Household Energy Use in Malawi

Report prepared by Kyran O’Sullivan (EWDEN) and Kevin Fitzgerald (Consultant)

June 17, 2006
Currency Equivalents
US$1.00 = 17.5 Malawi kwacha (MK) (October 1997)
US$1.00 = MK 42.5 (June 1999)
US$1.00 = MK 108 (August 2004)
US$1.00 = MK 123 (August 2005)

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Energy Content MJ/Unit</th>
<th>Typical Cooking Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPG (kg)</td>
<td>45.0</td>
<td>0.60</td>
</tr>
<tr>
<td>Electricity (kWh)</td>
<td>3.6</td>
<td>0.75</td>
</tr>
<tr>
<td>Kerosene (Paraffin) (liter)</td>
<td>35.0</td>
<td>0.35</td>
</tr>
<tr>
<td>Charcoal (kg), 5 % Moisture C. 4 % Ash</td>
<td>30.8</td>
<td>0.22</td>
</tr>
<tr>
<td>Wood (kg) 15 % Moisture. C. 1 % Ash</td>
<td>16.0</td>
<td>0.15</td>
</tr>
<tr>
<td>Dung (kg) 15 % Moisture. C. 20 % Ash</td>
<td>14.5</td>
<td>0.12</td>
</tr>
<tr>
<td>Straw (kg) 5 % Moisture. C. 4 % Ash</td>
<td>13.5</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Country Facts
Malawi with one of highest population densities in sub-Saharan Africa is among the world’s poorest countries with GNI in 2004 of US$170 per capita and life expectancy less than 40 years. Malawi has a population of approximately 11 million with a growth rate of around 2% per annum. It is bordered by Tanzania to the north, Zambia to the northwest, and Mozambique to the east and southwest. It is largely a rural economy with 85 per cent of the population living in rural areas and only 10 per cent of the population engaged in formal wage employment. About 85 per cent of Malawi’s people work in agriculture which is mainly rain-fed and drought prone. Approximately 2 million smallholders own on average 1 hectare on which they typically cultivate maize as the main food crop with most growing some other food crop as well. One third cultivate a cash crop such as burley tobacco, cotton or paprika. Tea, flue-cured tobacco, coffee, cane and burley tobacco is produced on estates.
# TABLE OF CONTENTS

Main Findings and Recommendations.......................................................... 4  
Introduction.................................................................................................. 6  
  Background to the report ................................................................. 6  
Energy Access and Expenditures................................................................. 6  
  Rural Households.............................................................................. 7  
  Urban Households (non-Lilongwe)............................................... 9  
  Urban Households in Lilongwe.................................................. 11  
  Comparative cooking energy costs ........................................ 12  
Energy Access............................................................................................. 14  
  Access to lighting fuels................................................................. 14  
  Electricity access and home enterprise............................... 15  
  School attendance................................................................... 16  
  Energy and Health.................................................................... 16  
Tariff Reform and Benefits of Electrification.............................................. 17  
  Tariff reform........................................................................... 17  
  Benefits of electrification in Malawi....................................... 19  
  Recommendations for improving energy questions in future IHS surveys. ... 24  
Identification and Assessment of Innovations in Electricity Service Provision ... 26  
  Background............................................................................... 26  
  Low cost innovations................................................................. 26  
  Proximate electricity access for improving benefits to those without direct access to electricity................................................................. 27
Main Findings and Recommendations

1. Gathered and purchased firewood meets the vast majority of cooking energy needs in the country—gathered wood in rural areas and purchased wood and charcoal in urban areas. 98% of rural households, 64% of households in Lilongwe and 42% in other cities use firewood. Electricity is mostly only available in urban areas. 30% of households in Lilongwe, 35% in other cities and about 2% in rural areas are connected to the ESCOM grid. Charcoal is mainly used in urban areas (50% of households in Lilongwe, 73% in others cities and less than 5% of households in rural areas). Paraffin is used as the primary lighting fuel in most households that do not have access to electricity.

2. If electricity tariffs were to be raised by 5% per annum over a five year period (total increase of 27.5%) the impact on households that are electrified would be to increase the percentage of expenditures on energy by approximately 1.1% (from 9.6% to 10.7%). If tariffs were increased to be cost reflective, the increase in expenditures would be on the order of 2.5% (+) for all electrified households. Moreover, since more than 80% of households that use electricity nationwide are higher income households, the burden of the tariff increase would fall mostly on those who are most able to pay. The relatively few low and modest income households that use electricity would face increases in the range of 1-3% increase in the share of their household expenditures for energy if tariffs were raised by 5% per annum. It may be concluded that phasing in of tariff increases of between 5% and 10% per annum over a five year period would not have severe impact on most households.

3. For cooking, the price of electricity is on par with charcoal in urban areas (i.e. on a per unit cost of useful heat delivered to the cooking process). As a consequence, electricity is used by a substantial share of better-off urban households for cooking (14% of urban households in Lilongwe [i.e. half of those connected to the grid] and 9% of households in other urban areas cook). In fact, the substitution of electricity for charcoal may be capping charcoal prices in Lilongwe. The market price of charcoal is substantially lower in Lilongwe, where a larger share of households cook with electricity, than in other urban areas. Even if domestic tariffs were raised to cover the full cost of service, electricity would remain competitive as a cooking fuel in urban areas.

4. The Second Integrated Household Survey did not ask any questions on LPG. According to BOC approximately 6,000 LPG cylinders were in circulation in 2005 so the number of households using LPG has to be less than 6,000. The very low use LPG for cooking is due in part to subsidized electricity prices. If cost reflective electricity tariffs

---

Footnote:

1 This report is a FY06 ESW deliverable and is recorded in SAP as project ID number (P080573) Project name (3A-ER/MW PSIA Electricity Sector). The task was partly financed by the additional budgetary and TF Resources for Poverty and Social Impact Analysis made available for FY05. The financial support of ESMAP is gratefully acknowledged.
were phased in over time, charcoal prices would be expected to increase and LPG would then become more competitive and find increased usage as a cooking fuel.

5. A number of factors appear to be limiting the wider adoption of electricity in urban and rural areas, including the high cost of imported appliances, connection policy that requires tin roof or other modern housing materials, and high connection fees. As many as 10% of higher income urban households and 5% of higher income rural households are now not electrified but are close to a service drop. If high connection fees can be reduced or rolled in to monthly charges, many of these higher income households may connect to the network. Connection fees for households are $12. It was discussed with ESCOM and agreed that the ISP would pilot for the market centers where it will make investments that the connection fees may be paid over an extended period of 6-12 months and that this will likely encourage larger numbers of consumers onto the new network and help to reduce the average cost per connection.

6. The benefits of electrification of rural households in Malawi are evaluated in terms of consumer surplus due to lighting fuel substitution at between MK 18 and 23 per kilowatt-hour (USD 0.17-0.21/kWh), on the assumption that the area under the lighting demand curve is only 5% of the area under a straight-line approximation. On this conservative assumption, the benefit still greatly exceeds the subsidized rate of MK 3 to 4 per kilowatt-hour.

7. In the context of this study an expert in low cost electricity distribution was engaged to make an assessment of the potential to apply low cost construction and operating techniques in order to reduce construction costs and make it more viable to extend the grid in to market centers in rural areas. The work was undertaken with a view to incorporating low cost innovations in network construction into the design of the Malawi Infrastructure Services Project (ISP) - scheduled for World Bank Board presentation and approval on June 27, 2006. The project will finance investments in the electricity distribution network. The low cost innovations that preliminary analysis showed to be potentially feasible in the Malawi context were discussed with ESCOM management and with consultants that prepared the feasibility report for the ISP. As a result, the ISP will pilot low cost methods that further detailed engineering and feasibility studies will find viable. Thus the preliminary work on low cost methods carried out in the context of this study has contributed to the design of the ISP.

8. In order that rural households that cannot afford electricity connection still gain benefits from rural electrification a number of measures can be taken. The ISP project will pilot these measures. For example streetlights should be mounted on the LV network poles in market centers to improve security in the market centers and public facilities including clinics, schools and police posts will be connected to enable service delivery.
Introduction

Background to the report

9. The purpose of the report was to analyze equity issues in access, pricing and use of fuels and electricity and to estimate the benefits electrification. The analysis was undertaken in order to inform policies associated with two critical aspects of electricity sector reform – tariff rebalancing and increasing household access. Tariff rebalancing is critical to ensure financial sustainability of the utility and its incentive to pursue aggressive electrification. Reducing the cost of electricity network construction is critical to improving the viability of grid extension.

10. The Malawi National Statistics Office (NSO) implemented its second Integrated Household Survey in 2004 by interviewing 11,280 households in all areas of Malawi. The Housing module of the IHS2004 included questions about sources of and expenditures on cooking and lighting fuels, water supply, electricity access and telephone use. Responses to these questions are the primary data source for the analysis presented in this report.

11. Initial examination of the data showed that household energy use patterns in rural households are substantially different from those of urban households. Rural households, even those classified as rural living within or nearby these cities, display remarkably similar fuel use and expenditure patterns. As such, this report presents findings for urban and rural dwellers separately. Urban areas in Malawi appear to be in the early stages of the transition to modern fuels. Moreover, since the patterns of household energy use in Lilongwe appear to be quite different from those in Mzuzu, Zomba and Blantyre, results for these cities are reported separately.

Energy Access and Expenditures

12. Key findings are presented by separate expenditure quintile for urban households in Lilongwe, those in other urban and all rural areas. Total monthly expenditures by quintile for households in these three main groups are shown in figure 1 below.

2 Firewood and charcoal appear to be the transition fuels of choice in urban Malawi, placing these areas early in the overall process examined across countries by Barnes, Krutilla and Hyde in The Urban Household Energy Transition, Resources for the Future and Energy Sector Management Assistance Program, 2005.
As expected, urban households generally have much higher cash expenditures than their rural counterparts. An exception is in Lilongwe, where the poorest 20% of households spend less than the poorest 20% of rural households nationwide. All results, unless otherwise noted, are weighted. As such, statistics reported for any given quintile are population estimates for households in that expenditure group.

<table>
<thead>
<tr>
<th></th>
<th>URBAN</th>
<th>RURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe</td>
<td>Other</td>
</tr>
<tr>
<td>Family size</td>
<td>4.28</td>
<td>4.29</td>
</tr>
<tr>
<td>Expen/mo (MKW/HH)</td>
<td>17,764</td>
<td>12,101</td>
</tr>
<tr>
<td>Expen/yr (US$/cap)</td>
<td>532</td>
<td>377</td>
</tr>
<tr>
<td>Energy share (%)</td>
<td>5.68%</td>
<td>11.29%</td>
</tr>
</tbody>
</table>

Source: Annex Table A-1.

Average family size, total expenditures and spending on energy by urban and rural households in all areas of Malawi is displayed in the table above. In Malawi, urban households are only slightly smaller than rural ones. Cash incomes (expenditures) are much higher in urban areas. Annual cash incomes are nearly three times higher in Lilongwe and more than twice as high in other urban areas than in rural areas. Despite higher cash incomes, urban households spend a much larger share of their budgets on fuels.

Rural Households

While urban households spend a substantial share of their family budgets on energy, rural households spend only 2-3% of their total cash budgets on fuels. This reflects the near universal use of firewood, most of which is collected, as the main cooking fuel in rural homes (see Table A-9). Constant and low budget shares for energy in rural households indicate that, all else equal, the pattern of energy use in rural
households is relatively fixed. Rural households use little charcoal, except near urban areas, and only about 2% of rural households have electricity service (see figure 2 and details in Table A-11).

**Figure 2 Share of Rural Households Using Each Fuel by Income**

![Bar chart showing the share of rural households using each fuel by income quintile.

Source: Annex Table A-8.](image)

**Figure 3 Rural Household Energy Expenditures by Income**

![Bar chart showing rural household energy expenditures by income quintile.

Source: Annex Table A-4.](image)

16. Most rural households cook with collected firewood and light with paraffin. The average rural household ‘spends’ between 20 and 60 Kwacha per month on firewood. Firewood is the dominant cooking fuel in rural households. In every region of the country, more than 80% of rural households collect firewood and more than 10%

---

3 ‘Spending’ on firewood includes the imputed value of collected wood. Households were asked to report the total value of firewood consumed in a normal week. Market prices of firewood were not reported. Table 1 includes imputed values for firewood spending and budget shares, but imputed values are not included in total household expenditures.
purchase it (details in Table A-9). The bulk of collected wood comes from unfarmed areas of the community and forest reserves (details in Table A-10). Rural dwellers in the sparsely populated North have the easiest access to firewood. They spend, on average, less than 20 minutes daily to collect wood while their counterparts in the Center and South spend roughly 40 minutes (details in Table A-13). They also spend less time collecting water than rural households in the Center and South.

17. Paraffin is the dominant lighting fuel in rural households. The average rural household spends between 80 and 120 Kwacha per month on paraffin, with little regional variation. The exceptions are in the Central region and households classified as rural in Lilongwe, where more than 10% of the poorest rural households report that they do not spend much, if anything, on paraffin, using instead collected firewood or grass as their main lighting fuel.

18. Figure 2 displays the share of rural households using each fuel and Figure 3 the average energy expenditures by income quintile (from Tables A-4 and A-8). Spending on paraffin for lighting and use of firewood for cooking both increase in rough proportion to income. But with charcoal and electricity being used by higher income households, total energy spending rises somewhat faster than income: the share of total expenditures devoted to energy use rises from 1.7% in the lowest income households to 2.6% in the highest (details in Table A-4).

19. While less than 2% of rural households are connected to the electric grid, these are nearly all in the highest income quintile, comprising roughly 7.5% of households in this category (details in Table A-8).

**Urban Households in Mzuzu, Zomba & Blantyre**

20. A higher share of cash incomes of urban households is spent on energy than is the case for households in rural areas because of the much higher use of charcoal and electricity in urban areas. Urban households in Lilongwe spend 5.7% of their cash incomes on energy. Households in Mzuzu, Zomba & Blantyre spend 11.3% of their cash incomes on fuels, though the highest income households spend a smaller share. The income patterns of fuel choice and energy spending are detailed in Tables A-3 and A-7 and are summarized in figures 4 and 5 below.
Figure 4 Share of Urban (non-Lilongwe) Households Using Each Fuel by Income

![Bar chart showing the share of urban households using different fuels by income quintile.]

Source: Annex Table A-7.

