



Household Energy Use in Selected Areas in and around Polokwane

FINAL

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The research budget for the South African SAMSET project was allocated to household energy profile clarification. This was because experience in modelling the energy picture in South African cities over the past decade reveals that household energy use is poorly understood, and researchers have had to revert to data more than a decade old and apply coarse assumptions around the allocation of supply-side totals in the compilation and modelling of the household energy picture to date. Enhancement of this data situation is therefore important, especially given the need to prioritise energy poverty and achievement of the energy MDGs in sustainable energy interventions.

Introduction

SAMSET has been supporting the City of Polokwane in implementing its Energy and Climate Change Strategy and will be undertaking a LEAP¹ Energy Future Scenario modelling exercise. In order to build the LEAP model, detailed household energy consumption data is needed. Given current structuring of electricity and energy supply, there is no easy method to disaggregate energy supply down to final household consumption. A survey was thus undertaken, by Mthenthe Research and Consulting Services, across 250 households in pre-selected areas in and around Polokwane. The intention was not to be statistically accurate, but rather to provide quantifiable, indicative data of household energy consumption among low, middle and high income areas.

Methodology

Primary research on energy use among households in Polokwane was collected through face-to-face interviews with 250 respondents, using a questionnaire developed by Sustainable Energy Africa (SEA). The survey was conducted in 10 residential areas. The areas were selected to ensure a sample of respondents drawn from high income, middle income and low income communities, so that energy use and sources could be measured across different living standards and dwelling types.

Survey findings

Residential energy consumption in Polokwane has the following characteristics:

- Cooking, lighting and water heating are the main consumers of energy in a household.
- Most households (84%) make use of electricity, while households that are unelectrified make use of fuelwood, paraffin and gas among other fuel sources.
- Most unelectrified households are in the Eskom distribution areas the municipality has recently started working with Eskom in electrifying households in these areas.
- Energy efficient compact fluorescent lamps (CFLs) have not reached saturation rate.
- The dominant water heating appliance used is conventional geysers in high income households (53%) and the kettle in mid income (61%) and in low income (40%) households.

¹ LEAP – Long Range Energy Alternatives Planning: a modeling package enabling future energy scenarios to be explored

Electricity consumption

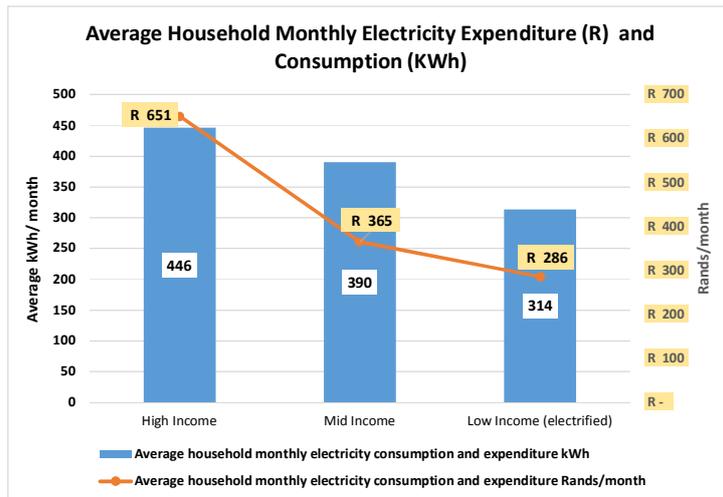
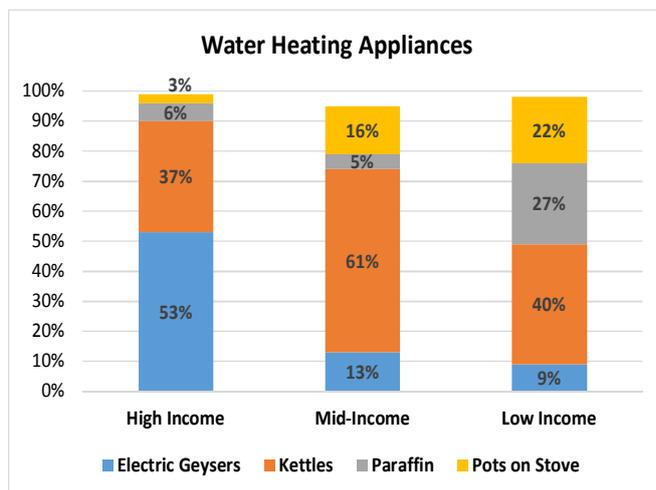


