0.00	5	bag	1200	per bag	6000	0.0	0.0	0	2.19	2.19	5,997.81	179,934.30
2	1,200.00	0.5	bag	1500	per bag	750	100.0	50.0	0	0.00	650.00	100.00	3,000.00
3	1,200.00	0.5	bag	1500	per bag	750	0.0	0.0	0	0.00	600.00	150.00	4,500.00
4	1,200.00	1	bag	1500	per bag	1500	0.0	0.0	0	0.00	1,200.00	300.00	9,000.00
5	0.00	1	bag	1200	per bag	1200	0.0	0.0	0	2.19	2.19	1,197.81	35,934.30
6	1,200.00	3	bag	1500	per bag	4500	0.0	0.0	0	0.00	3,600.00	900.00	27,000.00
7	0.00	1	bag	1200	per bag	1200	0.0	0.0	0	2.19	2.19	1,197.81	35,934.30
8	0.00	2	bag	1500	per bag	3000	0.0	0.0	0	2.19	2.19	2,997.81	89,934.30
9	1,500.00	7	tin	80	per tin	560	0.0	0.0	0	0.00	283.78	276.22	8,286.60
10	1,500.00	8	tin	100	per tin	800	0.0	0.0	0	0.00	324.32	475.68	14,270.40
11	750.00	3	bag	1500	per bag	4500	400.0	1,200.0	0	0.00	3,450.00	1,050.00	31,500.00
12	1,000.00	20	tin	100	per tin	2000	200.0	300.0	0	0.00	840.54	1,159.46	34,783.80
13	1,500.00	3	bag	2000	per bag	6000	400.0	1,200.0	0	0.00	5,700.00	300.00	9,000.00
14	0.00	1	bag	1300	per bag	1300	0.0	0.0	0	2.19	2.19	1,297.81	38,934.30
15	1,200.00	3	tin	70	per tin	210	0.0	0.0	0	2.19	99.49	110.51	3,315.30
16	1,400.00	12	tin	80	per tin	960	0.0	0.0	0	2.19	456.25	503.75	15,112.50
17	1,200.00	4	tin	80	per tin	320	0.0	0.0	0	2.19	131.92	188.08	5,642.40
18	0.00	1	bag	1200	per bag	1200	0.0	0.0	0	2.19	2.19	1,197.81	35,934.30
19	1,000.00	1	bag	1500	per bag	1500	0.0	0.0	0	2.19	56.25	1,443.75	43,312.50
20	0.00	0.5	bag	1200	per bag	600	0.0	0.0	0	2.19	2.19	597.81	17,934.30
21	1,500.00	3	tin	100	per tin	300	0.0	0.0	0	2.19	123.81	176.19	5,285.70
<b>Average profit for charcoal producers/sellers</b>												<b>62,077.16</b>	
<b>Average profit for charcoal sellers</b>												<b>15,286.37</b>	

## **4.7 Transportation methods of fuelwood and charcoal**

### **4.7.1 Ikwiriri Township**

The main methods that are being used to transport fuelwood and charcoal from the source in Ikwiriri are manual (by head loads) and bicycles. Others - on a small scale, include carts and motorized vehicles. Out of 311 respondents using fuelwood in Ikwiriri Township about 89.1% were using the manual method, 9.7% bicycles, 0.9% carts and 0.3% motorised vehicles. As far as charcoal is concerned, 169 charcoal users were interviewed. It was revealed that, 92.3% of them are using manual methods, 7.1% bicycles and 0.6% carts.

### **4.7.2 Mbunju - Mvuleni village**

Fuelwood and charcoal were transported manually and by bicycles in Mbunju - Mvuleni village. Out of 47 respondents using fuelwood, 92% were using manual transport and 8% were using bicycles. For charcoal, 11 respondents were interviewed of which 64% were transporting charcoal manually and 36% were using bicycles.

## **4.8 Authority for harvesting fuelwood and charcoal**

The survey revealed that fuelwood and charcoal are collected free from village woodlands and forest reserves without obtaining any authority.

## **5 Opportunities for improving utilisation efficiency of fuelwood and charcoal**

### **5.1 General**

The field survey revealed three sectors consuming fuelwood and charcoal in Ikwiriri Township and Mbunju - Mvuleni village. These are:

- Household sector. In the household sector fuelwood and charcoal are used for cooking, ironing, heating and lighting.
- Commercial sector. Uses of fuelwood and charcoal in the commercial sector include: catering (mainly cooking in hotels, bars, restaurants, brewing, etc), fish smoking, smelting of metals and pottery.
- Institutional sector. Various institutions in the study area were using fuelwood and charcoal for cooking and water heating.

With the exception of FDC - which has an improved institutional fuelwood stove, and two households - which were using improved charcoal stoves, the rest of fuelwood and charcoal users interviewed were using stoves with low energy efficiency. Based on TaTEDO experiences, there is a high potential for improving the utilisation efficiency of fuelwood and charcoal in Ikwiriri Township and Mbunju - Mvuleni village in all three consumption sectors.

### **5.2 Fuelwood utilisation efficiency with three stone stoves**

All respondents using fuelwood in Ikwiriri Township and Mbunju - Mvuleni village indicated they were using three stone stoves for cooking purposes with thermal efficiency of 10 – 15%. Experiences from other parts of Tanzania have shown that the efficiency of three-stone wood stoves can be improved to around 30% by constructing mud woodstoves. Commonly used mud stoves for households were found to be portable ceramic woodstoves and portable metal ceramic woodstoves. Brick fired woodstoves that can be used in both households and institutions also exist. Most of the materials that are required for constructing improved stoves outlined above are available in Ikwiriri Township and Mbunju - Mvuleni village.

### **5.3 Charcoal utilisation efficiency with traditional charcoal metal stoves**

Regarding charcoal, all charcoal user respondents in the study area indicated that they were using traditional cylindrical charcoal metal stoves. The efficiency of such stoves is reported to be around 15 – 26% (OECD/IEA 1997, Patience et al. 1992) but could be improved to about 30 – 44% using available local materials and skills in the study area.

### **5.4 Awareness on fuelwood and charcoal utilization efficient methods**

The survey revealed that 18% of the households surveyed in Ikwiriri Township were aware of improved charcoal stoves and 82% of the households were not aware of the technology. In Mbunju - Mvuleni village, about 24% of the surveyed households were aware of improved charcoal stoves but 76% were not aware (Table 13).

Among institutions surveyed, the Ikwiriri Folk Development College was the only one using improved stoves with efficiencies of 35% for cooking and baking.

Respondents with some awareness of improved stoves, indicated that they got the information from SIDO-Ikwiriri, radio programmes and from friends coming from Dar es Salaam.

**Table 13: Awareness on improved stoves and willingness to learn about improved stoves**

Village Name	Total Household surveyed	Heard about improved stoves				Total		Willing to learn about Improved stoves				Total	
		Yes	%	No	%	Figure	%	Yes	%	No	%	Figure	%
Mgomba kusini	54	8.0	14.8	46.0	85.2	54.0	100.0	53.0	98.1	1.0	1.9	54.0	100.0
Mgomba kati	44	10.0	22.7	34.0	77.3	44.0	100.0	44.0	100.0	0.0	0.0	44.0	100.0
Mgomba kaskazini	31	6.0	19.4	25.0	80.6	31.0	100.0	30.0	96.8	1.0	3.2	31.0	100.0
Ikwiriri kusini	71	16.0	22.5	55.0	77.5	71.0	100.0	66.0	93.0	5.0	7.0	71.0	100.0
Ikwiriri kati	21	4.0	19.0	17.0	81.0	21.0	100.0	21.0	100.0	0.0	0.0	21.0	100.0
Ikwiriri kaskazini	18	2.0	11.1	16.0	88.9	18.0	100.0	18.0	100.0	0.0	0.0	18.0	100.0
Umwe kusini	36	5.0	13.9	31.0	86.1	36.0	100.0	36.0	100.0	0.0	0.0	36.0	100.0
Umwe kati	58	7.0	12.1	51.0	87.9	58.0	100.0	55.0	94.8	3.0	5.2	58.0	100.0
Umwe kaskazini	28	7.0	25.0	21.0	75.0	28.0	100.0	27.0	96.4	1.0	3.6	28.0	100.0
<b>SUMMARY IKWIRIRI TOWNSHIP</b>	<b>361</b>	<b>65.0</b>	<b>18.0</b>	<b>296.0</b>	<b>82.0</b>	<b>361.0</b>	<b>100.0</b>	<b>350.0</b>	<b>97.0</b>	<b>11.0</b>	<b>3.0</b>	<b>361.0</b>	<b>100.0</b>
<b>MBUNJUMVULENI</b>	<b>49</b>	<b>12.0</b>	<b>24.5</b>	<b>37.0</b>	<b>75.5</b>	<b>49.0</b>	<b>100.0</b>	<b>49.0</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>	<b>49.0</b>	<b>100.0</b>



### 5.5 Previous extension services on improving efficiency of fuelwood and charcoal utilisation

The survey revealed that 96% of respondents in Ikwiriri Township and 100% in Mbunju - Mvuleni village, had not received extension services on improved fuelwood and charcoal efficient stoves for the past five years (Table 14). It was noted that the prevailing low knowledge on uses of energy saving stoves is due to un-availability of extension services (IIRR 1998, Ruth & Cornelia 1985).

**Table 14: Percentage of households that had received extension services on improving efficiency of fuelwood and charcoal utilisation**

VILLAGE NAME	% which had received extension services	% which had not received extension services
Mgomba kusini	4	96
Mgomba kati	0	100
Mgomba kaskazini	0	100
Umwe kusini	2	98
Umwe kati	0	100
Umwe kaskazini	2	98
Ikwiriri kusini	0	100
Ikwiriri kati	10	90
Ikwiriri kaskazini	0	100
<b>Summary of Ikwiriri Township</b>	<b>4</b>	<b>96</b>
<b>Mbunju - Mvuleni</b>	<b>0</b>	<b>100</b>

### 5.6 Potential for improving the efficiency of fuelwood and charcoal cooking methods

The field survey revealed that 100% of fuelwood users interviewed in Ikwiriri Township and Mbunju - Mvuleni village were using three stone woodstoves with low energy efficiency. However, of all the charcoal users interviewed in Ikwiriri Township, 1% (2 households out of 169 households using charcoal) were using improved ceramic charcoal stoves, whilst the remaining 99% were using traditional metal charcoal stoves. All charcoal users in Mbunju - Mvuleni village are using traditional metal charcoal stoves.

The willingness of respondents to learn about improved fuelwood and charcoal stoves were 97% in Ikwiriri Township and 100% in Mbunju - Mvuleni village (Table 13). This high willingness shows the potential for introducing a programme for production and utilisation of improved fuelwood, charcoal and residue stoves for household, commercial and institutions in the study area.

### 5.7 Potential for improving charcoal production

#### 5.7.1 General information about charcoal production

The simplest method of upgrading the value of wood as fuel is to convert it to charcoal. Charcoal production offers a rational means of utilising wood wastes, as it can be produced from logging residues, sawmill wastes and wood cleared for agricultural expansion – these materials are available in Ikwiriri and Mbunju - Mvuleni.

Traditional earth kilns are mainly used for charcoal production in Tanzania. The recovery percent of traditional kilns is reported to range from 8-15% on a weight basis (FAO 1983, Kaale 1985, Susan 1991). However, research in Tanzania and other African countries has shown that the recovery of earth

kilns can be improved to around 25 percent (on weight basis) through proper selection and treatment of fuelwood and management of the kiln during the carbonisation period.

### **5.7.2 Charcoal production method used in Ikwiriri and Mbunju - Mvuleni**

Ikwiriri Township charcoal producers are using earth mould kilns. Due to non-availability of technical assistance on improved charcoal production by using earth kilns, the recovery percent of wood used for charcoal production in Ikwiriri hinterland is low; on average 10% on weight basis.

Factors contributing to low charcoal recovery that could be improved through training and extension services to charcoal makers include:

- Mixing of dry and wet fuelwood in the same kiln. (It is recommended to use air dry fuelwood).
- Use of different trees species with different burning characteristics.
- Use of different sizes of fuelwood, ranging from large diameter logs to small diameter twigs.
- Poor loading of the kilns, resulting in large air gaps. For high recovery, efforts should be made to pack the fuelwood as tightly as possible. Big gaps can be packed with smaller pieces of wood.
- Poor selection of kiln sites. For good recovery, the kiln site should be dry and well drained. Suitable soil will also enhance recovery. For example free and porous soils allow too strong an upward draught of air to pass through the burning wood, while soils that are too stiff cause the kiln to burn too slowly (Susan 1991).
- Wrong orientation of kilns in relation to wind direction. Wind provides even carbonisation, but will also lower the temperature of the kiln, this can increase carbonisation time. In very windy places, it is recommended to erect some form of windbreak to protect the kiln.
- Poor management of kilns during the carbonisation period. Traditional kiln temperatures can reach 400-500<sup>o</sup>C during pyrolysis. Regular kiln supervision day and night is required to check on the carbonisation progress. With poor management, many kilns burst into flames during carbonisation, resulting in very low charcoal recovery. Charcoal producers in Ikwiriri Township and Mbunju - Mvuleni village indicated that they do not supervise their kilns at night.

Low income by the majority of charcoal producers in Ikwiriri and Mbunju - Mvuleni could hinder use of more advanced charcoal production methods, such as use of brick kilns and portable steel kilns that require high initial capital investments (Kiwele et.al. 1999, Witold & Gerhard 1990). However, training of charcoal producers on how to improve recovery rates by using earth mould kilns, provides a good opportunity for increasing income of charcoal producers and environmental conservation in Ikwiriri Township and Mbunju - Mvuleni village.

### **5.8 Production of improved fuelwood and charcoal stoves**

Availability of suitable material (clay and scrap metal), skills in pottery and production of metal stoves, influences the successful production of improved fuelwood and charcoal stoves. With the exception of scrap metal that could easily be obtained from Dar es Salaam, the other components are readily available in Ikwiriri Township and Mbunju - Mvuleni village.

Possible types of stoves to be produced based on the needs of fuelwood and charcoal consumers include:

Improved fixed and portable fuelwood stoves (Figure 10).

Improved ceramic metal charcoal stoves (Figure 11).

Mpalange village (1.5 km from Ikwiriri Township centre) and Mgomba Kusini village were identified as suitable sources of clay soil for stove production in Ikwiriri Township. Widespread use of improved stoves will contribute to environmental conservation, as it will reduce the rate of deforestation and lessen emissions of carbon dioxide and other greenhouse gases which contribute to global warming.

## 6 Projection of fuelwood, charcoal and kerosene consumption

### 6.1 General

Projections of fuelwood, charcoal and kerosene consumption for the years 2000, 2005 and 2010 were made with the year 2000 as the baseline. The prevailing population growth rate of 2.3% per annum was used for projecting energy consumption up to 2010. Due to differences in the consumption pattern, projections were made for households and for the commercial sector.

### 6.2 Forecast of household fuelwood charcoal and kerosene consumption

Based on results from the survey, total consumption of fuelwood, charcoal and kerosene in the survey area for the year 2000 were calculated. A forecast up to 2010 was made based on two scenarios namely: continuing with present utilisation efficiency and adoption of improved fuelwood and charcoal stoves - which could reduce current per capita consumption levels of fuelwood and charcoal by around 40 %.

In scenario one - without the use of improved stoves, fuelwood, charcoal and kerosene consumption was forecasted up to 2010 (Table 15).

In scenario two - with the use of efficient fuelwood and charcoal stoves, consumption up to 2010 was forecasted. It was assumed that the introduction of efficient stoves to the study area will be as follows: by the end of 2005, approx. 20% of fuel wood users will be using improved stoves. By the 2010, the number of households using improved fuelwood stoves will be approx. 50% of the total households in the study area.

With regard to charcoal, it was assumed that by the end of 2005, around 30% of households will be using improved charcoal stoves and by the 2010 the number of households using improved charcoal stoves will reach 70%.

Data on the forecasted total fuelwood and charcoal consumption for years 2000, 2005 and 2010 using the two scenarios and savings that would be made by the use of improved stoves are summarised in Table 15 and Figure 12. Data from Table 15 and Figure 12 illustrate that savings to be made by using improved stoves are significant, hence the importance of supporting a programme of production and utilisation of improved stoves for Ikwiriri Township and Mbunju - Mvuleni village. For example, savings of fuelwood by use of improved fuelwood stoves in Ikwiriri for the year 2005 was estimated to be around 1,015 tonnes (1450 m<sup>3</sup>), and for the year 2010 it was estimated to be around 2,842 tonnes (4060 m<sup>3</sup>). Savings in Mbunju - Mvuleni were estimated to be 97 tonnes (138 m<sup>3</sup>) in 2005 and 271 tonnes (387 m<sup>3</sup>) in 2010.

Charcoal saving by using improved stoves could also be significant. For Ikwiriri Township, savings of charcoal for the year 2005 are 124 tonnes and for year 2010 are 323 tonnes. For Mbunju - Mvuleni village, savings are 8 tonnes for the year 2005 and 20 tonnes for the year 2010.

Improvement of kerosene utilisation was not considered. It was assumed that utilisation efficiency of kerosene will not change much between year 2000 and 2010 in Ikwiriri Township and Mbunju - Mvuleni village.

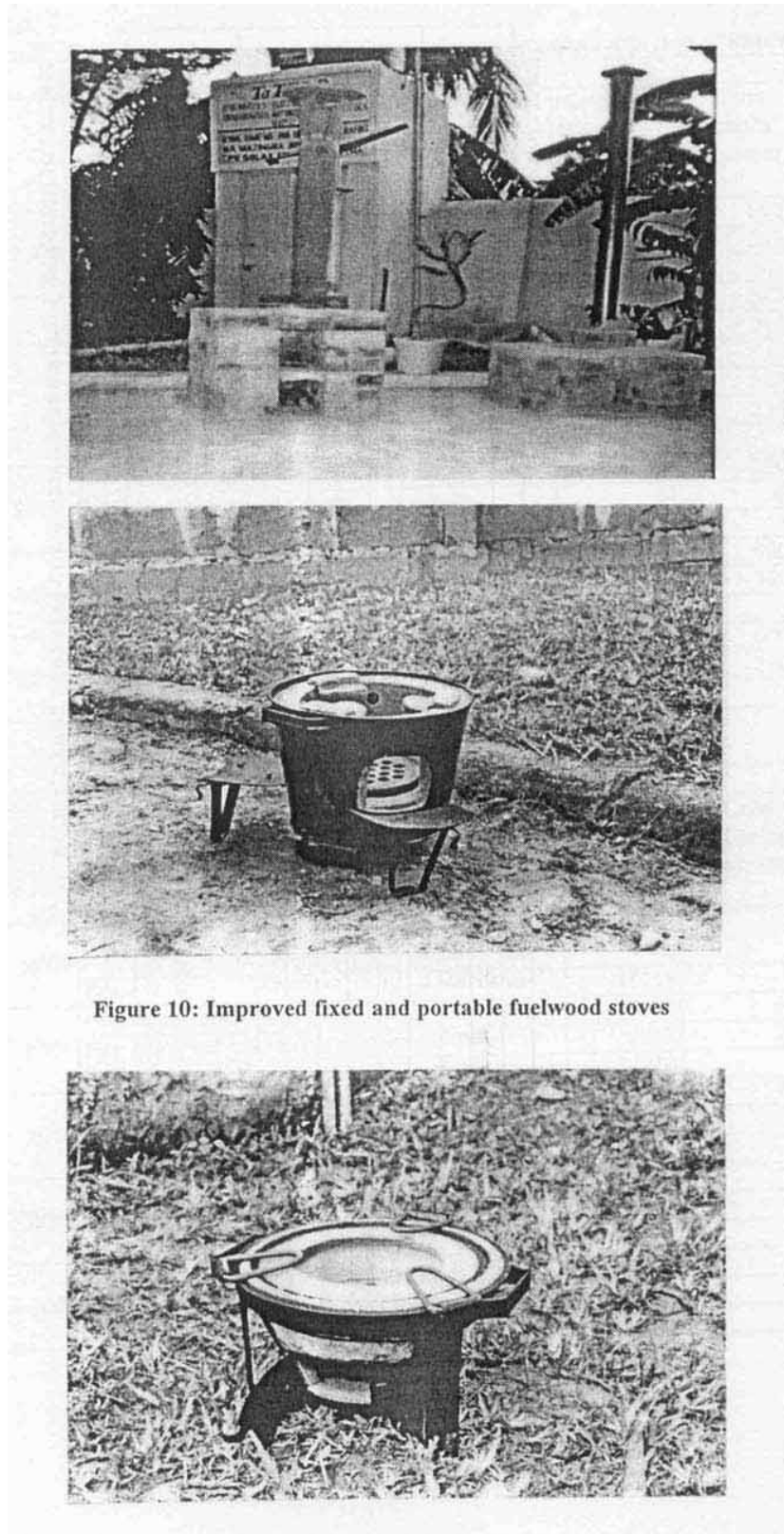


Figure 10: Improved fixed and portable fuelwood stoves

Figure 10 and Figure 11: Energy Efficient Stoves

**Table 15: Forecast of household fuelwood, charcoal and kerosene consumption**

(Without the use of improved fuelwood and charcoal efficient technologies)

Year	Village	Pop.	FUELWOOD		CHARCOAL		KEROSENE	
			Av. cons. per capita per annum Kg	Total cons. per annum Tonnes	Av. cons. per capita per annum KG	Total cons per annum Tonnes	Av. Cons. per capita per annum Litres	Total cons per annum Litres
2000	Ikwiriri township	21,669	523	11,333	42	910	7.7	166,851
	Mbunju Mvuleni	1,800	600	1,080	32	58	11.8	21,240
	<b>Total</b>	<b>23,469</b>		<b>12,413</b>		<b>968</b>		<b>188,091</b>
2005	Ikwiriri township	24,278	523	12,697	42	1,020	7.7	186,941
	Mbunju Mvuleni	2,017	600	1,210	32	65	11.8	23,801
	<b>Total</b>	<b>26,295</b>		<b>13,908</b>		<b>1,084</b>		<b>210,741</b>
2010	Ikwiriri township	27,201	523	14,226	42	1,142	7.7	209,448
	Mbunju Mvuleni	2,260	600	1,356	32	72	11.8	26,668
	<b>Total</b>	<b>29,461</b>		<b>15,582</b>		<b>1,215</b>		<b>236,116</b>

Source: Appendix 8, Table 3

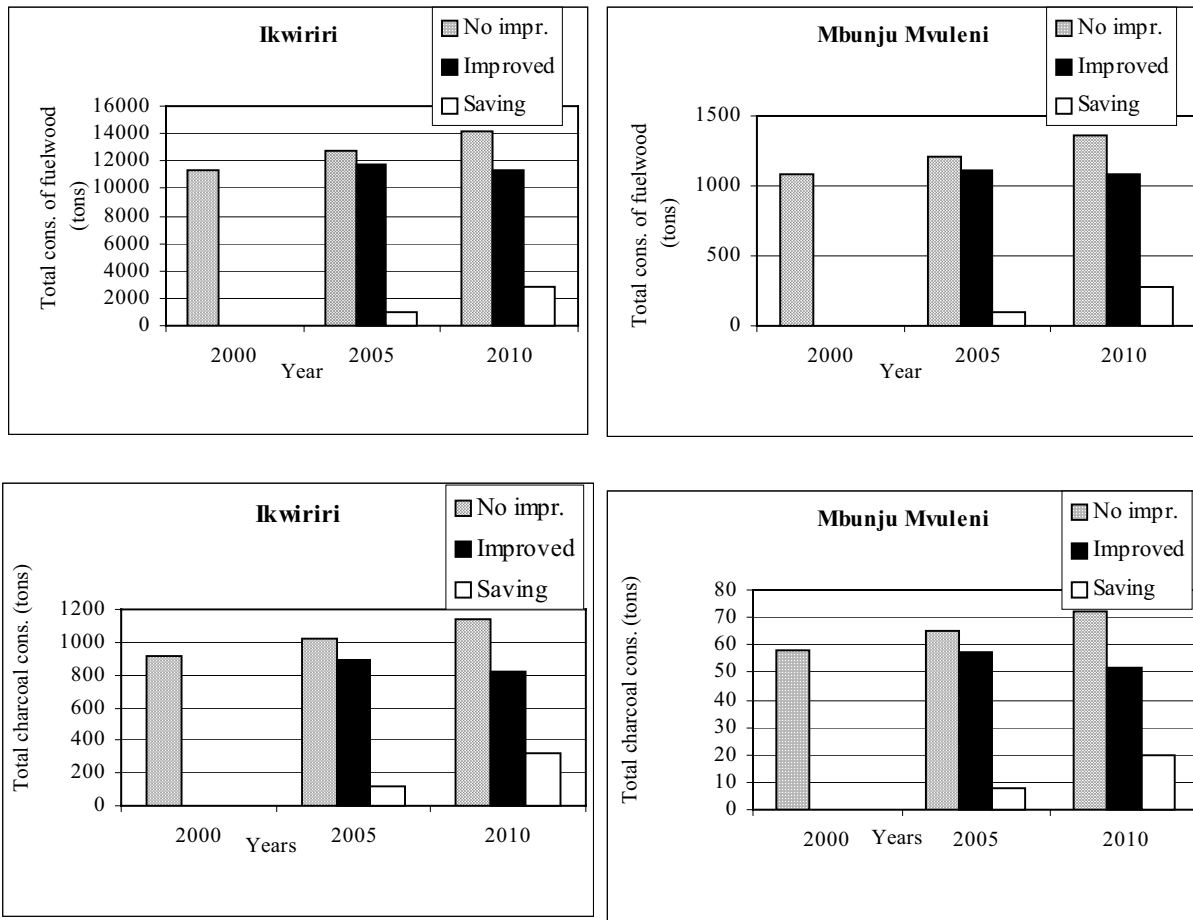
Table 16: Forecast of HH fuelwood and charcoal consumption with use of improved stoves

<b>FUELWOOD</b>					
	<b>Year</b>	<b>Description of population using different stoves</b>	<b>Number of people</b>	<b>Av. Cons per cap. per annum KG</b>	<b>Estimated total annual cons Tonnes</b>
Ikwiriri Township	2000	Pop using un-improved fuelwood stoves 100%.	21669	523	11333
		Pop using improved fuelwood stoves 0%	0	523	0
		<b>Total</b>	<b>21669</b>		<b>11333</b>
	2005	Pop using un-improved fuelwood stoves 80%	19422	523	10158
		Pop using improved fuelwood stoves 20%	4856	314	1525
		<b>Total</b>	<b>24278</b>		<b>11682</b>
	2010	Pop using un-improved fuelwood stoves 50%	13601	523	7113
		Pop using improved fuelwood stoves 50%	13600	314	4270
		<b>Total</b>	<b>27201</b>		<b>11384</b>
Mbunju Mvuleni village	2000	Pop using un-improved fuelwood stoves 100%	1800	600	1080
		Pop using improved fuelwood stoves 0%	0	0	0
		<b>Total</b>	<b>1800</b>		<b>1080</b>
	2005	Pop using un-improved fuelwood stoves 80%	1614	600	968
		Pop using improved fuelwood stoves 20%	403	360	145
		<b>Total</b>	<b>2017</b>		<b>1113</b>
	2010	Pop using un-improved fuelwood stoves 50%	1130	600	678
		Pop using improved fuelwood stoves 50%	1130	360	407
		<b>Total</b>	<b>2260</b>		<b>1085</b>
<b>CHARCOAL</b>					
	<b>Year</b>	<b>Description of population using different stoves</b>	<b>Number of people</b>	<b>Av. Cons per cap. per annum KG</b>	<b>Estimated total annual cons Tonnes</b>
Ikwiriri Township	2000	Pop using un-improved charcoal stoves 100%	21669	42	910
		Pop using improved charcoal stoves 0%	0	0	0
		<b>Total</b>	<b>21669</b>		<b>910</b>
	2005	Pop using un-improved charcoal stoves 70%	16995	42	714
		Pop using improved charcoal stoves 30%	7283	25	182
		<b>Total</b>	<b>24278</b>		<b>896</b>
	2010	Pop using un-improved charcoal stoves 30%	8160	42	343
		Pop using improved charcoal stoves 70%	19041	25	476
		<b>Total</b>	<b>27201</b>		<b>819</b>
Mbunju mvuleni village	2000	Pop using un-improved charcoal stoves 100%	1800	32	58
		Pop using improved charcoal stoves 0%	0	0	0
		<b>Total</b>	<b>1800</b>		<b>58</b>
	2005	Pop using un-improved charcoal stoves 70%	1412	32	45
		Pop using improved charcoal stoves 30%	605	19	11
		<b>Total **</b>	<b>2017</b>		<b>57</b>
	2010	Pop using un-improved charcoal stoves 30%	678	32	22
		Pop using improved charcoal stoves 70%	1582	19	30
		<b>Total</b>	<b>2260</b>		<b>52</b>

\*\* Adding of numbers shown on the table may not agree due to decimal points round-up by the computer

Source: Table 3 & 15, Appendix 8

Figure 12: Forecast of household consumption of fuelwood and charcoal



**Legend**

No impr. : Not using improved stoves

Improved: Using improved stoves.

Saving: Savings made by use of improved stoves.

**6.3 Forecast of commercial consumption of fuelwood and charcoal**

Forecast on commercial consumption of fuelwood and charcoal to up to 2010 for the study area was made using Ikwiriri Township annual population growth rate of 2.3 percent and data from Appendix 10 and 11. The estimated total consumption of fuelwood and charcoal for the study area in year 2000, 2005 and 2010 are summarised in Table 17.

**Table 17: Forecast of commercial consumption of fuelwood and charcoal**

**TOTAL FUEL CONSUMPTION IN COMMERCIAL SECTORS YEAR 2000**

Village name	Type of fuel	Total consumption per annum (kg)	Total Consumption per annum (tonnes)
Ikwiriri Township	Fuelwood	80,293.2	80.3
	Charcoal	78,808.8	78.8
Mbunju - Mvuleni	Fuelwood	35,356.8	35.4
	Charcoal	634.8	0.6

**TOTAL FUEL CONSUMPTION IN COMMERCIAL SECTORS YEAR 2005**

Village name	Type of fuel	Total consumption(kg)	Total energy content per annum (tonnes)
Ikwiriri Township	Fuelwood	89,928.4	89.9
	Charcoal	88,265.9	88.3
Mbunju - Mvuleni	Fuelwood	39,599.6	39.6
	Charcoal	711.0	0.7

**TOTAL FUEL CONSUMPTION IN COMMERCIAL SECTORS YEAR 2010**

Village name	Type of fuel	Total consumption (kg)	Total energy content per annum (tonnes)
Ikwiriri Township	Fuelwood	100,768.0	100.8
	Charcoal	98,905.0	98.9
Mbunju - Mvuleni	Fuelwood	44,372.8	44.4
	Charcoal	796.7	0.8



## 7 Matching demand/supply of fuelwood and charcoal

### 7.1 Demand

The demand for fuelwood and charcoal both for Ikwiriri Township and Mbunju - Mvuleni village is increasing in volume. Fuelwood and charcoal are used with low efficiency and there is no defined programme to minimise consumption rates of fuelwood and charcoal through use of improved wood utilisation technologies.

The survey showed that, availability of fuelwood and charcoal was starting to become a problem both in Ikwiriri Township and Mbunju - Mvuleni village. Based on research from Tanzania and other parts of Africa (Kaale 1985, Pasztor and Kristoferson 1990, Leach & Mearns 1988, FAO 1999), the main indicators of fuelwood scarcity which were prevailing in the present study area include:

- Increasing sale of fuelwood in areas where fuelwood was usually collected free from woodlands and farmlands.
- Progressive use of low quality fuelwood tree species due to scarcity of preferred species.
- People starting to use fuelwood more carefully through fire management (Some respondents indicated they were putting out fires after cooking to save fuelwood).
- People starting to collect green fuelwood (wet wood) due to the unavailability of dry wood from woodlands and farmlands.
- The increasing use of farm residues as a source of energy (residues being used in the study area included rice straw and sawdust).
- Increasing distances and duration for collecting fuelwood.

### 7.2 Supply

The sources of supply of wood for Ikwiriri Township and Mbunju - Mvuleni village are declining, leading to a scarcity of fuelwood and wood for charcoal production. Field visits to sources of wood supply for the study area confirmed the ongoing decline of tree intensity in the woodlands and forest reserves. Recent studies of forest resources in Rufiji District have also confirmed the ongoing decline of tree cover in the study area (Malimbwi 2000, Grah et al. 2000 and Herlocker 1999).

Village government leaders reported that Ikwiriri Township has no specific programme to enhance its sustainable supply of fuelwood and charcoal. However, Mbunju - Mvuleni village leaders reported that REMP was assisting them to start an environmental conservation programme for their village.

Based on reported wood annual increments - yields of less than 2.1 tonnes (3 m<sup>3</sup>) per ha per annum (section 4.5.4), the supply potential of accessible wood resources to residents of the study area is not enough to meet their demand of fuelwood and charcoal on a sustainable basis. For example in Ikwiriri Kaskazini village, one charcoal producer had clear-felled around one hectare of natural woodland to get fuelwood for one burn of charcoal production causing deforestation. Leaders of Ikwiriri Kaskazini and Umwe Kaskazini villages reported that, due to the scarcity of wood, charcoal producers were now cutting all available trees within an average radius of 300 metres from the centre of their kiln position. Selective tree felling was practiced when the study area had a good stock of trees, but now it is not possible due to the low stock of mature trees per unit area.

### 7.3 The Fuelwood - Charcoal Demand and Supply Gap

#### 7.3.1 Weakness of Quantitative Fuelwood demand and supply gap

Historically, the emergence of fuelwood and charcoal scarcity in an area was described in terms of a fuelwood gap between supply and demand which develops as a result of rising consumption and falling levels of supply (Kaale 1990 Moyo et al. 1993, Kgathi et al. 1997, ETC Foundation 1987). In most cases, the use of quantitative data on supply and demand gaps has proved wrong, providing misleading planning concepts.

Field experience from areas with fuelwood scarcity has demonstrated that people's fuelwood consumption and behaviour patterns are not fixed. When wood resources become harder to obtain, consumers of fuelwood tend to adapt their behaviour according to the prevailing circumstances. For example, Shinyanga region historically had an abundant supply of fuelwood resources. However - due to poor conservation of their forests, by the early 1980's most parts of Shinyanga region had lost their tree cover with acute scarcity of tree resources for fuelwood. To meet their domestic energy demands, villagers switched to the use of farm residues and cow dung for energy. Due to the lack of fuelwood, even sisal leaves and *Euphorbia* species are used for fuelwood - species that are not used in other parts of Tanzania for fuelwood (Hifab&TaTEDO 1998, Wizara ya Ardhi, Maliasili na Utalii 1984).

The major weaknesses with quantification of fuelwood demand/supply gaps include:

- Un-defined sources of fuelwood, ranging from residue of other wood products to being a primary product.
- Un-predictable behaviour of fuelwood consumers when faced with scarcity of fuelwood.

The indicators of fuelwood scarcity discussed in section 7.1, provides good warning of an impending fuelwood shortage in Ikwiriri Township and Mbunju - Mvuleni village, hence the need to initiate precautionary measures. Some quantitative data on the fuelwood supply/demand gap was made to illustrate the urgency of initiating an environmental conservation programme in the study area.

