

# A study on the market potential of paraffin appliances in South Africa

A report prepared for the Basic Energy Climate Change  
Adaptation Programme (BECCAP) of GTZ funded by the German  
Ministry for Environment (BMU)

by

The Paraffin Safety Association of Southern Africa  
(PASASA)

Compiled by Robynn Paulsen, Glenn Truran and Dehran Swart

March 2010



## Executive summary

Paraffin is a widely used energy source in low income households in South Africa. Its popularity can be attributed to its comparative affordability to other energy sources; availability; convenience; versatility; and ease of purchase, transportation and use; and availability. Unfortunately, the unsafe and inappropriate use of paraffin is linked to high incidence of morbidity, and costs the economy billions of rand in externalities annually (Palmer Development Group, 2003).

GTZ BECCAP commissioned PASASA to undertake a market study to assess the potential size of the South African market for safe paraffin stoves. The objectives of the study are to determine the current practices of households using paraffin stoves for cooking and establish the related costs, identify the distribution chains for paraffin stoves and the associated consumer prices, and determine consumers' willingness to purchase safe paraffin stoves. The study extracts primary and secondary data from three different sources and is structured in three parts: a literature review, a summary of data from PASASA's National Household Energy Surveillance System introduced in 2007 and this quantitative study.

The cross-sectional quantitative study was undertaken in 18 low-income areas in South Africa. In total, 4 427 households participated in the study. Low-income communities were chosen for the study due to their generally high paraffin usage. A questionnaire was designed to determine household energy consumption and the appeal of safe paraffin appliances to the market. It included sections on demographic and socio-economic characteristics, household energy use and expenditure, the use of paraffin appliances, and the demand for improved paraffin appliances.

Evidence indicates that paraffin usage in South Africa is decreasing (Statistics South Africa, 2007) and may be attributed to the escalating cost of paraffin, limited availability of suitable appliances, increased access to electricity and the provision of free basic electricity. Despite this, the findings revealed that a significant proportion of electrified and unelectrified low-income households continue to use paraffin for domestic purposes. Furthermore, the National Household Energy Surveillance System data and current market research data revealed that paraffin usage and consumption in the surveyed areas has remained consistent since data collection commenced in 2007. Paraffin is typically purchased at spaza shops, while appliances are generally purchased at wholesale stores. Wick-based stoves were significantly more widely used than pressure stoves. The findings revealed that the decision to replace existing stoves with new paraffin stoves is primarily dependent on the old stoves' performance,

meaning the stoves' level of functioning and excessive smoking, and is less dependent on the age of the stoves. The majority of households replace paraffin stoves after more than a year of use, while others claim to do this more frequently. Stove characteristics such as quality, safety, affordability and energy efficiency were highly regarded by the paraffin using households. It is clear that paraffin appliances should possess a combination of these attributes to meet consumers' needs for affordable energy safety. The majority of paraffin users were willing to pay slightly more for improved appliances, but it was evident that the financial situations of low income households dictated purchasing choices. The findings revealed that households spend sizable proportions of income on energy. This is particularly true for lower earning households who spend a substantially larger proportion on income of energy than higher-earning households do. This large expenditure on energy may contribute toward households' interest in energy efficient appliances. The findings also revealed that energy consumption is not exclusive and that many households use more than one energy type to meet their cooking, heating and lighting needs. Furthermore, while access to electricity has increased from the data collected in 2007 to the current data collected as part of this market survey, paraffin usage and consumption remained consistent during this time.

The market potential for paraffin appliances in South Africa is vast, possibly amounting to between 2 million and 5 million South African households. The potential for this market to grow is very likely but will depend on variables such as energy policy; fluctuations in energy supply, demand and pricing; the improvement of competitiveness in the appliance market and supply chains; and improvement in the quality of paraffin appliances and the paraffin delivery system. The quality of appliances is possibly the most significant of these variables and is likely to play a major role in the demand for paraffin as a fuel. The second most significant variable will be the supply chain – it will have to be very lean to keep costs down because of the sensitivity to price of the particular market. The projected exponential growth of informal, substandard housing and the increasing cost of electricity will likely increase the demand for paraffin and paraffin appliances, and highlights the need for safe, affordable appliances. The availability of safe, affordable and efficient appliances could transform the paraffin market and improve the energy situation of indigent households.