Figure 5 Urban (non-Lilongwe) Household Energy Expenditures by Income

![Bar chart showing the energy expenditures by income quintile.]

Source: Annex Table A-3.

21. Annual cash incomes (expenditures) of urban households in these cities are about twice rural incomes, rising from USD 200-300 per capita in the lowest income groups to nearly USD 850 in the highest income group (details in Table A-3). As such, even the poorest households have some spending power, reflected in substantial cash outlays for charcoal. Charcoal, rarely used by rural households and then only by those with the highest incomes, is the largest energy expenditure for almost all households in these cities. Even though a substantial share of households in all income groups report using firewood, actual expenditures show that charcoal has nearly completely displaced firewood as a cooking fuel in these cities.
22. Thirty-five percent of urban households in these cities are connected to grid electricity (Table A-5) and the share of households connected rises steadily with income (figure 4). In the highest income households, expenditures on electricity rival expenditures on charcoal and electricity appears to have almost completely displaced paraffin as a lighting fuel. In fact, the share of households using paraffin drops dramatically with income as more households connect to the electric grid. This pattern shows strong evidence that electricity is displacing paraffin as a lighting fuel in these urban markets. Electricity may also be substituting for charcoal in these cities. About 9% of households (25% of those electrified) report using electricity as their main cooking fuel (details in Table A-9).

Urban Households in Lilongwe

23. Urban households in Lilongwe spend less of their cash budgets on energy, roughly 6%, but there are important differences between households by income. Fully one half of the poorest urban households in Lilongwe spend, on average, less on energy than the poorest 20% of urban households in cities outside of Lilongwe. More than 20% report they collect firewood for cooking (see Table A-9) and most of these are in the lowest income quintile. Fuel choice and energy spending patterns are shown by expenditure quintile in figures 6 and 7 and are detailed in Tables A-2 and A-6.

Figure 6 Share of Urban Lilongwe Households Using Each Fuel by Income

Source: Annex Table A-6.
24. The poorest urban households in Lilongwe are poorer, in terms of total cash expenditures, than their rural counterparts. But higher income households have substantially more spending power than rural dwellers or residents of other cities. While the poor spend little on fuel for lighting or cooking, higher income households spend substantial amounts on charcoal for cooking. Firewood is still used by many households and appears to be the primary cooking fuel in lower income households. But charcoal is the dominant cooking fuel in Lilongwe, used by almost all but the poorest of households.

25. Nearly 30% of households in Lilongwe and more than 90% of the highest income households are connected to the electric grid (details in Table A-6). Households in the highest income group light almost exclusively with electricity and spend three times as much on electricity as they do on charcoal. These results strongly suggest that electricity is displacing charcoal for cooking in Lilongwe. Roughly half of those who use electricity in Lilongwe report that they use it as their main cooking fuel (14% of households in Lilongwe, Table A-9). Thus, households with access to and the ability to pay for electricity appear to prefer electricity as a cooking fuel.

**Comparative cooking energy costs**

26. Because roughly 85% of the people in Malawi live in rural areas and the vast majority of them collect firewood for cooking, collected firewood meets the bulk of cooking energy needs nationwide. Most households in cities and some rural dwellers choose to or must purchase their cooking fuel at market. Table 1 shows market prices for cooking fuels as well as the cost of cooking with each on an end-use basis using standard assumptions about stove efficiencies.
Table 1. Comparative Cooking Energy Costs in Malawi, 2004

<table>
<thead>
<tr>
<th></th>
<th>Price of energy delivered MK/MJ</th>
<th>stove efficiency (%)</th>
<th>Price of useful energy MK/MJ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Charcoal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lilongwe</td>
<td>6.25 per unit* kg 30</td>
<td>0.21</td>
<td>22</td>
</tr>
<tr>
<td>Other Urban</td>
<td>7.5 per unit kg 30</td>
<td>0.25</td>
<td>22</td>
</tr>
<tr>
<td>Rural</td>
<td>5 per unit kg 30</td>
<td>0.17</td>
<td>22</td>
</tr>
<tr>
<td><strong>Paraffin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lilongwe</td>
<td>100 per unit liter 35</td>
<td>2.86</td>
<td>35</td>
</tr>
<tr>
<td>Other Urban</td>
<td>100 per unit liter 35</td>
<td>2.86</td>
<td>35</td>
</tr>
<tr>
<td>Rural</td>
<td>130 per unit liter 35</td>
<td>3.71</td>
<td>35</td>
</tr>
<tr>
<td><strong>Electricity</strong></td>
<td>Domestic Tariff</td>
<td>3 kWh 3.6</td>
<td>0.83</td>
</tr>
</tbody>
</table>


27. When the prices of cooking fuels in urban Malawi were last analyzed in 1996, paraffin as a cooking fuel was more than twice as expensive as charcoal on an end-use basis. Paraffin has become even more expensive over the past ten years and is now roughly eight times more costly on an end-use basis when compared to charcoal. Because it is uncompetitive with other cooking fuels, paraffin is very rarely used as a cooking fuel anywhere in Malawi (details in Table A-9).

28. Electricity, highly subsidized for domestic users in 1996, was the cheapest cooking fuel at roughly 70% of the price of charcoal on an end-use basis. Domestic tariffs have been increased several times since then, but the analysis above shows that the comparative cost of cooking with electricity in urban areas is still on par with that of charcoal. Given this cost comparison, urban consumers with access and means can be expected to substitute the more convenient and modern electricity for wood and charcoal as a primary cooking fuel. This appears to be happening in urban Malawi. As reported above, 14% of urban households in Lilongwe (half of those connected to the grid) and 9% of households in other urban areas use electricity as their main cooking fuel.

29. In fact, the substitution of electricity for charcoal may be capping charcoal prices. The market price of charcoal is substantially lower in Lilongwe, where a larger share of households cook with electricity, than in other urban areas. The effect of modern fuel prices on traditional fuel prices in urban markets is not unique to Malawi. It was first explored by Barnes and Floor, 1996 using fuel prices in Haiti and is thoroughly examined by Barnes, et al., 2005 using data from many countries in all regions.

---

30. Since domestic tariffs in Malawi are subsidized, displacement of charcoal by electricity may be resulting in a misallocation of economic resources. The charcoal production trade has been found in other countries in the region to be an effective vehicle for redistributing cash resources from urban to rural areas. But uncontrolled charcoal production in other countries has also been found to misallocate economic resources because it often does not give proper incentive to conserve the biomass resource base around large urban markets. This study cannot assess the general economic efficiency of the charcoal trade in Malawi. This concern notwithstanding, if domestic tariffs were raised over time to levels that would cover the long-run marginal cost of service (roughly 60% increases would have been required in 2004, see below), households would then face the economic cost of providing electricity and cooking with electricity would likely still be competitive to charcoal in urban markets. What impact such tariff reform might have on charcoal markets and the biomass resource base in Malawi cannot be determined within this study.

Energy Access

Access to lighting fuels

31. The table below summarizes what urban and rural households use for lighting (more detail in Table A-11). Nearly 10% of rural households, basically the cash poor, don’t spend anything on lighting, reporting they use collected wood or grass for lighting. Paraffin is beyond the reach of more than 10% of urban households, those who light with wood, grass or candles. Paraffin is widely available and is used for lighting by all households that can afford it but don’t have access to or cannot afford electricity.

<table>
<thead>
<tr>
<th>Main lighting fuel</th>
<th>URBAN</th>
<th>RURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood/grass</td>
<td>1.9%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Candles</td>
<td>9.2%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Paraffin</td>
<td>56.0%</td>
<td>88.5%</td>
</tr>
<tr>
<td>Electricity</td>
<td>32.7%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Source: Annex Table A-11.

32. The energy expenditure patterns presented in prior sections show that access to and use of electricity is strongly associated with income. But some higher income urban households do not use electricity even when electric service is available within 100 meters.

33. The table below summarizes average incomes of higher income households by level of electric access: electrified and not electrified but with service available within 100 meters (details in Table A-14). Of urban households in the highest two expenditure quintiles, nearly 10% in Lilongwe and more than 12% in other urban areas do not use electricity, but are within 100 meters of service. More than 5% of rural households in the highest two expenditure categories similarly do not use electricity but are within 100 meters of service. Many of these higher income households, particularly those in urban
areas, would likely be able to pay for electric service. There is an open question as to why more of them have not connected.

Higher income households in each area by electric connection

<table>
<thead>
<tr>
<th></th>
<th>LILONGWE</th>
<th>OTHER URBAN</th>
<th>RURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mid-high</td>
<td>Highest</td>
<td>Mid-high</td>
</tr>
<tr>
<td><strong>Connected</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Exp (MKW/mo)</td>
<td>15,850</td>
<td>57,630</td>
<td>11,810</td>
</tr>
<tr>
<td>Share of households (%)</td>
<td>7.9%</td>
<td>18.5%</td>
<td>9.5%</td>
</tr>
<tr>
<td><strong>Not Connected w/in 100m</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Exp (MKW/mo)</td>
<td>14,805</td>
<td>25,500</td>
<td>11,660</td>
</tr>
<tr>
<td>Share of households (%)</td>
<td>8.1%</td>
<td>1.5%</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

Source: Annex Table A-14. Share of households (%) is the percent in each quintile—maximum 20%.

34. It may be that some households have judged the cost of electric service, including the cost of electric appliances, most of which are imported, to be beyond their reach. Some may live in structures that have traditional walls or roofing that may not be in compliance with existing ESCOM connection policies. The cost of house wiring, and purchase of light fixtures and lightbulbs could be barriers for some households. Others may have been connected at one time, but were disconnected for non-payment. Another possible reason is that some higher income households are unable to pay the connection fees. If the level of connection fees are in fact preventing connection by some of the higher income households that are near service, then some financing mechanism, such as rolling the connection fee into monthly charges, may present an opportunity to extend the benefits of electricity to substantially more households for the relatively inexpensive costs of short low-voltage service drops.

35. Additional investigation needs to be carried out on the reasons why households within 100 meters of the LV network do not connect.

**Electricity access and home enterprise**

36. Prior studies have not generally found strong evidence that productive activities in the home (home enterprises) are increased by electrification. Data from the IHS Survey indicate that households with a home enterprise are no more likely than those without to connect to electricity (details in Table A-15). But, in both urban and rural areas, households in or near an electrified neighborhood or village are substantially more likely to be engaged in a home enterprise than those in un-electrified areas. This finding—that households in electrified areas are substantially more likely to operate a home enterprise—may be due to the presence of electricity or to the presence of other infrastructure, proximity to markets, density of settlements and other spatial characteristics associated with electrification. The likely combination of these and other factors in explaining the number and productivity of home enterprises is an area for further research.

---

6 The connection fee is very reasonable in relation to fees in neighboring countries. In Tanzania the domestic connection fee is $200 and in Zambia the fee is $55.
School attendance
37. The IHS contains a rich module that characterizes the educational attainment and costs of schooling for each family member. Since household electrification generally leads to a dramatic improvement in the quality and duration of light, it has been observed to extend home study hours. It should be possible to measure the effect of electrification by observing if, all else equal, children from electrified homes complete more years of education than children from un-electrified homes.

38. Within the context of this study, a simple logistic regression model, with household income (expenditures) and electrification status as independent variables, was fitted to the data for school-aged boys and girls aged 7 to 18 from urban households to predict school attendance. Neither income nor electrification was statistically significant in predicting school attendance. But this is not surprising. School attendance is a complex function of school quality and cost, family income, opportunity cost of children’s time, children’s ability, expected returns to education and many other factors. Unless these factors are included in the analysis, the likely subtle independent effects of electrification are unlikely to be revealed. Further research will be required.

39. For reference, cross-tabulations of school attendance for boys and girls from electrified and non-electrified urban homes are presented in Tables A-20 and 21.

Energy and Health
40. Exposure to smoke from cooking with wood and other biomass fuels has been identified as one of the key health risk factors that can be reduced by a move to modern fuels. Almost all rural households in Malawi cook with wood or agricultural residues. But only 40% of urban households cook with wood, crop residues or sawdust (see Table A-9). Due to more exposure to smoke from wood fires while cooking, one would expect rural dwellers to report incidents of lower respiratory illness more frequently than those living in urban areas. This pattern is clear and statistically significant in Malawi (ANOVA results, not reported). More than 5% of rural respondents to the IHS Survey reported a recent incident of lower respiratory disease while less than 3% of urban respondents did so (details in Table A-22).

41. Beyond this broad finding, however, identifying and quantifying the health impacts of moving to more modern fuels becomes more difficult. A simple model to explain the incidence of lower respiratory disease worked well with location (urban/rural) and cooking fuel choice as independent variables. But when household income was introduced, the effect of fuel choice all but disappeared. There is little doubt that children and adults in households using wood and agricultural residues for cooking are exposed to more smoke and, consequently, experience a higher rate of respiratory disease. However, further specification of a formal model to include commonly known covariates of respiratory disease, such as child’s age, sex, birth order, nutritional status, the household education level, living standard, and location, was beyond the scope of this preliminary analysis.
Tariff Reform and Benefits of Electrification

42. The IHS results provide a modest basis for evaluating energy pricing policy reform and electrification generally.

Tariff increase

43. The ESCOM Tariff Study found that ESCOM’s total revenues fall short of its costs by roughly 39% and to cover its costs end use tariffs would need to be raised by about 63%. Further, it found that subsidization of domestic customers is the chief cause of the general under-recovery. The study proposed that all tariffs be increased toward cost-reflective tariffs in the short-term (5 years) at 5% per year.

44. It has been shown above that electricity is used only by middle and higher income households in Malawi, primarily in urban areas. As such, it is unlikely that tariff increases would have any direct impact the poor. But at the margin, substantial tariff increases may reduce the use of electricity for cooking and, thereby, possibly increase the demand for and market price of charcoal. While tariff reform may indirectly impact the urban poor through higher charcoal prices, the likelihood or magnitude of this possible response was not within the scope of this study.

45. The study did pose the question whether or not current electric users would be willing and able to pay increased prices on the order envisioned in the Tariff Study. This question is examined here by modeling the impact of modest 5% annual tariff increases on household spending. The Tariff Study assumed that households using electricity are relatively insensitive to its price and the scenarios reported below use this assumption of inelastic own-price demand. This assumption is reasonable as long as tariff increases are modest (5% to 15%) and phased in over time. Note that larger tariff increases may cause a more substantial response, wherein an unknown share of households may disconnect or severely cut back on electricity use. The likely response of current electric users to modest 5% annual tariff increases for one year and over a five year period (total increase of 27.5%) are summarized in Table 2 (see Table A-18 for details and Table A-19 for distributional impacts).