#### 7.3.2 Quantitative Fuelwood Supply/Demand Gap for Ikwiriri Township and Mbunju - Mvuleni

Fuelwood and charcoal supply catchment for Ikwiriri Township and Mbunju - Mvuleni village was identified and their areas calculated by using:

- Draft of Land Cover and Land Use Map of Rufiji District being prepared by the Institute of Resources Assessment (IRA) University of Dar es Salaam.
- Map of Tanzania Vegetation Cover Types – Dar es Salaam prepared by The Government of the United Republic of Tanzania (1989)
- Field observations from the Survey and discussions with individual household members, women's groups and village government representatives in Ikwiriri Township and Mbunju - Mvuleni village.

Catchment areas for wood supply to Ikwiriri Township and Mbunju - Mvuleni village are in most cases the same. For the purpose of calculating the fuelwood and charcoal supply/demand gap, the study area was considered as one unit.

#### 7.3.3 Supply sources and quantities of wood produced are:

- Miombo woodlands accessible to the residents of the study area were estimated to be around 5,400 ha. Sustainable mean annual increment per ha is estimated to be around 1.4 tonnes (2 m<sup>3</sup>). Available wood that could be harvested from 5,400 ha on a sustainable basis is 7560 tonnes (10,800m<sup>3</sup>). An average distance of 4 km from village boundaries was used as the limit for manual fuelwood collection (FAO 1984, Kaale 1985).
- Area of farmlands and floodplains was estimated to be around 13,000 ha, with a mean annual increment yield of 0.35 tonne (0.5m<sup>3</sup>) of wood per ha. Available wood that could be harvested

from 13,000 ha on a sustainable basis is 4,550 tonnes (6,500 m<sup>3</sup>). In spite of the low intensities of tree cover in farmlands, it was assumed that a substantial amount of wood could be obtained from pruning of cashew and mango trees.

- Total annual supply of wood on a sustainable basis from the catchment area is around 12,110 tonnes (17,300m<sup>3</sup>). Figure 13 contains a sketch map of the study area and its broad vegetation cover (land uses).

#### **7.3.4 Demand or consumption quantities are:**

- Based on data presented in Table 16 and 17, the total amount of fuelwood consumed per annum in the study area is 12,529 tonnes (17,899m<sup>3</sup>).
- Total amount of charcoal consumed per annum is 1047 tonnes. Based on charcoal production recovery of 10 percent on weight basis (Section 5.7.2), the amount of fuelwood used to produce the consumed charcoal are ( 1,047 X 10) 10,470 tonnes of wood (14,957 m<sup>3</sup>).
- Total consumption of wood for fuelwood and charcoal in the study area per annum is therefore around 22,999 tonnes (32,856m<sup>3</sup>).

#### **7.3.5 Supply/Demand Gap**

- Based on the above calculations, the annual supply potential of wood on a sustainable basis from the study area is around 12,110 tonnes (17,300m<sup>3</sup>) but the total consumption of wood for fuelwood/charcoal in the study area per annum is around 22,999 tonnes (32,856m<sup>3</sup>).
- The supply/demand gap is therefore a deficit of 10,889 tonnes (15,556m<sup>3</sup>) per annum.
- The deficit is met by consuming the growing stock, consequently contribution to vegetation and environmental degradation.
- The survey showed that about 60% of fuelwood consumed in the study area is collected from surrounding woodlands which is around 7,517 tonnes (10,739m<sup>3</sup>). Almost 100% of charcoal consumed in the study area is harvested from the woodlands which was estimated to be around 10,470 tonnes (14,957m<sup>3</sup>). The total quantity of wood for fuelwood and charcoal being harvested from the woodlands per annum is therefore around 17,987 tonnes (25,696 m<sup>3</sup>). The sustainable annual yield from the woodlands (5,400 ha) is 7560 tonnes (10,800 m<sup>3</sup>). Quantitatively there is a deficit of around 10,427 tonnes (14,896 m<sup>3</sup>) of wood to meet fuelwood/charcoal demand on a sustainable basis for the study area. The deficit is met by consuming the growing stock, resulting in deforestation and environmental degradation. It should be noted that besides the consumption of fuelwood and charcoal in the study area, other wood products are being harvested from the same woodlands but were not quantified by the study, these included:
  - Building poles.
  - Logs for timber production.
  - Charcoal production for sale outside the study area.

Trees in farmlands and the floodplains were contributing about 40% of the total fuelwood used in the study area, which is approx. 5,012 tonnes (7,159m<sup>3</sup>). The estimated sustainable yield from the farmlands and floodplains are 4,550 tonnes (6,500 m<sup>3</sup>). There is therefore a deficit of around 462 tonnes (660m<sup>3</sup>) of fuelwood in farmlands, which is met by consuming the growing stock.

Consumption of fuelwood and charcoal in the study area, exceeds the sustainable supply potential both in the surrounding woodlands and farmlands/flood plains. Studies of fuelwood/charcoal supply in the coast zones of Kenya and Tanzania have also reported an excess of wood fuel consumption above the sustainable wood supply leading to deforestation (Kaale 1985, FAO 1999).

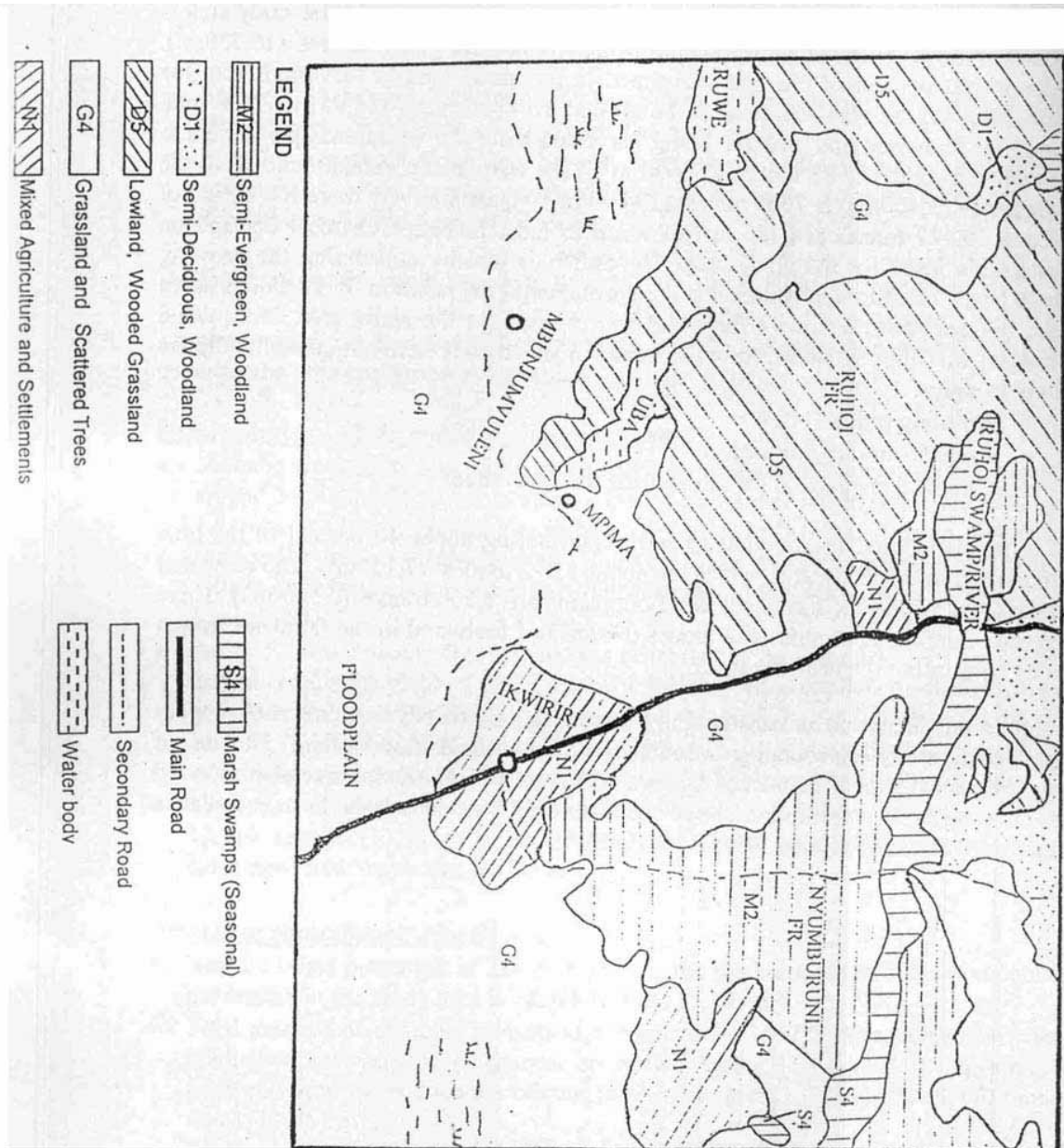


Figure 13: Map of the Study Area



## **8 Potential for using other non-woody biomass for energy production**

The study area has a good supply of various non-woody biomass that could be used for energy production such as:

- Rice straw (found in the floodplains) and rice husks that can be obtained from milling machines.
- Sedges and reeds (found in the floodplains).
- Sawmill residues - mainly sawdust, slabs and off-cuts (found in the uplands of Ikwiriri Township).

Even with satisfactory fuelwood supply, the use of these materials for energy production could enhance wise use of resources (Barnard & Kristoferson 1985). However, efforts are required to introduce suitable stoves for burning the non-woody biomass materials listed above. As reported earlier, few people in Ikwiriri Township are using residue stoves to burn sawdust as sources of energy. These materials provide practical examples of non-woody biomass and residues that can be used as alternative sources of energy in the study area.

## 9 Alternative fuel production/trading as possible new business enterprise for Mbunju - Mvuleni villagers

### 9.1 Alternative Fuel Production

Due to low income Mbunju - Mvuleni villagers will continue to depend on biomass fuels as their major sources of energy for cooking, heating and fish smoking/frying for the foreseeable future. Kerosene will continue to be the main source of energy for lighting.

### 9.2 Possible New Business Enterprises

Discussions with womens groups and villagers identified the following possible business enterprises:

- **Purchase of milling machines.** Currently the village has no milling machines. Villagers are travelling to Ikwiriri Township to mill their maize or rice at high costs. Manual milling is also consuming considerable time that could be used for other productive activities. Women are the most affected by the lack of milling machines as they are responsible for the manual milling of cereals.
- **Establish tailoring groups.** Currently the village has no tailor or sewing machine. The establishment of women/youth tailoring groups, will enhance income generation and employment opportunities in the village. Currently, tailoring activities for the village are conducted at Ikwiriri Township.
- **Production of improved firewood and charcoal stoves.** Demand of improved fuelwood stoves is high in the village and surrounding areas. The village has suitable clay for the production of stove liners. However, the majority of women's groups interviewed, indicated that production of improved fuelwood stoves could not be a viable commercial activity in Mbunju - Mvuleni village due to the low incomes and purchasing power of the majority of villagers. It was suggested that, once the technology of constructing improved stoves was acquired in the village, that women's groups could construct and widely disseminate the improved fuelwood stoves through a barter system. Such a system has been successful in Lushoto, Magu and Missungwi districts (Hifab & TaTEDO 1998).
- **Beekeeping.** The village is surrounded with suitable vegetation cover for beekeeping. Beekeeping was identified as a potential source of income to villagers at Mbunju - Mvuleni village with very low initial capital investments.
- **Production of mats.** Village leaders reported that the majority of women in Mbunju - Mvuleni have skills of producing quality mats. However, due to low market exposure, the women were experiencing problems in marketing their products. Technical assistance in mat production and marketing was suggested as an alternative way of improving the income of women and increasing job opportunities.
- **Purchase of farm tractors.** The village has no tractor for agricultural production. Purchase of tractors for hire could intensify agricultural production in the village and reduce farm labour inputs. Saved time could be used in implementing environmental conservation programmes in the village.

## 10 Stakeholders Workshop on Energy and Environment

### 10.1 Objectives of the workshop

A workshop was conducted at Ikwiriri Folk Development College on 12<sup>th</sup> May 2000. A total of twenty one participants of whom eight were women attended (Table 18).

The main objectives of the workshop were:

- To explain the terms of reference for the study.
- To present initial results of the study and discuss their relevance to Ikwiriri and Mbunju - Mvuleni.
- To obtain villagers views and suggestions for areas which require improvements.
- To obtain stakeholders suggestions on how to enhance sustainable environmental conservation and energy supply in Ikwiriri and Mbunju - Mvuleni.

### 10.2 Discussions and stakeholders' views

Discussions were held on the terms of reference and findings from the field. Activities requiring energy inputs and types of energy used to perform the activities based mainly on availability, suitability and consumers preference in Ikwiriri Township and Mbunju - Mvuleni village were indicated as:

- Cooking - Firewood and charcoal. (Few employed workers were using kerosene).
- Lighting - Kerosene and electricity.
- Ironing - Charcoal.
- Heating - Charcoal and firewood
- Fish smoking/frying - Charcoal and firewood
- Brewing - Firewood.

As found by the study team, the stakeholders workshop confirmed that fuelwood is the major source of energy in their area due to easy availability and low costs in comparison to other energy types. Sources of fuelwood were stated to include trees from farmlands, public woodlands, Forest Reserves and residues from sawmills.

Inefficient three stone fuelwood stoves and traditional metal charcoal stoves were used in all households. However, workshop participants indicated strong willingness to support a programme of producing and using improved stoves in their areas.

A list of potential business actors dealing with fuelwood, charcoal, poles, cutting of saw logs, fish smoking/drying, brewing and food vending was provided. A request was made to provide technical assistance on how to improve production and utilisation of wood products to enhance environmental conservation.

Women's representatives requested strong support for women's groups dealing with wood product businesses and environmental conservation as women had few opportunities for income generation in the study areas.

Wood products were collected from woodlands and forest reserves without any authority. However, some of the participants indicated that they were aware of the need to obtain permission to collect wood products for commercial purposes from Forest Reserves.

Participants indicated that the intensity of tree cover in their areas was declining fast. As a result, the availability of fuelwood and poles was becoming a problem. For fuelwood, people are now using available dry wood of any species. In the floodplains, it was reported that some people were using rice straw for heating and to supplement fuelwood for cooking.



Workshop participants were requested to suggest ways of solving the emerging fuelwood and environmental degradation problems that they had indicated. The following activities were suggested:

- To raise public awareness through extension services, seminars and workshops on the use of wood fuel efficient technologies.
- To train local people in Ikwiriri and Mbunju - Mvuleni in the production of efficient fuelwood and charcoal stoves.
- To train charcoal producers on efficient methods of charcoal production.
- To explore opportunities of using farm residues for energy production i.e. rice straw and rice husks.
- To initiate participatory community management and conservation of village woodlands.
- To intensify beekeeping in woodlands and forest reserves for income generation.

Alternative income-generation activities for Mbunju - Mvuleni village were suggested including; beekeeping, tailoring, weaving, operating of milling machines and introduction of farming tractors.

Stakeholders to implement an improved wood fuel efficient and environmental conservation programme in Ikwiriri and Mbunju - Mvuleni were stated to include: Village governments; Women's groups; Youth groups; Religious institutions; Individual households; Ward and Divisional Government representatives; Rufiji Beekeeping Project (RUBEP); TANESCO; Folk Development College; TEHIP; Secondary and Primary schools; NGOs and Mass Media representatives.

### **10.3 Conclusions of the stakeholders workshop**

The acting Divisional Secretary of Ikwiriri concluded the workshop by thanking all participants and workshop organisers for their active participation. He recommended that results of the study should be put in practice to enhance environmental conservation and socio-economic development of the division. He suggested that copies of the study report should be widely distributed to all stakeholders to enhance implementation of programme's that may emanate.

**Table 1: Participants to the Stakeholder Workshop**

No.	NAME	OCCUPATION	ADDRESS
1	Abdallah Saidi	Farmer	Box 62, Ikwiriri
2	Hadija Rajabu	Farmer	Box 62, Ikwiriri
3	Asia Mohamed M.	Farmer	Nil
4	Hashim Salum	Farmer	Box 14, Ikwiriri
5	Sultani Mohamed	Farmer	Mkongo, Rufiji
6	Subila Abdallah	Farmer	Ikwiriri
7	Magdalena Mohamed	Farmer	Box 12, Ikwiriri
8	Rikonga Mauridi	Farmer	Box 62, Ikwiriri
9	Kessy Kitumbi	Farmer	Box 62, Ikwiriri
10	Dyandumbo, A. J. M.	Teacher	Box 50, Ikwiriri
11	Eleuther Mwageni	Project Coordinator TEHIP	Box 401, Ikwiriri
12	Salum Makombo	Farmer	Nil
13	Hamidu Kilangai	Ward Secretary Mgomba	Box 62, Ikwiriri
14	Mwajuma H. Mkangaa	Chairperson	Mgomba kati
15	Abdallah A. Mtabula	Ag. Division Secretary	Ikwiriri
16	Barube E.E. Ruhembe	TANESCO Manager	Box 5, Ikwiriri
17	Salum Abdallah Makombo	Ward Secretary	Box 62, Ikwiriri
18	Lijani Omary	Farmer	Box 62, Ikwiriri
19	Hemedi S. Mpuwe	Ward Secretary	Box 62, Ikwiriri
20	Saidi A. Njengo	Farmer	Box 62, Ikwiriri
21	Narsis M. Kisenga	Beekeeping Officer	Box 62, Ikwiriri

## **11 Recommendations and Proposal to Support Development of Energy-Saving Alternatives in Ikwiriri and Mbunju-Mvuleni**

### **11.1 Identified environmental problems in the study area**

The main problems revealed by the study which need to be addressed in order to enhance energy supply and environmental conservation in the study area are:

- Lack of or low awareness of environmental conservation strategies.
- Low availability of technical assistance to promote efficient production and utilisation of fuelwood and charcoal.
- Low availability of technical assistance to promote community conservation of woodlands surrounding Ikwiriri and Mbunju - Mvuleni.
- Low intensity of tree growing efforts in farmland.
- Increasing fuelwood scarcity problem with environmental degradation.

### **11.2 Recommendation**

Problems outlined in section 11.1 above are in line with those addressed by the goal and objectives of REMP, hence solving them will assist successful implementation of the REMP programme and contribute positively to the improvement of peoples' living standards in Ikwiriri Township and Mbunju - Mvuleni village. REMP is commended for its active and ongoing environmental conservation programme in the study area. Based on results of the study, the main recommendation to REMP is to extend its field activities to cover the introduction of efficient methods for production and utilisation of fuelwood and charcoal in Ikwiriri Township and Mbunju - Mvuleni village. It is proposed that REMP should initiate a programme on "Efficient Methods for Production and Utilisation of Fuelwood and Charcoal".

### **11.3 Proposed Programme on Efficient Methods for Production and Utilisation of Fuelwood and Charcoal**

#### **11.3.1 Proposed objectives of the programme**

Based on the identified problems highlighted in section 11.1 above, the main objectives of the programme should be to;

- Raise public awareness on environmental strategies through local initiative efforts.
- Provide technical assistance on efficient production and utilisation of fuelwood and charcoal.
- Provide technical assistance on woodland conservation strategies through community participation and initiatives.
- Provide technical assistance on effective tree growing in farmlands.
- Provide technical assistance to the local community on vegetation monitoring of woodlands and forests within their villages.

#### **11.3.2 Proposed programme duration**

Experience on programmes intended to bring changes through empowerment of the local community, are normally slow to establish. However, with time they pick up with sustainable results (Moyo, O'Keefe and Sill 1993, IIRR 1998). Duration of the programme is proposed to be five years with an extension to another term of five years based on experiences gained.

#### **11.3.3 Programme activities proposed**

The main activities proposed to be undertaken in order to achieve the programme objectives are highlighted below.

### **Awareness creation**

The main goal of awareness creation will be to empower the local community with knowledge that will enable them - through local initiatives, to formulate effective strategies of conserving their environment and use of efficient methods for production and utilisation of fuelwood and charcoal. Emphasis will be on solving identified needs expressed by the majority of people in the study area. To achieve this, the awareness creation programme will be tailor made to local conditions.

Main activities could include:

- Sensitise local policy makers on environmental conservation strategies and use of efficient wood production and utilisation technologies through participatory workshops. Some workshops could be held at Division and Ward level, however the majority should be at village level. Awareness creation workshops should cover all aspects of the programme.
- Intensify teachers and school children's awareness on environmental issues of their area and the need for active participation of youth to support the programme. This should be done through workshops, issuing of publications and cooperation of teachers and school children in awareness campaigns through songs and drama.
- Intensify household awareness of the programme through visits. Almost 100% of the households visited during the survey indicated that they have not received any technical extension services on efficient use of wood products for the past five years. Physical contact with individual household members is important as it will increase the sharing of experiences with the main actors.
- Use mass media channels to supplement awareness creation efforts at group and individual levels.

### **Technical Assistance to Promote Efficient Production and Utilisation of Fuelwood and Charcoal**

Main activities should include:

- Identify existing local knowledge and skills in the production and utilisation of fuelwood and charcoal. Improvements should be made using existing skills as the starting point.
- Identify suitable sites for production and sale of fuelwood and charcoal stoves.
- Identify suitable sites for clay production and areas to get scrap metal for making portable fuelwood and charcoal stoves.
- Identify potential stakeholders who could be trained and used for the production and distribution of improved fuelwood and charcoal stoves.
- Train potential stakeholders in production and distribution of improved fuelwood and charcoal stoves.
- Evaluate quality of stoves produced and provide periodic support to improve quality of stoves based on customer's suggestions and recommendations.
- Provide periodic study tours for stove producers to other producers in Tanzania or neighbouring countries to enhance sharing of experiences.
- Identify potential charcoal producers in the study area, their skills in charcoal production and existing options for improvements based on local working conditions and financial capabilities of the producers.
- Initiate a training programme on the improvement of charcoal production, starting with improvements of the commonly used mould earth kiln.
- Facilitate the provision of credit to stove producers in order to minimise problems of acquiring initial capital investment.

### **Technical assistance to promote community conservation of miombo woodland**

Woodlands are the major source of fuelwood, charcoal and other wood products for residents of Ikwiriri Township and Mbunju - Mvuleni village. They are not managed for the sustainable supply of wood products. However, it was reported that efforts to initiate a management programme for natural woodlands in the study area were underway. Main activities under this section will include:

- Identify existing woodland resources to residents of the study area which are not within Forest Reserves and that could be managed through community efforts.
- Identify natural boundaries of the public woodlands, major wood products and services obtained from the woodlands by villagers.
- Identify main stakeholders in managing the woodlands and roles to be played by each stakeholder.
- Formulate a strategy to manage, conserve and utilise - in a wise manner, the public woodlands through community participation with equitable distribution of benefits to all stakeholders.
- Formulate a monitoring and evaluation strategy for the community conservation of public woodlands.
- Formulate a training programme to empower villagers and other stakeholders with technical skills on participatory management of natural woodlands.

### **Technical Assistance on Farmland Tree Growing**

The survey showed that tree growing in farmland could enhance environmental conservation and sustainable supply of fuelwood and other wood products at low costs. However, there was no active tree growing efforts in the farmlands. People are cutting existing trees but they are rarely planting new trees. To enhance environmental conservation and supply of wood products, tree planting efforts in the farmlands by individual households and other stakeholders should be intensified. Activities to be undertaken should include:

- Identify factors hindering tree growing efforts in the study area and explore solutions with active involvement of the local community.
- Identify suitable tree species to be grown that could provide desired products to tree growers.
- Initiate a programme of raising tree seedlings of desired species by involving all possible stakeholders i.e., individual households, schools, youth groups, women's groups, religious sectors and institutions to name a few.
- Train the community on proper farmland tree planting and management of planted trees.
- Initiate an exchange visit programme between tree growers to increase the sharing of experiences.

### **Technical assistance to the local community on vegetation monitoring of woodlands and forests within their villages**

The current survey and other surveys conducted in Rufiji District have indicated a rapid deterioration of vegetation cover in the district as a whole (Malimbwi 2000). Community awareness of the ongoing vegetation degradation and how it will affect their lives could enhance the initiation of a sustainable programme on environmental conservation through local participants efforts. Suggested activities in this sub-programme should include:

- Raise public awareness on the current status of their vegetation cover as compared to 5 or 10 years ago.
- Identify the main causes of vegetation deterioration and explore opportunities of vegetation conservation through community development.
- Establish simple criteria to be used by the community to monitor positive and negative aspects related to vegetation conservation in their area over a specified period.

#### **11.3.4 Expected results of the proposed programme**

The overall results/output of the programme should include:

- Awareness created on environmental conservation, efficient production and utilisation of fuelwood/ charcoal for residents of Ikwiriri Township (nine villages) and Mbunju - Mvuleni village. Awareness will be transformed into action, hence facilitating effective implementation of other activities of the programme.
- At least 10 centres for producing improved fuelwood stoves (one from each village) and 5 centres for producing improved charcoal stoves will be established by individuals or groups.
- Within five years, at least 60 percent of Ikwiriri Township and Mbunju - Mvuleni village households will be using improved fuelwood and charcoal stoves.
- At least 50 charcoal producers will be trained on efficient methods of charcoal production by using improved mould earth kilns.
- Representatives of 10 village governments will be trained on community management of village woodlands. Through integrated efforts of the 10 village governments, a programme to manage and conserve woodlands surrounding Ikwiriri Township and Mbunju - Mvuleni village will be initiated and sustained through local initiatives.
- Tree planting in farmlands will be initiated in 10 villages and household representatives will be knowledgeable on tree growing methods. In total about 4,200 households will benefit from the programme. A total of 500,000 trees will be planted in the initial five year period. Schools and progressive farmers will be used as demonstration centres for tree growing in Ikwiriri Township and Mbunju - Mvuleni village.
- A total of 40 village government representatives (4 from each village) will have received training on vegetation monitoring and formulation of strategies to conserve village vegetation through community efforts.

#### **11.3.5 Important assumptions for achieving the programme objectives**

The following assumptions were made:

- That Rufiji District Council and REMP will continue with its current efforts on environmental conservation through wise use of resources.
- Residents of Ikwiriri Township and Mbunju - Mvuleni village will participate effectively in implementing the programme.
- Stakeholders who will be identified to implement the programme will co-operate effectively.
- Suitable clay and other materials for production of improved fuelwood and charcoal stoves will be available.
- Favourable weather and flooding conditions will prevail to enhance tree growing in farmlands and conservation of woodlands.
- Local and donor financial support to implement the programme will be available.
- Successful implementation of the programme will contribute to improvement of living standards. It will also reduce women's workloads for fetching fuelwood.
- Experienced and professional human resources for implementing the programme will be available.
- That the programme will be sustainable.

### **11.3.6 Proposed Implementation Methodology**

It is proposed that Rufiji District Council should be the main co-ordinator of the programme. REMP should facilitate funding and implementation of the project in the field in collaboration with Rufiji District Council. Based on subject specialisation, other stakeholders could be invited by Rufiji District Council/REMP to contribute to implementation of the programme. Potential stakeholders could include:

- Ministry of Natural Resources and Tourism – on extension and training activities.
- Ikwiriri FDC – on extension and training activities.
- Individuals, Women and Youth groups - on establishment of stove production and dissemination centres.
- Primary schools and other institutions – on provision of practical demonstration centres on tree growing and use of improved fuelwood and charcoal stoves.
- Religious sectors – on extension and mobilisation.
- Ministry of Agriculture and cooperatives – on agroforestry.
- CBOs and NGOs dealing with promotion of efficient energy production and utilisation of fuelwood, charcoal and farm residues – on extension and training.

### **11.3.7 Contributions of the programme to development of women**

Women are the most affected by the increasing fuelwood scarcity in Ikwiriri and Mbunju - Mvuleni. Successful implementation of the programme will reduce workloads of women for collecting fuelwood, thus enabling them to concentrate their efforts in other development activities.

### **11.3.8 Budget**

Based on experiences of similar programmes in Tanzania, the estimated annual budget for implementing the programme is around Tsh. 175 million. Estimated costs for each activity and for a five year period are outlined in Table 19.

**Table 2: Programme Estimated Budget**

<b>Main Activities</b>	<b>Estimated Annual Budget in Tsh</b>	<b>Estimated Five Year Budget in Tsh</b>
Awareness creation	20,000,000	100,000,000
Production and distribution of improved fuelwood and charcoal stoves	100,000,000	500,000,000
Community conservation of natural forest	25,000,000	125,000,000
Farmland tree growing	25,000,000	100,000,000
Community vegetation monitoring	5,000,000	25,000,000
<b>Total</b>	<b>175,000,000</b>	<b>875,000,000</b>

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## 13 Appendices

### Appendix 1: Terms of Reference for a Consultancy in fuelwood and charcoal Energy use and alternatives.

#### Introduction

The Rufiji Environment management Project based at Utete Town, the headquarters of Rufiji District, Tanzania has as its goal *“to promote the long term conservation through “wise use” of the Lower Rufiji forests, woodland and wetlands such that biodiversity is conserved, critical ecological functions are maintained, renewable natural resources are used sustainably and the livelihoods of the areas inhabitants are secured and enhanced”*.

The three main objectives of the projects first five-year phase are:-

- a) To promote the integration of environmental conservation and sustainably development through environmental planning within the Rufiji delta and floodplain
- b) To promote the sustainable use of natural resources and enhance the livelihoods of local communities by implementing sustainable pilot development activities based on “wise use” principles
- c) To promote awareness of the values of forests, woodlands and wetlands and the importance of “wise use” at village, district, regional and central government levels and to influence national policies on natural resource management emphasizing the non-sectoral, multi-biome, integrated approach to the environment.

#### Background

The REMP project Proposal Document (REMP, May 1997) identifies the increasing demand for fuel wood and charcoal as a threat to the woodlands and forests of the Rufiji floodplain and delta. There are three large settlements in the district namely Ikwiriri, Utete and Kibiti. Ikwiriri is the largest settlement. It is estimated to have a human population of over 45,000 which has recently expanded due to the major Rufiji bridge - building project. It is assumed that, even though electricity and kerosene are available, the main cooking – fuel source is wood in the form of firewood or charcoal. The source of this fuelwood is the surrounding woodland, which consists of reserves, and open woodland. Ikwiriri is situated close to Mbunjumvuleni village, one of the REMP’s pilot villages, which has open woodland threatened by the increasing demands for energy in the Ikwiriri settlement. Some information has been collected regarding the fuel needs of the villages households.

Inhabitants of Ikwiriri and villagers adjacent to the floodplain live, for considerable periods, in the floodplain. They carry fuel wood from the higher ground to their temporary accommodation in the flood plain. This is a burden particularly on women. The flood plain vegetation is mainly grasses, sedges and Typha reeds with some Sesbania spp., Crotalaria spp. Which form part of a three to five year fallow system. there are also groups of mango trees along the Rufiji riverbank and scattered in the floodplain. It is possible that some of the sedges, reeds, shrubby species and crop residues could be used as energy sources.

Projects promoting fuel – saving and residue usage have established large institutional examples at the folk Development Collage in Ikwiriri. The Matumbi hills coastal Forest project has promoted in-situ clay fuelwood stoves at Nambunju village. Interests has been shown in the latter stove by villagers from the floodplain and delta. Portable firewood stoves could be explored as an option for use on the floor of “dungus” or silt houses during rice cultivation.

REMP/MUMARU has a policy of implementing all activities from a gender perspective, thus all input (data) is expected to be gender desegregated.

### Objectives of the consultancy

The two objectives of the consultancy are;

- To assess the present situation regarding demand for and supply of woody biomass energy (fuelwood and charcoal) in Ikwiriri township and in Mbunjumvuleni village.
- To make recommendations towards reducing the demand for woody biomass energy (fuelwood and charcoal) in both settlements.

### Task of the consultancy

The study will include the following tasks;

- 4.1 Assess the present situation as follows;
  - 4.1.1 List the fuels types used in Ikwiriri town and Mbunjumvuleni village and quantify the amounts of each used by households and commercial business on a daily, weekly or monthly basis.
  - 4.1.2 Describe peoples preferences for different types of fuel and their criteria for these preference.
  - 4.1.3 Explore the likelihood of change or diversification in fuel type and document the factors which would influence these choices.
  - 4.1.4 Make calculations of costs vs. benefits of individual fuels and combinations of different fuels.
  - 4.1.5 For wood – based fuels (fuelwood and charcoal);
    - 4.1.5.1 Describe the present chain of actors from primary producer to end user;
      - 4.1.5.1.1 Mention who each harvester /producer and sellers of these fuels are by age, gender, name, ethnic group and place of official residence.
      - 4.1.5.1.2 Describe the efficiency of methods they use in terms of quantity of woody material felled compared to calorific energy of the fuel, and the seasonality of their activities.
      - 4.1.5.1.3 Assess the profitability of their activities (TShs. Profit per unit time) and the stimuli which alter the species or the product which they supply.
      - 4.1.5.1.4 Detail their geographical sources, the species and purposes.
      - 4.1.5.1.5 Their transportation methods.
      - 4.1.5.1.6 Detail whether and where they get authority for fuelwood collection and charcoal making.
  - 4.1.6 Make separate projections of needs of wood – based fuels by Ikwiriri township and Mbunjumvuleni village in five years time and ten years time.

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- 4.1.7 Match the needs projections in (4.1.6) which the projected state of supply from the surrounding woodlands and comment on the balance or lack of it between the supply and demand projections of 5 and 10 years time.
- 4.2 Make recommendations for reducing the demand for woody biomass (fuelwood and charcoal) from the native woodlands adjacent to the two settlements including assessments of;
  - 4.2.1 The potential for improving the production of woody fuel products in terms of energy efficiency e.g. improved charcoal – making.
  - 4.2.2 The potential for diversification of fuels e.g. rice straw, rice bran (pumba ya punga), sawdust, other materials e.g. Sesbania spp., grasses, sedges or s eeds, reeds, urban rubbish, electricity, kerosene and others.
  - 4.2.3 The potential for improving the efficiency of fuelwood and charcoal cooking methods e.g. energy – saving stoves appropriate for urban and rural households and for commercial establishments.
  - 4.2.4 The types of stoves possible and investigate the feasibility from a materials (clay, tin or other), technical skills for production (potters, blacksmiths), user acceptability (ease of use, cost, transportability etc), environmental friendliness points of view.
  - 4.2.5 Stove production as a possible business diversification option for the craftsmen/women in Mbunjumvuleni village.
  - 4.2.6 Alternative fuel production/trading as a possible new business enterprise for Mbunjumvuleni villagers.
  - 4.2.7 Make recommendations to REMP/MUARU on whether to support development of energy – saving alternatives in the township or the pilot villages.
  - 4.2.8 If so, why, how, at what costs and with whom to make these interventions.

### **Outputs**

- 5.1 An assessment of the current situation with regard to use of fuelwood and charcoal energy in Ikwiriri and Mbunjumvuleni. (with mention of gender roles, access and ownership)
- 5.2 Detailed recommendations regarding interventions for the reduction of demand for fuelwood/charcoal i.e. woody biomass energy.

### **Expertise required**

The consultant will have specialist qualifications in engineering, Forest Engineering or Energy Engineering with at least five years experience of working with fuelwood energy- saving enterprises. Monitoring and Evaluation and or economics or business skills are also required. Swahili language skills will be an advantage.

**Reporting**

A report will be prepared corresponding with the outputs in 5.0 above. The first draft, prepared in English will be submitted in MS Word floppy disk and hard copy, within one month of the fieldwork. The final report, including a Swahili summary, will be submitted within three weeks of receipt of REMP's comments.