Figure 1: Average monthly electricity expenditure in Polokwane households

Expenditure on electricity varies with income groups. Low income households spend on average R286/month on electricity, mid-income (R365) and high income (R651) households. High income households consume on average 446kWh/month of electricity per month, and mid-income households on average consume 390kWh/month. Polokwane has a pro-poor electricity tariff structure and, together with the free basic electricity of 100kWh/month received by indigent households, enable good access by the poor to electricity. Poor households are spending about half that of wealthy households, but are able to access nearly three quarters of the amount of electricity.

²Water Heating Appliances



There is great potential for energy efficient water heating (solar water heaters and heat pumps) applications in Polokwane. In the low and mid income households it is clear that there is suppressed demand i.e. a low penetration of electric geysers. Once households in the mid & low income groups get to the point of affording electric geysers they would buy them. It is important that these households once they start investing in water heating appliances they invest in energy efficient appliances than the conventional non-efficient electric geyser.

² Suppressed demand is when household demand for basic services is low because people cannot afford them or there is a constraint on access or infrastructure, and not because of absence of consumer interest.

Housing Characteristics

Thermal insulation provided through the building envelope ensures that houses are kept cool in summer and warm in winter. A building's envelope consists of all the building elements which separate the inside from the outside. Heat losses through external walls and roofs account for more than 70% of the total heat losses in existing buildings. Therefore, improving thermal insulation is the most effective way to save energy. At the same time it will help improve thermal comfort. Poor thermal insulation in a house results in poor health (from cold, damp and the use of fuels with noxious gases indoors), and higher energy costs for the household.

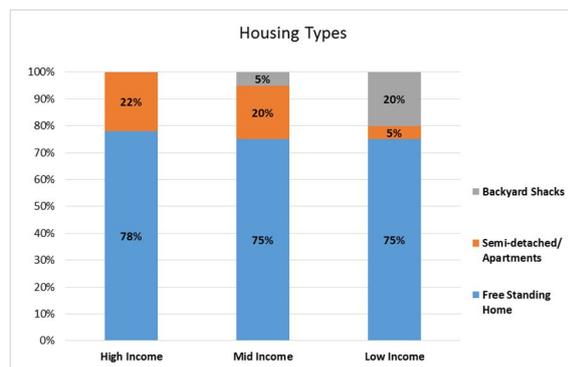


Figure 2a: Housing types in Polokwane

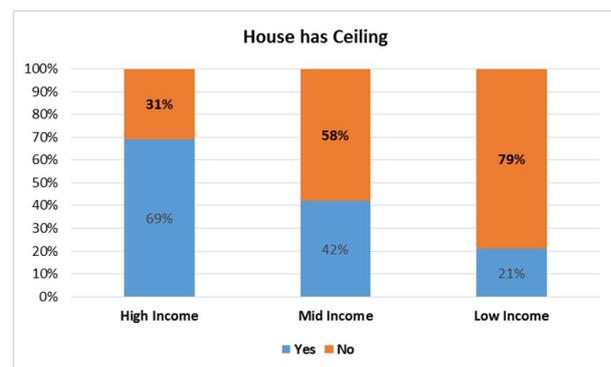
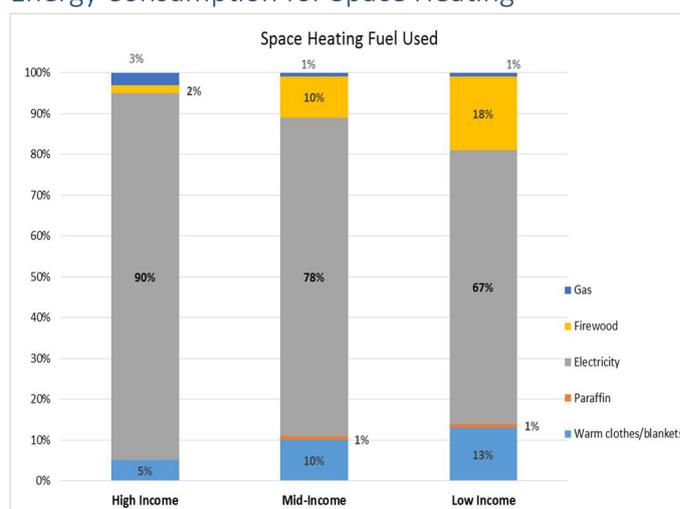


Figure 2b: Houses with ceilings

High income households in Polokwane are on average better insulated than both the mid and low income households. Poor people living mostly in informal housing (shacks) and those in government subsidised houses have little such insulation. Semi-detached housing does offer some thermal benefits. The low penetration (21%) of ceilings in low income households presents a huge potential for energy efficiency and improved thermal performance of the buildings once a ceiling retrofit programme is instituted in the municipality. Such a programme can be expanded to include mid-to-high income households.