---

7 ESCOM Tariff Study, 1 February 2005, Section 7.5.4, page 76.
8 ESCOM Tariff Study, 1 February 2005, Section 9.3.
9 Since the value of the Kwacha has declined since 2004 when the tariff study was carried out, imported materials have become more expensive adding to ESCOM’s costs. The study team was informed in May ’06 that ESCOM has government authorization to adjust tariffs in line with inflation. Therefore the size of the discrepancy between current tariff levels and marginal costs will have changed since 2004 and consequently the tariff increase necessary to reach cost recovery may differ from the 63% calculated in 2004.
10 The tariff study assumed a domestic user price elasticity of demand of \( e = -0.15 \). This means that for every 1% increase in electric price, total electric use can be expected to decrease by 0.15%. The scenarios modeled in Tables 2, A-18 and A-19 use this elasticity to examine the expected impact on the share of total household budgets going to energy expenditures, assuming all else remains unchanged.
Table 2. Impact of Proposed Tariff Reforms on Energy Share of Total Household Spending, Electrified Households Only, Malawi 2004

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th></th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe</td>
<td>Other Urban</td>
<td>Rural</td>
<td></td>
</tr>
<tr>
<td><strong>current conditions (2004)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy share of total</td>
<td>8.07%</td>
<td>11.56%</td>
<td>7.74%</td>
<td>9.56%</td>
</tr>
<tr>
<td><strong>5% tariff increase (one year)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy share of total</td>
<td>8.30%</td>
<td>11.76%</td>
<td>7.94%</td>
<td>9.77%</td>
</tr>
<tr>
<td><strong>5% tariff increase for 5 years (27.5% total increase)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy share of total</td>
<td>9.29%</td>
<td>12.60%</td>
<td>8.86%</td>
<td>10.67%</td>
</tr>
</tbody>
</table>

Source: Annex Table A-18.
Tariff increase scenarios assume price elasticity of demand of e = -0.15.

46. The scenarios in Table 2 model the impacts of tariff increases on households that were electrified in 2004. Overall, the share of family budgets going to energy in households using electricity nationwide can be expected to rise from 9.6% to 10.7% in response to the 27.5% tariff increase applied to domestic customers and phased in over a five year period. While the share of total budgets going to energy varies between households in Lilongwe, other urban areas and rural areas, the proposed five-year increase could be expected to increase average energy spending by just over 1.1% of family budgets.

47. Electrified households are generally those with the highest incomes in their areas. As such, they are the least price sensitive and the most able to sustain price increases. But the relatively small share of lower and middle income households that use electricity may find it more difficult to absorb even modest tariff increases. The table below summarizes the distributional impacts of the full five-year reform package on electrified households in each income category (details in Table A-19).

Impact of 5% annual domestic tariff increases over five years (27.5% total) on budgets of electrified households by income

<table>
<thead>
<tr>
<th></th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>Mid-high</th>
<th>highest</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lilongwe Urban</strong></td>
<td>3.0%</td>
<td>0.9%</td>
<td>1.2%</td>
<td>1.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Urban</strong></td>
<td>1.4%</td>
<td>0.9%</td>
<td>1.2%</td>
<td>1.0%</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Rural</strong></td>
<td>1.7%</td>
<td>1.4%</td>
<td>1.0%</td>
<td>1.1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Annex Table A-19.

48. According to the Second Integrated Household Survey, more than 85% of the urban households connected to the grid in Lilongwe are in the highest two income quintiles as are more than 75% of connected urban households in other urban areas. More than 85% of rural households connected to the grid are in the highest income quintile. The vast majority of domestic electricity in Malawi is consumed in these households. The
full five-year package of tariff increases would have only a marginal impact on budgets in these higher income households, ranging 1.0% to 1.2% on average.

49. The roughly 15% of connected urban households with low to middle incomes in Lilongwe, 25% in other urban areas, and the 15% of connected rural households with less than the highest incomes may find it more difficult to absorb the full 5-year increase which would be equivalent to 1.2% to 3.0% of total household expenditures. It was not possible to model the impacts of tariff reform on households in the lowest income quintiles in Lilongwe or in rural areas because no sampled households in these groups reported electric billing information. Moreover, where it was possible to model impacts on lower and middle income households, the estimates are based on only a few sampled households that reported billing information and are, accordingly, generally less reliable than estimates for higher income households. Nonetheless, it is evident that the impacts of tariff increases would be greater than those reported in Table 2 for lower and middle income households that use electricity. While the bulk of the tariff increases would be shouldered by households with the highest ability to pay, at the margin, lower and middle income connected households could be expected to be the most impacted by and the most responsive to price increases.

50. By extension, and maintaining the same assumptions (all else equal and tariff reform phased-in), domestic tariffs increases to fully cover system costs could be expected to be shouldered mainly by electrified households with the highest ability to pay for an increase on the order of 2.5%(+) of total family budgets.

Benefits of electrification in Malawi

51. When households connect to the grid the benefit is fairly immediate and dramatic. Electricity provides a much higher quality of light than paraffin or candles. Because of this, electric lighting has been found to be the first use adopted by virtually all newly electrified households throughout the developing world. Prior studies have found that the higher quality of light generally increases the amount of time spent by children for studying in the evening and members of households with electricity spend more time on leisure activities and communications, such as watching television and listening to the radio, than those without electricity.11

52. Table 3 shows the costs of lighting with paraffin and electricity per unit of light received using typical efficacies from standard lamps 12 and fuel prices in rural Malawi.

---

Table 3. Comparative Lighting Fuel Costs, Rural Malawi 2004

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Lamp</th>
<th>Fuel Price MK/unit</th>
<th>Unit</th>
<th>Lamp efficacy klmh/unit</th>
<th>Lumen Price MK/klmh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin</td>
<td>Simple Wick Lamp</td>
<td>130</td>
<td>Liter</td>
<td>0.94</td>
<td>138</td>
</tr>
<tr>
<td>Paraffin</td>
<td>Hurricane Lamp</td>
<td>130</td>
<td>Liter</td>
<td>1.57</td>
<td>83</td>
</tr>
<tr>
<td>Electric</td>
<td>40W incandescent</td>
<td>3</td>
<td>kWh</td>
<td>11</td>
<td>0.27</td>
</tr>
<tr>
<td>Electric</td>
<td>40W fluorescent</td>
<td>3</td>
<td>kWh</td>
<td>40</td>
<td>0.08</td>
</tr>
</tbody>
</table>

53. While hurricane lamps deliver substantially more light per liter of paraffin than simple wick lamps, electricity at existing tariffs can deliver light for only a fraction of the cost of paraffin. Even if domestic tariffs were increased to fully recover costs, lighting with electricity would still be far cheaper than lighting with paraffin on a lumen output basis.

54. The analysis below estimates the benefits that non-electrified households in Malawi would receive from less expensive lighting due to electrification. These lighting benefits are estimated by the difference between the maximum amount the households would be willing to pay for the consumption of lighting (measured in kilo-lumen hours or klmh) and the amount they actually would have to pay. The willingness-to-pay, in turn, is estimated by the area under a curve depicting the household demand for lighting in response to lower prices. The difference between this area and an area representing what they actually pay for lighting is conventionally referred to as “consumer surplus.”

55. The procedure used here closely follows similar methods used to estimate the benefits of rural electrification policies in India, the Philippines and Indonesia.13

56. As was the case in these prior studies, it was not possible to directly observe actual lighting consumption and prices—that is, the demand curve for lighting services—for any particular household in rural Malawi. Rather both consumption for lighting and prices are inferred from household level data on paraffin and electricity consumption. But in contrast to the cited studies, the IHS survey did not collect information on the holdings and daily use of light bulbs or on paraffin lanterns and share of paraffin used for lighting. As such, certain assumptions were necessary to obtain lighting and lighting price estimates for the benefits analysis.

57. The following conservative assumptions were used:

---

• For non-electrified households, 80% of their total paraffin consumption is assumed to be used for lighting and all of this in the more efficient hurricane lamp.

• Electrified households are assumed to light with incandescent bulbs, the least efficient electric lamp. 50% of electricity, up to 250 kWh per month, is assumed to be used for lighting and 25% is assumed to be used for lighting beyond 250 kWh per month.

58. These assumptions were used to estimate the lighting levels and lighting prices for each household. The resulting estimated mean lighting and lighting prices for electrified and non-electrified urban and rural households in Malawi are summarized in Table 4 (details in Tables A-16 and A-17). Table 4 presents estimates only for urban and rural expenditure quintiles with enough households using each fuel to form a reliable mean.

Table 4. Benefits of Electrification in Malawi, 2004
Consumer Surplus from Lighting Substitution by Income Quintile

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Source</th>
<th>HHs</th>
<th>Lumen Price (MK/klmh)</th>
<th>Lighting Consumed (klmh/mo)</th>
<th>Electric Lighting (kWh/mo)</th>
<th>Consumer Surplus (MK/KWh)</th>
<th>Consumer Surplus (USD/KWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>URBAN (non-Lilongwe)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low-mid Paraffin</td>
<td>116</td>
<td>67</td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>13</td>
<td>0.32</td>
<td>406</td>
<td>37</td>
<td>13,434</td>
<td>364</td>
<td>3.37</td>
</tr>
<tr>
<td>middle Paraffin</td>
<td>79</td>
<td>71</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>32</td>
<td>0.32</td>
<td>657</td>
<td>60</td>
<td>23,152</td>
<td>388</td>
<td>3.59</td>
</tr>
<tr>
<td>mid-hi Paraffin</td>
<td>77</td>
<td>73</td>
<td>4.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>68</td>
<td>0.31</td>
<td>830</td>
<td>75</td>
<td>30,183</td>
<td>400</td>
<td>3.70</td>
</tr>
<tr>
<td>highest Paraffin</td>
<td>21</td>
<td>82</td>
<td>3.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>160</td>
<td>0.29</td>
<td>1714</td>
<td>156</td>
<td>69,759</td>
<td>448</td>
<td>4.14</td>
</tr>
<tr>
<td><strong>RURAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>highest Paraffin</td>
<td>1,538</td>
<td>79</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric</td>
<td>138</td>
<td>0.30</td>
<td>1,293</td>
<td>118</td>
<td>50,622</td>
<td>431</td>
<td>3.99</td>
</tr>
</tbody>
</table>

*Source: Annex Tables A-16 and A-17.*

59. Table 4 also computes consumer surplus due to lighting substitution by households in each quintile assuming a straight line demand curve for lighting services. As households move from paraffin to electricity for lighting, the area under the lighting demand curve, from the high price per lumen of paraffin to the very low price per lumen of electricity is an estimate of consumer surplus or benefit from the substitution.

60. The general findings in Table 4 are instructive. As expected, benefits generally increase with income because demand for lighting increases with income, regardless of the source of lighting. As with prior studies, one of the most important findings is that lighting benefits greatly exceed what households actually pay for either paraffin or electricity. Although the consumer surplus gained by the highest income households are higher than for others, all households gain significantly from obtaining electricity for lighting.
61. But caution should be employed in interpreting these estimates of consumer surplus as the benefits of electrification in Malawi. The monthly estimates of consumer surplus are all well above total household expenditures in all expenditure groups. Several factors account for the massive size of these consumer surplus estimates. Imported paraffin is expensive in landlocked Malawi and electricity is subsidized. Because electricity is used mainly by higher income households in Malawi, newly electrified households would generally have lower incomes and would likely use less electricity. Lamp choice and lighting fuel use is by assumption and not from household responses to survey questions. Moreover, even with conservative lighting technology and use assumptions, the assumption that demand for lighting services follows a straight line from very expensive paraffin lighting to very cheap electric lighting is almost certainly not correct.

62. It should be noted that the benefits of electrification estimated for middle and mid-high income rural households would not be reliable based on a very small number of electrified rural households in the income groups. Therefore benefits are only reported where there are enough sampled households to support a reliable estimate, i.e., in the case of rural households this is for high income rural households only.

63. Prior studies using more complete data to better model lighting demand have found that consumer surplus estimates from better fit demand curves may be as little as 5% to 50% of the area under a straight-line lighting demand curve.\textsuperscript{14} Straight-line lighting demand for each income quintile implied by the price-lumen points in Table 4 are graphically displayed as dashed lines in figures 8 and 9, along with a solid line representing a hypothetical lighting demand curve (for the middle-high income quintile only in urban areas).

\textsuperscript{14} Barnes, et al., 2002, op cit, modeled lighting demand in rural India with segmented demand curves and controlled for other differences between households using a matched-pairs analysis to estimate consumer surplus from electrification on the order of 15-20 Rp/kWh (USD 0.40-0.55/kWh), roughly half of the consumer surplus under a straight-line demand curve. A power curve (price per lumen = a * lumens ^ -b) was found to best fit lighting demand in rural households of Bolivia for the Bolivia Solar Home Systems ERTIC project, World Bank, 2002. In that study, the areas under the best fit curves were found to be on the order of 5-15% of the areas under straight-line demand curves.
64. These prior studies show that better fit lighting demand curves are substantially convex toward the origin, like the solid curves in figures 8 and 9. Applying those results to the findings from Malawi would result in much lower consumer surplus estimates than the MK 360/kWh to MK 450/kWh estimates displayed in Table 4. If the area under the lighting demand curve is only 5% of the area under a straight-line approximation, consumer surplus estimates would range from MK 18 to 23 per kilowatt-hour consumed for lighting (USD 0.17-0.21/kWh), which still greatly exceeds the subsidized rate of MK 3 to 4 per kilowatt-hour. If the area under the lighting demand curve is more on the order of 50% of the area under a straight-line approximation, the estimates would range from
MK 180 to 230/kWh (USD 1.70-2.10/kWh). While this range of estimated benefits due to electrification is very large, the data collected by the IHS Survey limit further specificity.

65. Nonetheless, it is clear from these findings that the benefits of electrification in Malawi are substantial. No matter what assumption is made about the shape of the demand curve for lighting services, the magnitude of the benefits suggests that it may be possible to provide electricity service in urban and rural areas without subsidizing the cost of consumption in the long-run. But these findings that electrification may generate consumer surplus on the order of MK 18-230 per kilowatt-hour should not lead to the conclusion that it is possible to raise domestic electricity prices into this range. However, since electricity consumers are obviously obtaining very large benefits from electricity service, most consumers with high enough incomes would likely pay more than the existing subsidized rate.