**SECTION B: PRESENT SITUATION**

18 What type of energy source do you mainly use for the following activities

Energy Type	Activities							
	Cooking (1)	Lighting (2)	Ironing (3)	Heating (4)	Brewing (5)	Fish smoking /drying (6)	Brick burning (7)	Others (8)
Firewood								
Charcoal								
Electricity								
Kerosene								
Crop Residues								
Others								

19 What kind of fuel(s) do you mostly prefer for:

Activity	Energy type
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

Give reason(s) for use of that:-

	Relative Cheap	Can't afford others	Fast and Clean	No Payment	Used to it	Others
Firewood						
Charcoal						
Electricity						
Kerosene						
Crop Residues						
Others						

20 Are you aware of energy options for different activities?

- i. Yes                      ii No

If yes what are they?

Activity	Option
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

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21 Are there any hindering factors for using other energy type other than those mentioned in Qn 2 above for the following activities?

Activity	Hindering factors
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

22 What are your future plans (alternatives) to change to another alternative fuel other than those mentioned in Qn 2 above for the following activities?

(i) Yes (ii) No

Activity	Alternative fuel
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

23 What are the prices for the following energy types?

Energy type	Farm gate price (Tshs)	Market price (Tshs)	Wholesale Price (Tshs)	Retail price(Tshs)	Units used
Firewood					Bundles
Charcoal					Bags(kg)
Kerosene					lts
Electricity					kwh
Crop residues					kg
Others (specify)					



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24 At present, how much fuel do you use for? (per specified period ;day-week-month)

Activity	Energy type					
	Firewood	Charcoal	Kerosene	Electricity	Crop residues	Others (specify)
Cooking						
Lighting						
Ironing						
Heating						
Brewing						
Fish smoking						
Brick burning						
Others						
Unit used	bundles	Bags(kg)	lts	kwh	kg	

25 Who in the household decides what fuel to use?

- i. Male      ii. Female      iii. All

26 Is the choice of fuel depending on the season?

- i. Yes      ii. No

If yes can you list the type of energy required in each season and quantity?

Type of Energy	Season		Unit used
	Dry	Rainy	
Firewood			bundles
Charcoal			Bags(kg)
Electricity			kwh
Kerosene			lts
Crop residues			kg
Others			

27 Do you use some specific energy types for cooking certain foods?

- Yes      No

If yes, mention type of food and energy type

<u>Energy type</u>	<u>Type of food</u>	<u>Main reasons</u>
.....		
.....		
.....		

28 Is fuelwood supply a problem in this area?

- Yes      No

If YES, what is the main reason(s)

.....

29 In your own opinion, what do you think should be done to solve the fuelwood problem in this place?

.....

ready to contribute or participate to improve the situation?

- Yes      No

If yes, in what ways?

.....  
 .....

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

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31 How do you deal with the fuelwood shortages

32 What type of stove do you normally use in cooking

Have you ever heard anything about improved energy efficient stoves?

Yes No

(a) From where and when?

(b) Are you willing to learn about improved stoves?

i. Yes ii. No

(a) Are you buying firewood?

Yes  
No

(b) Are you buying firewood?

i. Yes  
ii. No

(a) If **YES** who sells firewood you?

Men Women Children

(b) Who sells charcoal to you?

Men Women Children

(a) Do you collect firewood freely for your household consumption?

i. Yes ii. No

(b) If **YES**, from which sources?

Individual farmland

Village woodland

Forest reserve

Others (specify).....

If you are collecting firewood from the forest reserve/ village woodlands where do you get authority for collection

i. Yes ii. No

What is the time used for one round trip of firewood collection from the sources?

What type of tree species do you prefer for firewood?

Firewood

(a) Any species

Specific species (name them)

Charcoal

Any species

Specific species

How do you transport firewood and charcoal from their sources

**A) Firewood**

Source	Average distance (Km)	Means of transport					
		Manual	Bicycle	Carts/ Wheelbarrow	Vehicle	Animals	Others (specify)
Individual farmland							
Village woodland							
Forest reserve							
Others(specify)							

**B) Charcoal**

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Source	Average distance (Km)	Means of transport					
		Manual	Bicycle	Carts/ wheelbarrow	Vehicle	Animals	Others (specify)
Individual farmland							
Village woodland							
Forest reserve							
Others(specify)							

32 Which part of the tree is used for firewood and charcoal?

Energy source	Part of tree		
	Bole	Branches	Others (specify)
Firewood			
Charcoal			

33 Is there any member in the household engage in collection of firewood or charcoal burning for selling to enhance income generation?

Yes No

If Yes, how?

Family member	Energy source		
	Firewood	Charcoal	Others(specify)
Male			
Female			
Children			

34 For the past five years:-Indicate if firewood and charcoal supply has increased or declined.

Energy source	Trend of supply		
	Increased	Declined	Same
Firewood			
Charcoal			

35 For the past five years, have you received any technical assistance in extension services on how to sustain your energy supply?

i. Yes ii. No

36 If Yes, when and whom?

37 Did you plant trees in the following years?  
 2000 yes.....No  
 1999 yes.....No  
 1998 yes.....No

38 Type of houses (main houses)  
 Pole/grass thatched  
 Pole/corrugated iron roof  
 Brick/corrugated iron roof  
 Others (specify )

39 Is your house electrified?  
 i. Yes ii. No

**B) COMMERCIAL ENTERPRISES QUESTIONNAIRE**

**CHARCOAL PRODUCERS AND SELLERS**

GENERAL INFORMATION

- 1 Name of the village .....
  - 2 Respondent Number.....
  - 3 Name of respondent.....
  - 4 Sex of respondent  
Male Female
  - 5 Respondent Age .....(When were you born ..... )
  - 6 Respondent religion.....
  - 7 Respondent Tribe .....
  - 8 Respondent Place of origin .....
  - 9 Which year did you move to this village? ..... Or your were born here? .....
- When did you start to sell charcoal? .....
- What were the main influencing factors which made you to join the charcoal business  
.....  
.....

12 Do you purchase and read newspapers? Which ones?

Yes No

13 Do you have a radio?

Yes No

14 Status of ownership. Are you operating the business alone or with other partners? Who are they?

Males ..... Females .....

15 Respondent income level (base on provided indicators by Rufiji officials)

- low
- medium
- high

**PRESENT SITUATION**

Are you making the charcoal yourself or you are buying from other producers? ..... If you are making the charcoal yourself please elaborate on the following.

**THOSE INVOLVED WITH CHARCOAL PRODUCTION**

Where are you harvesting trees for charcoal production? Name of area ..... Distance from village .....

Which are the most preferred species for charcoal production?  
.....

Are you paying for trees used for charcoal production/ If YES how much per unit.  
.....  
.....

To whom are you paying

What type of charcoal production method are you using? .....

How much charcoal can you produce per week or month?

.....  
Are you aware of other types of charcoal production kilns, which could increase production efficiency? Yes  
..... No.

Would you like to learn efficient methods of charcoal production if opportunities will exist?  
.....

How much do you pay per day for people helping you in charcoal production.  
Tsh .....

If someone was to employ you to help her/him in charcoal production how much money would you accept per day (Lowest limit) .....

**FOR THOSE BUYING CHARCOAL PRODUCERS**

Where are you buying your charcoal ( name of area ..... distance from village ..... Km,  
and mainly from whom ? Males % ..... Females % .....

What is the average price of charcoal at collection site in the forests ( Tsh ..... per unit .....

How do you transport your charcoal to the village or other selling points?  
.....

What are the tentative transport costs per unit Tsh .....

**TO ALL CHARCOAL SELLERS IN THE VILLAGE**

What are the average charcoal prices at the village Tsh ..... Per unit .....

Are charcoal prices fluctuating with seasons. If Yes ..... which season is the most profitable ... dry  
season ..... rainy season .....

How much charcoal can you sell per day ..... or week ..... in defined units (bags etc)

Who are your main customers?

At the village Males .....% Females .....%

Outside the village (indicate names of areas ..... and distance from the village in km  
..... How do you transport the charcoal to customers  
.....

Besides selling charcoal, what are your other income generating activities:  
.....

Of the different income activities you mentioned, would you rank them in priority list;

1 ..... 2 ..... 3. ....  
4..... 5.....

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

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Table showing sources of charcoal and transportation means

Source	Average distance (Km)	Means of transport					
		Manual	Bicycle	Carts/ Wheelbarrow	Vehicle	Animals	Others (specify)
Individual farmland							
Village woodland							
Forest reserve							
Others(specify)							

Which parts of a tree are used for charcoal production?

Branches ..... Stems ..... Roots .....  
 All woody materials .....

How many members in your family are engaged in production and sale of charcoal?

Males ----- Females ----- (Total family members .....

For the past five years:-Indicate if supply of firewood for charcoal production has increased or declined.

Increased ..... Declined ..... Same .....

For the past five years, have you received any technical assistance in extension services on how to improve your charcoal business? Yes ..... No .....

If Yes, when and who provided the extension services? .....

.....



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Are you paying for trees used for firewood production/ If YES how much per unit.  
.....

.....

To whom are you paying

What type of tools are you using for firewood production? .....

How much firewood can you produce per week or month?

.....

.....

Are you aware of other types tools for firewood production , which could increase production efficiency? Yes ..... No.

Would you like to learn efficient methods of firewood production if opportunities will exist.?

-----

How much do you pay per day for people helping you in firewood production.

Tsh .....

If someone was to employ you to help her/him in firewood production how much money would you accept per day (Lowest limit) .....

**FOR THOSE BUYING FIREWOOD**

Where are you buying your firewood ( name of area ..... distance from village ..... Km, and mainly from whom ? Males % ..... Females % .....

What is the average price of firewood at collection site in the forests ( Tsh ..... per unit .....

How do you transport your firewood to the village or other selling points?  
.....

What are the tentative transport costs per unit Tsh .....

**TO ALL FIREWOOD SELLERS IN THE VILLAGE**

What are the average firewood prices at the village Tsh ..... Per unit .....

Are firewood prices fluctuating with seasons. If Yes ..... which season is the most profitable ... dry season ..... rainy season .....

How much firewood can you sell per day ..... or week ..... in defined units (bags etc)



Who are your main customers?

At the village Males .....% Females .....%

Outside the village (indicate names of areas ..... and distance from the village in km ..... How do you transport the firewood to customers .....

Besides selling firewood, what are your other income generating activities:

.....

Of the different income activities you mentioned, would you rank them in priority list;

1 ..... 2 ..... 3. ....

4. .... 5. ....



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Give reason(s) for use of that:-

	Relative Cheap	Can't afford others	Fast and Clean	No Payment	Used to it	Others
Firewood						
Charcoal						
Electricity						
Kerosene						
Crop Residues						
Others						

4 Are you aware of energy options for different activities?

Yes No

5 If yes what are they?

Activity	Option
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

6. Are there any hindering factors for using other energy type other than those mentioned above for the following activities?

Activity	Hindering factors
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

7. What are your future plans (alternatives) to change to another alternative fuel other than those mentioned above for the following activities?

Activity	Alternative fuel
Cooking	
Lighting	
Ironing	
Heating	
Brewing	
Fish smoking/drying	
Brick burning	
Others (Specify)	

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

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8. What are the prices for the following energy types?

Energy type	Farm get price (Tshs)	Market price (Tshs)	Wholesale Price (Tshs)	Retail price(Tshs)	Units used
Firewood					Bundles
Charcoal					Bags(kg)
Kerosene					lts
Electricity					kwh
Crop residues					kg
Others (specify)					

9. At present, how much fuel do you use for? (Per specified period day-week-month)

Activity	Energy type					
	Firewood	Charcoal	Kerosene	Electricity	Crop residues	Others (specify)
Cooking						
Lighting						
Ironing						
Heating						
Brewing						
Fish smoking						
Brick burning						
Others						
Unit used	bundles	Bags (kg)	lts	kwh		

10. Is the choice of fuel depending on the season?

Yes  No

11. If yes can you list the type of energy required in each season and quantity?

Type of Energy	Season		Unit used
	Dry	Rainy	
Firewood			bundles
Charcoal			Bags(kg)
Electricity			kwh
Kerosene			lts
Crop residues			kg
Others			

12. Do you use some specific energy types for cooking certain foods?

Yes  No

13. If yes, mention type of food and energy type

**Energy type**                      **Type of food**    **Main reasons**

.....  
 .....  
 .....

14. Is fuelwood supply a problem in this area?

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

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Yes                      No

15.     If **YES**, what is the main reason(s)

.....

16.     In your own opinion, what do you think should be done to solve the fuelwood problem in this place?

.....

17.     Are you ready to contribute or participate to improve the situation?

Yes                                      No

If yes, in what ways?

.....

.....

How do you deal with the fuelwood shortages

What type of stove do you normally use .....

Have you ever heard anything about improved energy efficient stoves?

Yes                      No

If **YES**, from where and when?

Are you buying firewood or charcoal?

Yes                      No

If **YES**, who sells it to you?

Men                      Women                      Children

Others (specify).....

Do you collect firewood freely for your business consumption? If **YES**, from which sources?

Individual farmland

Village woodland

Forest reserve

iv.     Others (specify).....

If you are collecting firewood from the forest reserve/ village woodlands where do you get authority for collection?

What is the time used for one round trip of firewood collection from the sources?

What type of tree species do you prefer for firewood and charcoal?

Firewood.....

Charcoal.....

How do you transport firewood and charcoal from their sources?

Source	Average distance (Km)	Means of transport					
		Manual	Bicycle	Carts/ Wheelbarrow	Vehicle	Animals	Others (specify)
Individual farmland							
Village woodland							
Forest reserve							
Others(specify)							

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

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Which part of the tree is used for firewood and charcoal?

Energy source	Part of tree		
	Bole	Branches	Others (specify)
Firewood			
Charcoal			

31. Is there any member in the household engaged in collection of firewood or charcoal burning for selling to enhance income generation?

Yes                      No

32. If Yes, how?

Family member	Energy source		
	Firewood	Charcoal	Others(specify)
Male			
Female			
Children			

33. For the past five years:-Indicate if firewood and charcoal supply has increased or decreased.

Energy source	Trend of supply		
	Increased	Declined	Same
Firewood			
Charcoal			

34. For the past five years, have you received any technical assistance in extension services on how to sustain your energy supply?

- i. Yes
- ii. No

35. If Yes, when and from whom?

Appendix 3: Household Particulars Summary

Village Name	No. H/hold surveyed.	Res/sex		H/mbr sex		Total	H/members education												RADIO			Inc. Lev.							
		M	F	M	F		NS	PS		SS		COLL		AE		Total	Yes	No	Ch	Yes	No	Ch	L	M	H				
							M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
<b>Umwe Kusini</b>	36	7	29	36	131	129	260	92	85	35	42	4	2	0	0	0	131	129	260	18	18	36	20	16	36	20	16	0	36
<b>Percent</b>		19.4	80.6	100	50.4	49.6	100.0	35.4	32.7	13.5	16.2	1.5	0.8	0.0	0.0	0.0	50.4	49.6	100	50.0	50.0	100	55.6	44.4	100	55.6	44.4	0.0	100
<b>Umwe Kati</b>	58	8	50	58	159	200	359	88	110	64	84	6	6	1	0	0	159	200	359	17	41	58	29	29	58	39	19	0	58
<b>Percent</b>		13.8	86.2	100	44.3	55.7	100.0	24.5	30.6	17.8	23.4	1.7	1.7	0.3	0.0	0.0	44.3	55.7	100	29.3	70.7	100	50.0	50.0	100	67.2	32.8	0.0	100
<b>Umwe Kaskazini</b>	28	3	25	28	100	105	205	54	65	43	29	3	11	0	0	0	100	105	205	20	8	28	22	6	28	18	10	0	28
<b>Percent</b>		10.7	89.3	100	48.8	51.2	100.0	26.3	31.7	21.0	14.1	1.5	5.4	0.0	0.0	0.0	48.8	51.2	100	71.4	28.6	100	78.6	21.4	100	64.3	35.7	0.0	100
<b>Total Umwe</b>	122	18	104	122	390	434	824	234	260	142	155	13	19	1	0	0	390	434	824	55	67	122	71	51	122	77	45	0	122
<b>Percent</b>		14.8	85.2	100	47.3	52.7	100.0	28.4	31.6	17.2	18.8	1.6	2.3	0.1	0.0	0.0	47.3	52.7	100	45.1	54.9	100	58.2	41.8	100	63.1	36.9	0.0	100
<b>Total Ikwiriri Township</b>	361	40	321	361	1086	1279	2365	621	818	419	424	43	37	3	0	0	1086	1279	2365	152	209	361	197	164	361	269	92	0	361
<b>Percent</b>		11	89	100	45.92	54.08	100	26.3	35	18	17.9	2	2	0.1	0	0	45.9	54.1	100	42	58	100	55	45	100	75	25	0	100
<b>Mbunju Mvuleni</b>	49	6	43	49	124	154	278	67	87	56	65	1	2	0	0	0	124	154	278	23	26	49	16	33	49	41	8	0	49
<b>Percent</b>		12.2	87.8	100	44.6	55.4	100.0	24.1	31.3	20.1	23.4	0.4	0.7	0.0	0.0	0.0	44.6	55.4	100	46.9	53.1	100	32.7	67.3	100	83.7	16.3	0.0	100
<b>Grand total</b>	410	46	364	410	1210	1433	2643	688	905	475	489	44	39	3	0	0	1210	1433	2643	175	235	410	213	197	410	310	100	0	410
<b>Percent</b>		11.2	88.8	100	45.8	54.2	100.0	26.0	34.2	18.0	18.5	1.7	1.5	0.1	0.0	0.0	45.8	54.2	100	42.7	57.3	100	52.0	48.0	100	75.6	24.4	0.0	100

**Key**

H/hold - House hold  
 Res/sex - Respondent sex  
 H/mbr - House member  
 M - Male  
 F - Female  
 NS - No school  
 PS - Primary school  
 SS - Secondary school  
 Coll - College  
 AE - Advance education  
 Nws/P - Newspaper  
 Inc. Lev. - Income level  
 L - Low income  
 M - Medium income  
 H - High income  
 Ch - Check

## Appendix 4: Ethnic Groups and Places of Origin

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
<b>Mgomba kusini</b>	54	1	Ndengereko	44	81.5	1	Coast region		
		2	Pogoro	1	1.9		Rufiji	48	88.9
		3	Ngindo	7	13.0		Kisarawe	0	0.0
		4	Nyakyusa	1	1.9		Kilwa	3	5.6
		5	Chaga	0	0.0		Mafia	0	0.0
		6	Makonde	1	1.9		Kibaha	0	0.0
		7	Mwera	0	0.0	2	Morogoro	1	1.9
		8	Zaramo	0	0.0	3	Lindi	1	1.9
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	0	0.0	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	0	0.0
		13	Nyamwezi	0	0.0	8	Dsm	0	0.0
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	0	0.0	10	Mbeya	1	1.9
		16	Yao	0	0.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	0	0.0
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				
<b>Total</b>			54	100.0			54	100.0	
<b>Mgomba kati</b>	44	1	Ndengereko	36	81.8	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	40	90.9
		3	Ngindo	2	4.5		Kisarawe	1	2.3
		4	Nyakyusa	0	0.0		Kilwa	2	4.5
		5	Chaga	0	0.0		Mafia	0	0.0
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	1	2.3	2	Morogoro	0	0.0
		8	Zaramo	1	2.3	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	2	4.5	6.0	Tabora	1	2.3
		12	Nyakisoma	1	2.3	7.0	Mtwara	0	0.0
		13	Nyamwezi	1	2.3	8.0	Dsm	0	0.0
		14	Zigua	0	0.0	9.0	Moshi	0	0.0
		15	Ngoni	0	0.0	10.0	Mbeya	0	0.0
		16	Yao	0	0.0	11.0	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12.0	Iringa	0	0.0
		18	Gogo	0	0.0	13.0	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				
<b>Total</b>			44	100.0			44	100.0	



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**Appendix 4 Continued.**

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
<b>Mgomba kaskazini</b>	31	1	Ndengereko	19	61.3	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	21	67.7
		3	Ngindo	3	9.7		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	3	9.7
		5	Chaga	0	0.0		Mafia	0	0.0
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	2	6.5	2	Morogoro	0	0.0
		8	Zaramo	0	0.0	3	Lindi	3	9.7
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	5	16.1	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	1	3.2
		13	Nyamwezi	0	0.0	8	Dsm	3	9.7
		14	Zigua	1	3.2	9	Moshi	0	0.0
		15	Ngoni	1	3.2	10	Mbeya	0	0.0
		16	Yao	0	0.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	0	0.0
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				
<b>Total</b>				31	100.0			31	100.0
<b>SUMMARY MGOMBA WARD</b>	129	1	Ndengereko	99	76.7	1	Coast region		
		2	Pogoro	1	0.8		Rufiji	109	84.5
		3	Ngindo	12	9.3		Kisarawe	1	0.8
		4	Nyakyusa	1	0.8		Kilwa	8	6.2
		5	Chaga	0	0.0		Mafia	0	0.0
		6	Makonde	1	0.8		Kibaha	0	0.0
		7	Mwera	3	2.3	2	Morogoro	1	0.8
		8	Zaramo	1	0.8	3	Lindi	4	3.1
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	7	5.4	6	Tabora	1	0.8
		12	Nyakisoma	1	0.8	7	Mtwara	1	0.8
		13	Nyamwezi	1	0.8	8	Dsm	3	2.3
		14	Zigua	1	0.8	9	Moshi	0	0.0
		15	Ngoni	1	0.8	10	Mbeya	1	0.8
		16	Yao	0	0.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	0	0.0
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				
<b>Total</b>				129	100.0			129	100.0

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**Appendix 4 continued**

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
<b>Ikwiriri kusini</b>	71	1	Ndengereko	55	77.5	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	60	84.5
		3	Ngindo	3	4.2		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	3	4.2
		5	Chaga	1	1.4		Mafia	0	0.0
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	2	2.8	2	Morogoro	0	0.0
		8	Zaramo	0	0.0	3	Lindi	0	0.0
		9	Sambaa	1	1.4	4	Tanga	2	2.8
		10	Nyagatwa	1	1.4	5	Dodoma	1	1.4
		11	Tumbi	4	5.6	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	1	1.4
		13	Nyamwezi	0	0.0	8	Dsm	3	4.2
		14	Zigua	1	1.4	9	Moshi	1	1.4
		15	Ngoni	0	0.0	10	Mbeya	0	0.0
		16	Yao	1	1.4	11	Zanzibar	0	0.0
		17	Zuzuri	1	1.4	12	Iringa	0	0.0
		18	Gogo	1	1.4	13	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				
<b>Total</b>				71	100.0			71	100.0
<b>Ikwiriri kati</b>	21	1	Ndengereko	15	71.4	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	18	85.7
		3	Ngindo	3	14.3		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	1	4.8
		5	Chaga	0	0.0		Mafia	1	4.8
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	0	0.0	2	Morogoro	0	0.0
		8	Zaramo	0	0.0	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	1	4.8
		10	Nyagatwa	1	4.8	5	Dodoma	0	0.0
		11	Tumbi	1	4.8	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	0	0.0
		13	Nyamwezi	0	0.0	8	Dsm	0	0.0
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	0	0.0	10	Mbeya	0	0.0
		16	Yao	0	0.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	0	0.0
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	1	4.8				
		20	Hehe	0	0.0				
<b>Total</b>				21	100.0			21	100.0

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 4 Continued**

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
<b>Ikwiriri kaskazini</b>	18	1	Ndengereko	6	33.3	1.0	Coast region		
		2	Pogoro	1	5.6		Rufiji	13	72.2
		3	Ngindo	6	33.3		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	4	22.2
		5	Chaga	0	0.0		Mafia	0	0.0
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	0	0.0	2.0	Morogoro	0	0.0
		8	Zaramo	0	0.0	3.0	Lindi	0	0.0
		9	Sambaa	0	0.0	4.0	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5.0	Dodoma	0	0.0
		11	Tumbi	3	16.7	6.0	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7.0	Mtwara	0	0.0
		13	Nyamwezi	0	0.0	8.0	Dsm	0	0.0
		14	Zigua	0	0.0	9.0	Moshi	0	0.0
		15	Ngoni	0	0.0	10.0	Mbeya	0	0.0
		16	Yao	1	5.6	11.0	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12.0	Iringa	1	5.6
		18	Gogo	0	0.0	13.0	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	1	5.6				
<b>Total</b>				18	100.0			18	100.0
<b>SUMMARY IKWIRIRI WARD</b>	110	1	Ndengereko	76	69.1	1	Coast region		
		2	Pogoro	1	0.9		Rufiji	91	82.7
		3	Ngindo	12	10.9		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	8	7.3
		5	Chaga	1	0.9		Mafia	1	0.9
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	2	1.8	2	Morogoro	0	0.0
		8	Zaramo	0	0.0	3	Lindi	0	0.0
		9	Sambaa	1	0.9	4	Tanga	3	2.7
		10	Nyagatwa	2	1.8	5	Dodoma	1	0.9
		11	Tumbi	8	7.3	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	1	0.9
		13	Nyamwezi	0	0.0	8	Dsm	3	2.7
		14	Zigua	1	0.9	9	Moshi	1	0.9
		15	Ngoni	0	0.0	10	Mbeya	0	0.0
		16	Yao	2	1.8	11	Zanzibar	0	0.0
		17	Zuzuri	1	0.9	12	Iringa	1	0.9
		18	Gogo	1	0.9	13	Musoma	0	0.0
		19	Bena	1	0.9				
		20	Hehe	1	0.9				
<b>Total</b>				110	86.4			110	100.0

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**Appendix 4 Continued**

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
Umwe kusini	36	1	Ndengereko	23	63.9	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	32	88.9
		3	Ngindo	3	8.3		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	0	0.0
		5	Chaga	0	0.0		Mafia	1	2.8
		6	Makonde	0	0.0		Kibaha	1	2.8
		7	Mwera	1	2.8	2	Morogoro	0	0.0
		8	Zaramo	0	0.0	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	8	22.2	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	2	5.6
		13	Nyamwezi	0	0.0	8	Dsm	0	0.0
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	0	0.0	10	Mbeya	0	0.0
		16	Yao	0	0.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	0	0.0
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				
		21	Mwarabu	1	2.8				
<b>Total</b>				<b>36</b>	<b>100.0</b>			<b>36</b>	<b>100.0</b>
Umwe kati	58	1	Ndengereko	48	82.8	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	50	86.2
		3	Ngindo	1	1.7		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	2	3.4
		5	Chaga	0	0.0		Mafia	1	1.7
		6	Makonde	0	0.0		Kibaha	0	0.0
		7	Mwera	0	0.0	2	Morogoro	1	1.7
		8	Zaramo	2	3.4	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	2	3.4	6	Tabora	1	1.7
		12	Nyakisoma	0	0.0	7	Mtwara	1	1.7
		13	Nyamwezi	1	1.7	8	Dsm	1	1.7
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	0	0.0	10	Mbeya	0	0.0
		16	Yao	0	0.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	1	1.7
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0				
		20	Hehe	0	0.0				

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**Appendix 4 Continued**

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
<b>Umwe kati Continued</b>		21	Mwarabu	1	1.7				
		22	Nyasa	1	1.7				
		23	Luguru	1	1.7				
		24	Kinga	1	1.7				
<b>Total</b>				58	100.0			58	100.0
<b>Umwe kaskazini</b>	28	1	Ndengereko	19	67.9	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	22	78.6
		3	Ngindo	3	10.7		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	1	3.6
		5	Chaga	1	3.6		Mafia	0	0.0
		6	Makonde	1	3.6		Kibaha	1	3.6
		7	Mwera	1	3.6	2	Morogoro	0	0.0
		8	Zaramo	1	3.6	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	0	0.0	6	Tabora	1	3.6
		12	Nyakisoma	0	0.0	7	Mtwara	1	3.6
		13	Nyamwezi	1	3.6	8	Dsm	0	0.0
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	1	3.6	10	Mbeya	0	0.0
		16	Yao	0	0.0	11	Zanzibar	1	3.6
		17	Zuzuri	0	0.0	12	Iringa	0	0.0
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0	14	Songea	1	3.6
		20	Hehe	0	0.0				
		21	Mwarabu	0	0.0				
		22	Nyasa	0	0.0				
		23	Luguru	0	0.0				
		24	Kinga	0	0.0				
<b>Total</b>				28	100.0			28	100.0
<b>SUMMARY UMWE WARD</b>	122	1	Ndengereko	90	73.8	1	Coast region		
		2	Pogoro	0	0.0		Rufiji	103	84.4
		3	Ngindo	7	5.7		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	3	2.5
		5	Chaga	1	0.8		Mafia	2	1.6
		6	Makonde	1	0.8		Kibaha	2	1.6
		7	Mwera	2	1.6	2	Morogoro	1	0.8
		8	Zaramo	3	2.5	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	10	8.2	6	Tabora	2	1.6

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 4 Continued**

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
<b>SUMMARY UMWE WARD Continued</b>		12	Nyakisoma	0	0.0	7	Mtwara	4	3.3
		13	Nyamwezi	2	1.6	8	Dsm	1	0.8
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	1	0.8	10	Mbeya	0	0.0
		16	Yao	0	0.0	11	Zanzibar	1	0.8
		17	Zuzuri	0	0.0	12	Iringa	2	1.6
		18	Gogo	0	0.0	13	Musoma	0	0.0
		19	Bena	0	0.0	14	Songea	1	0.8
		20	Hehe	0	0.0				
		21	Mwarabu	2	1.6				
		22	Nyasa	1	0.8				
		23	Luguru	1	0.8				
	24	Kinga	1	0.8					
<b>Total</b>				122	100			122	100
		1	Ndengereko	265	73.4	1	Coast region		
<b>SUMMARY IKWIRIRI TOWNSHIP</b>	361	2	Pogoro	2	0.6		Rufiji	304	84.2
		3	Ngindo	31	8.6		Kisarawe	1	0.3
		4	Nyakyusa	1	0.3		Kilwa	20	5.5
		5	Chaga	2	0.6		Mafia	2	0.6
		6	Makonde	2	0.6		Kibaha	1	0.3
		7	Mwera	7	1.9	2	Morogoro	2	0.6
		8	Zaramo	4	1.1	3	Lindi	4	1.1
		9	Sambaa	1	0.3	4	Tanga	3	0.8
		10	Nyagatwa	2	0.6	5	Dodoma	1	0.3
		11	Tumbi	25	6.9	6	Tabora	3	0.8
		12	Nyakisoma	1	0.3	7	Mtwara	6	1.7
		13	Nyamwezi	3	0.8	8	Dsm	7	1.9
		14	Zigua	2	0.6	9	Moshi	1	0.3
		15	Ngoni	2	0.6	10	Mbeya	1	0.3
		16	Yao	2	0.6	11	Zanzibar	1	0.3
		17	Zuzuri	1	0.3	12	Iringa	3	0.8
		18	Gogo	1	0.3	13	Musoma	0	0.0
		19	Bena	1	0.3	14	Songea	0	0.0
		20	Hehe	1	0.3				
		21	Mwarabu	2	0.6				
		22	Nyasa	1	0.3				
		23	Luguru	1	0.3				
		24	Kinga	1	0.3				
		<b>Total</b>				<b>361</b>	<b>100.0</b>		

Appendix 4 Continued

Village name	Particulars								
	Total H/h Surveyed	Tribe				Place of Origin			
		No:	Name	Fig.	%	No:	Name of place	Fig.	%
MBUNJU MVULENI	49	1	Ndengereko	39	79.6	1	Coast region		
		2	Pogoro	1	2.0		Rufiji	43	87.8
		3	Ngindo	1	2.0		Kisarawe	0	0.0
		4	Nyakyusa	0	0.0		Kilwa	1	2.0
		5	Chaga	0	0.0		Mafia	0	0.0
		6	Makonde	1	2.0		Kibaha	0	0.0
		7	Mwera	0	0.0	2	Morogoro	1	2.0
		8	Zaramo	0	0.0	3	Lindi	0	0.0
		9	Sambaa	0	0.0	4	Tanga	0	0.0
		10	Nyagatwa	0	0.0	5	Dodoma	0	0.0
		11	Tumbi	1	2.0	6	Tabora	0	0.0
		12	Nyakisoma	0	0.0	7	Mtwara	2	4.1
		13	Nyamwezi	1	2.0	8	Dsm	0	0.0
		14	Zigua	0	0.0	9	Moshi	0	0.0
		15	Ngoni	1	2.0	10	Mbeya	0	0.0
		16	Yao	1	2.0	11	Zanzibar	0	0.0
		17	Zuzuri	0	0.0	12	Iringa	1	2.0
		18	Gogo	0	0.0	13	Musoma	1	2.0
		19	Bena	0	0.0	14	Songea	0	0.0
		20	Hehe	1	2.0				
		21	Mwarabu	0	0.0				
		22	Nyasa	0	0.0				
		23	Luguru	1	2.0				
		24	Kinga	0	0.0				
		25	Kurya	1	2.0				
<b>Total</b>			49	100.0			49	100.0	

Appendix 5: Summary of Household Fuelwood Consumption

Village	Household Number	H/hold Size	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments		
			Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons H/H per day kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg	Av. Cons per capita per day kg						
<b>Mgomba Kusini</b>																				
1		5	2	23	46	7	6.57	1.31	0	0	0	0	0.00	0.00	0.00	0.00	1.31	39	473	
2		10	2	23	46	7	6.57	0.66	0	0	0	0	0.00	0.00	0.00	0.00	0.66	20	237	
3		7	1	23	23	7	3.29	0.47	0	0	0	0	0.00	0.00	0.00	0.00	0.47	14	169	
4		6	3	23	69	7	9.86	1.64	0	0	0	0	0.00	0.00	0.00	0.00	1.64	49	591	
5		12	4	23	92	7	13.14	1.10	0	0	0	0	0.00	0.00	0.00	0.00	1.10	33	394	
6		4	0	0	0	0	0.00	0.00	30	6.2	186	30	6.20	1.55	6.20	1.55	1.55	47	558	
7		5	0	0	0	0	0.00	0.00	30	6.2	186	30	6.20	1.24	6.20	1.24	1.24	37	446	
8		10	4	23	92	7	13.14	1.31	0	0	0	0	0.00	0.00	0.00	0.00	1.31	39	473	
9		4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	0.00	0.00	1.92	58	690	
10		4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	0.00	0.00	1.92	58	690	
11		2	2	23	46	14	3.29	1.64	0	0	0	0	0.00	0.00	0.00	0.00	1.64	49	591	
12		11	2	23	46	4	11.50	1.05	0	0	0	0	0.00	0.00	0.00	0.00	1.05	31	376	
13		4	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.55	6.20	1.55	1.55	47	558	
14		12	2	23	46	3	15.33	1.28	0	0	0	0	0.00	0.00	0.00	0.00	1.28	38	460	
15		9	0	0	0	0	0.00	0.00	3	38	114	8	14.25	1.58	14.25	1.58	1.58	48	570	
16		1	0	0	0	0	0.00	0.00	2	6.2	12.4	7	1.77	1.77	1.77	1.77	1.77	53	638	
17		10	1	23	23	2	11.50	1.15	0	0	0	0	0.00	0.00	0.00	0.00	1.15	35	414	
18		5	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	2.48	12.40	2.48	2.48	74	893	
19		11	3	23	69	4	17.25	1.57	0	0	0	0	0.00	0.00	0.00	0.00	1.57	47	565	
20		3	1	23	23	7	3.29	1.10	0	0	0	0	0.00	0.00	0.00	0.00	1.10	33	394	Mkaa
21		7	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.77	12.40	1.77	1.77	53	638	
22		6	3	23	69	7	9.86	1.64	0	0	0	0	0.00	0.00	0.00	0.00	1.64	49	591	
23		12	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	1.55	18.60	1.55	1.55	47	558	
24		2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	Mkaa
25		10	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	Mkaa
26		8	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	Mkaa