Energy Consumption for Space Heating



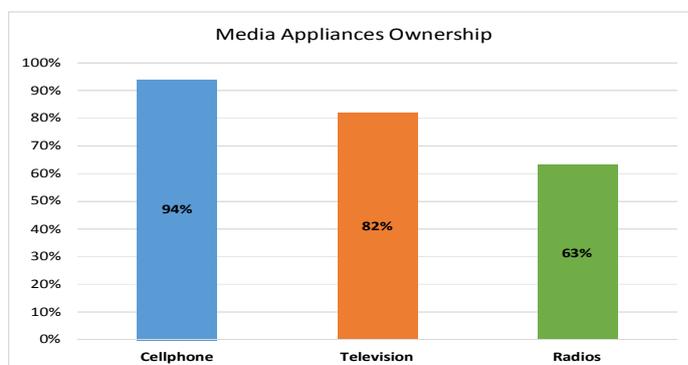
Space heating energy needs of households are partly a reflection of the poor thermal performance of the residential stock in Polokwane. However, there is a significant behavioural attitude of people that has to be considered around thermal comfort levels. People have different habits and expectations towards indoor thermal comfort and the means to obtain it. In low income households the use of different fuels or means to keep warm reflects suppressed demand.

Clothes washing



In Polokwane there is a low penetration of washing machines across all income groups. In future if these households were to buy washing machines it should be recommended that they purchase machines with a high energy efficiency rating on them i.e. A+ and higher.

Media Appliance Ownership



Households across all income groups use electricity to run 'media-related' appliances, such as cellphones, televisions and radios. These appliances however use less electricity compared to cooking and water heating for bathing.

Energy source for cooking in both electrified and unelectrified households

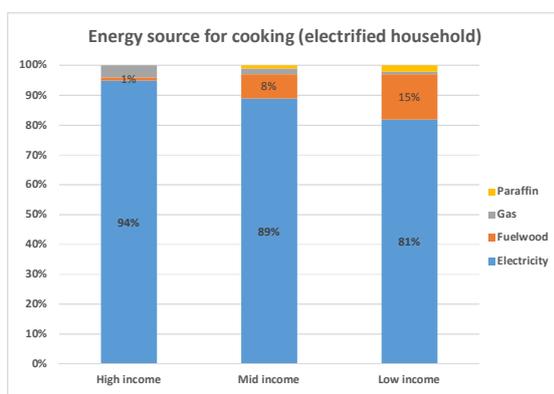


Figure 3a: Energy source for cooking in electrified households (Source: StatsSA, 2011)

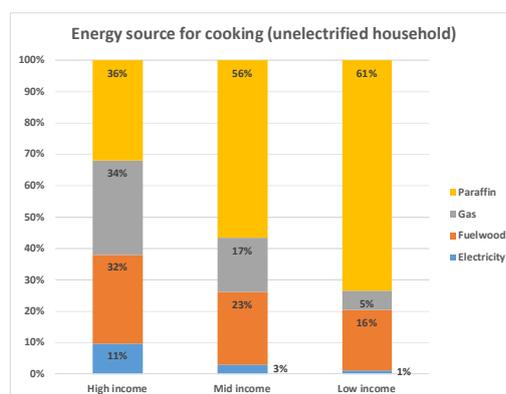


Figure 3b: Energy source for cooking in unelectrified households (Source: StatsSA, 2011)

According to the StatsSA (2011) electricity is the dominant energy source for cooking in electrified households across all income groups. Low income households display a higher fuel mix for cooking

purposes with significant proportions of fuelwood (15%) adding to the mix as well as paraffin (2%). In unelectrified households, across all income groups, paraffin is the dominant source of energy for cooking followed by fuelwood. Usage of fuelwood is also notable across the income groups however liquefied petroleum gas (LPG) usage is high (34%) in high income households than in both low and mid-income households. Indoor air pollution might be a big health concern in low income unelectrified households due to the indoor burning of polluting fuels (paraffin and fuelwood). In addition the high usage of fuelwood leads to concerns around deforestation taking place in and around Polokwane.