## List of abbreviations

ASI	Area Specific Intervention
BECCAP	Basic Energy Climate Change Adaptation Programme
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HSRC	Human Sciences Research Council
MRC	Medical Research Council
PASASA	Paraffin Safety Association of Southern Africa
WHO	World Health Organisation

## Table of Contents

Executive summary .....	2
List of abbreviations .....	4
1. Introduction.....	7
2. Literature Review .....	8
2.1 Prevalence of paraffin use in South Africa.....	8
2.2 The role of domestic paraffin use.....	9
2.2.1 The social aspect of paraffin use.....	9
2.2.2 Poverty and energy .....	10
2.3 Multiple fuel use .....	10
2.4 Paraffin appliances.....	11
2.4.1 Paraffin appliances and safety .....	11
2.4.2 Paraffin appliances and energy efficiency.....	12
2.5 Distribution of paraffin appliances in South Africa.....	13
3. Data from the National Household Energy Surveillance System.....	14
3.1 Demographics .....	14
3.2 Domestic energy consumption .....	14
3.3 Paraffin purchase and consumption.....	15
3.4 Paraffin appliances.....	15
4. Methodology of Market Study .....	16
4.1 Population and sampling.....	16
4.2 Questionnaire design.....	18
4.3 Data collection and analysis .....	18
4.4 Ethical considerations.....	19
5. Results of the Market Study .....	20
5.1 Demographics .....	20
5.2 Domestic energy consumption and expenditure .....	21
5.3 Paraffin purchase and consumption.....	23
5.4 Frequency of paraffin use.....	24
5.5 Motivating factors for paraffin use.....	25
5.6 Paraffin appliances.....	25
5.7 Willingness to purchase safe, energy efficient paraffin appliances .....	26
5.8 Perceptions of the paraffin stove market .....	27
5.9 Comparison of key findings.....	27
6. Discussion and conclusion .....	29

7. References .....	37
Appendix 1. Questionnaire .....	41

### List of figures

Figure 1 Distribution of paraffin stoves.....	13
Figure 2 Distribution of monthly household income .....	20
Figure 3 Types of energy sources used .....	21
Figure 4 Mixed energy use for cooking, heating and lighting.....	22
Figure 5 Paraffin and electricity use among users.....	22
Figure 6 Distribution of energy expenditure by monthly household income .....	23
Figure 7 Households' interest in safe paraffin appliances.....	26
Figure 8 Views on the paraffin stove market .....	27
Figure 9 Paraffin sales and average prices by Quarter from 2004-2009 .....	31

### List of tables

Table 1 Percentage distribution of households paraffin use by function. ....	9
Table 2 List of areas and sample sizes .....	17
Table 3 Monthly household expenditure on candles, electricity and paraffin.....	23
Table 4 Distribution of paraffin prices across provinces.....	24
Table 5 Distribution of paraffin prices (per litre) across paraffin distributors .....	24
Table 6 Paraffin stove attributes ranked according to importance .....	26
Table 7 Key findings from PASASA's National Household Energy Surveillance System data and current GTZ data .....	28
Table 8 Product Life Cycle.....	33

## 1. Introduction

Presently, South Africa is immersed in an intense debate on energy. This issue was further propelled into public attention when the national energy provider, Eskom, was forced to introduce load shedding in 2008. This period highlighted the inconsistency in access to reliable and clean energy, and demonstrated the complex nature of this debate. The continual neglect of the poor's energy needs merely intensifies this state of poverty.

Despite government's accelerated electrification programme, paraffin remains a widely used energy source in South Africa. The growth of informal settlements both nationally and internationally exacerbate the need for safe household energy (United Nations Population Fund, 2007). It is unlikely that only electricity will be able to satisfy the household energy needs of South Africa especially as the present ESKOM crisis continues (insufficient generating capacity, ageing infrastructure, reliance on coal, high emission levels, financing challenges and hike in tariff structure, etc.). It is predicted that the demand for paraffin and other household energy sources will increase. Unfortunately, the unsafe and inappropriate use of paraffin is linked to high incidence of morbidity, and costs the economy billions of rand in externalities annually (Palmer Development Group, 2003). If safe, efficient and affordable paraffin appliances are made available, paraffin can play a vital role in alleviating the demand on electricity.

The aim of the study is to inform stakeholders regarding the market potential for safe paraffin appliances in South Africa. The specific objectives of the study are:

1. To determine the potential size of the South African market for safe paraffin stoves;
2. To understand the current practices of households utilizing paraffin stoves for cooking and the associated costs;
3. To identify distribution chains for paraffin stoves and the associated consumer prices;
4. To establish the consumers' willingness to purchase safe paraffin stoves and consumers' view regarding the estimated price for a safe product.