Appendix 5 Continued

Village	No.	Bundles collected free from the forest										Bundles purchased						Comments
		Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day H/H kg	Av. Cons per capita kg	Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg		
<b>Mgomba Kusini continued</b>																		
27	4	2	23	46	7	6.57	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591		
28	7	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.89	0.89	27	319		
29	4	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	3.10	93	1,116	Ntilie		
30	9	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	2.07	62	744			
31	7	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.89	27	319			
32	4	2	23	46	7	6.57	1.64	0	0	0	0	0.00	0.00	1.64	49	591		
33	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
34	8	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.55	47	558			
35	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
36	4	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	Mkaa		
37	6	2	23	46	1	46.00	7.67	0	0	0	0	0.00	0.00	7.67	230	2,760		
38	6	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	2.07	62	744			
39	9	0	0	0	0	0.00	0.00	1	76	76	7	10.86	1.21	36	434			
40	6	0	0	0	0	0.00	0.00	3	6.2	18.6	7	2.66	0.44	13	159			
41	8	3	23	69	6	11.50	1.44	0	0	0	0	0.00	0.00	1.44	43	518		
42	5	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.24	37	446			
43	7	3	23	69	6	11.50	1.64	0	0	0	0	0.00	0.00	1.64	49	591		
44	2	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	3.10	93	1,116			
45	5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	Mkaa		
46	9	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.38	41	496			
47	6	1	23	23	4	5.75	0.96	0	0	0	0	0.00	0.00	0.96	29	345		
48	2	1	23	23	7	3.29	1.64	0	0	0	0	0.00	0.00	1.64	49	591		
49	7	2	23	46	5	9.20	1.31	0	0	0	0	0.00	0.00	1.31	39	473		
50	8	3	23	69	6	11.50	1.44	0	0	0	0	0.00	0.00	1.44	43	518		
51	2	2	23	46	7	6.57	3.29	0	0	0	0	0.00	0.00	3.29	99	1,183		
52	8	3	23	69	6	11.50	1.44	0	0	0	0	0.00	0.00	1.44	43	518		

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Comments			
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day H/H kg		Av. Cons per capita kg	Total firewood cons. per capita per day / kg	Cons. per month per capita kg
<b>Mgomba Kusini continued</b>																	
53	9	4	23	92	7	13.14	1.46	0	0	0	0.00	0.00	0.00	1.46	44	526	
54	6	0	0	0	0	0.00	0.00	1	76	76	7	10.86	1.81	1.81	54	651	
<b>Mgomba Kati</b>																	
55	2	1	23	23	3	7.67	3.83	0	0	0	0.00	0.00	0.00	3.83	115	1,380	
56	10	4	23	92	7	13.14	1.31	0	0	0	0.00	0.00	0.00	1.31	39	473	
57	6	3	23	69	7	9.86	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
58	14	6	23	138	7	19.71	1.41	0	0	0	0.00	0.00	0.00	1.41	42	507	
59	7	2	23	46	5	9.20	1.31	0	0	0	0.00	0.00	0.00	1.31	39	473	
60	11	1	23	23	5	4.60	0.42	2	40	80	2	40.00	3.64	4.05	122	1,460	
61	5	1	23	23	4	5.75	1.15	0	0	0	0.00	0.00	0.00	1.15	35	414	
62	11	3	23	69	4	17.25	1.57	0	0	0	0.00	0.00	0.00	1.57	47	565	
63	2	1	23	23	5	4.60	2.30	0	0	0	0.00	0.00	0.00	2.30	69	828	
64	12	2	23	46	3	15.33	1.28	0	0	0	0.00	0.00	0.00	1.28	38	460	
65	7	1	23	23	2	11.50	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
66	5	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.24	1.24	37	446	
67	9	3	23	69	6	11.50	1.28	0	0	0	0.00	0.00	0.00	1.28	38	460	
68	4	1	23	23	3	7.67	1.92	4	6.2	24.8	4	6.20	1.55	3.47	104	1,248	
69	7	3	23	69	6	11.50	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
70	9	3	23	69	6	11.50	1.28	0	0	0	0.00	0.00	0.00	1.28	38	460	
71	12	0	0	0	0	0.00	0.00	1	76	76	4	19.00	1.58	1.58	48	570	
72	5	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.24	1.24	37	446	
73	2	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	3.10	3.10	93	1,116	
74	7	3	23	69	7	9.86	1.41	0	0	0	0.00	0.00	0.00	1.41	42	507	
75	6	1	23	23	7	3.29	0.55	0	0	0	0.00	0.00	0.00	0.55	16	197	
76	5	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0	Mkaa	

**Key:** Cons – Consumption      Av. Cons - Average consumption      H/hold - House hold

Appendix 5 Continued

Village	Household Number	H/hold Size	Bundles collected free from the forest										Bundles purchased					Comments	
			Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg	Av. Cons per capita per day kg	Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg		
<b>Mgomba Kati Continued</b>																			
77		3	0	0	0	0	0.00	0.00	0.00	1	40	40	7	5.71	1.90	1.90	57	686	
78		8	1	23	23	2	11.50	1.44	1.44	0	0	0	0	0.00	1.44	1.44	43	518	
79		7	0	0	0	0	0.00	0.00	0.00	3	40	120	14	8.57	1.22	1.22	37	441	
80		7	3	23	69	7	9.86	1.41	1.41	0	0	0	0	0.00	1.41	1.41	42	507	
81		6	0	0	0	0	0.00	0.00	0.00	3	6.2	18.6	2	9.30	1.55	1.55	47	558	
82		4	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	3.10	3.10	93	1,116	
83		4	3	23	69	14	4.93	1.23	1.23	0	0	0	0	0.00	1.23	1.23	37	444	
84		4		0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558	
85		13	3	23	69	4	17.25	1.33	1.33	0	0	0	0	0.00	1.33	1.33	40	478	
86		9	1	23	23	3	7.67	0.85	0.85	0	0	0	0	0.00	0.85	0.85	26	307	
87		5	3	23	69	8	8.63	1.73	1.73	0	0	0	0	0.00	1.73	1.73	52	621	
88		4	1	23	23	4	5.75	1.44	1.44	0	0	0	0	0.00	1.44	1.44	43	518	
89		7	1	23	23	4	5.75	0.82	0.82	1	40	40	3	13.33	1.90	2.73	82	981	
90		5	0	0	0	0	0.00	0.00	0.00	1	40	40	4	10.00	2.00	2.00	60	720	
91		2	0	0	0	0	0.00	0.00	0.00	1	40	40	7	5.71	2.86	2.86	86	1,029	
92		8	1	23	23	2	11.50	1.44	1.44	0	0	0	0	0.00	1.44	1.44	43	518	
93		5	1	23	23	3	7.67	1.53	1.53	0	0	0	0	0.00	1.53	1.53	46	552	
94		5	3	23	69	8	8.63	1.73	1.73	0	0	0	0	0.00	1.73	1.73	52	621	
95		6	10	23	230	30	7.67	1.28	1.28	0	0	0	0	0.00	1.28	1.28	38	460	
96		10	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	1.24	1.24	37	446	
97		8	1	23	23	2	11.50	1.44	1.44	0	0	0	0	0.00	1.44	1.44	43	518	

Key: Cons – Consumption

Av. Cons - Average consumption

H/hold - House hold

REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments			
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg					Av. Cons per capita per day kg		
<b>Mgomba Kazkazini</b>																				
	98	12	0	0	0	0	0	0.00	0.00	0.00	1	76	76	2	38.00	3.17	3.17	95	1,140	
	99	4	0	0	0	7	0.00	0.00	0.00	1	76	76	7	10.86	2.71	2.71	81	977		
	100	10	2	23	46	3	15.33	1.53	1.53	0	0	0	0	0.00	0.00	1.53	46	552		
	101	3	1	23	23	4	5.75	1.92	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
	102	9	3	23	69	6	11.50	1.28	1.28	0	0	0	0	0.00	0.00	1.28	38	460		
	103	10	0	0	0	0	0.00	0.00	0.00	1	40	40	14	2.86	0.29	0.29	9	103		
	104	6	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa	
	105	9	3	23	69	6	11.50	1.28	1.28	0	0	0	0	0.00	0.00	1.28	38	460		
	106	6	2	23	46	5	9.20	1.53	1.53	0	0	0	0	0.00	0.00	1.53	46	552		
	107	8	1	23	23	2	11.50	1.44	1.44	0	0	0	0	0.00	0.00	1.44	43	518		
	108	6	2	23	46	5	9.20	1.53	1.53	0	0	0	0	0.00	0.00	1.53	46	552		
	109	3	1	23	23	4	5.75	1.92	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
	110	5	1	23	23	3	7.67	1.53	1.53	0	0	0	0	0.00	0.00	1.53	46	552		
	111	10	1	23	23	2	11.50	1.15	1.15	0	0	0	0	0.00	0.00	1.15	35	414		
	112	6	1	23	23	2	11.50	1.92	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
	113	6	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	1.03	1.03	31	372		
	114	4	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558		
	115	8	3	23	69	6	11.50	1.44	1.44	0	0	0	0	0.00	0.00	1.44	43	518		
	116	5	1	23	23	3	7.67	1.53	1.53	0	0	0	0	0.00	0.00	1.53	46	552		
	117	7	2	23	46	7	6.57	0.94	0.94	0	0	0	0	0.00	0.00	0.94	28	338		
	118	4	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa	
	119	8	2	23	46	4	11.50	1.44	1.44	0	0	0	0	0.00	0.00	1.44	43	518		
	120	3	3	23	69	14	4.93	1.64	1.64	0	0	0	0	0.00	0.00	1.64	49	591		
	121	5	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	2	3.10	0.62	0.62	19	223	Mkaa	
	122	6	3	23	69	6	11.50	1.92	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
	123	5	1	23	23	2	11.50	2.30	2.30	0	0	0	0	0.00	0.00	2.30	69	828		
<b>Key:</b>			<b>Cons – Consumption</b>						<b>Av. Cons - Average consumption</b>						<b>H/hold - House hold</b>					

REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day H/H kg				
<b>Mgomba Kazkazini continued</b>																	
	350	3	1	23	23	4	5.75	1.92	0	0	0	0.00	0.00	1.92	58	690	Mpima
	351	9	2	23	46	7	6.57	0.73	0	0	0	0.00	0.00	0.73	22	263	Mpima
	352	6	3	23	69	8	8.63	1.44	0	0	0	0.00	0.00	1.44	43	518	Mpima
	353	10	1	23	23	1	23.00	2.30	0	0	0	0.00	0.00	2.30	69	828	Mpima
	354	3	1	23	23	3	7.67	2.56	0	0	0	0.00	0.00	2.56	77	920	Mpima
	355	5	1	23	23	3	7.67	1.53	0	0	0	0.00	0.00	1.53	46	552	Mpima
<b>Ikwiriri Kusini</b>																	
	124	14	1	23	23	1	23.00	1.64	0	0	0	1.00	0.07	1.71	51	617	
	125	4	0	23	0	0	0.00	0.00	5	6.2	31	31.00	7.75	7.75	233	2,790	Brewing
	126	4	0	0	0	0	0.00	0.00	1	6.2	6.2	6.20	1.55	47	558		
	127	2	1	23	23	7	3.29	1.64	0	0	0	0.00	0.00	1.64	49	591	
	128	6	2	23	46	6	7.67	1.28	0	0	0	0.00	0.00	1.28	38	460	
	129	0	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0.00	0	0	Mkaa
	130	7	0	0	0	0	0.00	0.00	1	6.2	6.2	6.20	0.89	27	319		
	131	7	0	0	0	0	0.00	0.00	2	40	80	11.43	1.63	49	588		
	132	9	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0	Mkaa
	133	5	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0	Mkaa
	134	10	0	0	0	0	0.00	0.00	5	6.2	31	15.50	1.55	47	558		
	135	5	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0	Mkaa
	136	2	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0	Mkaa
	137	8	2	23	46	7	6.57	0.82	0	0	0	0.00	0.00	0.82	25	296	
	138	10	0	0	0	0	0.00	0.00	3	6.2	18.6	9.30	0.93	28	335	Mkaa	
	139	10	0	0	0	0	0.00	0.00	1	76	76	10.86	1.09	33	391	Mkaa	
	140	3	0	0	0	0	0.00	0.00	1	35	35	7.00	2.33	70	840		
	141	3	0	0	0	0	0.00	0.00	1	6.2	6.2	6.20	2.07	62	744		
	142	5	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0	Mkaa
<b>Key:</b>			<b>Cons – Consumption</b>		<b>Av. Cons - Average consumption</b>		<b>H/hold - House hold</b>										

REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources

Appendix 5 Continued

Village	No.	Bundles collected free from the forest										Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg	Av. Cons per capita per day kg							
<b>Ikwiriri Kusini continued</b>																					
143	2	0	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0.00	0.00	0	0	Mkaa	
144	15	0	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	1	1.24	1.24	37	446			
145	2	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1	3.10	3.10	93	1,116			
146	5	0	0	0	0	0	0.00	0.00	3	6.2	18.6	4	4.65	4	0.93	0.93	28	335	Mkaa		
147	4	2	23	46	7	6.57	1.64	0	0	0	0	0	0.00	0	1.64	1.64	49	591			
148	2	0	0	0	0	0.00	0.00	2	6.2	12.4	4	3.10	1.55	47	1.55	1.55	47	558			
149	6	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
150	10	0	0	0	0	0.00	0.00	5	6.2	31	1	31.00	3.10	93	3.10	3.10	93	1,116	Fish		
151	2	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
152	3	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	mkaa		
153	1	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
154	5	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	3.72	112	3.72	3.72	112	1,339	Ntilie		
155	8	3	23	69	6	11.50	1.44	0	0	0	0	0	0.00	0	1.44	1.44	43	518			
156	5	2	23	46	7	6.57	1.31	0	0	0	0	0	0.00	0	1.31	1.31	39	473			
157	14	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
158	5	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
159	13	6	23	138	7	19.71	1.52	0	0	0	0	0	0.00	0	1.52	1.52	45	546			
160	12	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
161	11	0	0	0	0	0.00	0.00	5	6.2	31	2	15.50	1.41	42	1.41	1.41	42	507			
162	10	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.24	37	1.24	1.24	37	446			
163	5	0	0	0	0	0.00	0.00	0	0	0	0	0	0.00	0	0.00	0.00	0	0	Mkaa		
164	6	0	0	0	0	0.00	0.00	3	6.2	18.6	2	9.30	1.55	47	1.55	1.55	47	558			
165	8	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.55	47	1.55	1.55	47	558			
166	11	0	0	0	0	0.00	0.00	2	40	80	5	16.00	1.45	44	1.45	1.45	44	524			
167	6	0	0	0	0	0.00	0.00	3	6.2	18.6	2	9.30	1.55	47	1.55	1.55	47	558			
168	3	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	2.07	62	2.07	2.07	62	744			
<b>Key:</b>		<b>Cons – Consumption</b>										<b>Av. Cons - Average consumption</b>						<b>H/hold - House hold</b>			

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments		
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg					Av. Cons per capita per day kg	
<b>Ikwiriri Kusini continued</b>																			
169	7	2	23	46	7	6.57	0.94	0	0	0	0	0.00	0.00	0.94	28	338			
170	5	3	23	69	10	6.90	1.38	0	0	0	0	0.00	0.00	1.38	41	497			
171	7	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.89	0.89	27	319			
172	4	0	0	0	0	0.00	0.00	2	6.2	12.4	2	6.20	1.55	1.55	47	558			
173	4	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558			
174	2	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
175	9	3	23	69	6	11.50	1.28	0	0	0	0	0.00	0.00	1.28	38	460			
176	2	2	23	46	14	3.29	1.64	0	0	0	0	0.00	0.00	1.64	49	591			
177	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	1.92	58	690			
178	4	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558			
179	11	1	23	23	2	11.50	1.05	0	0	0	0	0.00	0.00	1.05	31	376			
180	7	0	0	0	0	0.00	0.00	3	6.2	18.6	2	9.30	1.33	1.33	40	478			
181	8	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	2.33	2.33	70	837			
182	3	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
183	8	3	23	69	7	9.86	1.23	0	0	0	0	0.00	0.00	1.23	37	444			
184	6	3	23	69	10	6.90	1.15	0	0	0	0	0.00	0.00	1.15	35	414			
185	10	0	0	0	0	0.00	0.00	5	6.2	31	2	15.50	1.55	1.55	47	558			
186	1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
187	5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
188	7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
189	10	1	23	23	3	7.67	0.77	2	6.2	12.4	1	12.40	1.24	2.01	60	722			
190	7	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
191	8	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
192	1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
193	12	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	1.55	1.55	47	558			
194	6	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa		
<b>Key:</b>		<b>Cons – Consumption</b>						<b>Av. Cons - Average consumption</b>						<b>H/hold - House hold</b>					

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 5 Continued**

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments	
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg					Av. Cons per capita per day kg
<b>Ikwiriri Kati</b>																		
195	5	0	0	0	0	0	0.00	0.00	1	40	40	3	13.33	2.67	2.67	80	960	
196	5	1	23	23	23	3	7.67	1.53	0	0	0	0	0.00	0.00	0.00	46	552	
197	6	0	0	0	0	0	0.00	0.00	1	40	40	14	2.86	0.48	0.48	14	171	Mkaa
198	3	0	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa
199	15	1	23	23	23	1	23.00	1.53	0	0	0	0	0.00	0.00	0.00	46	552	
200	9	1	23	23	23	3	7.67	0.85	0	0	0	0	0.00	0.00	0.00	26	307	
201	7	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.89	0.89	27	319	
202	4	0	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	3.10	3.10	93	1,116	
203	15	1	23	23	23	2	11.50	0.77	0	0	0	0	0.00	0.00	0.00	23	276	
204	3	0	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa
205	6	0	0	0	0	0	0.00	0.00	3	6.2	18.6	2	9.30	1.55	1.55	47	558	
206	6	1	23	23	23	4	5.75	0.96	0	0	0	0	0.00	0.00	0.00	29	345	
207	8	0	0	0	0	0	0.00	0.00	3	6.2	18.6	2	9.30	1.16	1.16	35	419	
208	4	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558	
209	4	0	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	3.10	3.10	93	1,116	
210	8	0	0	0	0	0	0.00	0.00	1	76	76	7	10.86	1.36	1.36	41	489	
211	9	0	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.38	1.38	41	496	
212	10	1	23	23	23	7	3.29	0.33	0	0	0	0	0.00	0.00	0.00	10	118	Mkaa
213	8	1	23	23	23	7	3.29	0.41	0	0	0	0	0.00	0.00	0.00	12	148	
214	3	0	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	Mkaa
215	3	3	23	69	69	14	4.93	1.64	0	0	0	0	0.00	0.00	0.00	49	591	
<b>Key:</b>	<b>Cons – Consumption</b>						<b>Av. Cons - Average consumption</b>						<b>H/hold – House hold</b>					



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 5 Continued**

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments	
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg					Av. Cons per capita per day kg
<b>Ikwiriri Kazkazini</b>																		
216	8	2	23	46	7	6.57	0.82	0	0	0	0.00	0.00	0.82	25	296			
217	7	3	23	69	8	8.63	1.23	0	0	0	0.00	0.00	1.23	37	444			
218	4	1	23	23	2	11.50	2.88	0	0	0	0.00	0.00	2.88	86	1,035			
219	6	2	23	46	7	6.57	1.10	0	0	0	0.00	0.00	1.10	33	394			
220	5	1	23	23	2	11.50	2.30	0	0	0	0.00	0.00	2.30	69	828			
221	4	1	23	23	2	11.50	2.88	0	0	0	0.00	0.00	2.88	86	1,035			
222	8	3	23	69	8	8.63	1.08	0	0	0	0.00	0.00	1.08	32	388			
223	9	1	23	23	2	11.50	1.28	0	0	0	0.00	0.00	1.28	38	460			
224	5	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.24	37	446			
225	3	1	23	23	6	3.83	1.28	0	0	0	0.00	0.00	1.28	38	460			
226	6	3	23	69	8	8.63	1.44	0	0	0	0.00	0.00	1.44	43	518			
227	11	3	23	69	4	17.25	1.57	0	0	0	0.00	0.00	1.57	47	565			
228	18	3	23	69	6	11.50	0.64	0	0	0	0.00	0.00	0.64	19	230	Mkaa		
229	3	0	0	0	0	0.00	0.00	1	6.2	6.2	2	3.10	1.03	31	372	Mkaa		
230	8	1	23	23	2	11.50	1.44	0	0	0	0.00	0.00	1.44	43	518	Mkaa		
231	5	1	23	23	2	11.50	2.30	0	0	0	0.00	0.00	2.30	69	828			
232	5	1	23	23	3	7.67	1.53	0	0	0	0.00	0.00	1.53	46	552			
233	9	3	23	69	6	11.50	1.28	0	0	0	0.00	0.00	1.28	38	460			
<b>Umwe Kusini</b>																		
234	7	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0.00	0	0	mkaa		
235	7	0	0	0	0	0.00	0.00	6	6.2	37.2	7	5.31	0.76	23	273			
236	6	2	23	46	7	6.57	1.10	0	0	0	0.00	0.00	1.10	33	394			
237	8	0	0	0	0	0.00	0.00	4	6.2	24.8	7	3.54	0.44	13	159			
238	10	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.62	19	223			
239	6	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.03	31	372			
240	6	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.03	31	372			
<b>Key:</b>	<b>Cons – Consumption</b>						<b>Av. Cons - Average consumption</b>						<b>H/hold - House hold</b>					

REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments		
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons H/H per day kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg					Av. Cons per day kg	
<b>Umwe Kusini continued</b>																			
241	7	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.89	27	319			
242	5	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.24	37	446			
243	6	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.03	31	372			
244	12	0	0	0	0	0	0.00	0.00	3	6.2	18.6	2	9.30	0.78	23	279			
245	8	3	23	69	6	6	11.50	1.44	0	0	0	0	0.00	1.44	43	518			
246	12	2	23	46	3	3	15.33	1.28	0	0	0	0	0.00	1.28	38	460			
247	9	2	23	46	7	7	6.57	0.73	0	0	0	0	0.00	0.73	22	263			
248	22	2	23	46	2	2	23.00	1.05	0	0	0	0	0.00	1.05	31	376			
249	5	0	0	0	0	0	0.00	0.00	2	6.2	12.4	2	6.20	1.24	37	446			
250	8	0	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	mkaa		
251	4	0	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	3.10	93	1,116			
252	7	0	0	0	0	0	0.00	0.00	3	6.2	18.6	1	18.60	2.66	80	957			
253	12	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.52	16	186			
254	8	2	23	46	7	7	6.57	0.82	0	0	0	0	0.00	0.82	25	296			
255	4	3	23	69	14	14	4.93	1.23	0	0	0	0	0.00	1.23	37	444			
256	4	3	23	69	14	14	4.93	1.23	0	0	0	0	0.00	1.23	37	444			
257	12	1	23	23	2	2	11.50	0.96	0	0	0	0	0.00	0.96	29	345			
258	5	2	23	46	7	7	6.57	1.31	0	0	0	0	0.00	1.31	39	473			
259	11	0	0	0	0	0	0.00	0.00	2	40	80	7	11.43	1.04	31	374			
260	5	3	23	69	10	10	6.90	1.38	0	0	0	0	0.00	1.38	41	497			
261	3	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	2.07	62	744			
262	3	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	2.07	62	744			
263	4	1	23	23	3	3	7.67	1.92	0	0	0	0	0.00	1.92	58	690			
264	5	1	23	23	2	2	11.50	2.30	0	0	0	0	0.00	2.30	69	828			
265	6	0	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	1.03	31	372			
266	3	3	23	69	14	14	4.93	1.64	0	0	0	0	0.00	1.64	49	591			
<b>Key:</b>		<b>Cons – Consumption</b>						<b>Av. Cons – Average consumption</b>						<b>H/hold – House hold</b>					

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 5 Continued**

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments						
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg					Av. Cons per capita per day kg					
<b>Umwe Kusini continued</b>																							
267	8	0	0	0	0	0	0	0	0.00	0.00	0.00	3	6.2	18.6	2	9.30	1.16	1.16	35	419			
268	8	0	0	0	0	0	0	0	0.00	0.00	0.00	3	6.2	18.6	2	9.30	1.16	1.16	35	419			
269	5	3	23	69	8	8	8	8	8.63	1.73	0.00	0	0	0	0	0.00	0.00	1.73	52	621			
<b>Umwe Kati</b>																							
270	6	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	0	Mkaa	
271	11	0	0	0	0	0	0	0	0.00	0.00	0.00	2	35	70	3	23.33	2.12	2.12	64	764			
272	10	0	0	0	0	0	0	0	0.00	0.00	0.00	10	40	400	30	13.33	1.33	1.33	40	480			
273	4	0	0	0	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	3.10	3.10	93	1,116			
274	10	0	0	0	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	1.24	1.24	37	446			
275	6	0	0	0	0	0	0	0	0.00	0.00	0.00	3	6.2	18.6	2	9.30	1.55	1.55	47	558			
276	4	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	0	Mkaa	
277	4	0	0	0	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558			
278	6	0	0	0	0	0	0	0	0.00	0.00	0.00	3	6.2	18.6	1	18.60	3.10	3.10	93	1,116			
279	2	0	0	0	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	3.10	3.10	93	1,116			
280	5	0	0	0	0	0	0	0	0.00	0.00	0.00	4	6.2	24.8	3	8.27	1.65	1.65	50	595			
281	6	1	23	23	1	1	1	1	23.00	3.83	0.00	0	0	0	0	0.00	0.00	3.83	115	1,380			
282	6	0	0	0	0	0	0	0	0.00	0.00	0.00	3	6.2	18.6	2	9.30	1.55	1.55	47	558			
283	11	1	23	23	1	1	1	1	23.00	2.09	0.00	0	0	0	0	0.00	0.00	2.09	63	753			
284	10	0	0	0	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	1.24	1.24	37	446			
285	15	1	17	17	4	4	4	4	4.25	0.28	0.00	3	6.2	18.6	1	18.60	1.24	1.24	46	548			
286	7	0	0	0	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	1.77	1.77	53	638			
287	4	0	0	0	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	1.55	1.55	47	558			
288	7	0	0	0	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	0.89	0.89	27	319			
289	6	0	0	0	0	0	0	0	0.00	0.00	0.00	1	6.2	6.2	1	6.20	1.03	1.03	31	372			
290	7	0	0	0	0	0	0	0	0.00	0.00	0.00	2	76	152	30	5.07	0.72	0.72	22	261			
291	12	0	0	0	0	0	0	0	0.00	0.00	0.00	2	6.2	12.4	1	12.40	1.03	1.03	31	372			
<b>Key:</b>		<b>Cons – Consumption</b>							<b>Av. Cons – Average consumption</b>			<b>H/hold – House consumption</b>											

REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg				
<b>Umwwe Kati continued</b>																	
292	4	1	23	23	23	2	11.50	2.88	0	0	0	0.00	0.00	2.88	86	1,035	
293	12	2	23	46	3	15.33	1.28	0	0	0	0.00	0.00	0.00	1.28	38	460	
294	8	3	23	69	6	11.50	1.44	0	0	0	0.00	0.00	0.00	1.44	43	518	
295	3	1	23	23	3	7.67	2.56	0	0	0	0.00	0.00	0.00	2.56	77	920	
296	3	1	23	23	4	5.75	1.92	0	0	0	0.00	0.00	0.00	1.92	58	690	
297	4	2	23	46	7	6.57	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
298	2	1	23	23	4	5.75	2.88	0	0	0	0.00	0.00	0.00	2.88	86	1,035	
299	6	1	17	17	5	3.40	0.57	2	40	80	2.67	0.44	0.00	1.01	30	364	
300	7	1	23	23	2	11.50	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
301	4	1	23	23	3	7.67	1.92	0	0	0	0.00	0.00	0.00	1.92	58	690	
302	4	1	17	17	5	3.40	0.85	1	6.2	6.2	3.10	0.78	0.00	1.63	49	585	
303	5	2	23	46	6	7.67	1.53	0	0	0	0.00	0.00	0.00	1.53	46	552	
304	6	2	23	46	5	9.20	1.53	0	0	0	0.00	0.00	0.00	1.53	46	552	
305	2	1	23	23	4	5.75	2.88	0	0	0	0.00	0.00	0.00	2.88	86	1,035	
306	6	3	23	69	8	8.63	1.44	0	0	0	0.00	0.00	0.00	1.44	43	518	
307	6	1	23	23	3	7.67	1.28	0	0	0	0.00	0.00	0.00	1.28	38	460	
308	5	1	23	23	3	7.67	1.53	0	0	0	0.00	0.00	0.00	1.53	46	552	
309	7	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	1.77	53	638		
310	4	1	23	23	3	7.67	1.92	0	0	0	0.00	0.00	0.00	1.92	58	690	
311	4	2	23	46	7	6.57	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
312	6	0	0	0	0	0.00	0.00	3	40	120	8.57	1.43	0.00	1.43	43	514	
313	5	2	23	46	7	6.57	1.31	0	0	0	0.00	0.00	0.00	1.31	39	473	
314	10	2	23	46	3	15.33	1.53	0	0	0	0.00	0.00	0.00	1.53	46	552	
315	7	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0	0	Mkaa
316	7	1	23	23	2	11.50	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
317	2	1	23	23	7	3.29	1.64	0	0	0	0.00	0.00	0.00	1.64	49	591	
<b>Key:</b>			<b>Cons – Consumption</b>				<b>Av. Cons – Average consumption</b>				<b>H/hold – House hold</b>						

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 5 Continued**

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments		
		Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day per H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg	Av. Cons per capita per day kg						
<b>Umwe Kati continued</b>																			
	4	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0	0	0	mkaa		
	9	0	0	0	0	0.00	0.00	1	6.2	6.2	6.20	0.69	1	6.20	21	248			
	4	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	Mkaa		
	5	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	Mkaa		
	10	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	Mkaa		
	6	1	23	23	3	7.67	1.28	0	0	0	0.00	0.00	0	0.00	38	460			
	6	1	23	23	4	5.75	0.96	0	0	0	0.00	0.00	0	0.00	29	345			
	8	1	40	40	30	1.33	0.17	0	0	0	0.00	0.00	0	0.00	5	60	Mkaa		
	2	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	Mkaa		
	7	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	Mkaa		
<b>Umwe Kazkazini</b>																			
	9	1	23	23	2	11.50	1.28	0	0	0	0.00	0.00	0	0.00	38	460			
	15	1	17	17	3	5.67	0.38	1	6.2	6.2	6.20	0.41	1	6.20	24	285			
	9	3	23	69	7	9.86	1.10	0	0	0	0.00	0.00	0	0.00	33	394			
	7	3	23	69	7	9.86	1.41	0	0	0	0.00	0.00	0	0.00	42	507			
	7	0	0	0	0	0.00	0.00	2	40	80	11.43	1.63	7	11.43	49	588			
	5	0	0	0	0	0.00	0.00	3	76	228	7.60	1.52	30	7.60	46	547			
	5	1	23	23	2	11.50	2.30	0	0	0	0.00	0.00	0	0.00	69	828			
	6	3	23	69	10	6.90	1.15	0	0	0	0.00	0.00	0	0.00	35	414			
	20	0	0	0	0	0.00	0.00	9	40	360	360.00	18.00	1	360.00	540	6,480	Ntilie		
	2	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0			
	3	1	23	23	4	5.75	1.92	0	0	0	0.00	0.00	0	0.00	58	690			
	2	1	23	23	5	4.60	2.30	0	0	0	0.00	0.00	0	0.00	69	828			
	6	1	23	23	3	7.67	1.28	0	0	0	0.00	0.00	0	0.00	38	460			
	8	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	mkaa		
	8	1	23	23	2	0.00	0.00	0	0	0	0.00	0.00	0	0.00	0	0	mkaa		
<b>Key:</b>		<b>Cons – Consumption</b>						<b>Av. Cons - Average consumption</b>						<b>H/hold - House hold</b>					

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Comments		
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg			Av. Cons per capita per day kg	Cons. per month per capita kg
<b>Umwe Kazkazini continued</b>																	
	343	5	0	0	0	0	0.00	0.00	2	6.2	12.4	1	12.40	2.48	74	893	
	344	11	0	0	0	0	0.00	0.00	1	76	76	7	10.86	0.99	30	355	Wastes
	345	9	0	0	0	0	0.00	0.00	1	76	76	7	10.86	1.21	36	434	
	346	5	0	0	0	0	0.00	0.00	2	6.2	12.4	3	4.13	0.83	25	298	
	347	5	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	
	348	8	0	0	0	0	0.00	0.00	1	6.2	6.2	1	6.20	0.78	23	279	
	349	8	1	23	23	7	3.29	0.41	0	0	0	0	0.00	0.41	12	148	
	405	14	2	26	52	3	17.33	1.24	0	0	0	0	0.00	1.24	37	446	
	406	7	2	17	34	3	11.33	1.62	0	0	0	0	0.00	1.62	49	583	
	407	8	1	26	26	2	13.00	1.63	0	0	0	0	0.00	1.63	49	585	
	408	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	1.92	58	690	
	409	6	1	23	23	2	11.50	1.92	0	0	0	0	0.00	1.92	58	690	
	410	3	1	23	23	3	7.67	2.56	0	0	0	0	0.00	2.56	77	920	
<b>Mbunju – Mvuleni</b>																	
	356	10	3	23	69	6	11.50	1.15	0	0	0	0	0.00	1.15	35	414	
	357	6	1	23	23	7	3.29	0.55	0	0	0	0	0.00	0.55	16	197	
	358	6	3	23	69	7	9.86	1.64	0	0	0	0	0.00	1.64	49	591	
	359	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	1.92	58	690	
	360	1	0	0	0	0	0.00	0.00	0	0	0	0	0.00	0.00	0	0	Teacher
	361	5	1	23	23	3	7.67	1.53	0	0	0	0	0.00	1.53	46	552	
	362	8	3	23	69	6	11.50	1.44	0	0	0	0	0.00	1.44	43	518	
	363	5	1	19	19	2	9.50	1.90	0	0	0	0	0.00	1.90	57	684	
	364	9	3	23	69	6	11.50	1.28	0	0	0	0	0.00	1.28	38	460	
	365	10	1	23	23	1	23.00	2.30	0	0	0	0	0.00	2.30	69	828	fish
	366	5	1	23	23	3	7.67	1.53	0	0	0	0	0.00	1.53	46	552	
	367	4	1	19	19	2	9.50	2.38	0	0	0	0	0.00	2.38	71	855	
<b>Key:</b>			<b>Cons – Consumption</b>				<b>Av. Cons - Average consumption</b>										<b>H/hold - House hold</b>

REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources

Appendix 5 Continued

Village	No.	Bundles collected free from the forest						Bundles purchased						Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	Comments
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day per H/H kg	Av. Cons per capita per day kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per day per H/H kg				
<b>Mbunju – Mvuleni continued</b>																	
368	6	1	23	23	23	2	11.50	1.92	0	0	0	0.00	0.00	1.92	58	690	
369	3	1	23	23	23	3	7.67	2.56	0	0	0	0.00	0.00	2.56	77	920	
370	4	1	23	23	23	4	5.75	1.44	0	0	0	0.00	0.00	1.44	43	518	
371	6	3	23	69	69	8	8.63	1.44	0	0	0	0.00	0.00	1.44	43	518	
372	7	1	23	23	23	1	23.00	3.29	0	0	0	0.00	0.00	3.29	99	1,183	
373	4	2	23	46	46	7	6.57	1.64	0	0	0	0.00	0.00	1.64	49	591	
374	11	4	23	92	92	7	13.14	1.19	0	0	0	0.00	0.00	1.19	36	430	
375	1	1	23	23	23	3	7.67	7.67	0	0	0	0.00	0.00	7.67	230	2,760	
376	1	0	0	0	0	0	0.00	0.00	0	0	0	0.00	0.00	0.00	0	0	Teacher
377	5	2	23	46	46	7	6.57	1.31	0	0	0	0.00	0.00	1.31	39	473	
378	6	2	23	46	46	7	6.57	1.10	0	0	0	0.00	0.00	1.10	33	394	
379	6	1	23	23	23	7	3.29	0.55	0	0	0	0.00	0.00	0.55	16	197	
380	12	2	23	46	46	5	9.20	0.77	0	0	0	0.00	0.00	0.77	23	276	
381	4	2	23	46	46	14	3.29	0.82	0	0	0	0.00	0.00	0.82	25	296	
382	2	1	19	19	19	3	6.33	3.17	0	0	0	0.00	0.00	3.17	95	1,140	
383	1	1	10	10	10	3	3.33	3.33	0	0	0	0.00	0.00	3.33	100	1,200	
384	4	1	23	23	23	2	11.50	2.88	0	0	0	0.00	0.00	2.88	86	1,035	
385	9	1	23	23	23	2	11.50	1.28	0	0	0	0.00	0.00	1.28	38	460	
386	5	2	23	46	46	7	6.57	1.31	0	0	0	0.00	0.00	1.31	39	473	
387	9	1	23	23	23	7	3.29	0.37	0	0	0	0.00	0.00	0.37	11	131	
388	5	3	23	69	69	14	4.93	0.99	0	0	0	0.00	0.00	0.99	30	355	
389	8	3	23	69	69	6	11.50	1.44	0	0	0	0.00	0.00	1.44	43	518	
390	8	1	23	23	23	3	7.67	0.96	0	0	0	0.00	0.00	0.96	29	345	
391	7	3	23	69	69	10	6.90	0.99	0	0	0	0.00	0.00	0.99	30	355	
392	6	1	23	23	23	2	11.50	1.92	0	0	0	0.00	0.00	1.92	58	690	
393	7	1	23	23	23	2	11.50	1.64	0	0	0	0.00	0.00	1.64	49	591	
<b>Key:</b>			<b>Cons – Consumption</b>				<b>Av. Cons - Average consumption</b>		<b>H/hold - House consumption</b>								

Appendix 5 Continued

Village	No.	Bundles collected free from the forest										Bundles purchased						Comments
		H/hold Size	Bundles Collected	Bundle weight kg	Total bundles volume kg	Reported cons. per day kg	Av. Cons per day H/H kg	Av. Cons per capita kg	Bundles purchased	Bundle weight kg	Total bundles weight kg	Reported cons. days kg	Av. Cons per H/H kg	Av. Cons per day kg	Total firewood cons. per capita per day / kg	Cons. per month per capita kg	Cons. per year per capita kg	
<b>Mbunju – Mvuleni continued</b>																		
394	5	1	23	23	4	5.75	1.15	0	0	0	0	0.00	0.00	1.15	35	414		
395	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
396	6	2	23	46	7	6.57	1.10	0	0	0	0	0.00	0.00	1.10	33	394		
397	3	1	19	19	2	9.50	3.17	0	0	0	0	0.00	0.00	3.17	95	1,140		
398	4	1	23	23	4	5.75	1.44	0	0	0	0	0.00	0.00	1.44	43	518		
399	10	4	23	92	6	15.33	1.53	0	0	0	0	0.00	0.00	1.53	46	552		
400	7	3	23	69	6	11.50	1.64	0	0	0	0	0.00	0.00	1.64	49	591		
401	5	2	23	46	7	6.57	1.31	0	0	0	0	0.00	0.00	1.31	39	473		
402	4	1	23	23	3	7.67	1.92	0	0	0	0	0.00	0.00	1.92	58	690		
403	5	0	0	0	0	0.00	0.00	3	76	228	30	7.60	1.52	1.52	46	547		
404	4	1	23	23	4	5.75	1.44	0	0	0	0	0.00	0.00	1.44	43	518		



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 6: Summary of Household Charcoal Consumption**

CHARCOAL												
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Mgomba Kusini</b>												
1	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
2	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
3	7	kopo	1	5	5	7	0.71	0.10	0.71	3.06	36.73	
4	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
5	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
6	4	Kopo	1	1	1	1	1.00	0.25	1.75	7.50	90.00	
7	5	Kopo	1	1	1	30	0.03	0.01	0.05	0.20	2.40	Ironing
8	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
9	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
10	4	kopo	1	1	1	7	0.14	0.04	0.25	1.07	12.86	
11	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
12	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
13	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
14	12	kopo	1	1	1	7	0.14	0.01	0.08	0.36	4.29	Ironing
15	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
16	1	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
17	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
18	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
19	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
20	3	gunia	37	0.5	18.5	30	0.62	0.21	1.44	6.17	74.00	
21	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
22	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
23	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
24	2	gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
25	10	gunia	37	1	37	15	2.47	0.25	1.73	7.40	88.80	
26	8	kopo	1	2	2	1	2.00	0.25	1.75	7.50	90.00	
27	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
28	7	kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
29	4	kopo	1	2	2	1	2.00	0.50	3.50	15.00	180.00	
30	9	kopo	1	3	3	1	3.00	0.33	2.33	10.00	120.00	
31	7	kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
32	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
33	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
34	8	kopo	1	1	1	30	0.03	0.00	0.03	0.13	1.50	Ironing
35	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
36	4	gunia	37	1	37	30	1.23	0.31	2.16	9.25	111.00	
37	6	kopo	1	1	1	30	0.03	0.01	0.04	0.17	2.00	Ironing
38	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
39	9	kopo	1	5	5	7	0.71	0.08	0.56	2.38	28.57	
40	6	gunia	37	1	37	30	1.23	0.21	1.44	6.17	74.00	
41	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	

Key: Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>			<b>CHARCOAL</b>									
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Mgomba Kusini continued</b>												
42	5	gunia	37	1	37	17	2.18	0.44	3.05	13.06	156.71	
43	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
44	2	kopo	1	1	1	1	1.00	0.50	3.50	15.00	180.00	
45	5	gunia	37	2	74	30	2.47	0.49	3.45	14.80	177.60	
46	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
47	6	kopo	1	1	1	2	0.50	0.08	0.58	2.50	30.00	
48	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
49	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
50	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
51	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
52	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
53	9	kopo	1	1	1	4	0.25	0.03	0.19	0.83	10.00	
54	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
<b>Mgomba Kati</b>												
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
55	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
56	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
57	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
58	14	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
59	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
60	11	kopo	1	2	2	1	2.00	0.18	1.27	5.45	65.45	
61	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
62	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
63	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
64	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
65	7	Gunia	37	1	37	30	1.23	0.18	1.23	5.29	63.43	
66	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
67	9	Kopo	1	1	1	7	0.14	0.02	0.11	0.48	5.71	
68	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
69	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
70	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
71	12	Kopo	1	1	1	7	0.14	0.01	0.08	0.36	4.29	
72	5	Kopo	1	1	1	21	0.05	0.01	0.07	0.29	3.43	
73	2	kopo	1	1	1	30	0.03	0.02	0.12	0.50	6.00	
74	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
75	6	Gunia	37	1.25	46.25	30	1.54	0.26	1.80	7.71	92.50	Fish smoking
76	5	Gunia	37	1.5	55.5	30	1.85	0.37	2.59	11.10	133.20	Fish smoking
77	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
78	8	kopo	1	1	1	1	1.00	0.13	0.88	3.75	45.00	
79	7	kopo	1	1	1	7	0.14	0.02	0.14	0.61	7.35	
80	7	kopo	1	1	1	30	0.03	0.00	0.03	0.14	1.71	Ironing

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Key: Av. Cons - Average consumption H/hold - Household

Appendix 6 Continued													CHARCOAL
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments	
<b>Mgomba Kati continued</b>													
81	6	kopo	1	1	1	7	0.14	0.02	0.17	0.71	8.57	Ironing	
82	4	kopo	1	1	1	7	0.14	0.04	0.25	1.07	12.86	Ironing	
83	4	kopo	1	1	1	30	0.03	0.01	0.06	0.25	3.00	Ironing	
84	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
85	13	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
86	9	kopo	1	1	1	1	1.00	0.11	0.78	3.33	40.00	Ironing	
87	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
88	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
89	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
90	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
91	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
92	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
93	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
94	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
95	6	Gunia	37	1	37	30	1.23	0.21	1.44	6.17	74.00		
96	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
97	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
98	12	Kopo	1	2	2	1	2.00	0.17	1.17	5.00	60.00		
<b>Mgomba Kazkazini</b>													
99	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
100	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
101	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
102	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
103	10	Gunia	37	1	37	30	1.23	0.12	0.86	3.70	44.40		
104	6	Gunia	37	1	37	30	1.23	0.21	1.44	6.17	74.00		
105	9	Kopo	1	1	1	1	1.00	0.11	0.78	3.33	40.00		
106	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
107	8	Gunia	37	1	37	7	5.29	0.66	4.63	19.82	237.86	Kuni	
108	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
109	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
110	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
111	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
112	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00		
113	6	Kopo	1	1	1	3	0.33	0.06	0.39	1.67	20.00	Ironing	
114	4	Kopo	1	1	1	1	1.00	0.25	1.75	7.50	90.00		
115	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
116	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
117	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
118	4	Gunia	37	1	37	30	1.23	0.31	2.16	9.25	111.00		
119	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
120	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		
121	5	Gunia	37	1	37	45	0.82	0.16	1.15	4.93	59.20	Kuni	
122	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00		

Key: Av. Cons - Average consumption H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 6 Continued			CHARCOAL									
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Mgomba Kazkazini continued</b>												
123	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
350	3	gunia	37	1	37	14	2.64	0.88	6.17	26.43	317.14	
351	9	gunia	37	1	37	14	2.64	0.29	2.06	8.81	105.71	
352	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
353	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
354	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
355	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
<b>Ikwiriri Kusini continued</b>												
124	14	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
125	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
126	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
127	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
128	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
129	11	Gunia	37	1	37	14	2.64	0.24	1.68	7.21	86.49	
130	7	Kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
131	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
132	9	Gunia	37	1	37	15	2.47	0.27	1.92	8.22	98.67	
133	5	Kopo	1	2	2	1	2.00	0.40	2.80	12.00	144.00	
134	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
135	5	Kopo	1	2	2	1	2.00	0.40	2.80	12.00	144.00	
136	2	Gunia	37	1	37	21	1.76	0.88	6.17	26.43	317.14	
137	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
138	10	Gunia	37	1	37	14	2.64	0.26	1.85	7.93	95.14	
139	10	Gunia	37	1	37	14	2.64	0.26	1.85	7.93	95.14	
140	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
141	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
142	5	Kopo	1	1	1	1	1.00	0.20	1.40	6.00	72.00	
143	2	Gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
144	15	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
145	2	Kopo	1	1	1	1	1.00	0.50	3.50	15.00	180.00	
146	5	Kopo	1	1	1	1	1.00	0.20	1.40	6.00	72.00	
147	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
148	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
149	6	Gunia	37	2	74	30	2.47	0.41	2.88	12.33	148.00	
150	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
151	2	Kopo	1	1	1	1	1.00	0.50	3.50	15.00	180.00	
152	3	Gunia	1	37	37	14	2.64	0.88	6.17	26.43	317.14	
153	1	Gunia	1	37	37	14	2.64	2.64	18.50	79.29	951.43	
154	5	Gunia	1	37	37	14	2.64	0.53	3.70	15.86	190.29	
155	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
156	5	Kopo	1	1	1	14	0.07	0.01	0.10	0.43	5.14	Ironing
157	14	Gunia	1	37	37	30	1.23	0.09	0.62	2.64	31.71	
158	5	Gunia	1	37	37	14	2.64	0.53	3.70	15.86	190.29	

Key: Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>			<b>CHARCOAL</b>									
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Ikwiriri Kusini continued</b>												
159	13	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
160	12	Gunia	1	37	37	30	1.23	0.10	0.72	3.08	37.00	
161	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
162	10	Kopo	1	2	2	1	2.00	0.20	1.40	6.00	72.00	
163	5	Kopo	1	2	2	1	2.00	0.40	2.80	12.00	144.00	
164	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
165	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
166	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
167	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
168	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
169	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
170	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
171	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
172	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
173	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
174	2	Gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
175	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
176	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
177	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
178	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
179	11	Kopo	1	2	2	1	2.00	0.18	1.27	5.45	65.45	
180	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
181	8	Gunia	37	1	37	14	2.64	0.33	2.31	9.91	118.93	
182	3	Gunia	37	1	37	30	1.23	0.41	2.88	12.33	148.00	
183	8	Kopo	1	2	2	3	0.67	0.08	0.58	2.50	30.00	
184	6	Gunia	37	1	37	30	1.23	0.21	1.44	6.17	74.00	
185	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
186	1	Kopo	1	2	2	3	0.67	0.67	4.67	20.00	240.00	
187	5	Gunia	37	1	37	25	1.48	0.30	2.07	8.88	106.56	
188	7	Gunia	37	1	37	21	1.76	0.25	1.76	7.55	90.61	
189	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
190	7	Kopo	1	2	2	1	2.00	0.29	2.00	8.57	102.86	
191	8	Gunia	37	1	37	10	3.70	0.46	3.24	13.88	166.50	
192	1	Gunia	37	1	37	30	1.23	1.23	8.63	37.00	444.00	
193	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
194	6	Gunia	37	1	37	7	5.29	0.88	6.17	26.43	317.14	
<b>Ikwiriri Kati</b>												
195	5	Gunia	37	1	37	14	2.64	0.53	3.70	15.86	190.29	
196	5	Kopo	1	1	1	7	0.14	0.03	0.20	0.86	10.29	Ironing
197	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00	
198	3	Gunia	37	1	37	21	1.76	0.59	4.11	17.62	211.43	
199	15	Kopo	1	1	1	7	0.14	0.01	0.07	0.29	3.43	Ironing
200	9	Kopo	1	2	2	1	2.00	0.22	1.56	6.67	80.00	

Key: Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>												
<b>CHARCOAL</b>												
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Ikwiriri Kati continued</b>												
201	7	Gunia	37	1	37	14	2.64	0.38	2.64	11.33	135.92	
202	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
203	15	Kopo	1	1	1	1	1.00	0.07	0.47	2.00	24.00	
204	3	Gunia	37	1	37	30	1.23	0.41	2.88	12.33	148.00	
205	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
206	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00	
207	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
208	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
209	4	Kopo	1	2	2	1	2.00	0.50	3.50	15.00	180.00	
210	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
211	9	Kopo	1	1	1	1	1.00	0.11	0.78	3.33	40.00	
212	10	Gunia	37	1	37	30	1.23	0.12	0.86	3.70	44.40	
213	8	Gunia	37	1	37	30	1.23	0.15	1.08	4.63	55.50	Fish smoking
214	3	Gunia	37	1	37	21	1.76	0.59	4.11	17.62	211.43	
215	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
<b>Ikwiriri Kazkazini</b>												
216	8	Kopo	1	1	1	30	0.03	0.00	0.03	0.13	1.50	Ironing
217	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
218	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
219	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
220	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
221	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
222	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
223	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
224	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
225	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
226	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
227	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
228	18	Kopo	1	1	1	2	0.50	0.03	0.19	0.83	10.00	
229	3	Kopo	1	2	2	1	2.00	0.67	4.67	20.00	240.00	
230	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
231	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
232	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
233	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
<b>Umwe Kusini</b>												
234	7	Gunia	37	1	37	14	2.64	0.38	2.64	11.33	135.92	
235	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
236	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
237	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
238	10	Kopo	1	2	2	1	2.00	0.20	1.40	6.00	72.00	
239	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00	
240	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00	

Key: Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>			<b>CHARCOAL</b>									
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Umwe Kusini continued</b>												
241	7	Kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
242	5	Kopo	1	1	1	1	1.00	0.20	1.40	6.00	72.00	
243	6	Kopo	1	1	1	3	0.33	0.06	0.39	1.67	20.00	Ironing
244	12	Kopo	1	1	1	1	1.00	0.08	0.58	2.50	30.00	
245	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
246	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
247	9	Kopo	1	1	1	7	0.14	0.02	0.11	0.48	5.71	Ironing
248	22	Kopo	1	1	1	7	0.14	0.01	0.05	0.19	2.34	Ironing
249	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
250	8	Kopo	1	2	2	1	2.00	0.25	1.75	7.50	90.00	
251	4	Kopo	1	1	1	7	0.14	0.04	0.25	1.07	12.86	
252	7	Kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
253	12	Kopo	1	5.25	5.25	7	0.75	0.06	0.44	1.88	22.50	Fish smoking
254	8	Kopo	1	1	1	7	0.14	0.02	0.13	0.54	6.43	Ironing
255	4	Kopo	1	1	1	7	0.14	0.04	0.25	1.07	12.86	Ironing
256	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
257	12	Kopo	1	1	1	14	0.07	0.01	0.04	0.18	2.14	Ironing
258	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
259	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
260	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
261	3	Kopo	1	1	1	7	0.14	0.05	0.33	1.43	17.14	Ironing
262	3	Gunia	37	1	37	30	1.23	0.41	2.88	12.33	148.00	
263	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
264	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
265	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00	
266	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
267	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
268	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
269	5	Kopo	1	2	2	1	2.00	0.40	2.80	12.00	144.00	
<b>Umwe Kati</b>												
270	6	Gunia	37	1	37	20	1.85	0.31	2.16	9.25	111.00	
271	11	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
272	10	Gunia	37	1	37	30	1.23	0.12	0.86	3.70	44.40	
273	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
274	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
275	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
276	4	Kopo	1	3	3	1	3.00	0.75	5.25	22.50	270.00	
277	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
278	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
279	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
280	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
281	6	Kopo	1	1	1	30	0.03	0.01	0.04	0.17	2.00	Ironing
282	6	Kopo	1	1	1	14	0.07	0.01	0.08	0.36	4.29	Ironing

Key: Av. Cons - Average consumption H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>			<b>CHARCOAL</b>									
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Umwe Kati continued</b>												
283	11	Kopo	1	1	1	1	1.00	0.09	0.64	2.73	32.73	
284	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
285	15	Kopo	1	2	2	1	2.00	0.13	0.93	4.00	48.00	
286	7	Kopo	1	2	2	1	2.00	0.29	2.00	8.57	102.86	
287	4	Kopo	1	1	1	1	1.00	0.25	1.75	7.50	90.00	
288	7	Kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
289	6	Kopo	1	1	1	1	1.00	0.17	1.17	5.00	60.00	
290	7	Gunia	37	1	37	30	1.23	0.18	1.23	5.29	63.43	
291	12	Gunia	37	2	74	30	2.47	0.21	1.44	6.17	74.00	
292	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
293	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
294	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
295	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
296	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
297	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
298	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
299	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
300	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
301	4	Kopo	1	1	1	3	0.33	0.08	0.58	2.50	30.00	Ironing
302	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
303	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
304	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
305	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
306	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
307	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
308	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
309	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
310	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
311	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
312	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
313	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
314	10	Kopo	1	1	1	7	0.14	0.01	0.10	0.43	5.14	Ironing
315	7	Kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
316	7	Kopo	1	1	1	1	1.00	0.14	1.00	4.29	51.43	
317	2	Gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
318	4	Gunia	37	1	37	14	2.64	0.66	4.63	19.82	237.86	
319	9	Gunia	37	1	37	30	1.23	0.14	0.96	4.11	49.33	
320	4	Gunia	37	1	37	30	1.23	0.31	2.16	9.25	111.00	
321	5	Gunia	37	2	74	30	2.47	0.49	3.45	14.80	177.60	
322	10	Gunia	37	1	37	30	1.23	0.12	0.86	3.70	44.40	
323	6	Kopo	1	1	1	7	0.14	0.02	0.17	0.71	8.57	Ironing
324	6	Kopo	1	1	1	7	0.14	0.02	0.17	0.71	8.57	
325	8	Kopo	1	2	2	1	2.00	0.25	1.75	7.50	90.00	

Key: Av. Cons - Average consumption

H/hold - Household



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>					<b>CHARCOAL</b>							
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Umwe Kati continued</b>												
326	2	Gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
327	7	Gunia	37	1	37	30	1.23	0.18	1.23	5.29	63.43	
<b>Umwe Kazkazini</b>												
328	9	Kopo	1	1	1	1	1.00	0.11	0.78	3.33	40.00	
329	15	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
330	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
331	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
332	7	Kopo	1	3	3	1	3.00	0.43	3.00	12.86	154.29	
333	5	Gunia	37	1	37	30	1.23	0.25	1.73	7.40	88.80	
334	5	kopo	1	1	1	5	0.20	0.04	0.28	1.20	14.40	Ironing
335	6	Kopo	1	1	1	14	0.07	0.01	0.08	0.36	4.29	Ironing
336	20	Gunia	37	1	37	7	5.29	0.26	1.85	7.93	95.14	
337	2	Gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
338	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
339	2	Gunia	37	1	37	30	1.23	0.62	4.32	18.50	222.00	
340	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
341	8	Gunia	37	1	37	7	5.29	0.66	4.63	19.82	237.86	
342	8	Kopo	1	1	1	1	1.00	0.13	0.88	3.75	45.00	
343	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
344	11	Gunia	37	1	37	30	1.23	0.11	0.78	3.36	40.36	
345	9	Gunia	37	1	37	21	1.76	0.20	1.37	5.87	70.48	
346	5	Gunia	37	1	37	30	1.23	0.25	1.73	7.40	88.80	
347	5	Gunia	37	2	74	30	2.47	0.49	3.45	14.80	177.60	
348	8	Kopo	1	1	1	1	1.00	0.13	0.88	3.75	45.00	
349	8	Gunia	37	0.5	18.5	7	2.64	0.33	2.31	9.91	118.93	
405	14	0			0		0.00	0.00	0.00	0.00	0.00	
406	7	0			0		0.00	0.00	0.00	0.00	0.00	
407	8	0			0		0.00	0.00	0.00	0.00	0.00	
408	4	Gunia	37	1	37	30	1.23	0.31	2.16	9.25	111.00	
409	6	0			0		0.00	0.00	0.00	0.00	0.00	
410	3	0			0		0.00	0.00	0.00	0.00	0.00	
<b>Mbunju – Mvuleni</b>												
356	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
357	6	gunia	37	1	37	30	1.23	0.21	1.44	6.17	74.00	
358	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
359	4	gunia	37	1	37	15	2.47	0.62	4.32	18.50	222.00	
360	1	gunia	37	1	37	30	1.23	1.23	8.63	37.00	444.00	
361	5	gunia	37	1	37	15	2.47	0.49	3.45	14.80	177.60	
362	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
363	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
364	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
365	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
366	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	

Key:

Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

<b>Appendix 6 Continued</b>			<b>CHARCOAL</b>									
H/hold Number	H/hold Size	Units	Unit Weight kg	Units Bought	Total Weight Bought kg	Reported Cons days kg	Av. Cons per day per h/hold kg	Av. Cons per capita per day kg	Av. Cons per capita per week kg	Av. Cons per capita per month kg	Av. Cons per capita per year kg	Comments
<b>Mbunju – Mvuleni continued</b>												
367	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
368	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
369	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
370	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
371	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
372	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
373	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
374	11	kopo	1	1	1	30	0.03	0.00	0.02	0.09	1.09	Ironing
375	1	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
376	1	gunia	37	1	37	30	1.23	1.23	8.63	37.00	444.00	
377	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
378	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
379	6	gunia	37	1	37	30	1.23	0.21	1.44	6.17	74.00	
380	12	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
381	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
382	2	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
383	1	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
384	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
385	9	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
386	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
387	9	gunia	37	1	37	30	1.23	0.14	0.96	4.11	49.33	
388	5	kopo	1	1	1	7	0.14	0.03	0.20	0.86	10.29	ironing
389	8	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
390	8	gunia	37	1	37	30	1.23	0.15	1.08	4.63	55.50	
391	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
392	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
393	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
394	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
395	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
396	6	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
397	3	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
398	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
399	10	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
400	7	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
401	5	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
402	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	
403	5	kopo	1	1	1	14	0.07	0.01	0.10	0.43	5.14	
404	4	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7: Summary of Household Kerosene Consumption**

Household Number	KEROSENE										
	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Mgomba Kusini</b>											
1	5	kipimo	80	15	1200	30	40.00	8.00	56.00	240.00	2,880.00
2	10	kipimo	80	15	1200	30	40.00	4.00	28.00	120.00	1,440.00
3	7	kipimo	80	5	400	7	57.14	8.16	57.14	244.90	2,938.78
4	6	kipimo	80	3	240	7	34.29	5.71	40.00	171.43	2,057.14
5	12	kipimo	80	1	80	1	80.00	6.67	46.67	200.00	2,400.00
6	4	kipimo	80	1	80	2	40.00	10.00	70.00	300.00	3,600.00
7	5	kipimo	80	30	2400	30	80.00	16.00	112.00	480.00	5,760.00
8	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
9	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
10	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
11	2	kipimo	80	1	80	5	16.00	8.00	56.00	240.00	2,880.00
12	11	kipimo	80	1	80	2	40.00	3.64	25.45	109.09	1,309.09
13	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
14	12	kipimo	80	2	160	1	160.00	13.33	93.33	400.00	4,800.00
15	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
16	1	kipimo	80	1	80	2	40.00	40.00	280.00	1,200.00	14,400.00
17	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
18	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
19	11	kipimo	80	1	80	1	80.00	7.27	50.91	218.18	2,618.18
20	3	kipimo	80	1	80	7	11.43	3.81	26.67	114.29	1,371.43
21	7	kipimo	80	1	80	2	40.00	5.71	40.00	171.43	2,057.14
22	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
23	12	kipimo	80	3	240	1	240.00	20.00	140.00	600.00	7,200.00
24	2	kipimo	80	1	80	7	11.43	5.71	40.00	171.43	2,057.14
25	10	kipimo	80	2	160	7	22.86	2.29	16.00	68.57	822.86
26	8	kipimo	80	2	160	7	22.86	2.86	20.00	85.71	1,028.57
27	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
28	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
29	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
30	9	kipimo	80	6	480	1	480.00	53.33	373.33	1,600.00	19,200.00
31	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
32	4	kipimo	50	1	50	1	50.00	12.50	87.50	375.00	4,500.00
33	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
34	8	kipimo	80	3	240	1	240.00	30.00	210.00	900.00	10,800.00
35	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
36	4	kipimo	80	3	240	1	240.00	60.00	420.00	1,800.00	21,600.00
37	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
38	6	kipimo	80	3	240	1	240.00	40.00	280.00	1,200.00	14,400.00
39	9	kipimo	1000	3	3000	7	428.57	47.62	333.33	1,428.57	17,142.86
40	6	kipimo	500	1	500	7	71.43	11.90	83.33	357.14	4,285.71
41	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 7 continued			KEROSENE								
Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Mgomba Kusini continued</b>											
42	5	kipimo	1000	1	1000	7	142.86	28.57	200.00	857.14	10,285.71
43	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
44	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
45	5	kipimo	1000	10	10000	30	333.33	66.67	466.67	2,000.00	24,000.00
46	9	kipimo	80	3	240	1	240.00	26.67	186.67	800.00	9,600.00
47	6	kipimo	80	1	80	2	40.00	6.67	46.67	200.00	2,400.00
48	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
49	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
50	8	kipimo	80	1	80	2	40.00	5.00	35.00	150.00	1,800.00
51	2	kipimo	80	1	80	2	40.00	20.00	140.00	600.00	7,200.00
52	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
53	9	kipimo	80	2	160	1	160.00	17.78	124.44	533.33	6,400.00
54	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
<b>Mgomba Kati</b>											
55	2	kipimo	80	1	80	2	40.00	20.00	140.00	600.00	7,200.00
56	10	kipimo	80	1	80	2	40.00	4.00	28.00	120.00	1,440.00
57	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
58	14	kipimo	80	1	80	7	11.43	0.82	5.71	24.49	293.88
59	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
60	11	kipimo	80	1	80	1	80.00	7.27	50.91	218.18	2,618.18
61	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
62	11	kipimo	80	1	80	1	80.00	7.27	50.91	218.18	2,618.18
63	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
64	12	kipimo	80	1	80	1	80.00	6.67	46.67	200.00	2,400.00
65	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
66	5	kipimo	80	2	160	1	160.00	32.00	224.00	960.00	11,520.00
67	9	kipimo	80	2	160	1	160.00	17.78	124.44	533.33	6,400.00
68	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
69	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
70	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
71	12	kipimo	80	4	320	1	320.00	26.67	186.67	800.00	9,600.00
72	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
73	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
74	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
75	6	kipimo	1000	1	1000	7	142.86	23.81	166.67	714.29	8,571.43
76	5	kipimo	500	1	500	7	71.43	14.29	100.00	428.57	5,142.86
77	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
78	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
79	7	kipimo	80	9	720	7	102.86	14.69	102.86	440.82	5,289.80
80	7	kipimo	500	1	500	7	71.43	10.20	71.43	306.12	3,673.47
81	6	kipimo	1000	1	1000	7	142.86	23.81	166.67	714.29	8,571.43
82	4	kipimo	500	1	500	7	71.43	17.86	125.00	535.71	6,428.57
83	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Mgomba Kati continued</b>											
84	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
85	13	kipimo	80	1	80	1	80.00	6.15	43.08	184.62	2,215.38
86	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
87	5	kipimo	50	1	50	1	50.00	10.00	70.00	300.00	3,600.00
88	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
89	7	kipimo	80	3	240	2	120.00	17.14	120.00	514.29	6,171.43
90	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
91	2	kipimo	80	1	80	2	40.00	20.00	140.00	600.00	7,200.00
92	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
93	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
94	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
95	6	kipimo	1000	5	5000	30	166.67	27.78	194.44	833.33	10,000.00
96	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
97	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
98	12	kipimo	80	1	80	1	80.00	6.67	46.67	200.00	2,400.00
<b>Mgomba Kaskazini</b>											
99	4	kipimo	80	1	80	2	40.00	10.00	70.00	300.00	3,600.00
100	10	kipimo	80	4	320	1	320.00	32.00	224.00	960.00	11,520.00
101	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
102	9	kipimo	80	3	240	1	240.00	26.67	186.67	800.00	9,600.00
103	10	kipimo	80	1	80	2	40.00	4.00	28.00	120.00	1,440.00
104	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
105	9	kipimo	80	2	160	1	160.00	17.78	124.44	533.33	6,400.00
106	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
107	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
108	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
109	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
110	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
111	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
112	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
113	6	kipimo	50	1	50	1	50.00	8.33	58.33	250.00	3,000.00
114	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
115	8	kipimo	80	1	80	2	40.00	5.00	35.00	150.00	1,800.00
116	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
117	7	kipimo	80	1	80	2	40.00	5.71	40.00	171.43	2,057.14
118	4	kipimo	80	5	400	14	28.57	7.14	50.00	214.29	2,571.43
119	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
120	3	kipimo	50	1	50	1	50.00	16.67	116.67	500.00	6,000.00
121	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
122	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
123	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
350	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
351	9	kipimo	80	2	160	1	160.00	17.78	124.44	533.33	6,400.00

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Mgomba Kazkazini continued</b>											
352	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
353	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
354	3	kipimo	80	1	80	2	40.00	13.33	93.33	400.00	4,800.00
355	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
<b>Ikwiriri Kusini</b>											
124	14	kipimo	80	1	80	1	80.00	5.71	40.00	171.43	2,057.14
125	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
126	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
127	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
128	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
129	11	kipimo	80	2	160	1	160.00	14.55	101.82	436.36	5,236.36
130	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
131	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
132	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
133	5	kipimo	80	2	160	1	160.00	32.00	224.00	960.00	11,520.00
134	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
135	5	kipimo	80	2	160	1	160.00	32.00	224.00	960.00	11,520.00
136	2	kipimo	80	1	80	2	40.00	20.00	140.00	600.00	7,200.00
137	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
138	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
139	10	kipimo	1000	5	5000	14	357.14	35.71	250.00	1,071.43	12,857.14
140	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
141	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
142	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
143	2	kipimo	80	5	400	1	400.00	200.00	1400.00	6,000.00	72,000.00
144	15	kipimo	80	4	320	1	320.00	21.33	149.33	640.00	7,680.00
145	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
146	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
147	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
148	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
149	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
150	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
151	2	kipimo	1000	1	1000	14	71.43	35.71	250.00	1,071.43	12,857.14
152	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
153	1	kipimo	80	1	80	1	80.00	80.00	560.00	2,400.00	28,800.00
154	5	kipimo	80	3	240	1	240.00	48.00	336.00	1,440.00	17,280.00
155	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
156	5	kipimo	1000	1	1000	3	333.33	66.67	466.67	2,000.00	24,000.00
157	14	kipimo	80	1	80	1	80.00	5.71	40.00	171.43	2,057.14
158	5	kipimo	80	1	80	3	26.67	5.33	37.33	160.00	1,920.00
159	13	kipimo	80	1	80	1	80.00	6.15	43.08	184.62	2,215.38
160	12	kipimo	80	1	80	2	40.00	3.33	23.33	100.00	1,200.00
161	11	kipimo	80	4	320	1	320.00	29.09	203.64	872.73	10,472.73

Key: Cons - Consumption

Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Ikwiriri Kusini continued</b>											
162	10	kipimo	80	3	240	1	240.00	24.00	168.00	720.00	8,640.00
163	5	kipimo	80	2	160	1	160.00	32.00	224.00	960.00	11,520.00
164	6	kipimo	80	1	80	3	26.67	4.44	31.11	133.33	1,600.00
165	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
166	11	kipimo	80	1	80	2	40.00	3.64	25.45	109.09	1,309.09
167	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
168	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
169	7	kipimo	80	1	80	2	40.00	5.71	40.00	171.43	2,057.14
170	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
171	7	kipimo	80	1	80	2	40.00	5.71	40.00	171.43	2,057.14
172	4	kipimo	80	1	80	2	40.00	10.00	70.00	300.00	3,600.00
173	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
174	2	kipimo	80	1	80	4	20.00	10.00	70.00	300.00	3,600.00
175	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
176	2	kipimo	80	2	160	1	160.00	80.00	560.00	2,400.00	28,800.00
177	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
178	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
179	11	kipimo	80	1	80	1	80.00	7.27	50.91	218.18	2,618.18
180	7	kipimo	80	3	240	1	240.00	34.29	240.00	1,028.57	12,342.86
181	8	kipimo	1000	5	5000	30	166.67	20.83	145.83	625.00	7,500.00
182	3	kipimo	1000	5	5000	30	166.67	55.56	388.89	1,666.67	20,000.00
183	8	kipimo	80	3	240	1	240.00	30.00	210.00	900.00	10,800.00
184	6	kipimo	80	1	80	3	26.67	4.44	31.11	133.33	1,600.00
185	10	kipimo	80	3	240	1	240.00	24.00	168.00	720.00	8,640.00
186	1	kipimo	80	4	320	6	53.33	53.33	373.33	1,600.00	19,200.00
187	5	kipimo	80	3	240	2	120.00	24.00	168.00	720.00	8,640.00
188	7	kipimo	1000	5	5000	30	166.67	23.81	166.67	714.29	8,571.43
189	10	kipimo	80	2	160	1	160.00	16.00	112.00	480.00	5,760.00
190	7	kipimo	80	3	240	1	240.00	34.29	240.00	1,028.57	12,342.86
191	8	kipimo	80	5	400	1	400.00	50.00	350.00	1,500.00	18,000.00
192	1	kipimo	80	3	240	1	240.00	240.00	1680.00	7,200.00	86,400.00
193	12	kipimo	80	3	240	1	240.00	20.00	140.00	600.00	7,200.00
194	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
<b>Ikwiriri Kati</b>											
195	5	kipimo	80	2	160	1	160.00	32.00	224.00	960.00	11,520.00
196	5	kipimo	80	3	240	1	240.00	48.00	336.00	1,440.00	17,280.00
197	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
198	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
199	15	kipimo	80	2	160	1	160.00	10.67	74.67	320.00	3,840.00
200	9	kipimo	80	2	160	1	160.00	17.78	124.44	533.33	6,400.00
201	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
202	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
203	15	kipimo	80	2	160	1	160.00	10.67	74.67	320.00	3,840.00