**Recommendations for improving energy questions in future IHS surveys.**

66. The Integrated Survey of Households (IHS) is based on the Living Standards Measurement Survey. A fuller set of energy questions were added to the Second Malawi Integrated Survey. Responses to these questions are analyzed and presented in this report.

67. In general, the questions on firewood, G14 to G19, did not work well. Since wood fuels are the most important household fuels in Malawi and probably constitute around 90% of the total energy consumed in the entire economy, it is important to get some measure of the quantities consumed by households. Because of wide variation in the weights and volumes of wood collected and purchased, this is often difficult even in formal household energy surveys. Question G19 of the survey asked for the total value of consumption over the past week. This is important, but without market prices, it is not possible to convert this value into the physical quantities of wood consumed.

68. For collected wood, it would be best to ask how frequently it is collected and how much is collected each time. Informal units can be used, such as head-load, arm-load, bundle, etc. Then at the village level, informal units can be converted to weights (as they vary from place to place).

69. For purchased wood, it would be best to ask how frequently it is purchased, the price per unit, how much is spent and how many units are purchased each time. As with collected wood, local units should be converted to weights at the market or village level.

70. The survey did not ask for expenditures on bottled liquefied petroleum gas (LPG). According to BOC approximately 6,000 LPG cylinders were in circulation in 2005. Households should be asked if they use LPG, how often it is purchased, the amount purchased each time (kg), and the price per kg. The very low use LPG for cooking is due in part to subsidized electricity prices. If cost reflective electricity tariffs were phased in
over time, charcoal prices would be expected to increase. LPG would then become more competitive and find increased usage as a cooking fuel.

71. The survey did not ask for expenditures on dry cell batteries. In un-electrified areas around the world, dry cell batteries for radios and flashlights are often substantial expenditures, often treated as being substitutable by electrification. Households should be asked for their expenditures on dry cell batteries, frequency of purchase, etc. It is unlikely that any analysis will be done quantifying the energy in the batteries themselves, so the type and size of battery is not important—expenditures should suffice.

72. The survey should ask for expenditures on candles—frequency of purchase and total amount spent.

73. **G22 What was the total cost for electricity in the household over the last period (IF ESCOM, LAST BILL RECEIVED)?** Some ESCOM electrified households had monthly expenditures lower than the MK 91 monthly standing charge. Others reported monthly costs nearly equal to the standing charge. It is unclear if these households (and others) were using pre-paid meters with no standing charge. Future surveys should ask for the type of service (regular metered or pre-paid meter), kWh/month for regular service and the household estimate of monthly expenditures for pre-paid service.

74. To do a formal analysis of electrification benefits, future surveys should ask detailed questions about electric and paraffin lighting. For paraffin: households should be asked what share they consume for lighting and what types of paraffin lamps they have. For electricity: households should be asked for the wattage of each incandescent bulb and fluorescent tube and how many hours each lamp is used, on average, daily. Holdings, wattages and daily use of televisions and radios can also be useful. Holdings of refrigerators and any other durable white goods (air conditioners, electric stoves, etc.) should also be recorded.

75. Future surveys should record the quantities fuel and electricity purchased and consumed so that these data do not have to be inferred from expenditure data.

76. Future surveys should record the purpose for which fuels and electricity are used by the household. This information will be of use when estimating willingness to pay for electricity. Household’s consumption of kerosene for example may be for number of uses including use as a starter fuel for firewood, cooking and lighting. The household may be expected to replace only that portion used for lighting with electricity when it gains access.

77. Incorporating the questions above will provide survey results that can indicate to ESCOM and DOE the target that they may aim at for electrification of the area, what average consumption is likely, the capital cost constraints and whether the project may be viable.
Identification and Assessment of Innovations in Electricity Service Provision

78. In the context of this study an expert in low cost electricity distribution was engaged to make an assessment of the potential to apply low cost construction and operating techniques in order to reduce construction costs and make it more viable to extend the grid to market centers in rural areas. A number of low cost methods were identified and discussed with ESCOM management. Low cost methods that further detailed engineering and feasibility studies will find viable will be piloted in the Malawi Infrastructure Services Project (ISP) that is scheduled for presentation and approval by the World Bank Board on June 27, 2006.

Background

79. The technical specifications and payment modes of electricity service delivery for the poor and not so poor in Malawi are the same, as are their costs. A premise of the analysis undertaken is that there is potential to introduce innovations in service delivery that would lower its cost and thus make the cost of connections and the cost of consumption more affordable for rural households including low-income households. Any innovations introduced should also strengthen and not weaken the financial status of ESCOM.

Low cost innovations

80. In discussion with ESCOM it was suggested that MCs networks could be constructed in a cost effective way by applying the following initiatives:

- It is critical when sizing the distribution network to have accurate estimates of maximum demand and consumption levels.
- Consider the use of SWER technology.
- Use single-phase supplies for maize mills and shellers.
- Design and construct the SWER lines in such a way that they could be upgraded later to conventional 33kV MV lines.
- Consider using and training local labor for construction.
- Consider using trained local labor for meter reading and first line maintenance, thereby reducing O&M costs. O&M costs in Malawi are currently $6.37 per consumer per month and it was agreed that it may be possible to reduce these costs.
- Make connections first to those who will use can afford electricity and will use the power, preferably for productive use.
- Market the use of electricity and thereby boost sales aiming for a minimum of 100kWh per month average for houses, offices and shops and 300kWh per month for the General tariff customers.
- Control losses, including revenue collection, reducing from 21% to a target of 11% within 6 years.
81. It was noted that application of the above techniques have the potential to reduce the financial contribution required from government and lead to a situation where it is commercially viable for ESCOM to extend service to market centers.

82. It is noted that ESCOM have responded positively to the above suggestions and a pilot project using SWER technology has been included in one of the proposed MC corridors of the ISP project. ESCOM also stated that they believe that they can save costs using the techniques suggested in ‘appropriate engineering’ and were already taking steps to adjust their standards and investigation the possible cost savings that might accrue. They also felt that they could make better use of local labor for both construction and maintenance and they would look at both these aspects.

83. ESCOM has already embraced the idea of ready boards and has tested these with limited success in urban areas. Some customers by-passed the load limiter on the ready board. As a result ESCOM will in future make ready boards available in conjunction with conventional or pre-payment meters and will no longer use them with load limiters. ESCOM will look at the feasibility of having these boards produced locally. Pre-payment meters, however, are more expensive than conventional meters and may be less suitable for the rural environment as there has to be at least one vending station in each centre. Another problem of pre-payment meters is that they have short life spans and are less robust with respect to surges and lightning strikes.

Statutory fees, connection fees and tariffs.

84. Connection fees for domestic dwellings are $12 and for commercial premises $24. It was discussed with ESCOM and agreed that the ISP would pilot for the market centers where it will make investments that the connection fees may be paid over an extended period of 6-12 months and that this will likely encourage larger numbers of consumers onto the new networks and help to reduce the average cost per connection. These are very reasonable fees in relation to connection fees in neighboring countries. In Tanzania the domestic connection fee is $200. In Zambia the fee is $55.

Proximate electricity access for improving benefits to those without direct access to electricity

85. The following ideas were suggested. These will be tested and if proved feasible, will be mainstreamed through the ISP project.

86. Streetlights should be mounted on the ESCOM poles in market centers. Local Government should pay O&M costs. It is recommended that high efficiency, long life, high intensity discharge lamps such as 50W high pressure sodium, or 80W mercury vapor or 35W low pressure sodium be installed in an inexpensive and robust fitting. Typically these will cost $100 each and should cost no more than $1 per month supply with power and $4 per month to maintain, especially if local labor is employed for the job. Street lighting would improve security for all residents in the market centre.
87. All clinics and Police Stations should be connected to electricity so that better service can be offered over longer hours. The cost estimate for each unit supplied and wired is $2,000 assuming that the buildings are within 50m of the LV line.

88. Homes of health workers and schoolteachers should also be connected, as this will encourage qualified personnel into these areas. The cost estimate for each unit supplied and wired is $1,000 assuming that the buildings are within 50m of the LV line and fitted with ready boards.

89. At least two classrooms in every school should be connected and fitted with lights and power outlets. This will allow the schools to be used for extended periods, facilitate homework and promote the opportunity for adult education in the evenings. If and when funds are available, IT facilities and computers can be installed and operated. The estimated cost for each school supplied and wired is $1,800 and the running cost is estimated to be under $13 per month (including maintenance).
<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Lilongwe City</td>
</tr>
<tr>
<td>Household Size</td>
<td>Mean</td>
<td>4.28</td>
<td>4.29</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Annual HH Exp (Kwacha)</td>
<td>Mean</td>
<td>213162.94</td>
<td>145210.27</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Annual Exp (Kwacha/cap)</td>
<td>Mean</td>
<td>57465.49</td>
<td>40720.78</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Annual HH Exp (USD)</td>
<td>Mean</td>
<td>1973.73</td>
<td>1344.54</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Annual HH Exp (USD/cap)</td>
<td>Mean</td>
<td>532.09</td>
<td>377.04</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Monthly HH Exp (Kwacha)</td>
<td>Mean</td>
<td>17763.58</td>
<td>12100.86</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Spd/mo on firewood</td>
<td>Mean</td>
<td>52.42</td>
<td>31.24</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Spd/mo on charcoal</td>
<td>Mean</td>
<td>381.56</td>
<td>708.52</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Spd/mo on paraffin</td>
<td>Mean</td>
<td>100.52</td>
<td>118.25</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Spd/mo on electricity</td>
<td>Mean</td>
<td>539.42</td>
<td>305.38</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Total spd/mo on energy</td>
<td>Mean</td>
<td>1073.93</td>
<td>1163.40</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
<tr>
<td>Energy share of total</td>
<td>Mean</td>
<td>5.68%</td>
<td>11.29%</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
</tr>
</tbody>
</table>

Firewood spending includes imputed value of collected wood. Total expenditures do not include imputed values.
<table>
<thead>
<tr>
<th>Table A-2 MALAWI LILONGWE URBAN HOUSEHOLD CHARACTERISTICS and ENERGY EXPENDITURES by INCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urban Lilongwe Household Expenditure Quintiles</strong></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
</tr>
<tr>
<td><strong>Household Size</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Annual HH Exp (Kwacha)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Annual Exp (Kwacha/cap)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Annual HH Exp (USD)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Annual Exp (USD/cap)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Monthly HH Exp (Kwacha)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Spd/mo on firewood</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Spd/mo on charcoal</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Spd/mo on paraffin</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Spd/mo on electricity</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Total spd/mo on energy</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Energy share of total</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Quintiles</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household Size</strong></td>
<td>Mean</td>
<td>3.01</td>
<td>3.71</td>
<td>4.14</td>
<td>5.00</td>
<td>5.59</td>
<td>4.29</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Annual HH Exp</strong></td>
<td>Mean</td>
<td>44552.62</td>
<td>70114.81</td>
<td>96160.54</td>
<td>140647.48</td>
<td>375688.73</td>
<td>145210.27</td>
</tr>
<tr>
<td><strong>(Kwacha)</strong></td>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Annual Exp</strong></td>
<td>Mean</td>
<td>21679.56</td>
<td>25475.49</td>
<td>29734.94</td>
<td>35561.83</td>
<td>91418.31</td>
<td>40720.78</td>
</tr>
<tr>
<td><strong>(Kwacha/cap)</strong></td>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Annual HH Exp</strong></td>
<td>Mean</td>
<td>412.52</td>
<td>649.21</td>
<td>890.38</td>
<td>1302.29</td>
<td>3478.60</td>
<td>1344.54</td>
</tr>
<tr>
<td><strong>(USD)</strong></td>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Annual Exp</strong></td>
<td>Mean</td>
<td>200.74</td>
<td>235.88</td>
<td>275.32</td>
<td>329.28</td>
<td>846.47</td>
<td>377.04</td>
</tr>
<tr>
<td><strong>(USD/cap)</strong></td>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Monthly HH Exp</strong></td>
<td>Mean</td>
<td>3712.72</td>
<td>5842.90</td>
<td>8013.38</td>
<td>11720.62</td>
<td>31307.39</td>
<td>12100.86</td>
</tr>
<tr>
<td><strong>(Kwacha)</strong></td>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Spd/mo on firewood</strong></td>
<td>Mean</td>
<td>45.90</td>
<td>17.04</td>
<td>17.51</td>
<td>43.90</td>
<td>31.67</td>
<td>31.24</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Spd/mo on charcoal</strong></td>
<td>Mean</td>
<td>304.57</td>
<td>581.86</td>
<td>788.71</td>
<td>958.71</td>
<td>908.81</td>
<td>708.52</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Spd/mo on paraffin</strong></td>
<td>Mean</td>
<td>128.34</td>
<td>167.83</td>
<td>129.82</td>
<td>123.13</td>
<td>41.98</td>
<td>118.25</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Spd/mo on electricity</strong></td>
<td>Mean</td>
<td>12.96</td>
<td>19.23</td>
<td>88.60</td>
<td>228.67</td>
<td>1181.74</td>
<td>305.38</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Total spd/mo on energy</strong></td>
<td>Mean</td>
<td>491.78</td>
<td>785.96</td>
<td>1024.64</td>
<td>1354.42</td>
<td>2164.20</td>
<td>1163.40</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180720</td>
</tr>
<tr>
<td><strong>Energy share of total</strong></td>
<td>Mean</td>
<td>11.92%</td>
<td>13.26%</td>
<td>12.64%</td>
<td>10.78%</td>
<td>7.83%</td>
<td>11.29%</td>
</tr>
<tr>
<td><strong>Valid N</strong></td>
<td></td>
<td>36157</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td>180332</td>
</tr>
</tbody>
</table>

Firewood spending includes imputed value of collected wood. Total expenditures do not include imputed values.
### TABLE A-4 MALAWI RURAL HOUSEHOLD CHARACTERISTICS and ENERGY EXPENDITURES by INCOME