Lighting

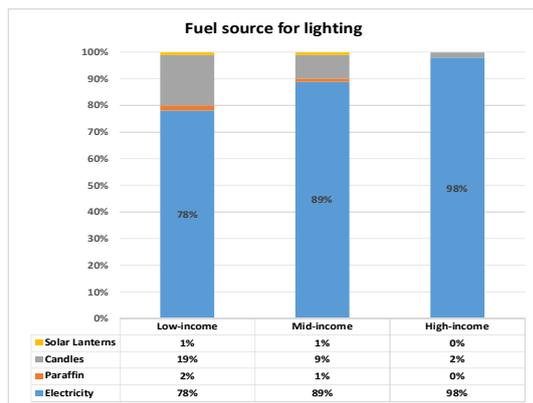


Figure 4a: Fuel source for lighting

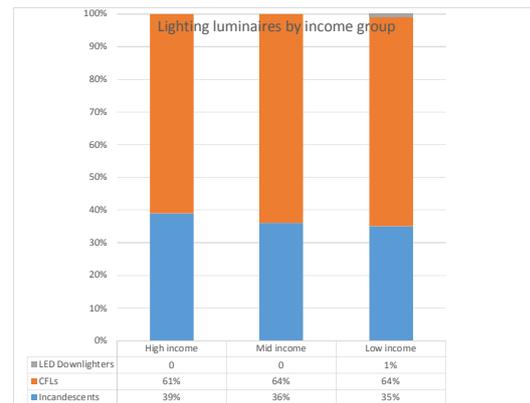
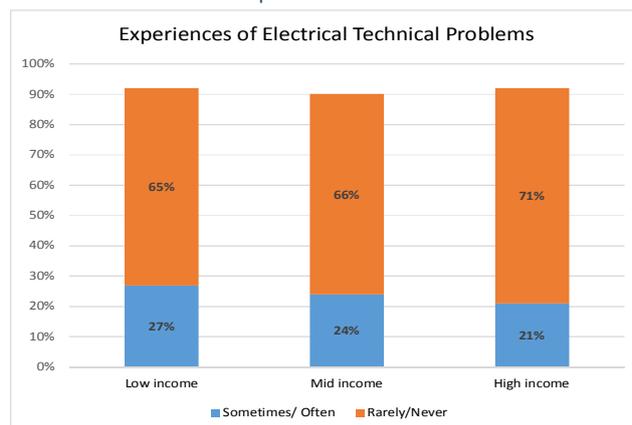


Figure 5: Lighting luminaires by income group

Electricity is the dominant source of lighting in households in Polokwane. Usage of candles for lighting is significant in unelectrified low income households (19%). Paraffin usage for lighting is very low across the municipality only unelectrified low income (2%) households are using it.