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Ikwiriri Kati continued</b>											
204	3	kipimo	1000	5	5000	14	357.14	119.05	833.33	3,571.43	42,857.14
205	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
206	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
207	8	kipimo	80	1	80	3	26.67	3.33	23.33	100.00	1,200.00
208	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
209	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
210	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
211	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
212	10	kipimo	1000	5	5000	30	166.67	16.67	116.67	500.00	6,000.00
213	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
214	3	kipimo	1000	5	5000	30	166.67	55.56	388.89	1,666.67	20,000.00
215	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
<b>Ikwiriri Kazkazini</b>											
216	8	kipimo	80	1	80	2	40.00	5.00	35.00	150.00	1,800.00
217	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
218	4	kipimo	80	1	80	2	40.00	10.00	70.00	300.00	3,600.00
219	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
220	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
221	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
222	8	kipimo	80	3	240	1	240.00	30.00	210.00	900.00	10,800.00
223	9	kipimo	80	1	80	2	40.00	4.44	31.11	133.33	1,600.00
224	5	kipimo	80	2	160	1	160.00	32.00	224.00	960.00	11,520.00
225	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
226	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
227	11	kipimo	80	1	80	1	80.00	7.27	50.91	218.18	2,618.18
228	18	kipimo	80	2	160	1	160.00	8.89	62.22	266.67	3,200.00
229	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
230	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
231	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
232	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
233	9	kipimo	80	1	80	2	40.00	4.44	31.11	133.33	1,600.00
<b>Umwe Kusini</b>											
234	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
235	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
236	6	kipimo	80	1	80	2	40.00	6.67	46.67	200.00	2,400.00
237	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
238	10	kipimo	80	1	80	2	40.00	4.00	28.00	120.00	1,440.00
239	6	kipimo	80	3	240	1	240.00	40.00	280.00	1,200.00	14,400.00
240	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
241	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
242	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
243	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
244	12	kipimo	80	1	80	3	26.67	2.22	15.56	66.67	800.00

Key: Cons - Consumption

Av. Cons - Average consumption

H/hold - Household



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Umwe Kusini continued</b>											
245	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
246	12	kipimo	80	1	80	1	80.00	6.67	46.67	200.00	2,400.00
247	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
248	22	kipimo	80	8	640	1	640.00	29.09	203.64	872.73	10,472.73
249	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
250	8	kipimo	80	3	240	1	240.00	30.00	210.00	900.00	10,800.00
251	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
252	7	kipimo	80	3	240	1	240.00	34.29	240.00	1,028.57	12,342.86
253	12	kipimo	1000	1	1000	7	142.86	11.90	83.33	357.14	4,285.71
254	8	kipimo	500	1	500	7	71.43	8.93	62.50	267.86	3,214.29
255	4	kipimo	500	1	500	7	71.43	17.86	125.00	535.71	6,428.57
256	4	kipimo	80	9	720	7	102.86	25.71	180.00	771.43	9,257.14
257	12	kipimo	1000	1	1000	7	142.86	11.90	83.33	357.14	4,285.71
258	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
259	11	kipimo	500	1	500	7	71.43	6.49	45.45	194.81	2,337.66
260	5	kipimo	500	1	500	7	71.43	14.29	100.00	428.57	5,142.86
261	3	kipimo	1000	1	1000	7	142.86	47.62	333.33	1,428.57	17,142.86
262	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
263	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
264	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
265	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
266	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
267	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
268	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
269	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
<b>Umwe Kati</b>											
270	6	kipimo	80	1	80	2	40.00	6.67	46.67	200.00	2,400.00
271	11	kipimo	80	3	240	7	34.29	3.12	21.82	93.51	1,122.08
272	10	kipimo	1000	4	4000	30	133.33	13.33	93.33	400.00	4,800.00
273	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
274	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
275	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
276	4	kipimo	500	1	500	1	500.00	125.00	875.00	3,750.00	45,000.00
277	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
278	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
279	2	kipimo	80	2	160	1	160.00	80.00	560.00	2,400.00	28,800.00
280	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
281	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
282	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
283	11	kipimo	80	1	80	1	80.00	7.27	50.91	218.18	2,618.18
284	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
285	15	kipimo	500	1	500	1	500.00	33.33	233.33	1,000.00	12,000.00
286	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Umwe Kati continued</b>											
287	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
288	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
289	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
290	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
291	12	kipimo	80	2	160	1	160.00	13.33	93.33	400.00	4,800.00
292	4	kipimo	80	1	80	2	40.00	10.00	70.00	300.00	3,600.00
293	12	kipimo	80	2	160	2	80.00	6.67	46.67	200.00	2,400.00
294	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
295	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
296	3	kipimo	80	1	80	1	80.00	26.67	186.67	800.00	9,600.00
297	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
298	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
299	6	kipimo	500	1	500	3	166.67	27.78	194.44	833.33	10,000.00
300	7	kipimo	500	1	500	2	250.00	35.71	250.00	1,071.43	12,857.14
301	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
302	4	kipimo	80	1	80	2	40.00	10.00	70.00	300.00	3,600.00
303	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
304	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
305	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
306	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
307	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
308	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
309	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
310	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
311	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
312	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
313	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
314	10	kipimo	80	2	160	1	160.00	16.00	112.00	480.00	5,760.00
315	7	kipimo	80	2	160	1	160.00	22.86	160.00	685.71	8,228.57
316	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
317	2	kipimo	1000	5	5000	30	166.67	83.33	583.33	2,500.00	30,000.00
318	4	kipimo	1000	5	5000	30	166.67	41.67	291.67	1,250.00	15,000.00
319	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
320	4	kipimo	1000	5	5000	30	166.67	41.67	291.67	1,250.00	15,000.00
321	5	kipimo	1000	1	1000	14	71.43	14.29	100.00	428.57	5,142.86
322	10	kipimo	80	2	160	7	22.86	2.29	16.00	68.57	822.86
323	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
324	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
325	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
326	2	kipimo	500	1	500	5	100.00	50.00	350.00	1,500.00	18,000.00
327	7	kipimo	80	1	80	3	26.67	3.81	26.67	114.29	1,371.43
<b>Umwe Kazkazini</b>											
328	9	Kipimo	500	1	500	7	71.43	7.94	55.56	238.10	2,857.14

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Umwe Kazkazini continued</b>											
329	15	kipimo	80	1	80	1	80.00	5.33	37.33	160.00	1,920.00
330	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
331	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
332	7	kipimo	80	1	80	3	26.67	3.81	26.67	114.29	1,371.43
333	5	kipimo	80	1	80	3	26.67	5.33	37.33	160.00	1,920.00
334	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
335	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
336	20	kipimo	1000	1	1000	1	1000.00	50.00	350.00	1,500.00	18,000.00
337	2	kipimo	80	1	80	2	40.00	20.00	140.00	600.00	7,200.00
338	3	kipimo	80	2	160	1	160.00	53.33	373.33	1,600.00	19,200.00
339	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
340	6	kipimo	80	3	240	1	240.00	40.00	280.00	1,200.00	14,400.00
341	8	kipimo	80	1	80	2	40.00	5.00	35.00	150.00	1,800.00
342	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
343	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
344	11	kipimo	80	4	320	1	320.00	29.09	203.64	872.73	10,472.73
345	9	kipimo	80	4	320	1	320.00	35.56	248.89	1,066.67	12,800.00
346	5	kipimo	1000	1	1000	1	1000.00	200.00	1400.00	6,000.00	72,000.00
347	5	kipimo	80	1	80	3	26.67	5.33	37.33	160.00	1,920.00
348	8	kipimo	1000	5	5000	30	166.67	20.83	145.83	625.00	7,500.00
349	8	kipimo	500	1	500	7	71.43	8.93	62.50	267.86	3,214.29
405	14	kipimo	80	3	240	1	240.00	17.14	120.00	514.29	6,171.43
406	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
407	8	kipimo	80	2	160	1	160.00	20.00	140.00	600.00	7,200.00
408	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
409	6	kipimo	0	0	0	0	0.00	0.00	0.00	0.00	0.00
410	3	kipimo	80	3	240	1	240.00	80.00	560.00	2,400.00	28,800.00
<b>Mbunju - Mvuleni</b>											
356	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
357	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
358	6	kipimo	80	1	80	2	40.00	6.67	46.67	200.00	2,400.00
359	4	kipimo	1000	5	5000	30	166.67	41.67	291.67	1,250.00	15,000.00
360	1	kipimo	1000	5	5000	14	357.14	357.14	2500.00	10,714.29	128,571.43
361	5	kipimo	1000	5	5000	14	357.14	71.43	500.00	2,142.86	25,714.29
362	8	kipimo	80	1	80	2	40.00	5.00	35.00	150.00	1,800.00
363	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
364	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
365	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
366	5	kipimo	80	1	80	2	40.00	8.00	56.00	240.00	2,880.00
367	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
368	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
369	3	kipimo	80	2	160	1	160.00	53.33	373.33	1,600.00	19,200.00
370	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

**Appendix 7 continued**

**KEROSENE**

Household Number	H/hold size	Units	Unit Volume ml	Units bought ml	Total Volume bought ml	Reported cons. days ml	Av. Cons. per capita per h/hold ml	Av. cons. per capita per day ml	Av. Cons. per capita per week ml	Av. cons. per capita per month ml	Av. Cons. per capita per year ml
<b>Mbunju – Mvuleni</b>											
371	6	kipimo	80	2	160	1	160.00	26.67	186.67	800.00	9,600.00
372	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
373	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
374	11	kipimo	80	3	240	7	34.29	3.12	21.82	93.51	1,122.08
375	1	kipimo	80	1	80	2	40.00	40.00	280.00	1,200.00	14,400.00
376	1	kipimo	1000	5	5000	14	357.14	357.14	2500.00	10,714.29	128,571.43
377	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
378	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
379	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
380	12	kipimo	80	3	240	7	34.29	2.86	20.00	85.71	1,028.57
381	4	kipimo	80	3	240	7	34.29	8.57	60.00	257.14	3,085.71
382	2	kipimo	80	1	80	1	80.00	40.00	280.00	1,200.00	14,400.00
383	1	kipimo	80	1	80	1	80.00	80.00	560.00	2,400.00	28,800.00
384	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
385	9	kipimo	80	1	80	2	40.00	4.44	31.11	133.33	1,600.00
386	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
387	9	kipimo	80	1	80	1	80.00	8.89	62.22	266.67	3,200.00
388	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
389	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
390	8	kipimo	80	1	80	1	80.00	10.00	70.00	300.00	3,600.00
391	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
392	6	kipimo	80	1	80	0	0.00	0.00	0.00	0.00	0.00
393	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
394	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
395	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
396	6	kipimo	80	1	80	1	80.00	13.33	93.33	400.00	4,800.00
397	3	kipimo	80	1	80	2	40.00	13.33	93.33	400.00	4,800.00
398	4	kipimo	80	2	160	1	160.00	40.00	280.00	1,200.00	14,400.00
399	10	kipimo	80	1	80	1	80.00	8.00	56.00	240.00	2,880.00
400	7	kipimo	80	1	80	1	80.00	11.43	80.00	342.86	4,114.29
401	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
402	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00
403	5	kipimo	80	1	80	1	80.00	16.00	112.00	480.00	5,760.00
404	4	kipimo	80	1	80	1	80.00	20.00	140.00	600.00	7,200.00

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

Appendix 8: Summary of Fuelwood, Charcoal, and Kerosene Consumption in MJ

H/hold Number	H/hold size	FUELWOOD				CHARCOAL				Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	KEROSENE				Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml			Total kerosene cons. Mj					
<b>Mgomba Kusini</b>																	
1	5	473	13.8	6527.4	0	30.8	0.0	6,527	100	2,880	0.035	101	6,628	1.5			
2	10	237	13.8	3270.6	0	30.8	0.0	3,271	100	1,440	0.035	50	3,321	1.5			
3	7	169	13.8	2332.2	36.73	30.8	1131.3	3,463	67	2,939	0.035	103	3,566	2.9			
4	6	591	13.8	8155.8	0	30.8	0.0	8,156	100	2,057	0.035	72	8,228	0.9			
5	12	394	13.8	5437.2	0	30.8	0.0	5,437	100	2,400	0.035	84	5,521	1.5			
6	4	558	13.8	7700.4	90	30.8	2772.0	10,472	74	3,600	0.035	126	10,598	1.2			
7	5	446	13.8	6154.8	2.4	30.8	73.9	6,229	99	5,760	0.035	202	6,430	3.1			
8	10	473	13.8	6527.4	0	30.8	0.0	6,527	100	2,880	0.035	101	6,628	1.5			
9	4	690	13.8	9522	0	30.8	0.0	9,522	100	7,200	0.035	252	9,774	2.6			
10	4	690	13.8	9522	12.86	30.8	396.1	9,918	96	7,200	0.035	252	10,170	2.5			
11	2	591	13.8	8155.8	0	30.8	0.0	8,156	100	2,880	0.035	101	8,257	1.2			
12	11	376	13.8	5188.8	0	30.8	0.0	5,189	100	1,309	0.035	46	5,235	0.9			
13	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2			
14	12	460	13.8	6348	4.29	30.8	132.1	6,480	98	4,800	0.035	168	6,648	2.5			
15	9	570	13.8	7866	0	30.8	0.0	7,866	100	3,200	0.035	112	7,978	1.4			
16	1	638	13.8	8804.4	0	30.8	0.0	8,804	100	14,400	0.035	504	9,308	5.4			
17	10	414	13.8	5713.2	0	30.8	0.0	5,713	100	2,880	0.035	101	5,814	1.7			
18	5	893	13.8	12323.4	0	30.8	0.0	12,323	100	5,760	0.035	202	12,525	1.6			
19	11	565	13.8	7797	0	30.8	0.0	7,797	100	2,618	0.035	92	7,889	1.2			
20	3	394	13.8	5437.2	74	30.8	2279.2	7,716	70	1,371	0.035	48	7,764	0.6			
21	7	638	13.8	8804.4	0	30.8	0.0	8,804	100	2,057	0.035	72	8,876	0.8			
22	6	591	13.8	8155.8	0	30.8	0.0	8,156	100	4,800	0.035	168	8,324	2.0			
23	12	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2			
24	2	0	13.8	0	222	30.8	6837.6	6,838	0	2,057	0.035	72	6,910	1.0			
25	10	0	13.8	0	88.8	30.8	2735.0	2,735	0	823	0.035	29	2,764	1.0			
26	8	0	13.8	0	90	30.8	2772.0	2,772	0	1,029	0.035	36	2,808	1.3			

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 continued		FUELWOOD			CHARCOAL			KEROSENE			Percent kerosene to total energy consumed			
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita		Energy content in Mj per ml	Total kerosene cons. Mj	Total cons. fuelwood+ charcoal + kerosene Mj
<b>Mgomba Kusini continued</b>														
27	4	591	13.8	8155.8	0	30.8	0.0	8,156	100	7,200	0.035	252	8,408	3.0
28	7	319	13.8	4402.2	51.43	30.8	1584.0	5,986	74	8,229	0.035	288	6,274	4.6
29	4	1116	13.8	15400.8	180	30.8	5544.0	20,945	74	7,200	0.035	252	21,197	1.2
30	9	744	13.8	10267.2	120	30.8	3696.0	13,963	74	19,200	0.035	672	14,635	4.6
31	7	319	13.8	4402.2	51.43	30.8	1584.0	5,986	74	8,229	0.035	288	6,274	4.6
32	4	591	13.8	8155.8	0	30.8	0.0	8,156	100	4,500	0.035	158	8,313	1.9
33	4	690	13.8	9522	0	30.8	0.0	9,522	100	14,400	0.035	504	10,026	5.0
34	8	558	13.8	7700.4	1.5	30.8	46.2	7,747	99	10,800	0.035	378	8,125	4.7
35	4	690	13.8	9522	0	30.8	0.0	9,522	100	7,200	0.035	252	9,774	2.6
36	4	0	13.8	0	111	30.8	3418.8	3,419	0	21,600	0.035	756	4,175	18.1
37	6	2760	13.8	38088	2	30.8	61.6	38,150	100	4,800	0.035	168	38,318	0.4
38	6	744	13.8	10267.2	0	30.8	0.0	10,267	100	14,400	0.035	504	10,771	4.7
39	9	434	13.8	5989.2	28.57	30.8	880.0	6,869	87	17,143	0.035	600	7,469	8.0
40	6	159	13.8	2194.2	74	30.8	2279.2	4,473	49	4,286	0.035	150	4,623	3.2
41	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	7,200	0.035	252	7,400	3.4
42	5	446	13.8	6154.8	156.71	30.8	4826.7	10,981	56	10,286	0.035	360	11,341	3.2
43	7	591	13.8	8155.8	0	30.8	0.0	8,156	100	8,229	0.035	288	8,444	3.4
44	2	1116	13.8	15400.8	180	30.8	5544.0	20,945	74	14,400	0.035	504	21,449	2.3
45	5	0	13.8	0	177.6	30.8	5470.1	5,470	0	24,000	0.035	840	6,310	13.3
46	9	496	13.8	6844.8	0	30.8	0.0	6,845	100	9,600	0.035	336	7,181	4.7
47	6	345	13.8	4761	30	30.8	924.0	5,685	84	2,400	0.035	84	5,769	1.5
48	2	591	13.8	8155.8	0	30.8	0.0	8,156	100	14,400	0.035	504	8,660	5.8
49	7	473	13.8	6527.4	0	30.8	0.0	6,527	100	4,114	0.035	144	6,671	2.2
50	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	1,800	0.035	63	7,211	0.9
51	2	1183	13.8	16325.4	0	30.8	0.0	16,325	100	7,200	0.035	252	16,577	1.5
52	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 continued		FUELWOOD			CHARCOAL			KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed		
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita			Energy content in Mj per ml	Total kerosene cons. Mj
<b>Mgomba Kusini continued</b>														
53	9	526	13.8	7258.8	10	30.8	308.0	7,567	96	6,400	0.035	224	7,791	2.9
54	6	651	13.8	8983.8	0	30.8	0.0	8,984	100	9,600	0.035	336	9,320	3.6
	<b>Total</b>	<b>29,654</b>		<b>409,225</b>	<b>1,795</b>		<b>55,296</b>	<b>464,521</b>	<b>88</b>	<b>375,155</b>		<b>13,130</b>	<b>477,651</b>	<b>2.7</b>
	<b>Av.</b>	<b>549</b>		<b>7,578</b>	<b>33</b>		<b>1,024</b>	<b>8,602</b>		<b>6,947</b>		<b>243</b>	<b>8,845</b>	
<b>Mgomba Kati</b>														
55	2	1380	13.8	19044	0	30.8	0.0	19,044	100	7,200	0.035	252	19,296	1.3
56	10	473	13.8	6527.4	0	30.8	0.0	6,527	100	1,440	0.035	50	6,578	0.8
57	6	591	13.8	8155.8	0	30.8	0.0	8,156	100	4,800	0.035	168	8,324	2.0
58	14	507	13.8	6996.6	0	30.8	0.0	6,997	100	294	0.035	10	7,007	0.1
59	7	473	13.8	6527.4	0	30.8	0.0	6,527	100	4,114	0.035	144	6,671	2.2
60	11	1460	13.8	20148	65.45	30.8	2015.9	22,164	91	2,618	0.035	92	22,255	0.4
61	5	414	13.8	5713.2	0	30.8	0.0	5,713	100	5,760	0.035	202	5,915	3.4
62	11	565	13.8	7797	0	30.8	0.0	7,797	100	2,618	0.035	92	7,889	1.2
63	2	828	13.8	11426.4	0	30.8	0.0	11,426	100	14,400	0.035	504	11,930	4.2
64	12	460	13.8	6348	0	30.8	0.0	6,348	100	2,400	0.035	84	6,432	1.3
65	7	591	13.8	8155.8	63.43	30.8	1953.6	10,109	81	4,114	0.035	144	10,253	1.4
66	5	446	13.8	6154.8	0	30.8	0.0	6,155	100	11,520	0.035	403	6,558	6.1
67	9	460	13.8	6348	5.71	30.8	175.9	6,524	97	6,400	0.035	224	6,748	3.3
68	4	1248	13.8	17222.4	0	30.8	0.0	17,222	100	7,200	0.035	252	17,474	1.4
69	7	591	13.8	8155.8	0	30.8	0.0	8,156	100	4,114	0.035	144	8,300	1.7
70	9	460	13.8	6348	0	30.8	0.0	6,348	100	3,200	0.035	112	6,460	1.7
71	12	570	13.8	7866	4.29	30.8	132.1	7,998	98	9,600	0.035	336	8,334	4.0
72	5	446	13.8	6154.8	3.43	30.8	105.6	6,260	98	5,760	0.035	202	6,462	3.1
73	2	1116	13.8	15400.8	6	30.8	184.8	15,586	99	14,400	0.035	504	16,090	3.1
74	7	507	13.8	6996.6	0	30.8	0.0	6,997	100	8,229	0.035	288	7,285	4.0
75	6	197	13.8	2718.6	92.5	30.8	2849.0	5,568	49	8,571	0.035	300	5,868	5.1

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 continued		FUELWOOD			CHARCOAL			KEROSENE			Percent kerosene to total energy consumed			
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita		Energy content in Mj per ml	Total kerosene cons. Mj	Total cons. fuelwood+ charcoal + kerosene Mj
<b>Mgomba Kati continued</b>														
76	5	0	13.8	0	133.2	30.8	4102.6	4,103	0	5,143	0.035	180	4,283	4.2
77	3	686	13.8	9466.8	0	30.8	0.0	9,467	100	9,600	0.035	336	9,803	3.4
78	8	518	13.8	7148.4	45	30.8	1386.0	8,534	84	3,600	0.035	126	8,660	1.5
79	7	441	13.8	6085.8	7.35	30.8	226.4	6,312	96	5,290	0.035	185	6,497	2.8
80	7	507	13.8	6996.6	1.71	30.8	52.7	7,049	99	3,673	0.035	129	7,178	1.8
81	6	558	13.8	7700.4	8.57	30.8	264.0	7,964	97	8,571	0.035	300	8,264	3.6
82	4	1116	13.8	15400.8	12.86	30.8	396.1	15,797	97	6,429	0.035	225	16,022	1.4
83	4	444	13.8	6127.2	3	30.8	92.4	6,220	99	14,400	0.035	504	6,724	7.5
84	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2
85	13	478	13.8	6596.4	0	30.8	0.0	6,596	100	2,215	0.035	78	6,674	1.2
86	9	307	13.8	4236.6	40	30.8	1232.0	5,469	77	3,200	0.035	112	5,581	2.0
87	5	621	13.8	8569.8	0	30.8	0.0	8,570	100	3,600	0.035	126	8,696	1.4
88	4	518	13.8	7148.4	0	30.8	0.0	7,148	100	7,200	0.035	252	7,400	3.4
89	7	981	13.8	13537.8	0	30.8	0.0	13,538	100	6,171	0.035	216	13,754	1.6
90	5	720	13.8	9936	0	30.8	0.0	9,936	100	2,880	0.035	101	10,037	1.0
91	2	1029	13.8	14200.2	0	30.8	0.0	14,200	100	7,200	0.035	252	14,452	1.7
92	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7
93	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	5,760	0.035	202	7,819	2.6
94	5	621	13.8	8569.8	0	30.8	0.0	8,570	100	2,880	0.035	101	8,671	1.2
95	6	460	13.8	6348	74	30.8	2279.2	8,627	74	10,000	0.035	350	8,977	3.9
96	10	446	13.8	6154.8	0	30.8	0.0	6,155	100	2,880	0.035	101	6,256	1.6
97	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7
98	12	1140	13.8	15732	60	30.8	1848.0	17,580	89	2,400	0.035	84	17,664	0.5
<b>Total</b>		<b>27,520</b>		<b>379,776</b>	<b>627</b>		<b>19,296</b>	<b>399,072</b>	<b>95</b>	<b>256,246</b>		<b>8,969</b>	<b>408,041</b>	<b>2.2</b>
<b>Av.</b>		<b>625</b>		<b>8,631</b>	<b>14</b>		<b>439</b>	<b>9,070</b>		<b>5,824</b>		<b>204</b>	<b>9,274</b>	

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 continued		FUELWOOD			CHARCOAL			KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed		
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj		
<b>Mgomba Kazkazini</b>														
99	4	977	13.8	13482.6	0	30.8	0.0	13,483	100	3,600	0.035	126	13,609	0.9
100	10	552	13.8	7617.6	0	30.8	0.0	7,618	100	11,520	0.035	403	8,021	5.0
101	3	690	13.8	9522	0	30.8	0.0	9,522	100	9,600	0.035	336	9,858	3.4
102	9	460	13.8	6348	0	30.8	0.0	6,348	100	9,600	0.035	336	6,684	5.0
103	10	103	13.8	1421.4	44.4	30.8	1367.5	2,789	51	1,440	0.035	50	2,839	1.8
104	6	0	13.8	0	74	30.8	2279.2	2,279	0	4,800	0.035	168	2,447	6.9
105	9	460	13.8	6348	40	30.8	1232.0	7,580	84	6,400	0.035	224	7,804	2.9
106	6	552	13.8	7617.6	0	30.8	0.0	7,618	100	9,600	0.035	336	7,954	4.2
107	8	518	13.8	7148.4	237.86	30.8	7326.1	14,474	49	7,200	0.035	252	14,726	1.7
108	6	552	13.8	7617.6	0	30.8	0.0	7,618	100	4,800	0.035	168	7,786	2.2
109	3	690	13.8	9522	0	30.8	0.0	9,522	100	9,600	0.035	336	9,858	3.4
110	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	5,760	0.035	202	7,819	2.6
111	10	414	13.8	5713.2	0	30.8	0.0	5,713	100	2,880	0.035	101	5,814	1.7
112	6	690	13.8	9522	60	30.8	1848.0	11,370	84	4,800	0.035	168	11,538	1.5
113	6	372	13.8	5133.6	20	30.8	616.0	5,750	89	3,000	0.035	105	5,855	1.8
114	4	558	13.8	7700.4	90	30.8	2772.0	10,472	74	7,200	0.035	252	10,724	2.3
115	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	1,800	0.035	63	7,211	0.9
116	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	5,760	0.035	202	7,819	2.6
117	7	338	13.8	4664.4	0	30.8	0.0	4,664	100	2,057	0.035	72	4,736	1.5
118	4	0	13.8	0	111	30.8	3418.8	3,419	0	2,571	0.035	90	3,509	2.6
119	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7
120	3	591	13.8	8155.8	0	30.8	0.0	8,156	100	6,000	0.035	210	8,366	2.5
121	5	223	13.8	3077.4	59.2	30.8	1823.4	4,901	63	2,880	0.035	101	5,002	2.0
122	6	690	13.8	9522	0	30.8	0.0	9,522	100	4,800	0.035	168	9,690	1.7
123	5	828	13.8	11426.4	0	30.8	0.0	11,426	100	5,760	0.035	202	11,628	1.7
350	3	690	13.8	9522	317.14	30.8	9767.9	19,290	49	9,600	0.035	336	19,626	1.7
351	9	263	13.8	3629.4	105.71	30.8	3255.9	6,885	53	6,400	0.035	224	7,109	3.2

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 continued		FUELWOOD			CHARCOAL			KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed		
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita			Energy content in Mj per ml	Total kerosene cons. Mj
<b>Mgomba Kazkazini continued</b>														
352	6	518	13.8	7148.4	0	30.8	0.0	7,148	100	4,800	0.035	168	7,316	2.3
353	10	828	13.8	11426.4	0	30.8	0.0	11,426	100	2,880	0.035	101	11,527	0.9
354	3	920	13.8	12696	0	30.8	0.0	12,696	100	4,800	0.035	168	12,864	1.3
355	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	5,760	0.035	202	7,819	2.6
	<b>Total</b>	<b>16,169</b>		<b>223,132</b>	<b>1,159</b>		<b>35,707</b>	<b>258,839</b>	<b>86</b>	<b>171,269</b>		<b>5,994</b>	<b>264,833</b>	<b>2.3</b>
	<b>Av.</b>	<b>522</b>		<b>7,198</b>	<b>37</b>		<b>1,152</b>	<b>8,350</b>		<b>5,525</b>		<b>193</b>	<b>8,543</b>	
<b>Ikwiriri Kusini</b>														
124	14	617	13.8	8514.6	0	30.8	0.0	8,515	100	2,057	0.035	72	8,587	0.8
125	4	2790	13.8	38502	0	30.8	0.0	38,502	100	7,200	0.035	252	38,754	0.7
126	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2
127	2	591	13.8	8155.8	0	30.8	0.0	8,156	100	14,400	0.035	504	8,660	5.8
128	6	460	13.8	6348	0	30.8	0.0	6,348	100	9,600	0.035	336	6,684	5.0
129	11	0	13.8	0	86.49	30.8	2663.9	2,664	0	5,236	0.035	183	2,847	6.4
130	7	319	13.8	4402.2	51.43	30.8	1584.0	5,986	74	4,114	0.035	144	6,130	2.3
131	7	588	13.8	8114.4	0	30.8	0.0	8,114	100	4,114	0.035	144	8,258	1.7
132	9	0	13.8	0	98.67	30.8	3039.0	3,039	0	3,200	0.035	112	3,151	3.6
133	5	0	13.8	0	144	30.8	4435.2	4,435	0	11,520	0.035	403	4,838	8.3
134	10	558	13.8	7700.4	0	30.8	0.0	7,700	100	2,880	0.035	101	7,801	1.3
135	5	0	13.8	0	144	30.8	4435.2	4,435	0	11,520	0.035	403	4,838	8.3
136	2	0	13.8	0	317.14	30.8	9767.9	9,768	0	7,200	0.035	252	10,020	2.5
137	8	296	13.8	4084.8	0	30.8	0.0	4,085	100	3,600	0.035	126	4,211	3.0
138	10	335	13.8	4623	95.14	30.8	2930.3	7,553	61	2,880	0.035	101	7,654	1.3
139	10	391	13.8	5395.8	95.14	30.8	2930.3	8,326	65	12,857	0.035	450	8,776	5.1
140	3	840	13.8	11592	0	30.8	0.0	11,592	100	9,600	0.035	336	11,928	2.8
141	3	744	13.8	10267.2	0	30.8	0.0	10,267	100	9,600	0.035	336	10,603	3.2
142	5	0	13.8	0	72	30.8	2217.6	2,218	0	5,760	0.035	202	2,419	8.3
Key:		Cons - Consumption	Av. Cons - Average consumption	H/hold - Household										

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 continued		FUELWOOD				CHARCOAL				Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed	
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml			Total kerosene cons. Mj					
<b>Ikwiriri Kusini continued</b>																	
143	2	0	13.8	0	222	30.8	6837.6	6,838	0	72,000	0.035	2,520	9,358	26.9			
144	15	446	13.8	6154.8	0	30.8	0.0	6,155	100	7,680	0.035	269	6,424	4.2			
145	2	1116	13.8	15400.8	180	30.8	5544.0	20,945	74	14,400	0.035	504	21,449	2.3			
146	5	335	13.8	4623	72	30.8	2217.6	6,841	68	2,880	0.035	101	6,941	1.5			
147	4	591	13.8	8155.8	0	30.8	0.0	8,156	100	7,200	0.035	252	8,408	3.0			
148	2	558	13.8	7700.4	0	30.8	0.0	7,700	100	14,400	0.035	504	8,204	6.1			
149	6	0	13.8	0	148	30.8	4558.4	4,558	0	4,800	0.035	168	4,726	3.6			
150	10	1116	13.8	15400.8	0	30.8	0.0	15,401	100	2,880	0.035	101	15,502	0.7			
151	2	0	13.8	0	180	30.8	5544.0	5,544	0	12,857	0.035	450	5,994	7.5			
152	3	0	13.8	0	317.14	30.8	9767.9	9,768	0	9,600	0.035	336	10,104	3.3			
153	1	0	13.8	0	951.43	30.8	29304.0	29,304	0	28,800	0.035	1,008	30,312	3.3			
154	5	1339	13.8	18478.2	190.29	30.8	5860.9	24,339	76	17,280	0.035	605	24,944	2.4			
155	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7			
156	5	473	13.8	6527.4	5.15	30.8	158.6	6,686	98	24,000	0.035	840	7,526	11.2			
157	14	0	13.8	0	31.71	30.8	976.7	977	0	2,057	0.035	72	1,049	6.9			
158	5	0	13.8	0	190.29	30.8	5860.9	5,861	0	1,920	0.035	67	5,928	1.1			
159	13	546	13.8	7534.8	0	30.8	0.0	7,535	100	2,215	0.035	78	7,612	1.0			
160	12	0	13.8	0	37	30.8	1139.6	1,140	0	1,200	0.035	42	1,182	3.6			
161	11	507	13.8	6996.6	0	30.8	0.0	6,997	100	10,473	0.035	367	7,363	5.0			
162	10	446	13.8	6154.8	72	30.8	2217.6	8,372	74	8,640	0.035	302	8,675	3.5			
163	5	0	13.8	0	144	30.8	4435.2	4,435	0	11,520	0.035	403	4,838	8.3			
164	6	558	13.8	7700.4	0	30.8	0.0	7,700	100	1,600	0.035	56	7,756	0.7			
165	8	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2			
166	11	524	13.8	7231.2	0	30.8	0.0	7,231	100	1,309	0.035	46	7,277	0.6			
167	6	558	13.8	7700.4	0	30.8	0.0	7,700	100	4,800	0.035	168	7,868	2.1			
168	3	744	13.8	10267.2	0	30.8	0.0	10,267	100	9,600	0.035	336	10,603	3.2			