<table>
<thead>
<tr>
<th>Rural Household Expenditure Quintiles</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Size Mean Valid N</td>
<td>3.10</td>
<td>4.05</td>
<td>4.59</td>
<td>5.10</td>
<td>5.91</td>
<td>4.55</td>
</tr>
<tr>
<td>Annual HH Exp (Kwacha) Mean Valid N</td>
<td>26363.19</td>
<td>42591.83</td>
<td>58951.17</td>
<td>83250.09</td>
<td>166932.54</td>
<td>75611.15</td>
</tr>
<tr>
<td>Annual Exp (Kwacha/cap) Mean Valid N</td>
<td>11592.73</td>
<td>14102.01</td>
<td>16384.35</td>
<td>20577.27</td>
<td>34459.31</td>
<td>19422.04</td>
</tr>
<tr>
<td>Annual HH Exp (USD) Mean Valid N</td>
<td>244.10</td>
<td>394.37</td>
<td>545.84</td>
<td>770.83</td>
<td>1545.67</td>
<td>700.10</td>
</tr>
<tr>
<td>Annual Exp (USD/cap) Mean Valid N</td>
<td>107.34</td>
<td>130.57</td>
<td>151.71</td>
<td>190.53</td>
<td>319.07</td>
<td>179.83</td>
</tr>
<tr>
<td>Monthly HH Exp (Kwacha) Mean Valid N</td>
<td>2196.93</td>
<td>3549.32</td>
<td>4912.60</td>
<td>6937.51</td>
<td>13911.04</td>
<td>6300.93</td>
</tr>
<tr>
<td>Spd/mo on firewood Mean Valid N</td>
<td>9.95</td>
<td>16.53</td>
<td>26.93</td>
<td>50.05</td>
<td>80.55</td>
<td>36.86</td>
</tr>
<tr>
<td>Spd/mo on charcoal Mean Valid N</td>
<td>.23</td>
<td>1.01</td>
<td>2.96</td>
<td>11.66</td>
<td>77.01</td>
<td>18.54</td>
</tr>
<tr>
<td>Spd/mo on paraffin Mean Valid N</td>
<td>38.60</td>
<td>65.01</td>
<td>82.88</td>
<td>113.77</td>
<td>167.33</td>
<td>93.56</td>
</tr>
<tr>
<td>Spd/mo on electricity Mean Valid N</td>
<td>.26</td>
<td>.00</td>
<td>.79</td>
<td>3.69</td>
<td>72.59</td>
<td>15.44</td>
</tr>
<tr>
<td>Total spd/mo on energy Mean Valid N</td>
<td>49.05</td>
<td>82.56</td>
<td>113.55</td>
<td>179.16</td>
<td>397.47</td>
<td>164.39</td>
</tr>
<tr>
<td>Energy share of total Mean Valid N</td>
<td>1.69%</td>
<td>2.04%</td>
<td>2.08%</td>
<td>2.38%</td>
<td>2.61%</td>
<td>2.16%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Rural - North</td>
<td>Rural - Central</td>
<td>Rural - South</td>
<td></td>
</tr>
<tr>
<td>Fuelwood users</td>
<td>Mean</td>
<td>63.75%</td>
<td>42.17%</td>
<td>99.17%</td>
<td>98.03%</td>
<td>98.40%</td>
<td>98.79%</td>
<td>98.61%</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
<td>251616</td>
<td>332976</td>
<td>145056</td>
<td>722832</td>
<td>918936</td>
</tr>
<tr>
<td>Wood cost/mo</td>
<td>Mean</td>
<td>165.54</td>
<td>271.59</td>
<td>71.37</td>
<td>18.45</td>
<td>39.82</td>
<td>49.02</td>
<td>33.89</td>
</tr>
<tr>
<td>(incl value of</td>
<td>Valid N</td>
<td>44779</td>
<td>20789</td>
<td>228813</td>
<td>317267</td>
<td>129009</td>
<td>647766</td>
<td>835626</td>
</tr>
<tr>
<td>collected)</td>
<td>Charcoal</td>
<td>Mean</td>
<td>50.00%</td>
<td>72.55%</td>
<td>3.02%</td>
<td>5.52%</td>
<td>4.89%</td>
<td>2.50%</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
<td>251616</td>
<td>332976</td>
<td>145056</td>
<td>722832</td>
<td>918936</td>
</tr>
<tr>
<td>Charcoal price/kg</td>
<td>Mean</td>
<td>6.25</td>
<td>7.64</td>
<td>5.90</td>
<td>5.68</td>
<td>4.88</td>
<td>4.73</td>
<td>5.05</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>135516</td>
<td>176196</td>
<td>31452</td>
<td>151044</td>
<td>38836</td>
<td>210378</td>
<td>480524</td>
</tr>
<tr>
<td>Charcoal use kg/mo</td>
<td>Mean</td>
<td>131.35</td>
<td>127.58</td>
<td>90.86</td>
<td>91.90</td>
<td>57.37</td>
<td>134.39</td>
<td>107.37</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>67463</td>
<td>130996</td>
<td>1311</td>
<td>16990</td>
<td>3628</td>
<td>16361</td>
<td>28464</td>
</tr>
<tr>
<td>Charcoal cost/mo</td>
<td>Mean</td>
<td>763.13</td>
<td>976.62</td>
<td>334.73</td>
<td>610.85</td>
<td>356.91</td>
<td>539.65</td>
<td>523.96</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>70704</td>
<td>131109</td>
<td>7601</td>
<td>18380</td>
<td>7091</td>
<td>18103</td>
<td>34160</td>
</tr>
<tr>
<td>Paraffin users</td>
<td>Mean</td>
<td>57.29%</td>
<td>49.89%</td>
<td>82.40%</td>
<td>78.79%</td>
<td>85.13%</td>
<td>75.41%</td>
<td>84.61%</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
<td>251616</td>
<td>332976</td>
<td>145056</td>
<td>722832</td>
<td>918936</td>
</tr>
<tr>
<td>Paraffin price/liter</td>
<td>Mean</td>
<td>98.43</td>
<td>96.98</td>
<td>121.18</td>
<td>148.88</td>
<td>124.95</td>
<td>131.67</td>
<td>129.59</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>141408</td>
<td>169862</td>
<td>246374</td>
<td>304640</td>
<td>138712</td>
<td>689228</td>
<td>900316</td>
</tr>
<tr>
<td>Paraffin use liters/mo</td>
<td>Mean</td>
<td>2.12</td>
<td>2.97</td>
<td>1.26</td>
<td>1.01</td>
<td>1.41</td>
<td>1.17</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>81015</td>
<td>84323</td>
<td>202603</td>
<td>243335</td>
<td>117143</td>
<td>519315</td>
<td>762781</td>
</tr>
<tr>
<td>Paraffin cost/mo</td>
<td>Mean</td>
<td>175.45</td>
<td>237.02</td>
<td>134.59</td>
<td>120.91</td>
<td>151.92</td>
<td>128.50</td>
<td>94.44</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>81015</td>
<td>90160</td>
<td>207321</td>
<td>262336</td>
<td>123487</td>
<td>545119</td>
<td>777530</td>
</tr>
<tr>
<td>Connected to</td>
<td>Mean</td>
<td>29.79%</td>
<td>35.09%</td>
<td>1.25%</td>
<td>.88%</td>
<td>1.21%</td>
<td>1.84%</td>
<td>2.29%</td>
</tr>
<tr>
<td>grid</td>
<td>Valid N</td>
<td>141408</td>
<td>180720</td>
<td>251616</td>
<td>332976</td>
<td>145056</td>
<td>722832</td>
<td>918936</td>
</tr>
<tr>
<td>Electric price/kWh</td>
<td>Mean</td>
<td>3.27</td>
<td>3.33</td>
<td>3.40</td>
<td>3.16</td>
<td>3.26</td>
<td>3.34</td>
<td>3.38</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>32995</td>
<td>58773</td>
<td>3407</td>
<td>2710</td>
<td>1506</td>
<td>13105</td>
<td>16895</td>
</tr>
<tr>
<td>Electric use kWh/mo</td>
<td>Mean</td>
<td>695.35</td>
<td>294.58</td>
<td>269.32</td>
<td>279.45</td>
<td>248.75</td>
<td>333.09</td>
<td>286.10</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>32995</td>
<td>58773</td>
<td>3407</td>
<td>2710</td>
<td>1506</td>
<td>13105</td>
<td>16895</td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>Mean</td>
<td>2311.82</td>
<td>939.01</td>
<td>871.10</td>
<td>855.23</td>
<td>773.85</td>
<td>1065.11</td>
<td>958.26</td>
</tr>
<tr>
<td></td>
<td>Valid N</td>
<td>32995</td>
<td>58773</td>
<td>3407</td>
<td>2710</td>
<td>1506</td>
<td>13105</td>
<td>16895</td>
</tr>
</tbody>
</table>

Source: MALAWI Second Integrated Household Survey, 2004 (weighted). Monthly use and costs are for households using each fuel only.
<table>
<thead>
<tr>
<th>Fuelwood users</th>
<th>Mean</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>94.79%</td>
<td>77.08%</td>
<td>73.96%</td>
<td>48.96%</td>
<td>23.96%</td>
<td>63.75%</td>
<td></td>
</tr>
<tr>
<td>Valid N</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>141408</td>
<td></td>
</tr>
<tr>
<td>Wood cost/mo (incl value of collected)</td>
<td>Mean</td>
<td>37.15</td>
<td>161.00</td>
<td>167.45</td>
<td>1055.88</td>
<td></td>
<td>165.54</td>
</tr>
<tr>
<td>Valid N</td>
<td>22095</td>
<td>13257</td>
<td>6187</td>
<td>3241</td>
<td>0</td>
<td>44779</td>
<td></td>
</tr>
<tr>
<td>Charcoal users</td>
<td>Mean</td>
<td>10.42%</td>
<td>40.63%</td>
<td>61.46%</td>
<td>70.83%</td>
<td>66.67%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Valid N</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>141408</td>
<td></td>
</tr>
<tr>
<td>Charcoal price/kg</td>
<td>Mean</td>
<td>6.75</td>
<td>6.06</td>
<td>5.95</td>
<td>6.15</td>
<td>6.35</td>
<td>6.25</td>
</tr>
<tr>
<td>Valid N</td>
<td>28282</td>
<td>27987</td>
<td>27103</td>
<td>27987</td>
<td>24157</td>
<td>135516</td>
<td></td>
</tr>
<tr>
<td>Charcoal use kg/mo</td>
<td>Mean</td>
<td>39.30</td>
<td>76.92</td>
<td>83.70</td>
<td>153.21</td>
<td>206.69</td>
<td>131.35</td>
</tr>
<tr>
<td>Valid N</td>
<td>2946</td>
<td>11195</td>
<td>16792</td>
<td>20033</td>
<td>16498</td>
<td>67463</td>
<td></td>
</tr>
<tr>
<td>Charcoal cost/mo</td>
<td>Mean</td>
<td>287.14</td>
<td>417.03</td>
<td>489.95</td>
<td>880.46</td>
<td>1175.56</td>
<td>763.13</td>
</tr>
<tr>
<td>Valid N</td>
<td>2946</td>
<td>11489</td>
<td>17381</td>
<td>20033</td>
<td>18854</td>
<td>70704</td>
<td></td>
</tr>
<tr>
<td>Paraffin users</td>
<td>Mean</td>
<td>71.88%</td>
<td>88.54%</td>
<td>70.83%</td>
<td>42.71%</td>
<td>12.50%</td>
<td>57.29%</td>
</tr>
<tr>
<td>Valid N</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>141408</td>
<td></td>
</tr>
<tr>
<td>Paraffin price/liter</td>
<td>Mean</td>
<td>90.56</td>
<td>112.90</td>
<td>107.33</td>
<td>111.78</td>
<td>69.57</td>
<td>98.43</td>
</tr>
<tr>
<td>Valid N</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>141408</td>
<td></td>
</tr>
<tr>
<td>Paraffin use liters/mo</td>
<td>Mean</td>
<td>1.29</td>
<td>1.63</td>
<td>2.44</td>
<td>2.77</td>
<td>6.28</td>
<td>2.12</td>
</tr>
<tr>
<td>Valid N</td>
<td>20327</td>
<td>25041</td>
<td>20033</td>
<td>12079</td>
<td>18854</td>
<td>67463</td>
<td></td>
</tr>
<tr>
<td>Paraffin cost/mo</td>
<td>Mean</td>
<td>110.43</td>
<td>131.65</td>
<td>197.33</td>
<td>257.77</td>
<td>454.29</td>
<td>175.45</td>
</tr>
<tr>
<td>Valid N</td>
<td>20327</td>
<td>25041</td>
<td>20033</td>
<td>12079</td>
<td>18854</td>
<td>67463</td>
<td></td>
</tr>
<tr>
<td>Connected to grid</td>
<td>Mean</td>
<td>2.08%</td>
<td>4.17%</td>
<td>12.50%</td>
<td>38.54%</td>
<td>91.67%</td>
<td>29.79%</td>
</tr>
<tr>
<td>Valid N</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>28282</td>
<td>141408</td>
<td></td>
</tr>
<tr>
<td>Electric price/kWh</td>
<td>Mean</td>
<td>.</td>
<td>.</td>
<td>3.55</td>
<td>3.34</td>
<td>3.23</td>
<td>3.27</td>
</tr>
<tr>
<td>Valid N</td>
<td>0</td>
<td>0</td>
<td>1768</td>
<td>7070</td>
<td>24157</td>
<td>32995</td>
<td></td>
</tr>
<tr>
<td>Electric use kWh/mo</td>
<td>Mean</td>
<td>.</td>
<td>.</td>
<td>373.61</td>
<td>209.72</td>
<td>861.03</td>
<td>695.35</td>
</tr>
<tr>
<td>Valid N</td>
<td>0</td>
<td>0</td>
<td>1768</td>
<td>7070</td>
<td>24157</td>
<td>32995</td>
<td></td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>Mean</td>
<td>.</td>
<td>.</td>
<td>1316.67</td>
<td>666.04</td>
<td>2866.33</td>
<td>2311.82</td>
</tr>
<tr>
<td>Valid N</td>
<td>0</td>
<td>0</td>
<td>1768</td>
<td>7070</td>
<td>24157</td>
<td>32995</td>
<td></td>
</tr>
</tbody>
</table>

Monthly use and costs are for households using each fuel only.
### Table A-7 Malawi Other Urban Household Energy Price and Use by Income