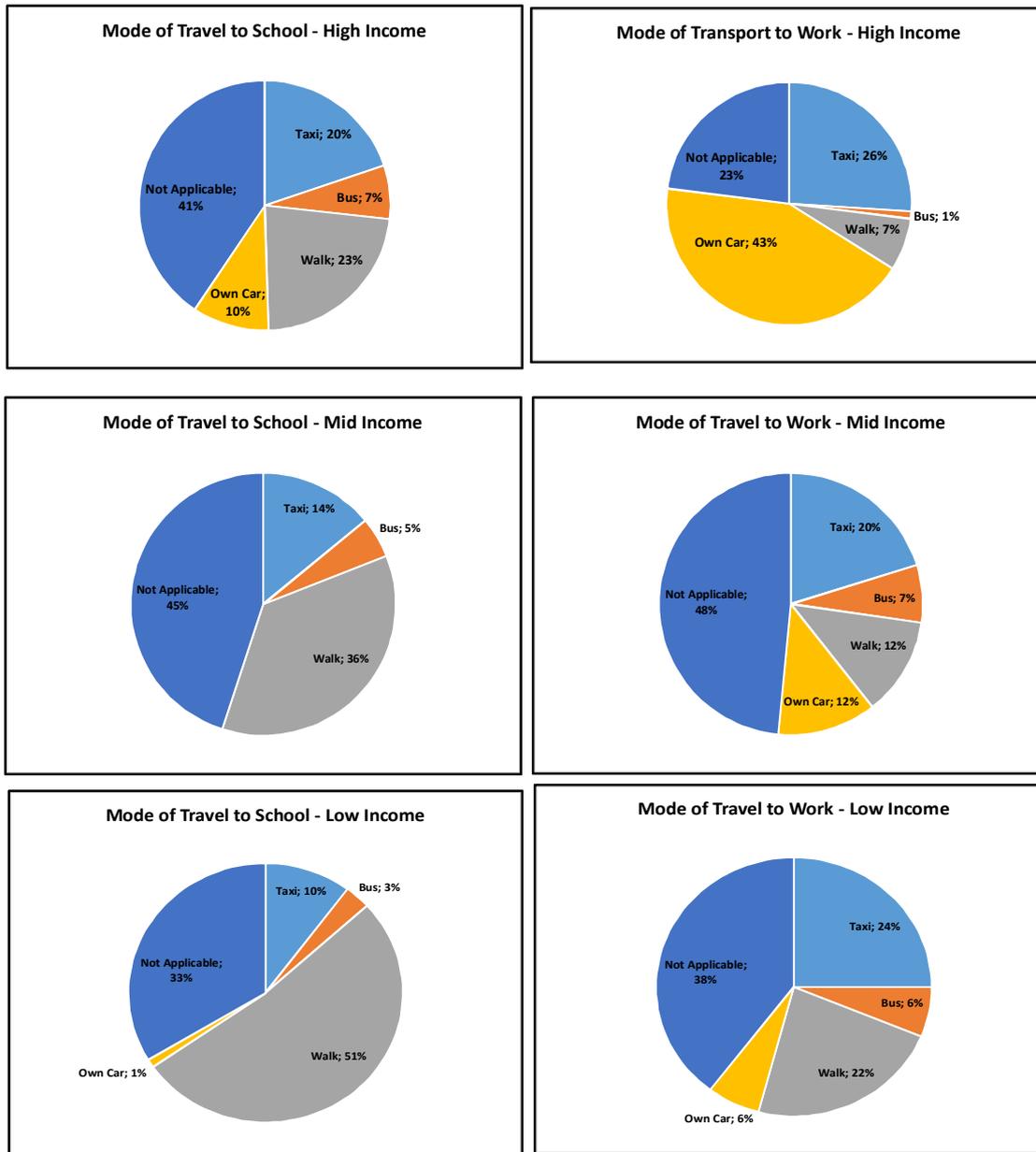
Electrical technical problems



Technical problems related to electricity supply were most often attributed to severe weather conditions such as wind and lightning. Several of these problems relate to the low amp (20Amp) connections provided to low income households. This also indicates the importance of ongoing system maintenance.

Transportation and Mobility

Mode of travel to either **school** or **work** by different income groups.



There is a significant culture of walking among households in Polokwane especially in the low and mid-income groups. There is a need to maintain this culture through proper planning ensuring that people live close to areas of economic activity, schools and public facilities. The municipality in collaboration with private business should promote cycling and cycle routes should be provide to ensure the safety of cyclists. Car sharing in high income groups should be encouraged so as to reduce the number of cars on the road and also save on overall energy consumption in the municipality.

Conclusion

This research contributes to a greater understanding of household energy consumption in Polokwane. Although the electrification rate is high in Polokwane multi-fuel use is common among low income households which might be a result of the high cost of electricity. In unelectrified households there is a high reliance on paraffin and fuelwood which will need to be addressed due to the health and safety associated with these fuel sources. There is a great potential for energy efficiency savings in the

municipality through energy efficient water heating and lighting in households. The municipality should aim to maintain and promote the culture of walking in the municipality and other non-motorised transport modes. This can be done through the planning for compact and walkable communities. The municipality can prioritise 'in-fill' developments close to areas of economic opportunity.

The municipality should look into improving the thermal performance of all households which can be achieved through a municipal wide ceiling retrofit project. A solar water heater rollout programme will greatly improve energy efficiency and reduce electricity peak demand. Gas is an important fuel source that can be promoted in the municipality for both cooking and indoor heating purposes. However, this is very much dependent on the availability of the gas and gas prices relative to electricity.