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

H/hold Number	H/hold size	FUELWOOD			CHARCOAL			Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	KEROSENE			Total cons. fuelwood+ charcoal+ kerosene Mj	Percent kerosene to total energy consumed
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj			Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj		
<b>Ikwiriri Kusini continued</b>														
169	7	338	13.8	4664.4	0	30.8	0.0	4,664	100	2,057	0.035	72	4,736	1.5
170	5	497	13.8	6858.6	0	30.8	0.0	6,859	100	5,760	0.035	202	7,060	2.9
171	7	318	13.8	4388.4	0	30.8	0.0	4,388	100	2,057	0.035	72	4,460	1.6
172	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	3,600	0.035	126	7,826	1.6
173	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2
174	2	0	13.8	0	222	30.8	6837.6	6,838	0	3,600	0.035	126	6,964	1.8
175	9	460	13.8	6348	0	30.8	0.0	6,348	100	3,200	0.035	112	6,460	1.7
176	2	591	13.8	8155.8	0	30.8	0.0	8,156	100	28,800	0.035	1,008	9,164	11.0
177	4	690	13.8	9522	0	30.8	0.0	9,522	100	7,200	0.035	252	9,774	2.6
178	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2
179	11	376	13.8	5188.8	65.45	30.8	2015.9	7,205	72	2,618	0.035	92	7,296	1.3
180	7	478	13.8	6596.4	0	30.8	0.0	6,596	100	12,343	0.035	432	7,028	6.1
181	8	837	13.8	11550.6	118.93	30.8	3663.0	15,214	76	7,500	0.035	263	15,476	1.7
182	3	0	13.8	0	148	30.8	4558.4	4,558	0	20,000	0.035	700	5,258	13.3
183	8	444	13.8	6127.2	30	30.8	924.0	7,051	87	10,800	0.035	378	7,429	5.1
184	6	414	13.8	5713.2	74	30.8	2279.2	7,992	71	1,600	0.035	56	8,048	0.7
185	10	558	13.8	7700.4	0	30.8	0.0	7,700	100	8,640	0.035	302	8,003	3.8
186	1	0	13.8	0	240	30.8	7392.0	7,392	0	19,200	0.035	672	8,064	8.3
187	5	0	13.8	0	106.56	30.8	3282.0	3,282	0	8,640	0.035	302	3,584	8.4
188	7	0	13.8	0	90.61	30.8	2790.8	2,791	0	8,571	0.035	300	3,091	9.7
189	10	722	13.8	9963.6	0	30.8	0.0	9,964	100	5,760	0.035	202	10,165	2.0
190	7	0	13.8	0	102.86	30.8	3168.1	3,168	0	12,343	0.035	432	3,600	12.0
191	8	0	13.8	0	166.5	30.8	5128.2	5,128	0	18,000	0.035	630	5,758	10.9
192	1	0	13.8	0	444	30.8	13675.2	13,675	0	86,400	0.035	3,024	16,699	18.1
193	12	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2
194	6	0	13.8	0	317.14	30.8	9767.9	9,768	0	4,800	0.035	168	9,936	1.7
<b>Total</b>		<b>28,975</b>		<b>399,855</b>	<b>5,971</b>		<b>183,909</b>	<b>583,764</b>	<b>68</b>	<b>724,540</b>		<b>25,359</b>	<b>609,123</b>	<b>4.2</b>
<b>Av.</b>		<b>408</b>		<b>5,632</b>	<b>84</b>		<b>2,590</b>	<b>8,222</b>		<b>10,205</b>		<b>357</b>	<b>8,579</b>	

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

H/hold Number	H/hold size	FUELWOOD			CHARCOAL			Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj			Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj		
<b>Ikwiriri Kati</b>														
195	5	960	13.8	13248	190.29	30.8	5860.9	19,109	69	11,520	0.035	403	19,512	2.1
196	5	552	13.8	7617.6	10.29	30.8	316.9	7,935	96	17,280	0.035	605	8,539	7.1
197	6	171	13.8	2359.8	60	30.8	1848.0	4,208	56	9,600	0.035	336	4,544	7.4
198	3	0	13.8	0	211.43	30.8	6512.0	6,512	0	9,600	0.035	336	6,848	4.9
199	15	552	13.8	7617.6	3.43	30.8	105.6	7,723	99	3,840	0.035	134	7,858	1.7
200	9	307	13.8	4236.6	80	30.8	2464.0	6,701	63	6,400	0.035	224	6,925	3.2
201	7	319	13.8	4402.2	135.92	30.8	4186.3	8,589	51	8,229	0.035	288	8,877	3.2
202	4	1116	13.8	15400.8	0	30.8	0.0	15,401	100	14,400	0.035	504	15,905	3.2
203	15	276	13.8	3808.8	24	30.8	739.2	4,548	84	3,840	0.035	134	4,682	2.9
204	3	0	13.8	0	148	30.8	4558.4	4,558	0	42,857	0.035	1,500	6,058	24.8
205	6	558	13.8	7700.4	0	30.8	0.0	7,700	100	4,800	0.035	168	7,868	2.1
206	6	345	13.8	4761	60	30.8	1848.0	6,609	72	4,800	0.035	168	6,777	2.5
207	8	419	13.8	5782.2	0	30.8	0.0	5,782	100	1,200	0.035	42	5,824	0.7
208	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	14,400	0.035	504	8,204	6.1
209	4	1116	13.8	15400.8	180	30.8	5544.0	20,945	74	14,400	0.035	504	21,449	2.3
210	8	489	13.8	6748.2	0	30.8	0.0	6,748	100	3,600	0.035	126	6,874	1.8
211	9	496	13.8	6844.8	40	30.8	1232.0	8,077	85	3,200	0.035	112	8,189	1.4
212	10	118	13.8	1628.4	44.4	30.8	1367.5	2,996	54	6,000	0.035	210	3,206	6.6
213	8	148	13.8	2042.4	55.5	30.8	1709.4	3,752	54	7,200	0.035	252	4,004	6.3
214	3	0	13.8	0	211.43	30.8	6512.0	6,512	0	20,000	0.035	700	7,212	9.7
215	3	591	13.8	8155.8	0	30.8	0.0	8,156	100	9,600	0.035	336	8,492	4.0
	<b>Total</b>	<b>9,091</b>		<b>125,456</b>	<b>1,455</b>		<b>44,804</b>	<b>170,260</b>	<b>74</b>	<b>216,766</b>		<b>7,587</b>	<b>177,847</b>	<b>4.3</b>
	<b>Av.</b>	<b>433</b>		<b>5,974</b>	<b>69</b>		<b>2,134</b>	<b>8,108</b>		<b>10,322</b>		<b>361</b>	<b>8,469</b>	

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

H/hold Number	H/hold size	FUELWOOD				CHARCOAL				Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	KEROSENE				Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed
		Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml			Total kerosene cons. Mj					
<b>Ikwiriri Kazkazini</b>																	
216	8	296	13.8	4084.8	1.5	30.8	46.2	4,131	1,800	0.035	63	4,194	1.5				
217	7	444	13.8	6127.2	0	30.8	0.0	6,127	4,114	0.035	144	6,271	2.3				
218	4	1035	13.8	14283	0	30.8	0.0	14,283	3,600	0.035	126	14,409	0.9				
219	6	394	13.8	5437.2	0	30.8	0.0	5,437	9,600	0.035	336	5,773	5.8				
220	5	828	13.8	11426.4	0	30.8	0.0	11,426	2,880	0.035	101	11,527	0.9				
221	4	1035	13.8	14283	0	30.8	0.0	14,283	14,400	0.035	504	14,787	3.4				
222	8	388	13.8	5354.4	0	30.8	0.0	5,354	10,800	0.035	378	5,732	6.6				
223	9	460	13.8	6348	0	30.8	0.0	6,348	1,600	0.035	56	6,404	0.9				
224	5	446	13.8	6154.8	0	30.8	0.0	6,155	11,520	0.035	403	6,558	6.1				
225	3	460	13.8	6348	0	30.8	0.0	6,348	9,600	0.035	336	6,684	5.0				
226	6	518	13.8	7148.4	0	30.8	0.0	7,148	9,600	0.035	336	7,484	4.5				
227	11	565	13.8	7797	0	30.8	0.0	7,797	2,618	0.035	92	7,889	1.2				
228	18	230	13.8	3174	10	30.8	308.0	3,482	3,200	0.035	112	3,594	3.1				
229	3	372	13.8	5133.6	240	30.8	7392.0	12,526	9,600	0.035	336	12,862	2.6				
230	8	518	13.8	7148.4	0	30.8	0.0	7,148	3,600	0.035	126	7,274	1.7				
231	5	828	13.8	11426.4	0	30.8	0.0	11,426	5,760	0.035	202	11,628	1.7				
232	5	552	13.8	7617.6	0	30.8	0.0	7,618	2,880	0.035	101	7,718	1.3				
233	9	460	13.8	6348	0	30.8	0.0	6,348	1,600	0.035	56	6,404	0.9				
<b>Total</b>		<b>9,829</b>		<b>135,640</b>	<b>252</b>		<b>7,746</b>	<b>143,386</b>	<b>108,772</b>		<b>3,807</b>	<b>147,193</b>	<b>2.6</b>				
<b>Av.</b>		<b>546</b>		<b>7,536</b>	<b>14</b>		<b>430</b>	<b>7,966</b>	<b>6,043</b>		<b>212</b>	<b>8,177</b>					
<b>Umwe Kusini</b>																	
234	7	0	13.8	0	135.92	30.8	4186.3	4,186	4,114	0.035	144	4,330	3.3				
235	7	273	13.8	3767.4	0	30.8	0.0	3,767	4,114	0.035	144	3,911	3.7				
236	6	394	13.8	5437.2	0	30.8	0.0	5,437	2,400	0.035	84	5,521	1.5				
237	8	159	13.8	2194.2	0	30.8	0.0	2,194	3,600	0.035	126	2,320	5.4				
238	10	223	13.8	3077.4	72	30.8	2217.6	5,295	1,440	0.035	50	5,345	0.9				
239	6	372	13.8	5133.6	60	30.8	1848.0	6,982	14,400	0.035	504	7,486	6.7				
<b>Key:</b>	Cons - Consumption		Av. Cons - Average consumption					H/hold - Household									

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed		
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita			Energy content in Mj per ml	Total kerosene cons. Mj
<b>Umwe Kusini continued</b>														
240	6	372	13.8	5133.6	60	30.8	1848.0	6,982	74	4,800	0.035	168	7,150	2.3
241	7	319	13.8	4402.2	51.43	30.8	1584.0	5,986	74	4,114	0.035	144	6,130	2.3
242	5	446	13.8	6154.8	72	30.8	2217.6	8,372	74	5,760	0.035	202	8,574	2.4
243	6	372	13.8	5133.6	20	30.8	616.0	5,750	89	9,600	0.035	336	6,086	5.5
244	12	279	13.8	3850.2	30	30.8	924.0	4,774	81	800	0.035	28	4,802	0.6
245	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7
246	12	460	13.8	6348	0	30.8	0.0	6,348	100	2,400	0.035	84	6,432	1.3
247	9	263	13.8	3629.4	5.71	30.8	175.9	3,805	95	3,200	0.035	112	3,917	2.9
248	22	376	13.8	5188.8	2.34	30.8	72.1	5,261	99	10,473	0.035	367	5,627	6.5
249	5	446	13.8	6154.8	0	30.8	0.0	6,155	100	5,760	0.035	202	6,356	3.2
250	8	0	13.8	0	90	30.8	2772.0	2,772	0	10,800	0.035	378	3,150	12.0
251	4	1116	13.8	15400.8	12.86	30.8	396.1	15,797	97	14,400	0.035	504	16,301	3.1
252	7	957	13.8	13206.6	51.43	30.8	1584.0	14,791	89	12,343	0.035	432	15,223	2.8
253	12	186	13.8	2566.8	22.5	30.8	693.0	3,260	79	4,286	0.035	150	3,410	4.4
254	8	296	13.8	4084.8	6.43	30.8	198.0	4,283	95	3,214	0.035	113	4,395	2.6
255	4	444	13.8	6127.2	12.86	30.8	396.1	6,523	94	6,429	0.035	225	6,748	3.3
256	4	444	13.8	6127.2	0	30.8	0.0	6,127	100	9,257	0.035	324	6,451	5.0
257	12	345	13.8	4761	2.14	30.8	65.9	4,827	99	4,286	0.035	150	4,977	3.0
258	5	473	13.8	6527.4	0	30.8	0.0	6,527	100	5,760	0.035	202	6,729	3.0
259	11	374	13.8	5161.2	0	30.8	0.0	5,161	100	2,338	0.035	82	5,243	1.6
260	5	497	13.8	6858.6	0	30.8	0.0	6,859	100	5,143	0.035	180	7,039	2.6
261	3	744	13.8	10267.2	17.14	30.8	527.9	10,795	95	17,143	0.035	600	11,395	5.3
262	3	744	13.8	10267.2	148	30.8	4558.4	14,826	69	9,600	0.035	336	15,162	2.2
263	4	690	13.8	9522	0	30.8	0.0	9,522	100	7,200	0.035	252	9,774	2.6
264	5	828	13.8	11426.4	0	30.8	0.0	11,426	100	5,760	0.035	202	11,628	1.7
265	6	372	13.8	5133.6	60	30.8	1848.0	6,982	74	4,800	0.035	168	7,150	2.3
266	3	591	13.8	8155.8	0	30.8	0.0	8,156	100	9,600	0.035	336	8,492	4.0

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE			Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed		
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita			Energy content in Mj per ml	Total kerosene cons. Mj
<b>Umwe Kusini continued</b>														
267	8	419	13.8	5782.2	0	30.8	0.0	5,782	100	7,200	0.035	252	6,034	4.2
268	8	419	13.8	5782.2	0	30.8	0.0	5,782	100	3,600	0.035	126	5,908	2.1
269	5	621	13.8	8569.8	144	30.8	4435.2	13,005	66	5,760	0.035	202	13,207	1.5
<b>Total</b>		<b>15,832</b>		<b>218,482</b>	<b>1,077</b>		<b>33,164</b>	<b>251,646</b>	<b>87</b>	<b>229,493</b>		<b>8,032</b>	<b>259,678</b>	<b>3.1</b>
<b>Av.</b>		<b>440</b>		<b>6,069</b>	<b>30</b>		<b>921</b>	<b>6,990</b>		<b>6,375</b>		<b>223</b>	<b>7,213</b>	
<b>Umwe Kati</b>														
270	6	0	13.8	0	111	30.8	3418.8	3,419	0	2,400	0.035	84	3,503	2.4
271	11	764	13.8	10543.2	0	30.8	0.0	10,543	100	1,122	0.035	39	10,582	0.4
272	10	480	13.8	6624	44.4	30.8	1367.5	7,992	83	4,800	0.035	168	8,160	2.1
273	4	1116	13.8	15400.8	0	30.8	0.0	15,401	100	14,400	0.035	504	15,905	3.2
274	10	446	13.8	6154.8	0	30.8	0.0	6,155	100	2,880	0.035	101	6,256	1.6
275	6	558	13.8	7700.4	0	30.8	0.0	7,700	100	4,800	0.035	168	7,868	2.1
276	4	0	13.8	0	270	30.8	8316.0	8,316	0	45,000	0.035	1,575	9,891	15.9
277	4	558	13.8	7700.4	0	30.8	0.0	7,700	100	7,200	0.035	252	7,952	3.2
278	6	1116	13.8	15400.8	0	30.8	0.0	15,401	100	4,800	0.035	168	15,569	1.1
279	2	1116	13.8	15400.8	0	30.8	0.0	15,401	100	28,800	0.035	1,008	16,409	6.1
280	5	595	13.8	8211	0	30.8	0.0	8,211	100	5,760	0.035	202	8,413	2.4
281	6	1380	13.8	19044	2	30.8	61.6	19,106	100	4,800	0.035	168	19,274	0.9
282	6	558	13.8	7700.4	4.29	30.8	132.1	7,833	98	4,800	0.035	168	8,001	2.1
283	11	753	13.8	10391.4	32.73	30.8	1008.1	11,399	91	2,618	0.035	92	11,491	0.8
284	10	446	13.8	6154.8	0	30.8	0.0	6,155	100	2,880	0.035	101	6,256	1.6
285	15	548	13.8	7562.4	48	30.8	1478.4	9,041	84	12,000	0.035	420	9,461	4.4
286	7	638	13.8	8804.4	102.86	30.8	3168.1	11,972	74	8,228	0.035	288	12,260	2.3
287	4	558	13.8	7700.4	90	30.8	2772.0	10,472	74	7,200	0.035	252	10,724	2.3
288	7	319	13.8	4402.2	51.43	30.8	1584.0	5,986	74	4,114	0.035	144	6,130	2.3
289	6	372	13.8	5133.6	60	30.8	1848.0	6,982	74	9,600	0.035	336	7,318	4.6
290	7	261	13.8	3601.8	63.43	30.8	1953.6	5,555	65	4,114	0.035	144	5,699	2.5

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household



**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE			Percent of fuelwood cons. to total fuel/charc.	Total energy consumption fuelwood and charcoal Mj	Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj				
<b>Umwe Kati continued</b>														
291	12	372	13.8	5133.6	74	30.8	2279.2	7,413	69	4,800	0.035	168	7,581	2.2
292	4	1035	13.8	14283	0	30.8	0.0	14,283	100	3,600	0.035	126	14,409	0.9
293	12	460	13.8	6348	0	30.8	0.0	6,348	100	2,400	0.035	84	6,432	1.3
294	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	7,200	0.035	252	7,400	3.4
295	3	920	13.8	12696	0	30.8	0.0	12,696	100	9,600	0.035	336	13,032	2.6
296	3	690	13.8	9522	0	30.8	0.0	9,522	100	9,600	0.035	336	9,858	3.4
297	4	591	13.8	8155.8	0	30.8	0.0	8,156	100	7,200	0.035	252	8,408	3.0
298	2	1035	13.8	14283	0	30.8	0.0	14,283	100	14,400	0.035	504	14,787	3.4
299	6	364	13.8	5023.2	0	30.8	0.0	5,023	100	10,000	0.035	350	5,373	6.5
300	7	591	13.8	8155.8	0	30.8	0.0	8,156	100	12,857	0.035	450	8,606	5.2
301	4	690	13.8	9522	30	30.8	924.0	10,446	91	7,200	0.035	252	10,698	2.4
302	4	585	13.8	8073	0	30.8	0.0	8,073	100	3,600	0.035	126	8,199	1.5
303	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	5,760	0.035	202	7,819	2.6
304	6	552	13.8	7617.6	0	30.8	0.0	7,618	100	4,800	0.035	168	7,786	2.2
305	2	1035	13.8	14283	0	30.8	0.0	14,283	100	14,400	0.035	504	14,787	3.4
306	6	518	13.8	7148.4	0	30.8	0.0	7,148	100	4,800	0.035	168	7,316	2.3
307	6	460	13.8	6348	0	30.8	0.0	6,348	100	9,600	0.035	336	6,684	5.0
308	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	5,760	0.035	202	7,819	2.6
309	7	638	13.8	8804.4	0	30.8	0.0	8,804	100	8,229	0.035	288	9,092	3.2
310	4	690	13.8	9522	0	30.8	0.0	9,522	100	14,400	0.035	504	10,026	5.0
311	4	591	13.8	8155.8	0	30.8	0.0	8,156	100	7,200	0.035	252	8,408	3.0
312	6	514	13.8	7093.2	0	30.8	0.0	7,093	100	9,600	0.035	336	7,429	4.5
313	5	473	13.8	6527.4	0	30.8	0.0	6,527	100	5,760	0.035	202	6,729	3.0
314	10	552	13.8	7617.6	5.14	30.8	158.3	7,776	98	5,760	0.035	202	7,978	2.5
315	7	0	13.8	0	51.43	30.8	1584.0	1,584	0	8,229	0.035	288	1,872	15.4
316	7	591	13.8	8155.8	51.43	30.8	1584.0	9,740	84	4,114	0.035	144	9,884	1.5
317	2	591	13.8	8155.8	222	30.8	6837.6	14,993	54	30,000	0.035	1,050	16,043	6.5

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE			Percent of fuelwood cons. to total fuel/charc.	Total energy consumption fuelwood and charcoal Mj	Total cons. fuelwood+ charcoal+ kerosene Mj	Percent kerosene to total energy consumed
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj				
<b>Umwe Kati continued</b>														
318	4	0	13.8	0	237.86	30.8	7326.1	7,326	0	15,000	0.035	525	7,851	6.7
319	9	248	13.8	3422.4	49.33	30.8	1519.4	4,942	69	3,200	0.035	112	5,054	2.2
320	4	0	13.8	0	111	30.8	3418.8	3,419	0	15,000	0.035	525	3,944	13.3
321	5	0	13.8	0	177.6	30.8	5470.1	5,470	0	5,143	0.035	180	5,650	3.2
322	10	0	13.8	0	44.4	30.8	1367.5	1,368	0	823	0.035	29	1,396	2.1
323	6	460	13.8	6348	8.57	30.8	264.0	6,612	96	4,800	0.035	168	6,780	2.5
324	6	345	13.8	4761	8.57	30.8	264.0	5,025	95	9,600	0.035	336	5,361	6.3
325	8	60	13.8	828	90	30.8	2772.0	3,600	23	7,200	0.035	252	3,852	6.5
326	2	0	13.8	0	222	30.8	6837.6	6,838	0	18,000	0.035	630	7,468	8.4
327	7	0	13.8	0	63.43	30.8	1953.6	1,954	0	1,371	0.035	48	2,002	2.4
	<b>Total</b>	<b>29,855</b>		<b>411,999</b>	<b>2,327</b>		<b>71,669</b>	<b>483,668</b>	<b>85</b>	<b>493,323</b>		<b>17,266</b>	<b>500,934</b>	<b>3.4</b>
	<b>Av.</b>	<b>515</b>		<b>7,103</b>	<b>40</b>		<b>1,236</b>	<b>8,339</b>		<b>8,506</b>		<b>298</b>	<b>8,637</b>	
<b>Umwe Kazkazini</b>														
328	9	460	13.8	6348	40	30.8	1232.0	7,580	84	2,857	0.035	100	7,680	1.3
329	15	285	13.8	3933	0	30.8	0.0	3,933	100	1,920	0.035	67	4,000	1.7
330	9	394	13.8	5437.2	0	30.8	0.0	5,437	100	3,200	0.035	112	5,549	2.0
331	7	507	13.8	6996.6	0	30.8	0.0	6,997	100	4,114	0.035	144	7,141	2.0
332	7	588	13.8	8114.4	154.29	30.8	4752.1	12,867	63	1,371	0.035	48	12,915	0.4
333	5	547	13.8	7548.6	88.8	30.8	2735.0	10,284	73	1,920	0.035	67	10,351	0.6
334	5	828	13.8	11426.4	14.4	30.8	443.5	11,870	96	5,760	0.035	202	12,072	1.7
335	6	414	13.8	5713.2	4.29	30.8	132.1	5,845	98	4,800	0.035	168	6,013	2.8
336	20	6480	13.8	89424	95.14	30.8	2930.3	92,354	97	18,000	0.035	630	92,984	0.7
337	2	0	13.8	0	222	30.8	6837.6	6,838	0	7,200	0.035	252	7,090	3.6
338	3	690	13.8	9522	0	30.8	0.0	9,522	100	19,200	0.035	672	10,194	6.6
339	2	828	13.8	11426.4	222	30.8	6837.6	18,264	63	14,400	0.035	504	18,768	2.7
340	6	460	13.8	6348	0	30.8	0.0	6,348	100	14,400	0.035	504	6,852	7.4
341	8	0	13.8	0	237.86	30.8	7326.1	7,326	0	1,800	0.035	63	7,389	0.9

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE			Percent of fuelwood cons. to total fuel/charc.	Total energy consumption fuelwood and charcoal Mj	Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj				
<b>Umwe Kazkazini continued</b>														
342	8	0	13.8	0	45	30.8	1386.0	1,386	0	7,200	0.035	252	1,638	15.4
343	5	893	13.8	12323.4	0	30.8	0.0	12,323	100	2,880	0.035	101	12,424	0.8
344	11	355	13.8	4899	40.36	30.8	1243.1	6,142	80	10,473	0.035	367	6,509	5.6
345	9	434	13.8	5989.2	70.48	30.8	2170.8	8,160	73	12,800	0.035	448	8,608	5.2
346	5	298	13.8	4112.4	88.8	30.8	2735.0	6,847	60	72,000	0.035	2,520	9,367	26.9
347	5	0	13.8	0	177.6	30.8	5470.1	5,470	0	1,920	0.035	67	5,537	1.2
348	8	279	13.8	3850.2	45	30.8	1386.0	5,236	74	7,500	0.035	263	5,499	4.8
349	8	148	13.8	2042.4	118.93	30.8	3663.0	5,705	36	3,214	0.035	113	5,818	1.9
405	14	446	13.8	6154.8	0	30.8	0.0	6,155	100	6,171	0.035	216	6,371	3.4
406	7	583	13.8	8045.4	0	30.8	0.0	8,045	100	4,114	0.035	144	8,189	1.8
407	8	585	13.8	8073	0	30.8	0.0	8,073	100	7,200	0.035	252	8,325	3.0
408	4	690	13.8	9522	111	30.8	3418.8	12,941	74	14,400	0.035	504	13,445	3.7
409	6	690	13.8	9522	0	30.8	0.0	9,522	100	0	0.035	0	9,522	0.0
410	3	920	13.8	12696	0	30.8	0.0	12,696	100	28,800	0.035	1,008	13,704	7.4
<b>Total</b>		<b>18,802</b>		<b>259,468</b>	<b>1,776</b>		<b>54,699</b>	<b>314,167</b>	<b>83</b>	<b>279,616</b>		<b>9,787</b>	<b>323,953</b>	<b>3.0</b>
<b>Av.</b>		<b>672</b>		<b>9,267</b>	<b>63</b>		<b>1,954</b>	<b>11,220</b>		<b>9,986</b>		<b>350</b>	<b>11,570</b>	
<b>Mbunju – Mvuleni</b>														
356	10	414	13.8	5713.2	0	30.8	0.0	5,713	100	2,880	0.035	101	5,814	1.7
357	6	197	13.8	2718.6	74	30.8	2279.2	4,998	54	4,800	0.035	168	5,166	3.3
358	6	591	13.8	8155.8	0	30.8	0.0	8,156	100	2,400	0.035	84	8,240	1.0
359	4	690	13.8	9522	222	30.8	6837.6	16,360	58	15,000	0.035	525	16,885	3.1
360	1	0	13.8	0	444	30.8	13675.2	13,675	0	128,571	0.035	4,500	18,175	24.8
361	5	552	13.8	7617.6	177.6	30.8	5470.1	13,088	58	25,714	0.035	900	13,988	6.4
362	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	1,800	0.035	63	7,211	0.9
363	5	684	13.8	9439.2	0	30.8	0.0	9,439	100	5,760	0.035	202	9,641	2.1
364	9	460	13.8	6348	0	30.8	0.0	6,348	100	3,200	0.035	112	6,460	1.7
365	10	828	13.8	11426.4	0	30.8	0.0	11,426	100	2,880	0.035	101	11,527	0.9

Key: Cons - Consumption      Av. Cons - Average consumption      H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE			Percent of fuelwood cons. to total fuel/charc.	Total energy consumption fuelwood and charcoal Mj	Kerosene consumed ml per annum per capita	Energy content in Mj per ml	Total kerosene cons. Mj	Total cons. fuelwood+ charcoal + kerosene Mj	Percent kerosene to total energy consumed
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita							
<b>Mbunju – Mvuleni continued</b>																	
366	5	552	13.8	7617.6	0	30.8	0.0	7,618	100	2,880	0.035	101	7,718	1.3			
367	4	855	13.8	11799	0	30.8	0.0	11,799	100	7,200	0.035	252	12,051	2.1			
368	6	690	13.8	9522	0	30.8	0.0	9,522	100	4,800	0.035	168	9,690	1.7			
369	3	920	13.8	12696	0	30.8	0.0	12,696	100	19,200	0.035	672	13,368	5.0			
370	4	518	13.8	7148.4	0	30.8	0.0	7,148	100	14,400	0.035	504	7,652	6.6			
371	6	518	13.8	7148.4	0	30.8	0.0	7,148	100	9,600	0.035	336	7,484	4.5			
372	7	1183	13.8	16325.4	0	30.8	0.0	16,325	100	4,114	0.035	144	16,469	0.9			
373	4	591	13.8	8155.8	0	30.8	0.0	8,156	100	7,200	0.035	252	8,408	3.0			
374	11	430	13.8	5934	1.09	30.8	33.6	5,968	99	1,122	0.035	39	6,007	0.7			
375	1	2760	13.8	38088	0	30.8	0.0	38,088	100	14,400	0.035	504	38,592	1.3			
376	1	0	13.8	0	444	30.8	13675.2	13,675	0	128,571	0.035	4,500	18,175	24.8			
377	5	473	13.8	6527.4	0	30.8	0.0	6,527	100	5,760	0.035	202	6,729	3.0			
378	6	394	13.8	5437.2	0	30.8	0.0	5,437	100	4,800	0.035	168	5,605	3.0			
379	6	197	13.8	2718.6	74	30.8	2279.2	4,998	54	4,800	0.035	168	5,166	3.3			
380	12	276	13.8	3808.8	0	30.8	0.0	3,809	100	1,029	0.035	36	3,845	0.9			
381	4	296	13.8	4084.8	0	30.8	0.0	4,085	100	3,086	0.035	108	4,193	2.6			
382	2	1140	13.8	15732	0	30.8	0.0	15,732	100	14,400	0.035	504	16,236	3.1			
383	1	1200	13.8	16560	0	30.8	0.0	16,560	100	28,800	0.035	1,008	17,568	5.7			
384	4	1035	13.8	14283	0	30.8	0.0	14,283	100	7,200	0.035	252	14,535	1.7			
385	9	460	13.8	6348	0	30.8	0.0	6,348	100	1,600	0.035	56	6,404	0.9			
386	5	473	13.8	6527.4	0	30.8	0.0	6,527	100	5,760	0.035	202	6,729	3.0			
387	9	131	13.8	1807.8	49.33	30.8	1519.4	3,327	54	3,200	0.035	112	3,439	3.3			
388	5	355	13.8	4899	10.29	30.8	316.9	5,216	94	5,760	0.035	202	5,418	3.7			
389	8	518	13.8	7148.4	0	30.8	0.0	7,148	100	3,600	0.035	126	7,274	1.7			
390	8	345	13.8	4761	55.5	30.8	1709.4	6,470	74	3,600	0.035	126	6,596	1.9			
391	7	355	13.8	4899	0	30.8	0.0	4,899	100	4,114	0.035	144	5,043	2.9			
392	6	690	13.8	9522	0	30.8	0.0	9,522	100	0	0.035	0	9,522	0.0			

Key: Cons - Consumption      Av. Cons - Average consumption

H/hold - Household

**REMP Technical Report 4: Fuelwood, Charcoal and Alternative Energy Sources**

Appendix 8 cont		FUELWOOD			CHARCOAL			KEROSENE				Percent kerosene to total energy consumed		
H/hold Number	H/hold size	Fuelwood consumed kg per capita	Energy content in Mj	Total Fuel wood consumed Mj	Charcoal consumed kg per capita	Energy content in Mj	Total charcoal consumed Mj	Total energy consumption fuelwood and charcoal Mj	Percent of fuelwood cons. to total fuel/charc.	Kerosene consumed ml per annum per capita	Energy content in Mj per ml		Total kerosene cons. Mj	Total cons. fuelwood+ charcoal + kerosene Mj
<b>Mbunju – Mvuleni continued</b>														
393	7	591	13.8	8155.8	0	30.8	0.0	8,156	100	4,114	0.035	144	8,300	1.7
394	5	414	13.8	5713.2	0	30.8	0.0	5,713	100	5,760	0.035	202	5,915	3.4
395	4	690	13.8	9522	0	30.8	0.0	9,522	100	7,200	0.035	252	9,774	2.6
396	6	394	13.8	5437.2	0	30.8	0.0	5,437	100	4,800	0.035	168	5,605	3.0
397	3	1140	13.8	15732	0	30.8	0.0	15,732	100	4,800	0.035	168	15,900	1.1
398	4	518	13.8	7148.4	0	30.8	0.0	7,148	100	14,400	0.035	504	7,652	6.6
399	10	552	13.8	7617.6	0	30.8	0.0	7,618	100	2,880	0.035	101	7,718	1.3
400	7	591	13.8	8155.8	0	30.8	0.0	8,156	100	4,114	0.035	144	8,300	1.7
401	5	473	13.8	6527.4	0	30.8	0.0	6,527	100	5,760	0.035	202	6,729	3.0
402	4	690	13.8	9522	0	30.8	0.0	9,522	100	7,200	0.035	252	9,774	2.6
403	5	547	13.8	7548.6	5.14	30.8	158.3	7,707	98	5,760	0.035	202	7,909	2.5
404	4	518	13.8	7148.4	0	30.8	0.0	7,148	100	7,200	0.035	252	7,400	3.4
Total		<b>29,407</b>		<b>405,817</b>	<b>1,557</b>		<b>47,954</b>	<b>453,771</b>	<b>89</b>	<b>577,991</b>		<b>20,230</b>	<b>474,000</b>	<b>4.3</b>
Av.		<i>600</i>		<i>8,282</i>	<i>32</i>		<i>979</i>	<i>9,261</i>		<i>11,796</i>		<i>413</i>	<i>9,673</i>	

Appendix 9: Household Preference to Fuelwood, Charcoal, and Kerosene Use by Percentage

Village	No. of household	Fuelwood only	%	Charcoal only	%	Fuelwood & Charcoal	%	Kerosene only	%
Mg/kusini	54	31	57.4	5	9.3	18	33.3	0	0.0
Mg/kati	44	28	63.6	1	2.3	15	34.1	0	0.0
Mg/kaskazini	31	20	64.5	2	6.5	9	29.0	0	0.0
Ikwi/kusini	71	35	49.3	24	33.8	12	16.9	0	0.0
Ikwi/kati	21	6	28.6	3	14.3	12	57.1	0	0.0
Ikwi/kaskazini	18	15	83.3	0	0.0	3	16.7	0	0.0
Um/kusini	36	15	41.7	2	5.6	19	52.8	0	0.0
Um/kati	58	31	53.4	9	15.5	18	31.0	0	0.0
Um/kaskazini	28	11	39.3	4	14.3	13	46.4	0	0.0
<b>Sub-total</b>	<b>361</b>	<b>192</b>	<b>53.2</b>	<b>50</b>	<b>13.9</b>	<b>119</b>	<b>33.0</b>	<b>0</b>	<b>0.0</b>
Mbunju	49	36	73.5	2	4.1	9	18.4	2	4.1
<b>Total</b>	<b>410</b>	<b>228</b>	<b>55.6</b>	<b>52</b>	<b>12.7</b>	<b>128</b>	<b>31.2</b>	<b>2</b>	<b>0.5</b>

Appendix 10: Commercial Sector Fuelwood Consumption Rate

Village name		COLLECTED										PURCHASED					Grand total	Annual con.						
		Activity	Unit	Total cons. reported	Conv. factor kg	Total con. Kg	Con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported	Conver. factor kg	Total Con. Kg	No. of days	Con. per day Kg	Effect. days/month			Total con. per month Kg.	Con. Per month Kg	Conver. energy factor Mj/kg	Grand total con. per month Mj		
UMWE KUSINI																								
1	F/wood	Frying	Bundle	0	23.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	6.2	12.4	1	12.4	30	372.0	13.8	5,133.6	61,603.2
MGOMBA KAS.																								
3	F/Wood	Frying	Bundle	2	23.0	46.0	3	15.3	30	460.0	0	460.0	0	0.0	0	6.2	0.0	0	0.0	0	460.0	13.8	6,348.0	76,176.0
MGOMBA KUSINI																								
4	F/wood	Frying	Bundle	0	23.0	0.0		0.0	0	0.0	1	38.0	2	19.0	30	570.0	38.0	50.4	942.0	570.0	1,402.0	13.8	7,866.0	94,392.0
<b>TOTAL CONS. FOR FISH FRYING</b>												<b>460.0</b>	<b>50.4</b>	<b>942.0</b>	<b>1,402.0</b>	<b>19,347.6</b>	<b>77,390.4 MJ</b>							