<table>
<thead>
<tr>
<th></th>
<th>Expenditure Quintiles</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lowest</td>
<td>low-mid</td>
<td>middle</td>
<td>mid-high</td>
<td>highest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuelwood users</td>
<td>Mean</td>
<td>67.13%</td>
<td>47.39%</td>
<td>38.18%</td>
<td>32.12%</td>
<td>25.97%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42.17%</td>
</tr>
<tr>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180720</td>
<td></td>
</tr>
<tr>
<td>Wood cost/mo (incl value of collected)</td>
<td>Mean</td>
<td>205.08%</td>
<td>127.34%</td>
<td>259.40%</td>
<td>421.05%</td>
<td>699.39%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>271.59</td>
</tr>
<tr>
<td>Valid N</td>
<td>8118</td>
<td>4809</td>
<td>2443</td>
<td>3791</td>
<td>1629</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20789</td>
<td></td>
</tr>
<tr>
<td>Charcoal users</td>
<td>Mean</td>
<td>49.14%</td>
<td>74.39%</td>
<td>80.27%</td>
<td>83.30%</td>
<td>75.67%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>72.55%</td>
</tr>
<tr>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180720</td>
<td></td>
</tr>
<tr>
<td>Charcoal price/kg</td>
<td>Mean</td>
<td>7.76%</td>
<td>7.85%</td>
<td>7.91%</td>
<td>7.59%</td>
<td>7.10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.64%</td>
</tr>
<tr>
<td>Valid N</td>
<td>34234</td>
<td>34800</td>
<td>35627</td>
<td>35792</td>
<td>35743</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>176196</td>
<td></td>
</tr>
<tr>
<td>Charcoal use kg/mo</td>
<td>Mean</td>
<td>81.14%</td>
<td>97.13%</td>
<td>119.35%</td>
<td>149.94%</td>
<td>171.98%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>127.58</td>
</tr>
<tr>
<td>Valid N</td>
<td>17823</td>
<td>26730</td>
<td>29054</td>
<td>30285</td>
<td>27105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>130996</td>
<td></td>
</tr>
<tr>
<td>Charcoal cost/mo</td>
<td>Mean</td>
<td>619.81%</td>
<td>782.14%</td>
<td>982.52%</td>
<td>1150.94%</td>
<td>1201.03%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>976.62</td>
</tr>
<tr>
<td>Valid N</td>
<td>17823</td>
<td>26730</td>
<td>29054</td>
<td>30285</td>
<td>27218</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>131109</td>
<td></td>
</tr>
<tr>
<td>Paraffin users</td>
<td>Mean</td>
<td>73.42%</td>
<td>72.23%</td>
<td>50.01%</td>
<td>41.12%</td>
<td>12.59%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>49.89%</td>
</tr>
<tr>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180720</td>
<td></td>
</tr>
<tr>
<td>Paraffin price/liter</td>
<td>Mean</td>
<td>124.09%</td>
<td>92.97%</td>
<td>88.64%</td>
<td>90.04%</td>
<td>89.43%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>96.98%</td>
</tr>
<tr>
<td>Valid N</td>
<td>33714</td>
<td>33623</td>
<td>33885</td>
<td>34615</td>
<td>34024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>169862</td>
<td></td>
</tr>
<tr>
<td>Paraffin use liters/mo</td>
<td>Mean</td>
<td>2.00%</td>
<td>3.05%</td>
<td>3.51%</td>
<td>3.65%</td>
<td>4.04%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.97%</td>
</tr>
<tr>
<td>Valid N</td>
<td>25205</td>
<td>24300</td>
<td>16721</td>
<td>14181</td>
<td>3917</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>84323</td>
<td></td>
</tr>
<tr>
<td>Paraffin cost/mo</td>
<td>Mean</td>
<td>174.80%</td>
<td>232.36%</td>
<td>259.57%</td>
<td>299.45%</td>
<td>333.46%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>237.02</td>
</tr>
<tr>
<td>Valid N</td>
<td>26630</td>
<td>25951</td>
<td>18101</td>
<td>14950</td>
<td>4528</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90160</td>
<td></td>
</tr>
<tr>
<td>Connected to grid</td>
<td>Mean</td>
<td>6.62%</td>
<td>9.29%</td>
<td>25.95%</td>
<td>47.46%</td>
<td>86.27%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35.09%</td>
</tr>
<tr>
<td>Valid N</td>
<td>36270</td>
<td>35931</td>
<td>36193</td>
<td>36357</td>
<td>35970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>180720</td>
<td></td>
</tr>
<tr>
<td>Electric price/kWh</td>
<td>Mean</td>
<td>3.59%</td>
<td>3.55%</td>
<td>3.55%</td>
<td>3.44%</td>
<td>3.17%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.33%</td>
</tr>
<tr>
<td>Valid N</td>
<td>2036</td>
<td>3064</td>
<td>7937</td>
<td>15706</td>
<td>30030</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>58773</td>
<td></td>
</tr>
<tr>
<td>Electric use kWh/mo</td>
<td>Mean</td>
<td>67.81%</td>
<td>64.74%</td>
<td>120.79%</td>
<td>164.08%</td>
<td>447.59%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>294.58</td>
</tr>
<tr>
<td>Valid N</td>
<td>2036</td>
<td>3064</td>
<td>7937</td>
<td>15706</td>
<td>30030</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>58773</td>
<td></td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>Mean</td>
<td>230.95%</td>
<td>225.53%</td>
<td>404.00%</td>
<td>529.33%</td>
<td>1415.50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>939.01</td>
</tr>
<tr>
<td>Valid N</td>
<td>2036</td>
<td>3064</td>
<td>7937</td>
<td>15706</td>
<td>30030</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>58773</td>
<td></td>
</tr>
</tbody>
</table>

Monthly use and costs are for households using each fuel only.
## Table A-8 Malawi Rural Household Energy Price and Use by Income

<table>
<thead>
<tr>
<th>Fuelwood users</th>
<th>Mean</th>
<th>lowest</th>
<th>low-mid</th>
<th>mid</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid N</td>
<td>99.45%</td>
<td>99.62%</td>
<td>99.32%</td>
<td>98.83%</td>
<td>95.93%</td>
<td>98.63%</td>
<td></td>
</tr>
<tr>
<td>Wood cost/mo (incl value of collected)</td>
<td>Mean</td>
<td>10.30</td>
<td>17.41</td>
<td>28.57</td>
<td>54.90</td>
<td>103.27</td>
<td>40.49</td>
</tr>
<tr>
<td>Valid N</td>
<td>457364</td>
<td>450399</td>
<td>446395</td>
<td>432161</td>
<td>369278</td>
<td>2158482</td>
<td></td>
</tr>
<tr>
<td>Charcoal users</td>
<td>Mean</td>
<td>.10%</td>
<td>.76%</td>
<td>1.43%</td>
<td>4.10%</td>
<td>11.63%</td>
<td>3.60%</td>
</tr>
<tr>
<td>Valid N</td>
<td>473393</td>
<td>474152</td>
<td>473541</td>
<td>473970</td>
<td>473475</td>
<td>2371416</td>
<td></td>
</tr>
<tr>
<td>Charcoal price/kg</td>
<td>Mean</td>
<td>5.36</td>
<td>5.15</td>
<td>4.91</td>
<td>5.02</td>
<td>5.06</td>
<td>5.10</td>
</tr>
<tr>
<td>Valid N</td>
<td>185188</td>
<td>188393</td>
<td>179394</td>
<td>169277</td>
<td>189387</td>
<td>912234</td>
<td></td>
</tr>
<tr>
<td>Charcoal use kg/mo</td>
<td>Mean</td>
<td>55.95</td>
<td>23.39</td>
<td>43.50</td>
<td>62.76</td>
<td>131.96</td>
<td>107.01</td>
</tr>
<tr>
<td>Valid N</td>
<td>291</td>
<td>2508</td>
<td>4058</td>
<td>14624</td>
<td>45272</td>
<td>66753</td>
<td></td>
</tr>
<tr>
<td>Charcoal cost/mo</td>
<td>Mean</td>
<td>223.44</td>
<td>132.54</td>
<td>207.07</td>
<td>284.35</td>
<td>662.24</td>
<td>515.27</td>
</tr>
<tr>
<td>Valid N</td>
<td>487</td>
<td>3604</td>
<td>6759</td>
<td>19428</td>
<td>55056</td>
<td>85335</td>
<td></td>
</tr>
<tr>
<td>Paraffin users</td>
<td>Mean</td>
<td>66.69%</td>
<td>82.08%</td>
<td>84.34%</td>
<td>87.73%</td>
<td>83.27%</td>
<td>80.79%</td>
</tr>
<tr>
<td>Valid N</td>
<td>473393</td>
<td>474152</td>
<td>473541</td>
<td>473970</td>
<td>473475</td>
<td>2371416</td>
<td></td>
</tr>
<tr>
<td>Paraffin price/liter</td>
<td>Mean</td>
<td>138.12</td>
<td>132.37</td>
<td>132.53</td>
<td>130.30</td>
<td>124.47</td>
<td>131.60</td>
</tr>
<tr>
<td>Valid N</td>
<td>458396</td>
<td>458129</td>
<td>453489</td>
<td>453324</td>
<td>453047</td>
<td>2279270</td>
<td></td>
</tr>
<tr>
<td>Paraffin use liters/mo</td>
<td>Mean</td>
<td>.55</td>
<td>.76</td>
<td>.94</td>
<td>1.24</td>
<td>1.95</td>
<td>1.11</td>
</tr>
<tr>
<td>Valid N</td>
<td>307334</td>
<td>376287</td>
<td>382474</td>
<td>400918</td>
<td>376810</td>
<td>1845178</td>
<td></td>
</tr>
<tr>
<td>Paraffin cost/mo</td>
<td>Mean</td>
<td>57.88</td>
<td>79.20</td>
<td>98.26</td>
<td>129.67</td>
<td>200.95</td>
<td>115.81</td>
</tr>
<tr>
<td>Valid N</td>
<td>315724</td>
<td>389206</td>
<td>399408</td>
<td>415831</td>
<td>394271</td>
<td>1915793</td>
<td></td>
</tr>
<tr>
<td>Connected to grid</td>
<td>Mean</td>
<td>.13%</td>
<td>.07%</td>
<td>.19%</td>
<td>.90%</td>
<td>7.62%</td>
<td>1.78%</td>
</tr>
<tr>
<td>Valid N</td>
<td>473393</td>
<td>474152</td>
<td>473541</td>
<td>473970</td>
<td>473475</td>
<td>2371416</td>
<td></td>
</tr>
<tr>
<td>Electric price/kWh</td>
<td>Mean</td>
<td>3.30</td>
<td>3.55</td>
<td>3.37</td>
<td>3.34</td>
<td>3.35</td>
<td></td>
</tr>
<tr>
<td>Valid N</td>
<td>262</td>
<td>0</td>
<td>910</td>
<td>3867</td>
<td>32585</td>
<td>37624</td>
<td></td>
</tr>
<tr>
<td>Electric use kWh/mo</td>
<td>Mean</td>
<td>143.72</td>
<td>126.20</td>
<td>137.09</td>
<td>324.26</td>
<td>298.97</td>
<td></td>
</tr>
<tr>
<td>Valid N</td>
<td>262</td>
<td>0</td>
<td>910</td>
<td>3867</td>
<td>32585</td>
<td>37624</td>
<td></td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>Mean</td>
<td>474.00</td>
<td>411.14</td>
<td>451.81</td>
<td>1054.30</td>
<td>972.78</td>
<td></td>
</tr>
<tr>
<td>Valid N</td>
<td>262</td>
<td>0</td>
<td>910</td>
<td>3867</td>
<td>32585</td>
<td>37624</td>
<td></td>
</tr>
</tbody>
</table>

Monthly use and costs are for households using each fuel only.
### TABLE A-9 MALAWI HOUSEHOLD COOKING FUEL SOURCE by AREA

<table>
<thead>
<tr>
<th>What is your source of cooking fuel?</th>
<th>Urban</th>
<th>Rural</th>
<th>Rural - North</th>
<th>Rural - Central</th>
<th>Rural - South</th>
<th>Group Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Group Total</td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Rural - North</td>
</tr>
<tr>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
</tr>
<tr>
<td>Collected firewood</td>
<td>22.1%</td>
<td>6.4%</td>
<td>13.3%</td>
<td>81.9%</td>
<td>90.3%</td>
<td>82.7%</td>
</tr>
<tr>
<td>Purchased firewood</td>
<td>27.1%</td>
<td>22.6%</td>
<td>24.6%</td>
<td>15.7%</td>
<td>5.8%</td>
<td>15.1%</td>
</tr>
<tr>
<td>Paraffin</td>
<td>1.0%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>.1%</td>
<td>.1%</td>
<td>.1%</td>
</tr>
<tr>
<td>Electricity</td>
<td>14.2%</td>
<td>9.4%</td>
<td>11.5%</td>
<td>.4%</td>
<td>.2%</td>
<td>.4%</td>
</tr>
<tr>
<td>Gas</td>
<td>1.0%</td>
<td>.3%</td>
<td>.6%</td>
<td>.1%</td>
<td>.1%</td>
<td>.1%</td>
</tr>
<tr>
<td>Charcoal</td>
<td>33.5%</td>
<td>59.7%</td>
<td>48.2%</td>
<td>.2%</td>
<td>3.1%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Crop residue</td>
<td>.2%</td>
<td>.1%</td>
<td>1.7%</td>
<td>.5%</td>
<td>1.1%</td>
<td>.2%</td>
</tr>
<tr>
<td>Saw dust</td>
<td>.8%</td>
<td>.3%</td>
<td>.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>


### TABLE A-10 MALAWI HOUSEHOLD COLLECTED WOOD SOURCE by AREA

<table>
<thead>
<tr>
<th>Where do you go to collect firewood?</th>
<th>Urban</th>
<th>Rural</th>
<th>Rural - North</th>
<th>Rural - Central</th>
<th>Rural - South</th>
<th>Group Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Group Total</td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Rural - North</td>
</tr>
<tr>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
</tr>
<tr>
<td>Own woodlot</td>
<td>67.7%</td>
<td>88.3%</td>
<td>79.3%</td>
<td>8.8%</td>
<td>4.6%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Community woodlot</td>
<td>9.4%</td>
<td>.6%</td>
<td>4.5%</td>
<td>7.8%</td>
<td>15.5%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Forest reserve</td>
<td>5.6%</td>
<td>1.0%</td>
<td>3.0%</td>
<td>2.6%</td>
<td>1.0%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Unfarmed areas of community</td>
<td>1.5%</td>
<td>5.0%</td>
<td>3.5%</td>
<td>4.2%</td>
<td>12.0%</td>
<td>16.0%</td>
</tr>
<tr>
<td>Other</td>
<td>12.5%</td>
<td>4.5%</td>
<td>8.0%</td>
<td>44.9%</td>
<td>64.8%</td>
<td>59.9%</td>
</tr>
<tr>
<td>Group Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### TABLE A-11 MALAWI HOUSEHOLD LIGHTING FUEL SOURCE by AREA