Village name		COLLECTED										PURCHASED					Grand total	Annual con.						
		Activity	Unit	Total cons. reported	Conv. factor kg	Total con. Kg	Con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported	Conver. factor kg	Total Con. Kg	No. of days	Con. per day Kg	Effect. days/month			Total con. per month Kg.	Con. Per month Kg	Conver. energy factor Mj/kg	Grand total con. per month Mj		
UMWE KUSINI																								
2	F/wood	Smoking	Bundle	1	23.0	23.0	1	23.0	4	92.0	0	92.0	0	0.0	0	6.2	0.0	0	0.0	0	92.0	13.8	1,269.6	15,235.2

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Business activity: **FOOD VENDORS**

Village name	Fuel Type	Activity	Unit	COLLECTED						PURCHASED						Grand total	Annual con. MJ					
				Total cons. reported	Conv. factor kg	Total con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported	Conver. factor kg	Total con. days	No. of days	Con. per day Kg	Effect. days/month			Total con. per month Kg.	Con. Per month Kg	Conver. energy factor Mj/kg	Grand total con. per month Mj	
MGOMBA KUSINI																						
5	F/wood	Cooking	Bundle	0	0.0	0	0.0	0	0.0	0	0.0	1	6.2	6.2	1	6.2	30	186.0	186.0	13.8	2,566.8	30,801.6
	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	1.0	1	1.0	30	30.0	30.0	30.8	924.0	11,088.0
	<b>Total 5</b>				<b>0.0</b>				<b>0.0</b>				<b>7.2</b>	<b>7.2</b>		<b>7.2</b>		<b>216.0</b>	<b>216.0</b>		<b>3,490.8</b>	<b>41,889.6</b>
IKWIRIRI KUSINI																						
6	F/wood	Cooking	Bundle	0	0.0	0	0.0	0	0.0	0	0.0	1	6.2	6.2	1	6.2	30	186.0	186.0	13.8	2,566.8	30,801.6
7	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0	2.0	1	2.0	30	60.0	60.0	30.8	1,848.0	22,176.0
8	Charc.	Cooking	Bag	0	0.0	0	0.0	0	0.0	0	0.0	1	37.0	37.0	14	2.6	30	79.3	79.3	30.8	2,442.0	29,304.0
9	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0	2.0	1	2.0	30	60.0	60.0	30.8	1,848.0	22,176.0
14	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	4	1.0	4.0	1	4.0	30	120.0	120.0	30.8	3,696.0	44,352.0
15	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	6	1.0	6.0	1	6.0	30	180.0	180.0	30.8	5,544.0	66,528.0
16	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	7	1.0	7.0	1	7.0	30	210.0	210.0	30.8	6,468.0	77,616.0
UMWE KATI																						
17	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	3	1.0	3.0	1	3.0	30	90.0	90.0	30.8	2,772.0	33,264.0
18	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	5	1.0	5.0	1	5.0	30	150.0	150.0	30.8	4,620.0	55,440.0
19	F/wood	Cooking	Bundle	0	0.0	0	0.0	0	0.0	0	0.0	1	6.2	6.2	1	6.2	30	186.0	186.0	13.8	2,566.8	30,801.6
	Charc.	Cooking	Tin	0	0.0	0	0.0	0	0.0	0	0.0	4	1.0	4.0	1	4.0	30	120.0	120.0	30.8	3,696.0	44,352.0
	<b>Total 19</b>				<b>0.0</b>				<b>0.0</b>				<b>10.2</b>	<b>10.2</b>		<b>10.2</b>		<b>306.0</b>	<b>306.0</b>		<b>6,262.8</b>	<b>75,153.6</b>
<b>TOTAL CONS. FOR FOOD VENDING</b>					<b>0.0</b>				<b>0.0</b>				<b>89.6</b>	<b>89.6</b>		<b>55.2</b>		<b>1,657.3</b>	<b>1,657.3</b>		<b>41,558.4</b>	<b>498,700.8</b>
																						<b>45,336.4 MJ</b>



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Business activity: Hotel

Village name	Fuel Type	Activity	Unit	COLLECTED					PURCHASED					Grand total	Annual con.									
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days per day	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg	Total. Con. Kg	No. of days			Con. per day Kg	Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. energy factor Mj/kg	Grand total con. per month Mj			
IKWIRIRI KUSINI																								
20	Charc.	Cooking	Bag	0	0.0	0.0	0	0.0	0	0.0	0	0	0.0	1	37.0	37.0	2	18.5	30	555.0	555.0	30.8	17,094.0	205,128.0

Business activity: Bar

Village name	Fuel Type	Activity	Unit	COLLECTED					PURCHASED					Grand total	Annual con.										
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days per day	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg	Total. Con. Kg	No. of days			Con. per day Kg	Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. energy factor Mj/kg	Grand total con. per month Mj				
UMWE KATI																									
21	Charc.	Cooking	Bag	0	0.0	0.0	0	0.0	0	0.0	0	0	0.0	1	37.0	37.0	2	18.5	30	555.0	555.0	30.8	17,094.0	205,128.0	
22	Charc.	Cooking	Bag	0	0.0	0.0	0	0.0	0	0.0	0	0	0.0	1	37.0	37.0	30	1.2	30	37.0	37.0	30.8	1,139.6	13,675.2	
<b>TOTAL CONS. FOR BARS</b>						<b>0.0</b>							<b>0.0</b>		<b>74.0</b>	<b>592.0</b>		<b>19.7</b>		<b>592.0</b>	<b>592.0</b>		<b>18,233.6</b>	<b>218,803.2</b>	

**ANNUAL AVERAGE FUELS CONSUMPTION FOR BARS 109,401.6 MJ**

Business activity: Smelting

Village name	Fuel Type	Activity	Unit	COLLECTED					PURCHASED					Grand total	Annual con.													
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days per day	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg	Total. Con. Kg	No. of days			Con. per day Kg	Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. energy factor Mj/kg	Grand total con. per month Mj							
MGOMBA KAS.																												
23	Charc.	Smelting	Bag	2	37.0	74.0	7	10.6	30	317.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	317.1	30.8	9,768.0	117,216.0
24	Charc.	Smelting	Bag	1	37.0	37.0	14	2.6	30	79.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	79.3	30.8	2,442.0	29,304.0	
IKWIRIRI KATI																												
25	Charc.	Smelting	Bag	0	0.0	0.0	0	0.0	0	0.0	2	37.0	74.0	30	2.5	30	74.0	74.0	30.8	2,279.2	2,279.2	30.8	14,489.2	173,870.4				
<b>TOTAL CON. FOR SMELTING</b>						<b>111.0</b>				<b>396.4</b>		<b>74.0</b>	<b>74.0</b>		<b>74.0</b>	<b>470.4</b>		<b>30.8</b>		<b>14,489.2</b>	<b>14,489.2</b>		<b>14,489.2</b>	<b>173,870.4</b>				
<b>ANNUAL AVERAGE FUELS CONSUMPTION FOR</b>													<b>470.4</b>	<b>SMELTING</b>					<b>57,956.8 MJ</b>									

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**Business activity: Local Brewing**

Village name	Fuel Type	Activity	Unit	COLLECTED				PURCHASED				Grand total	Annual con.							
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg			Con. per day Kg	No. of days	Con. Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. Grand total per month Mj	
UMWE KAS.																				
26	F/wood	Brewing	Bundle	2	23.0	46.0	7	6.6	30	197.1	0	0.0	0	0.0	0	0.0	197.1	13.8	2,720.6	32,646.9
27	F/wood	Brewing	Bundle	0	0.0	0.0	0	0.0	0	0.0	3	6.2	18.6	1	18.6	30	558.0	13.8	7,700.4	92,404.8
28	Charc.	Brewing	Tin	0	0.0	0.0	0	0.0	0	0.0	2	1.0	2.0	1	2.0	30	60.0	30.8	1,848.0	22,176.0
29	Charc.	Brewing	Bag	0	0.0	0.0	0	0.0	0	0.0	1	37.0	37.0	10	3.7	30	111.0	30.8	3,418.8	41,025.6
<b>TOTAL CON. FOR LOCAL BREW</b>						<b>46.0</b>				<b>197.1</b>			<b>57.6</b>			<b>729.0</b>	<b>926.1</b>		<b>15,687.8</b>	<b>188,253.3</b>
												<b>ANNUAL AVERAGE FUELS CONSUMPTION FOR LOCAL BREWING</b>					<b>FOR 47,063.3 MJ</b>			

**Business activity: Pottery**

Village name	Fuel Type	Activity	Unit	COLLECTED				PURCHASED				Grand total	Annual con.								
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg			Con. per day Kg	No. of days	Con. Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. Grand total per month Mj		
M/GOMBA KATI																					
31	F/wood	Pottery	W/barr.	0	0.0	0.0	0	0.0	0	0.0	1	76.0	76.0	4	19.0	8	152.0	152.0	13.8	2,097.6	25,171.2
IKWIRIRI KATI																					
32	F/wood	Pottery		0	0.0	0.0	0	0.0	0	0.0	0	0.0	0.0	0	0.0	0	0.0	0.0	0.0	No current production	
<b>TOTAL CON. FOR POTTERY</b>						<b>0.0</b>				<b>0.0</b>			<b>76.0</b>				<b>152.0</b>	<b>152.0</b>		<b>2,097.6</b>	<b>25,171.2</b>
												<b>ANNUAL AVERAGE FUELS CONSUMPTION FOR POTTERY</b>					<b>FOR 12,585.6 MJ</b>				

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**Business activity: RESTAURANTS**

Village name	Fuel Type	Activity	Unit	COLLECTED					PURCHASED					Grand total	Annual con.					
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg	Total. Con. Kg	No. of days			Con. per day Kg	Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. energy factor Mj/kg
MGOMBA KAS.																				
34	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	0	1	38.0	38.0	1,140.0	1,140.0	13.8	15,732.0	188,784.0	
35	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	0	2	6.2	12.4	372.0	372.0	13.8	5,133.6	61,603.2	
IKWIRI KUSINI																				
36	Charc.	Cooking	Tin	0	0.0	0.0	0	0.0	0	0.0	0	6	1.0	6.0	180.0	180.0	30.8	5,544.0	66,528.0	
37	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	0	3	6.2	18.6	558.0	558.0	13.8	7,700.4	92,404.8	
	Charc.	Cooking	Bag	0	0.0	0.0	0	0.0	0	0.0	0	1	37.0	37.0	158.6	158.6	30.8	4,884.0	58,608.0	
<b>Total 37</b>						<b>0.0</b>								<b>55.6</b>	<b>716.6</b>	<b>716.6</b>		<b>12,584.4</b>	<b>151,012.8</b>	
UMWE KATI																				
38	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	0	5	6.2	31.0	930.0	930.0	13.8	12,834.0	154,008.0	
<b>TOTAL CONS. FOR RESTAURANTS</b>						<b>0.0</b>								<b>143.0</b>	<b>3,338.6</b>	<b>3,338.6</b>		<b>51,828.0</b>	<b>621,936.0</b>	
<b>ANNUAL AVERAGE FUELS CONSUMPTION FOR RESTAURANTS</b>																				
																				<b>124,387.2 MJ</b>

**MBUNJUMULENI VILLAGE**

**Business activity: FOOD VENDING**

Village name	Fuel Type	Activity	Unit	COLLECTED					PURCHASED					Grand total	Annual con.					
				Total cons. reported	Conv. factor kg	Total con. Kg	Con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported factor kg	Total. Con. Kg	No. of days			Con. per day Kg	Effect. days/month	Total con. per month Kg	Con. Per month Kg	Conver. energy factor Mj/kg
MBUNJUMV ULENI																				
10	F/wood	Cooking	Bundle	1	19.0	19.0	1	19.0	30	570.0	0	0	0.0	0.0	0.0	0.0	570.0	13.8	7,866.0	94,392.0
11	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	3	3	19.0	57.0	855.0	855.0	13.8	11,799.0	141,588.0	
12	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	3	4	19.0	57.0	427.5	427.5	13.8	5,899.5	70,794.0	
13	F/wood	Cooking	Bundle	0	0.0	0.0	0	0.0	0	0.0	2	1	6.2	12.4	372.0	372.0	13.8	5,133.6	61,603.2	
<b>TOTAL CONS. FOR FOOD VENDING</b>						<b>19.0</b>				<b>570.0</b>			<b>126.4</b>	<b>1,654.5</b>	<b>1,654.5</b>		<b>30,698.1</b>	<b>368,377.2</b>		
<b>ANNUAL AVERAGE FUELS CONSUMPTION FOR FOOD VENDING</b>																				
																				<b>92,094.3 MJ</b>

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**Business activity: POTTERY**

Village name	Fuel Type	Activity	Unit	COLLECTED						PURCHASED						Grand total	Annual con.				
				Total cons. reported	Conv. factor kg	Total con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported	Conver. factor kg	Total con. days	No. of days	Con. per day Kg	Effect. days/month			Total con. per month Kg.	Con. Per month Kg	Conver. Grand total per month Mj	
MBUNJUMV ULENI																					
30	F/wood	Pottery	Bundle	2	19.0	38.0	2	19.0	8	152.0	0	0.0	0.0	0	0.0	0	0.0	152.0	13.8	2,097.6	12,585.6

**Business activity: RESTAURANTS**

Village name	Fuel Type	Activity	Unit	COLLECTED						PURCHASED						Grand total	Annual con.					
				Total cons. reported	Conv. factor kg	Total con. days	Av. Cons. per day Kg	Effective days per month	Total cons. per month Kg	Total con. reported	Conver. factor kg	Total con. days	No. of days	Con. per day Kg	Effect. days/month			Total con. per month Kg.	Con. Per month Kg	Conver. Grand total per month Mj		
MBUNJUMV ULENI																						
33	F/wood	Cooking	Bundle	1	19.0	19.0	1	19.0	30	570.0	0	0.0	0.0	0	0.0	0	0.0	570.0	13.8	7,866.0	47,196.0	
	Charc.	Cooking	Bag	0	0.0	0.0	0	0.0	0	0.0	1	37.0	37.0	21	1.8	30	52.9	52.9	30.8	1,628.0	9,768.0	
<b>TOTAL CONS. FOR RESTAURANT</b>				<b>19.0</b>		<b>37.0</b>		<b>570.0</b>		<b>570.0</b>		<b>37.0</b>		<b>52.9</b>		<b>622.9</b>		<b>9,494.0</b>		<b>56,964.0</b>		

**Key:**

- Con - Consumption
- Av. Cons - Average consumption
- Conver. - Conversion
- Effect. - Effective

**Appendix 11: Dealers in Fuelwood and Charcoal Production / Selling - Surveyed**

<b>FUELWOOD</b>						
No.	Name	Sex	Age	Ethnic group	Place of origin	Official residence
1	Mohamed I. Bongoyo	M	70	Ngoni	Morogoro	Mpima
2	Asha Mussa	F	24	Zaramo	Ikwiriri	Ikwiriri kati
3	Rehema Yusufu	F	31	Ndengereko	Miango	Mgomba kati
4	Sofia Bakari	F	18	Ndengereko	Muyuyu	Mgomba kati
5	Mwajabu Omari Malungele	F	26	Ndengereko	Ikwiriri	Umwe kusini
6	Zalia Seif	F	35	Ndengereko	Ikwiriri	Umwe kusini
7	Kisilo Tunyungu	M	35	Ndengereko	Ikwiriri	Mgomba kati
8	Mohamed Abdallah Msanga	M	70	Yao	Ikwiriri	Mgomba kaskazini
9	Juma Salum Matimbwa	M	26	Ndengereko	Bondeni	Mgomba kaskazini
10	Aisha Somboko	F	29	Ndengereko	Ikwiriri	Mgomba kusini

<b>CHARCOAL</b>						
No.	Name	Sex	Age	Ethnic group	Place of origin	Official residence
1	Ally Makeo	M	50	Matumbi	Kilwa	Ikwiriri kaskazini
2	Tatu kassim	F	25	Ndengereko	Mbuchi	Mgomba kati
3	Ngawaje Mwamedu	F	25	Ndengereko	Ikwiriri	Umwe kusini
4	Zaina Abdalla	F	40	Ndengereko	Ikwiriri	Umwe kaskazini
5	Juma Mandai	M	38	Ndengereko	Ikwiriri	Ikwiriri kaskazini
6	Juma Ally Kanka	M	42	Ndengereko	Ikwiriri	Ikwiriri kaskazini
7	MamaSalima Nyachambale	F	47	Ndengereko	Ikwiriri	Ikwiriri kaskazini
8	Midadi Aly	M	36	Ngindo	Lindi	Mgomba kati
9	Asia Yusuph	F	23	Ndengereko	Chumbi	Mgomba kati
10	Tumu Y. Mgombe	F	27	Ndengereko	Chumbi	Mgomba kati
11	Mohamed Abdalla Msanga	M	70	Yao	Rufiji	Mgomba kati
12	Habiba Abdallah	F	40	Ndengereko	Kitonga	Umwe kaskazini
13	Saidi Ally Mtinde	M	58	Ngindo	Kilwa	Ikwiriri kaskazini
14	Seif Saidi Machale	M	50	Ndengereko	Ikwiriri	Ikwiriri kaskazini
15	Asuma Sultani	F	48	Ndengereko	Umwe	Bondeni
16	Yusuph Salum Mipi	M	55	Ndengereko	Ikwiriri	Umwe kati
17	Amina Saidi	F	22	Ngindo	Kilwa	Umwe kati
18	Abdallah saidi	M	40	Ngindo	Ikwiriri	Umwe kaskazini
19	Mohamed Bakari Matengerea	M	29	Ngindo	Ikwiriri	Umwe kaskazini
20	Angelina Dominic	F	39	Makonde	Msumbiji	Umwe kaskazini
21	Amida Hassani	F	22	Ndengereko	Mgomba	Mgomba kusini

**Appendix 12: Names of Dealers in Commercial Business related to Fuelwood, Charcoal, and other Wood Products (As Provided by Village Government Leaders)**

Village name	CHARCOAL PRODUCERS/ SELLERS			
	No:	Name	Sex	Comments
<b>Mgomba Kusini</b>	1	Mbwana Bendekete	M	
	2	Mr.King'ang'a (junior).	M	
	3	Mr.King'ang'a (senior)	M	
	4	Zawadi Ali Mgwaya	F	
	5	Mrs Kimamule	F	
	6	Mrs Mpasabe	F	
<b>Mgomba kati</b>	1	Hemed Kinganga	M	
	2	Sudi Kiganga	M	
	3	Bene Kambangwa	M	
	4	Mzee Msanga	M	
	5	Tatu Kasimu	F	Surveyed
	6	Tuma Mgombe	F	Surveyed
	7	Mama Ndole	F	
	8	Fatuma Mlumbuka	F	
<b>Mgomba kaskazini</b>	1	Tatu Mponda	F	
	2	Abdallah Mbilau	M	
	3	Salum Saidi Mbekilwe	M	
	4	Saidi Mbirue	M	
	5	Muhani	M	
<b>Umwe kaskazini</b>	1	Jabu ALI Mpuche	F	
	2	Shani Momboka	F	
	3	Chiku Urongo	F	
	4	Hamina Hamis	F	
<b>Umwe kati</b>	1	Mzee Lwambo	F	
	2	Omari Kiuta	F	
<b>Ikwiriri Kaskazini</b>	1	Said Ali Njembo	M	
	2	Salim Said Mauzi	M	
	3	Salum Liputi	M	
	4	Mzee Amboni	M	
	5	Habibu Mbonde	M	
	6	Rajabu Mwichande Mponda	M	
	7	Juma A. Kanka	M	Surveyed
	8	Juma Mboni	M	
	9	Bakari Mboni	M	
	10	Sultani Pwilukiti	M	
	11	Seif Machale	M	Surveyed
	12	Bakari Mparaki	M	
	13	Salum Omari Mpawane	M	
	14	Ashindi Omari Mpawane	M	
	15	Nguka Mkenda	M	
	16	Mohamedi Shabani Mbula	M	
	17	Chande Machota	M	

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Village name	CHARCOAL PRODUCERS/ SELLERS			
	No:	Name	Sex	Comments
	18	Ali Machota	M	
	19	Athumani Mponda	M	
	20	Thobias Ajinyonga	M	
	21	Mzee Njiwa	M	
<b>Cont.</b>	22	George Sabelo	M	
<b>Ikwiriri Kaskazini</b>	23	Kijana Kingwande	F	
	24	Zainabu Mussa Kalamu	F	
	25	Aisha Abdulaman Mtanga	F	
	26	Mtakwisha Ali Msenga	F	
	27	Fatuma Abdallah Farahani	F	
	28	Zubeda M. Mnongelage	F	
	29	Mwajabu H. Mtanga	F	
	30	Josephina Komba Daudi	F	
	31	Helena Joseph	F	
	32	Zabibu Abdallah Nangingite	F	
	33	Mwanahawa M. Kilindo	F	
	34	Mwanahawa Hemedi	F	
	35	Rehema S. Mtanga	F	
	36	Zainabu Selemani Liputi	F	
	37	Asha S. Mandai	F	
	38	Mwalimu S. Mshamu	F	
	39	Sofia Mbwana Mbweweto	F	
	40	Salima H. Mponda	F	
<b>Ikwiriri Kusini</b>	1	Fatuma Kassimu Mkwanywe	F	
	2	Sharifa Omari Ndumbwasi	F	
	3	Abdul Rashid Mkongoma	M	
	4	Nyangasinda	M	
	5	Asha Rashid Shomari	F	
	6	Juma Ngasinda	M	
<b>Mgomba Kusini</b>	1	Mrs Kingwande	F	
	2	Mrs Kongoi	F	
	3	Fakila Mponjo	F	
	4	Musa Mkata	M	
	5	Ali Libogile	M	
	6	Mrs Mchochole	F	
	7	Juma Libinge	M	
<b>Mgomba Kati</b>	1	Sophia Msango	F	
	2	Mama Ligonge	F	
	3	Mama Mpembeta	F	
	4	Mama Mganga Jamali	F	
<b>Mgomba Kaskazini</b>	1	Mwirami Salum Matimbwa	M	
	2	Juma Salum Matimbwa	M	Surveyed
	3	Rajabu Salum Matimbwa	M	
	4	Mohamedi Msanga	M	Surveyed

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Village name	FUELWOOD PRODUCERS/ SELLERS			
	No:	Name	Sex	Comments
<b>Umwe Kaskazini</b>	5	Zeti Mkangama	F	
	6	Bahati Kiongoli	F	
	7	Juma Mponda	M	
	8	Nassor Kapirima	M	
<b>Umwe Kati</b>	1	Halima Liyumu	F	
	2	Nyamponda	M	
<b>Ikwiriri Kaskazini</b>	1	Omari Ali Maluka	M	
	2	Iddi Mwangia	M	
	3	Mwalami Mlweta	M	
	4	Ali Omari Maluka	M	
	5	Iddi Omari Kitumbukia	M	
	6	Shabani Abdallah Kibou	M	
	7	Seif Machale	M	
	8	Salum Omari Mpawane	M	
	9	Nguka Mkenda	M	
<b>Ikwiriri Kusini</b>	1	Ramadhani Ayubu Magese	M	
	2	Mama Khalifa Kilungi	F	

Village name	POLE SELLERS			
	No:	Name	Sex	Comments
<b>Mgomba Kati</b>	1	Mzee Mgomi	M	
<b>Mgomba Kaskazini</b>	1	Swalehe Malembo	M	
	2	Mbwana Mbilai	M	
<b>Umwe Kaskazini</b>	1	Mussa Marombwa	M	
	2	Ramadhani Magoga	M	
	3	Musa Sobo	M	
	4	Badiru Magoma	M	
<b>Umwe Kati</b>	5	Mzee Makungwa	M	
	6	Mzee Mkungutwe	M	
	7	Juma Bulungundu	M	
<b>Ikwiriri Kaskazini</b>	1	Omari Ally Maluka	M	
	2	Iddi Mwangia	M	
	3	Mwalami Mlweta	M	
	4	Musa Miliango	M	
	5	Salum Bakari Mlawa	M	
	6	Idd Omari Kitumbukia	M	
	7	Shabani Abdallah Kibou	M	
	8	Seif Machale	M	
	9	Salum Omari Mpawane	M	
	10	Ashindi Omari Mpawane	M	
	11	Juma Kauka	M	
	12	Nguka Mkenda	M	
	13	Mohamed Shabani Mbula	M	
	14	Kitumbi	M	



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Village name	LOG SELLERS			
	No:	Name	Sex	Comments
Mgomba Kaskazini	1	Hemedi Ali Konewa	M	
	2	Rashidi Hemedi Konewa	M	
	3	Mandimu	M	
	4	Said Ali Linyango	M	
Umwe Kaskazini	1	Omari Mkangama	M	
	2	Jaffari Mponjo	M	
	3	Jumanne Shuwari	M	
Ikwiriri Kaskazini	1	Hamadi Abdallah	M	
	2	Kassim Abdallah Mtweta	M	
	3	Rajabu Mchande Mtweta	M	
	4	Abdallah Said	M	Surveyed
	5	Ally Ibrahim Ngaoma	M	
	6	Mohamedi Salum Mlawa	M	

Village name	POTTERY SELLERS			
	No:	Name	Sex	Comments
Mgomba Kati	1	Binti Hamdani	F	Surveyed
	2	Mama Luanda	F	
Mgomba Kaskazini	1	Mama Nyandundu	F	
	2	Mama Nabaruani	F	
	3	Hawa Mwera	F	
	4	Mama Ntulia	F	
Umwe Kaskazini	1	Farashuu Kibinda	F	
	2	Zainabu Kiongoli	F	
	3	Saburi Bint Salum	F	
Umwe Kati	1	Zainabu Mkali	F	
Ikwiriri Kaskazini	1	Joa Saum	F	
	2	Mama Mandwange	F	
	3	Mama Nyilindo Mkumbatia	F	

Village name	FOOD VENDORS			
	No:	Name	Sex	Comments
Mgomba Kati	1	Mama Ngonde	F	
	2	Mama Nungando Msango	F	
Mgomba Kaskazini	1	Pili Yusufu Ngwele	F	
	2	Pili Nyawaba	F	
Umwe Kaskazini	1	Mtumwa Athumani	F	
	2	Sikudhani Omari	F	
Umwe Kati	1	Mama Shukuru	F	
	2	Shani Tutu	F	
	3	Zakia Mang'ula	F	
	4	Zaina A. Mkana	F	
	5	Kilio Juma	F	
Ikwiriri Kaskazini	1	Limbale Kisona	F	

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<b>FOOD VENDORS</b>				
<b>Village name</b>	<b>No:</b>	<b>Name</b>	<b>Sex</b>	<b>Comments</b>
<b>Ikwiriri Kusini</b>	1	Mwanaidi Mnete	F	
	2	Duji Selemani Sakoro	F	
	3	Mama Tutu	F	
	4	Sauda Matenda	F	
	5	Hadija Mpili	F	
	6	Raila Mombokayene	F	
	7	Mwanahamisi Ndupe	F	
	8	Mgeni Mkwanywe	F	
	9	Tabu Mkwenya	F	
	10	Sharifa Kibebo	F	
	11	Munguni Nyamhumbuka	F	
	12	Zuhura Mkamba	F	
	13	Wahida	F	

<b>SMITHERS</b>				
<b>Village name</b>	<b>No:</b>	<b>Name</b>	<b>Sex</b>	<b>Comments</b>
<b>Mgomba Kusini</b>	1	Mbwana Said Qegelu	M	
	2	Ramadhani Mussa Kinjumbe	M	
	3	Mwanahamisi Idd Malepia	F	
<b>Mgomba Kati</b>	1	Mzee Mikongo	M	Surveyed
<b>Mgomba Kaskazini</b>	1	Mzee Mhani	M	
	2	Omari Mikonga	M	Surveyed
	3	Amiri Sadala	M	
	4	Jumane Ngwele	M	
	5	Mzee Kiroboto	M	
	6	Mmakonde	M	

### Appendix 13: Details of Sawmills Operating at Ikwiriri

**BADR E.A ENTERPRISES LTD**  
**P.O BOX 79 IKWIRIRI**  
**Phone 29**

A small sawmill with a bend saw as the main log breakdown and two circular saws for re-saw.

Authorities of the sawmill were reluctant to reveal data on their logs input and sawn timber outputs. Nonetheless, it was estimated the sawmill logs input capacity per day was around 5 m<sup>3</sup> of solid wood.

Based on saws used and quality of logs observed at the sawmill log yard, sawn timber recovery rate was estimated to be around 40 percent. In general logs quality was goods with little taper hence giving high recovery rate.

Sawmill wastes included sawdust, slabs and off-cuts. Sawdust was burned within the sawmill compound. However, sawdust has a potential as an alternative source of energy in the near future. Daily production of slabs and off-cuts was estimated to be around 2.5 m<sup>3</sup> and monthly production was around 62.5m<sup>3</sup> assuming the sawmill was operating for 25 days a month. Observations and discussions with sawmill workers indicated that about 80 percent of slabs and off-cuts were used for charcoal production. The estimated volume of slabs and off-cuts used for charcoal production was around 50m<sup>3</sup> and the volume left for firewood was around 12.5m<sup>3</sup> per month which were either sold or issued free. Sawmill management reported that, both men and women were collecting firewood from the mill. Men accounted for about 15 percent while women accounted for about 85 percent of firewood collected from the mill. For safety reasons, it was reported that men were allowed to collect firewood any time of the day. However, women were allowed to collect firewood from the mill only in the evenings, after switching off all sawmill machines. In most cases women are accompanied by children hence the need for safety precautions. Firewood was normally collected free from the mill. However, few collectors interviewed indicated they were sometimes buying firewood from the sawmill.

Main tree species sawn at the sawmill are summarized below.

Main species used at Badr Sawmill

Local name	Botanical name	Main products	Main customers
Mpangapanga	<i>Lonchocarpus capassa</i>	Tiles	Export market
Mkongo	<i>Azelia quqzensis</i>	Sawn wood	
Mumanga Ngwalu			
Msekeseke	<i>Swartzia madagascariensis</i>	Tiles	Export market
Mlopolopo	<i>Trichilia emetica</i>	Sawn wood	
Mnangu		Sawn wood	
Mndundu		Sawn wood	
Mkarati		Sawn wood	
Mnyamakwenge		Sawn wood	

The mill had 9 full time workers (all men) and 29 part-time workers (of which 2 were women). Average daily wage for the part-time workers was around Tsh. 750- 1000.

Availability of saw logs was reported to have declined sharply over the past five years. Logs are now collected from Utete and log diameters are declining progressively. Previously they used to collect logs with mid girth ranging from 10 to 18 ft. Nowadays (2000) they are collecting logs with mid girth ranging from 6ft to 12 ft.

Electricity was used for operating the sawmill machines. Average electricity costs per month is around Tsh 300,000.

**Portfolio Investment Company Ltd.**  
**PO Box 52 Ikwiriri**  
**Phone 39.**

The sawmill was established in 1996 and it started operation in 1998.

It is a small sawmill with bend saw as breakdown and few circular saws for re-saw and sizing. Average log input per day was reported to be around 8 m<sup>3</sup>. Recovery in terms of sawn timber was reported to be around 40 percent. The mill operates 6 days a week or 26 days a month. Logs input per month was estimated to be around 208 m<sup>3</sup> of solid wood. With 40 percent recovery, volume of sawdust, slabs and off-cuts per month was estimated to be around 125m<sup>3</sup>. However, production of slabs and off-cuts per month was estimated to be around 115 m<sup>3</sup>. As for Badri sawmill, around 80 percent of slabs and off-cuts were used at the mill for charcoal production using a simple earth kiln. On average, the mill was producing 200 bags of charcoal per month. The produced charcoal was mainly sold to women (70% of customers were women) at an average price of tsh 1,200 per bag. Later some of the women were selling the charcoal at Tsh 1,400 to 1,500 at the market or at their homesteads on retail basis.

About 23m<sup>3</sup> of small slabs and off-cuts were left at the sawmill as firewood, which was mostly issued free to women and sometimes sold to commercial dealers of firewood at Tsh 200 per wheelbarrow load. Neighbours to the mill were encouraged to collect off-cuts and small pieces of slabs from the sawmill to enhance cleanliness and fire protection. Collection was allowed mostly in the evenings after switching off- sawmill machines, to enhance safety.

Volume of sawdust and small particles of bark from the mill per month was estimated to be around 10m<sup>3</sup>. Most of them were burned within the sawmill compound. However, a small amount of sawdust was collected free by a total of 7 customers who were using it as a source of energy. Discussion with one users of the sawdust (foremen of the sawmill) indicated that sawdust was a good source of energy for activities which required long cooking period like cooking of beans, maize and water heating. The user suggested that, efforts should be made to raise public awareness on the use of sawdust accompanied by production of appropriate sawdust stoves at Ikwiriri.

The sawmill has 11 full time workers and 8 part time workers, all of which were men. Average wages for the part time workers (labourers) is around Tsh. 750 but with provision of free tea and bites in the morning.

Electricity was used for operating the sawmill machines. Average electricity costs per month is around Tsh 250,000.

Main tree species currently used by the sawmill are summarised below.

Main tree species used by Portfolio sawmill which were mainly sawn for timber include:

Local name	Botanical name	Main source Forest area	Log prices per m <sup>3</sup> in the forest in Tsh
Mtondoro		Ngumbuluni	5,000
Mnangu		Ngumbuluni	5,000
Mlopolopo	<i>Trichilia emetica</i>	Luhoi	5,000
Mpangapanga	<i>Lonchocarpus capassa</i>	Ngambo	25,000
Mwangangalu		Un – specified	5,000
Mdundu		Un – specified	5,000
Mkongo	<i>Azelia quanzensis</i>	Mngaru	25,000
Myamakwenge		Utete	5,000
Mkarati		Un – specified	5,000

Availability of logs was reported to decline rapidly. Causes were reported to include:

- Un-controlled harvesting of trees in the forests by un-specified customers from Ikwiriri and Dar es salaam.
- Lack of management plans for existing forested areas to enhance sustainable supply of saw logs.

**Mahmood International Ltd**  
**Box 28 Ikwiriri**  
**Phone 14/15 Ikwiriri**

Official contacted Mr. Hassan Issa (Supervisor)

The sawmill was established in 1995. Owner stays in DSM. It was sawing only one tree species *Dalbergia melanoxylon* (Mpingo) for export market.

The supervisor indicated that he had no quantitative data on volume of saw log inputs or sawn wood outputs. Volume estimates of log inputs and sawn wood outputs were therefore estimated based on quantity of logs found in the mill yard, quality and quantity of sawing machines and on discussion with the sawmill workers. Logs input to the mill was estimated to be around 2 m<sup>3</sup> per day. Log quality was rather poor, crooked, with high percentage of sapwood. Only heartwood was used as sawn wood end product. Recovery in terms of sawn wood was around 10 percent of log inputs.

Based on the above estimations, the monthly log inputs for the mill is about 52 m<sup>3</sup>. Sawn wood outputs per month was around 5.2 m<sup>3</sup>. Volume of sawdust, slabs and off-cuts produced per month was estimated to be around 46.8 m<sup>3</sup>. Generally slabs and off-cuts are issued free as firewood to Ikwiriri residents and the sawmill was not involved in charcoal production.

The Mpingo sawmill has 10 full time workers and 5 part time workers, all of whom are men. Electricity was used for operating the sawmill machines. Average electricity costs per month were reported to be around Tsh 200,000.

Availability of Mpingo logs to the mill from Ikwiriri was reported to decline. Currently logs are collected mainly from Utete and Kilwa over 100 km away.