<table>
<thead>
<tr>
<th>What is your main source of lighting fuel?</th>
<th>Urban</th>
<th>Rural</th>
<th>Group Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Group Total</td>
</tr>
<tr>
<td>collected firewood/grass</td>
<td>1.3%</td>
<td>0.3%</td>
<td>0.7%</td>
</tr>
<tr>
<td>purchased firewood</td>
<td>0.8%</td>
<td>0.2%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Paraffin</td>
<td>53.9%</td>
<td>57.7%</td>
<td>56.0%</td>
</tr>
<tr>
<td>Electricity</td>
<td>29.6%</td>
<td>35.1%</td>
<td>32.7%</td>
</tr>
<tr>
<td>Gas</td>
<td>0.2%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Battery/dry cell</td>
<td>0.2%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Candles</td>
<td>12.5%</td>
<td>6.6%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Other</td>
<td>0.4%</td>
<td>0.0%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Matches</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>


**TABLE A-12 MALAWI HOUSEHOLD WATER SUPPLY SOURCE by AREA**

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Rural - North</th>
<th>Rural - Central</th>
<th>Rural - South</th>
<th>Group Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Group Total</td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Rural - North</td>
</tr>
<tr>
<td></td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
<td>Col %</td>
</tr>
<tr>
<td>What was main source of drinking water over the past mo.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piped into dwelling unit</td>
<td>16.9%</td>
<td>9.3%</td>
<td>12.6%</td>
<td>.5%</td>
<td>.4%</td>
<td>.8%</td>
</tr>
<tr>
<td>Piped outside dwelling unit</td>
<td>15.1%</td>
<td>15.9%</td>
<td>15.5%</td>
<td>.5%</td>
<td>.9%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Communal standpipe</td>
<td>36.4%</td>
<td>58.5%</td>
<td>48.8%</td>
<td>3.9%</td>
<td>9.6%</td>
<td>19.6%</td>
</tr>
<tr>
<td>Personal handpump</td>
<td>1.0%</td>
<td>1.4%</td>
<td>1.2%</td>
<td>.2%</td>
<td>.5%</td>
<td>.1%</td>
</tr>
<tr>
<td>Communal handpump</td>
<td>12.6%</td>
<td>6.6%</td>
<td>9.2%</td>
<td>44.0%</td>
<td>58.7%</td>
<td>48.6%</td>
</tr>
<tr>
<td>Protected spring</td>
<td>.2%</td>
<td>.3%</td>
<td>.2%</td>
<td></td>
<td></td>
<td>1.4%</td>
</tr>
<tr>
<td>Personal open, unprotected well</td>
<td>5.0%</td>
<td>1.6%</td>
<td>3.1%</td>
<td>8.8%</td>
<td>1.0%</td>
<td>.5%</td>
</tr>
<tr>
<td>Communal open, unprotected well</td>
<td>11.9%</td>
<td>5.4%</td>
<td>8.3%</td>
<td>39.9%</td>
<td>22.5%</td>
<td>11.5%</td>
</tr>
<tr>
<td>River, spring</td>
<td>.6%</td>
<td>.2%</td>
<td>.4%</td>
<td>2.2%</td>
<td>6.4%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Lake, reservoir</td>
<td>.1%</td>
<td>.0%</td>
<td>.1%</td>
<td>2.6%</td>
<td>.3%</td>
<td>.3%</td>
</tr>
<tr>
<td>Other</td>
<td>.2%</td>
<td>.9%</td>
<td>.6%</td>
<td>.1%</td>
<td>.1%</td>
<td>.0%</td>
</tr>
<tr>
<td>Group Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

**TABLE A-13 MALAWI HOUSEHOLD TIME (minutes) to COLLECT WOOD and WATER by AREA**

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Rural - North</th>
<th>Rural - Central</th>
<th>Rural - South</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Rural - North</td>
<td>Rural - Central</td>
</tr>
<tr>
<td>Mins to walk fr home to collect FW</td>
<td>33.20</td>
<td>48.46</td>
<td>25.97</td>
<td>24.14</td>
<td>18.91</td>
<td>41.31</td>
</tr>
<tr>
<td>Time in min walk to water source</td>
<td>7.05</td>
<td>6.72</td>
<td>7.55</td>
<td>14.06</td>
<td>9.19</td>
<td>11.56</td>
</tr>
</tbody>
</table>

### TABLE A-14 MALAWI HOUSEHOLD EXPENDITURES by INCOME and ELECTRIC ACCESS

#### Urban Lilongwe Household Expenditure Quintiles

<table>
<thead>
<tr>
<th>access to electricity</th>
<th>Connect</th>
<th>Monthly HH Exp (Kwacha)</th>
<th>Mean</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>connected</td>
<td></td>
<td></td>
<td>2585.66</td>
<td>5984.86</td>
<td>9292.27</td>
<td>15852.84</td>
<td>57629.61</td>
<td>40283.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>.4%</td>
<td>.8%</td>
<td>2.7%</td>
<td>7.9%</td>
<td>18.5%</td>
<td>30.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no elec, but within 100m</td>
<td></td>
<td></td>
<td>3372.98</td>
<td>6070.66</td>
<td>9244.83</td>
<td>14805.85</td>
<td>25500.10</td>
<td>10142.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>3.3%</td>
<td>6.9%</td>
<td>10.8%</td>
<td>8.1%</td>
<td>1.5%</td>
<td>30.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no elec, 100 m+</td>
<td></td>
<td></td>
<td>2997.87</td>
<td>6095.46</td>
<td>9309.26</td>
<td>14323.77</td>
<td>.</td>
<td>6172.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>16.3%</td>
<td>12.3%</td>
<td>6.5%</td>
<td>4.0%</td>
<td>.</td>
<td>39.0%</td>
<td></td>
</tr>
</tbody>
</table>

#### Urban Mzuzu/Zomba/Blantyre Household Expenditure Quintiles

<table>
<thead>
<tr>
<th>access to electricity</th>
<th>Connect</th>
<th>Monthly HH Exp (Kwacha)</th>
<th>Mean</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>connected</td>
<td></td>
<td></td>
<td>4011.99</td>
<td>5833.39</td>
<td>7971.94</td>
<td>11811.22</td>
<td>32704.03</td>
<td>20909.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>1.3%</td>
<td>1.8%</td>
<td>5.2%</td>
<td>9.5%</td>
<td>17.3%</td>
<td>35.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no elec, but within 100m</td>
<td></td>
<td></td>
<td>3732.71</td>
<td>5862.20</td>
<td>8039.51</td>
<td>11661.86</td>
<td>22009.70</td>
<td>7496.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>15.3%</td>
<td>16.5%</td>
<td>13.1%</td>
<td>9.8%</td>
<td>2.5%</td>
<td>57.1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no elec, 100 m+</td>
<td></td>
<td></td>
<td>3510.78</td>
<td>5585.93</td>
<td>7942.12</td>
<td>11350.50</td>
<td>18788.07</td>
<td>5885.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>3.5%</td>
<td>1.5%</td>
<td>1.8%</td>
<td>.8%</td>
<td>.1%</td>
<td>7.6%</td>
<td></td>
</tr>
</tbody>
</table>

#### Rural Household Expenditure Quintiles

<table>
<thead>
<tr>
<th>access to electricity</th>
<th>Connect</th>
<th>Monthly HH Exp (Kwacha)</th>
<th>Mean</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>connected</td>
<td></td>
<td></td>
<td>2170.93</td>
<td>3958.82</td>
<td>5205.91</td>
<td>7362.24</td>
<td>21980.39</td>
<td>19529.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>.0%</td>
<td>.0%</td>
<td>.1%</td>
<td>.2%</td>
<td>1.7%</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no elec, but within 100m</td>
<td></td>
<td></td>
<td>2190.07</td>
<td>3559.11</td>
<td>4936.20</td>
<td>7097.63</td>
<td>13640.98</td>
<td>7175.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>1.9%</td>
<td>1.9%</td>
<td>1.7%</td>
<td>2.3%</td>
<td>3.1%</td>
<td>10.9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no elec, 100 m+</td>
<td></td>
<td></td>
<td>2199.18</td>
<td>3548.77</td>
<td>4909.95</td>
<td>6909.30</td>
<td>13077.05</td>
<td>5887.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col %</td>
<td>18.1%</td>
<td>18.0%</td>
<td>18.2%</td>
<td>17.5%</td>
<td>15.1%</td>
<td>87.1%</td>
<td></td>
</tr>
</tbody>
</table>


**TABLE A-15 MALAWI HOUSEHOLD ENTERPRISE by ELECTRIC ACCESS**

<table>
<thead>
<tr>
<th>HH member engage in enterprise</th>
<th>Yes</th>
<th>No</th>
<th>Row %</th>
<th>Row %</th>
<th>Row %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urban</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>access to electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>connected</td>
<td>33.4%</td>
<td>66.6%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no elec, but within 100m</td>
<td>43.4%</td>
<td>56.6%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no elec, 100 m+</td>
<td>24.6%</td>
<td>75.4%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>access to electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>connected</td>
<td>40.7%</td>
<td>59.3%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no elec, but within 100m</td>
<td>41.7%</td>
<td>58.3%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no elec, 100 m+</td>
<td>28.6%</td>
<td>71.4%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>connected</td>
<td>36.1%</td>
<td>63.9%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no elec, but within 100m</td>
<td>43.4%</td>
<td>56.6%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no elec, 100 m+</td>
<td>24.6%</td>
<td>75.4%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**TABLE A-16 MALAWI OTHER URBAN HOUSEHOLD LIGHTING FUEL PRICE and USE by INCOME**

<table>
<thead>
<tr>
<th>Urban Mzuzu/Zomba/Blantyre Household Expenditure Quintiles</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paraffin users</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>73.58%</td>
<td>212</td>
<td>181</td>
<td>180</td>
<td>187</td>
<td>200</td>
</tr>
<tr>
<td><strong>Paraffin light liters/mo</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.23</td>
<td>143</td>
<td>116</td>
<td>79</td>
<td>77</td>
<td>21</td>
</tr>
<tr>
<td><strong>Para light price MK/klmh</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>102.65</td>
<td>143</td>
<td>116</td>
<td>79</td>
<td>77</td>
<td>21</td>
</tr>
<tr>
<td><strong>Paraffin light klmh/mo</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.96</td>
<td>143</td>
<td>116</td>
<td>79</td>
<td>77</td>
<td>21</td>
</tr>
<tr>
<td><strong>Connected to grid</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.72%</td>
<td>212</td>
<td>181</td>
<td>180</td>
<td>187</td>
<td>200</td>
</tr>
<tr>
<td><strong>Electric kWh/mo</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>32.77</td>
<td>8</td>
<td>13</td>
<td>32</td>
<td>68</td>
<td>160</td>
</tr>
<tr>
<td><strong>Elec light price MK/klmh</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.33</td>
<td>8</td>
<td>13</td>
<td>32</td>
<td>68</td>
<td>160</td>
</tr>
<tr>
<td><strong>Electric light klmh/mo</strong></td>
<td>Mean</td>
<td>Valid N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>360.49</td>
<td>8</td>
<td>13</td>
<td>32</td>
<td>68</td>
<td>160</td>
</tr>
</tbody>
</table>

Assumptions: 80% of paraffin is used for lighting, all in hurricane lamps.
50% of electricity up to 250 kWh/mo and 25% above 250 kWh/mo is used for lighting, all in incandescent bulbs.
TABLE A-17 MALAWI RURAL HOUSEHOLD LIGHTING FUEL PRICE and USE by INCOME

<table>
<thead>
<tr>
<th>Rural Household Expenditure Quintiles</th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin users Mean</td>
<td>66.98%</td>
<td>82.17%</td>
<td>84.14%</td>
<td>87.59%</td>
<td>83.11%</td>
<td>80.81%</td>
</tr>
<tr>
<td>Paraffin light liters/mo Mean</td>
<td>.45</td>
<td>.62</td>
<td>.78</td>
<td>1.00</td>
<td>1.55</td>
<td>.90</td>
</tr>
<tr>
<td>Valid N</td>
<td>1259</td>
<td>1572</td>
<td>1592</td>
<td>1673</td>
<td>1538</td>
<td>7639</td>
</tr>
<tr>
<td>Para light price MK/klmh Mean</td>
<td>86.62</td>
<td>83.89</td>
<td>82.18</td>
<td>82.01</td>
<td>78.73</td>
<td>82.53</td>
</tr>
<tr>
<td>Valid N</td>
<td>1259</td>
<td>1572</td>
<td>1592</td>
<td>1673</td>
<td>1538</td>
<td>7639</td>
</tr>
<tr>
<td>Paraffin light klmh/mo Mean</td>
<td>.73</td>
<td>.99</td>
<td>1.25</td>
<td>1.59</td>
<td>2.48</td>
<td>1.43</td>
</tr>
<tr>
<td>Valid N</td>
<td>1259</td>
<td>1572</td>
<td>1592</td>
<td>1673</td>
<td>1538</td>
<td>7639</td>
</tr>
<tr>
<td>Connected to grid Mean</td>
<td>.10%</td>
<td>.05%</td>
<td>.25%</td>
<td>.81%</td>
<td>7.81%</td>
<td>1.80%</td>
</tr>
<tr>
<td>Electric light kWh/mo Mean</td>
<td>71.86</td>
<td>.</td>
<td>59.48</td>
<td>70.57</td>
<td>117.58</td>
<td>111.29</td>
</tr>
<tr>
<td>Valid N</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>14</td>
<td>138</td>
<td>158</td>
</tr>
<tr>
<td>Elec light price MK/klmh Mean</td>
<td>.30</td>
<td>.</td>
<td>.32</td>
<td>.31</td>
<td>.30</td>
<td>.31</td>
</tr>
<tr>
<td>Valid N</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>14</td>
<td>138</td>
<td>158</td>
</tr>
<tr>
<td>Electric light klmh/mo Mean</td>
<td>790.44</td>
<td>.</td>
<td>654.23</td>
<td>776.30</td>
<td>1293.36</td>
<td>1224.14</td>
</tr>
<tr>
<td>Valid N</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>14</td>
<td>138</td>
<td>158</td>
</tr>
</tbody>
</table>

Assumptions: 80% of paraffin is used for lighting, all in hurricane lamps.
50% of electricity up to 250 kWh/mo and 25% above 250 kWh/mo is used for lighting, all in incandescent bulbs.
TABLE A-18 MALAWI IMPACT of TARIFF REFORM on ELECTRIFIED HOUSEHOLDS

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Other Urban</th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Size</td>
<td>5.49</td>
<td>4.82</td>
<td>5.39</td>
<td>5.16</td>
</tr>
<tr>
<td>Monthly HH Exp (Kwacha)</td>
<td>47865.92</td>
<td>21525.99</td>
<td>19384.94</td>
<td>27620.17</td>
</tr>
<tr>
<td>Spd/mo on firewood</td>
<td>0.00</td>
<td>10.85</td>
<td>39.22</td>
<td>16.33</td>
</tr>
<tr>
<td>Spd/mo on charcoal</td>
<td>667.35</td>
<td>942.87</td>
<td>383.23</td>
<td>709.88</td>
</tr>
<tr>
<td>Spd/mo on paraffin</td>
<td>40.26</td>
<td>15.72</td>
<td>24.93</td>
<td>24.65</td>
</tr>
<tr>
<td>Electric use kWh/mo</td>
<td>695.35</td>
<td>294.58</td>
<td>298.97</td>
<td>398.05</td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>2311.82</td>
<td>939.01</td>
<td>972.78</td>
<td>1298.90</td>
</tr>
<tr>
<td>Total Energy cost/mo</td>
<td>3019.42</td>
<td>1908.44</td>
<td>1420.55</td>
<td>2049.88</td>
</tr>
<tr>
<td>Energy share of total</td>
<td>8.07%</td>
<td>11.56%</td>
<td>7.74%</td>
<td>9.56%</td>
</tr>
</tbody>
</table>

5% tariff increase (one year)

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Other Urban</th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric use kWh/mo</td>
<td>690.48</td>
<td>292.51</td>
<td>296.88</td>
<td>395.27</td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>2408.91</td>
<td>978.45</td>
<td>1013.64</td>
<td>1353.45</td>
</tr>
<tr>
<td>Total Energy cost/mo</td>
<td>3116.52</td>
<td>1947.88</td>
<td>1461.01</td>
<td>2104.32</td>
</tr>
<tr>
<td>Energy share of total</td>
<td>8.30%</td>
<td>11.76%</td>
<td>7.94%</td>
<td>9.77%</td>
</tr>
</tbody>
</table>

5% tariff increase for 5 years (27.5% total increase)

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Other Urban</th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric use kWh/mo</td>
<td>667.54</td>
<td>282.79</td>
<td>287.01</td>
<td>382.13</td>
</tr>
<tr>
<td>Electric cost/mo</td>
<td>2831.98</td>
<td>1150.29</td>
<td>1191.66</td>
<td>1591.15</td>
</tr>
<tr>
<td>Total Energy cost/mo</td>
<td>3539.58</td>
<td>2119.72</td>
<td>1639.03</td>
<td>2342.02</td>
</tr>
<tr>
<td>Energy share of total</td>
<td>9.29%</td>
<td>12.60%</td>
<td>8.86%</td>
<td>10.67%</td>
</tr>
</tbody>
</table>

Source: MALAWI Second Integrated Household Survey, 2004 (weighted). This table includes electrified households only. The two scenarios model electrified household response to a 5% annual domestic tariff increase for one year and five years (27.5% total increase). Assumes household demand is relatively inelastic: price elasticity of demand = -0.15.
### TABLE A-19 IMPACT of 27.5% TARIFF INCREASE on BUDGETS of ELECTRIFIED HOUSEHOLDS by INCOME

<table>
<thead>
<tr>
<th></th>
<th>lowest</th>
<th>low-mid</th>
<th>middle</th>
<th>mid-high</th>
<th>highest</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lilongwe Urban</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connected to Grid (%)</td>
<td>2.08%</td>
<td>4.17%</td>
<td>12.50%</td>
<td>38.54%</td>
<td>91.67%</td>
<td>29.79%</td>
</tr>
<tr>
<td>Connected to Grid (Number HHs)</td>
<td>588</td>
<td>1,179</td>
<td>3,535</td>
<td>10,900</td>
<td>25,926</td>
<td>42,125</td>
</tr>
<tr>
<td>Total Spending (MK/month)</td>
<td>9,608</td>
<td>16,467</td>
<td>59,855</td>
<td>47,866</td>
<td>47,866</td>
<td>47,866</td>
</tr>
<tr>
<td>Energy Share of Total (2004)</td>
<td>15.29%</td>
<td>9.62%</td>
<td>7.09%</td>
<td>8.07%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Share After 27.5% Increase</td>
<td>18.29%</td>
<td>10.52%</td>
<td>8.27%</td>
<td>9.29%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMPACT of Increase (% of Budget)</td>
<td>3.00%</td>
<td>0.90%</td>
<td>1.18%</td>
<td>1.21%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Urban</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connected to Grid (%)</td>
<td>6.62%</td>
<td>9.29%</td>
<td>25.95%</td>
<td>47.46%</td>
<td>86.27%</td>
<td>35.09%</td>
</tr>
<tr>
<td>Connected to Grid (Number HHs)</td>
<td>2,401</td>
<td>3,338</td>
<td>9,392</td>
<td>17,255</td>
<td>31,031</td>
<td>63,415</td>
</tr>
<tr>
<td>Total Spending (MK/month)</td>
<td>4,039</td>
<td>5,848</td>
<td>7,910</td>
<td>11,779</td>
<td>33,008</td>
<td>21,526</td>
</tr>
<tr>
<td>Energy Share of Total (2004)</td>
<td>16.89%</td>
<td>14.08%</td>
<td>14.79%</td>
<td>14.46%</td>
<td>8.58%</td>
<td>11.56%</td>
</tr>
<tr>
<td>Energy Share After 27.5% Increase</td>
<td>18.28%</td>
<td>14.95%</td>
<td>15.95%</td>
<td>15.48%</td>
<td>9.58%</td>
<td>12.60%</td>
</tr>
<tr>
<td>IMPACT of Increase (% of Budget)</td>
<td>1.39%</td>
<td>0.87%</td>
<td>1.17%</td>
<td>1.02%</td>
<td>1.00%</td>
<td>1.03%</td>
</tr>
<tr>
<td><strong>Rural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connected to Grid (%)</td>
<td>0.13%</td>
<td>0.07%</td>
<td>0.19%</td>
<td>0.90%</td>
<td>7.62%</td>
<td>1.78%</td>
</tr>
<tr>
<td>Connected to Grid (Number HHs)</td>
<td>615</td>
<td>332</td>
<td>900</td>
<td>4,266</td>
<td>36,079</td>
<td>42,211</td>
</tr>
<tr>
<td>Total Spending (MK/month)</td>
<td>5,580</td>
<td>7,345</td>
<td>21,339</td>
<td>23,139</td>
<td>42,211</td>
<td>42,211</td>
</tr>
<tr>
<td>Energy Share of Total (2004)</td>
<td>8.78%</td>
<td>8.15%</td>
<td>7.53%</td>
<td>7.74%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Share After 27.5% Increase</td>
<td>10.45%</td>
<td>9.54%</td>
<td>8.57%</td>
<td>8.86%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMPACT of Increase (% of Budget)</td>
<td>1.67%</td>
<td>1.39%</td>
<td>1.04%</td>
<td>1.12%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: MALAWI Second Integrated Household Survey, 2004 (weighted). This table includes electrified households only and assumes electricity demand is relatively inelastic: price elasticity of demand = -0.15. There were very few electrified households in the sample in the poorest two expenditure quintiles in Lilongwe and in rural areas and none of these reported electricity use and spending from an electricity bill. As such, tariff reform could not be modeled for households in these expenditure groups.
### TABLE A-20 HH mem age betwn 7 and 18 * Boys&Girl 7-18 attending sch Crosstabulation

Count of school-aged children from urban electrified households

<table>
<thead>
<tr>
<th></th>
<th>.00</th>
<th>1.00</th>
<th>2.00</th>
<th>3.00</th>
<th>4.00</th>
<th>5.00</th>
<th>6.00</th>
<th>7.00</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH mem age betwn 7 and 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.00</td>
<td>137</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>137</td>
</tr>
<tr>
<td>1.00</td>
<td>25</td>
<td>91</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>116</td>
</tr>
<tr>
<td>2.00</td>
<td>1</td>
<td>19</td>
<td>77</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>97</td>
</tr>
<tr>
<td>3.00</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>4.00</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>10</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>5.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>6.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>164</td>
<td>113</td>
<td>95</td>
<td>45</td>
<td>30</td>
<td>11</td>
<td>1</td>
<td>2</td>
<td>461</td>
</tr>
</tbody>
</table>


### TABLE A-21 HH mem age betwn 7 and 18 * Boys&Girl 7-18 attending sch Crosstabulation

Count of school-aged children from urban non-electrified households

<table>
<thead>
<tr>
<th></th>
<th>.00</th>
<th>1.00</th>
<th>2.00</th>
<th>3.00</th>
<th>4.00</th>
<th>5.00</th>
<th>6.00</th>
<th>7.00</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH mem age betwn 7 and 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.00</td>
<td>419</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>419</td>
</tr>
<tr>
<td>1.00</td>
<td>84</td>
<td>143</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>227</td>
</tr>
<tr>
<td>2.00</td>
<td>13</td>
<td>33</td>
<td>129</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>175</td>
</tr>
<tr>
<td>3.00</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>68</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>88</td>
</tr>
<tr>
<td>4.00</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>34</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>46</td>
</tr>
<tr>
<td>5.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>6.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>7.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>517</td>
<td>181</td>
<td>151</td>
<td>77</td>
<td>37</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>979</td>
</tr>
</tbody>
</table>


### TABLE A-22 MALAWI LOWER RESP. INCIDENCE RATES by URBAN / RURAL

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.75%</td>
<td>5.33%</td>
<td>5.04%</td>
</tr>
<tr>
<td>Valid N</td>
<td>1,380,872</td>
<td>10,793,253</td>
<td>12,174,124</td>
</tr>
</tbody>
</table>

### TABLE A-23 MALAWI SECOND INTEGRATED HOUSEHOLD SURVEY SAMPLE FRAME

<table>
<thead>
<tr>
<th>DISTRICT</th>
<th>Urban</th>
<th>Rural</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lilongwe City</td>
<td>Other City</td>
<td>Lilongwe City</td>
</tr>
<tr>
<td>Chitipa</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karonga</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nkhata Bay</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rumphi</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mzimba/Mzuzu City</td>
<td>240</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Kasungu</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Nkhotakota</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>NMChisi</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Dowa</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Salima</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Lilongwe/Lilongwe City</td>
<td>480</td>
<td>960</td>
<td></td>
</tr>
<tr>
<td>Mchinji</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Dedza</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>NMCheu</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Mangochi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinga</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Zomba/Zomba City</td>
<td>240</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Chiradzulu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blantyre/Blantyre City</td>
<td>480</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Mwanza</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Thyolo</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Mulanje</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Phalombe</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Chikwawa</td>
<td></td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Nsanje</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Balaka</td>
<td></td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Table Total</td>
<td>480</td>
<td>960</td>
<td>960</td>
</tr>
</tbody>
</table>
### TABLE A-24 MALAWI SECOND INTEGRATED HOUSEHOLD SURVEY SAMPLE FRAME (weighted)

<table>
<thead>
<tr>
<th>DISTRICT</th>
<th>Urban Lilongwe City</th>
<th>Urban Other City</th>
<th>Rural Lilongwe City</th>
<th>Rural Other City</th>
<th>Rural - North</th>
<th>Rural - Central</th>
<th>Rural - South</th>
<th>Table Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chitipa</td>
<td>31008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31008</td>
</tr>
<tr>
<td>Karonga</td>
<td>47136</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47136</td>
</tr>
<tr>
<td>Nkhata Bay</td>
<td>38064</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>38064</td>
</tr>
<tr>
<td>Rumphi</td>
<td>28848</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>28848</td>
</tr>
<tr>
<td>Mzimba/Mzuzu</td>
<td>135192</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>27144</td>
<td>108048</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kasungu</td>
<td>118608</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>118608</td>
</tr>
<tr>
<td>Nkhotakota</td>
<td>60000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60000</td>
</tr>
<tr>
<td>NMChisi</td>
<td>44544</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>44544</td>
</tr>
<tr>
<td>Dowa</td>
<td>103248</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>103248</td>
</tr>
<tr>
<td>Salima</td>
<td>72792</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>72792</td>
</tr>
<tr>
<td>Lilongwe/Lilongwe City</td>
<td>393024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>141408</td>
<td>251616</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mchinji</td>
<td>86088</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>86088</td>
</tr>
<tr>
<td>Dedza</td>
<td>135840</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>135840</td>
</tr>
<tr>
<td>NMCheu</td>
<td>101712</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>101712</td>
</tr>
<tr>
<td>Mangochi</td>
<td>176328</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>176328</td>
</tr>
<tr>
<td>Machinga</td>
<td>101856</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>101856</td>
</tr>
<tr>
<td>Zomba/Zomba</td>
<td>161544</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>21720</td>
<td>139824</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiradzulu</td>
<td>67992</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67992</td>
</tr>
<tr>
<td>Blantyre/Blantyre City</td>
<td>216960</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>131856</td>
<td>85104</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mwanza</td>
<td>85104</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85104</td>
</tr>
<tr>
<td>Thyolo</td>
<td>163392</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>163392</td>
</tr>
<tr>
<td>Mulanje</td>
<td>37920</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>37920</td>
</tr>
<tr>
<td>Phalombe</td>
<td>71568</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>71568</td>
</tr>
<tr>
<td>Chikwawa</td>
<td>94224</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>94224</td>
</tr>
<tr>
<td>Nsanje</td>
<td>49824</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>49824</td>
</tr>
<tr>
<td>Balaka</td>
<td>70728</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70728</td>
</tr>
<tr>
<td>Table Total</td>
<td>141408</td>
<td>180720</td>
<td>251616</td>
<td>332976</td>
<td>145056</td>
<td>722832</td>
<td>2693544</td>
<td>918936</td>
</tr>
</tbody>
</table>