The sources of information used in this study included a literature review, analysis of data in PASASA's National Household Energy Surveillance System, and a quantitative market study.

## 2. Literature Review

Energy usage remains a fundamental component of domestic activities worldwide. This is largely due to the numerous services it provides. On a household level, these services typically include heating, cooking, and lighting. Approximately one-third of households globally does not have access to electricity and rely on other fuels to meet their domestic energy requirements (Shepherd & Perez, 2008). Research estimates on the domestic energy activities of South African households is limited; this is in spite of the dynamic conversations taking place on energy and energy policy (Aitken, 2007).

### 2.1 Prevalence of paraffin use in South Africa

Paraffin, or kerosene as it is known internationally, remains a widely used energy source in low income households in South Africa (Rukato, 2002). While accurate figures on domestic paraffin consumption are limited, it is estimated that over 4 million households use paraffin to meet their energy needs (Truran, 2004). Furthermore, evidence estimates that at least 60% of households with no access to electricity rely on paraffin (Rukato, 2002). A national study conducted by Markinor in 2004 estimated that 43% of South African households used paraffin as a domestic energy source (Markinor, 2004).

Various other local studies have investigated domestic paraffin consumption within specific areas of the country and projected usage to be high. A recent study conducted in four areas [Benoni, Galeshewe, Gugulethu and Lady Grey] estimated that 56-91% of households in these areas used paraffin (Roberts & Wentzel, 2006). Another study estimated that more than 70% of low income households in Durban used paraffin (Jones et al., 1996; Muller et al., 2003). Research conducted in Eshane, KwaZulu-Natal observed that 86% of households used paraffin and found no significant variation in consumption between electrified and non-electrified areas (Matzopoulos et al., 2006).

National studies conducted in recent years estimated paraffin usage to be decreasing, possibly due to increased access to electricity (Statistics South Africa, 2007). Their findings indicated a decrease in paraffin use with regard to cooking (2001: 21.4%; 2007: 14.8%), heating (2001: 14.6%; 2007: 13%) and lighting (2001: 6.8%; 2007: 5.3%) [Refer to Table 1 below for these figures].

According to Statistics South Africa (2007), 14.8% of households in South Africa use paraffin as their primary energy source for cooking; this equates to approximately 1.85 million households.



While this figure provides a solid foundation for estimating paraffin use for cooking, it underestimates paraffin use by disregarding the role of multiple energy sources.

Table 1 Percentage distribution of households paraffin use by function.

Purpose	Census 2001	Community Survey 2007
Cooking	21.4%	14.8%
Heating	14.6%	13.0%
Lighting	6.8%	5.3%

(Source: Community Survey 2007, Statistics South Africa)

Although the decline in paraffin consumption is widely attributed to the electrification of low income households since democracy, three further reasons can explain the decline in the demand of paraffin over recent years:

1. A reduction in the consumption of paraffin in the industrial and transports sectors (spiking of diesel in transport and industrial applications)
2. The increase in price of paraffin in recent years
3. The lack of availability of suitable appliances due to the introduction of rigorous standards and compulsory specifications.

## 2.2 The role of domestic paraffin use

Paraffin is widely used primarily because of its relative affordability; convenience; versatility; ease of purchase, transportation and use; and availability (Truran, 2004). Rukato (2002: 9) cites issues such as the “*decreasing availability of fuel wood in rural areas; increased urbanization; population growth; and wide availability from informal and flexible distribution networks*” as important reasons for the widespread use of paraffin. While domestic paraffin use is typically associated with low income households, evidence suggests that many higher income households also incorporate this fuel in their energy mix (Truran, 2009). Consumers generally purchase paraffin from retailers such as corner shops, wholesalers, petrol filling stations, spaza shops and general dealers.

### 2.2.1 The social aspect of paraffin use

Another approach asserts that social components of paraffin consumption should not be underestimated. This perspective regards paraffin as an entrenched feature of the social fabric of family life; its use has therefore become common sense in these communities (Banks,

1997). Banks (1997) asserts that communities regard paraffin as reliable, affordable and safe, and understand that paraffin itself is not inherently dangerous, but rather that congested living environments, the substandard quality of paraffin appliances, and the poor use of paraffin are the main culprits behind the fuel's tarnished image.

### 2.2.2 Poverty and energy

The level of poverty in South Africa is extensive and highlights the need for low cost domestic energy, a need that is likely to persist for many years. Despite increased electrification, numerous energy sources such as paraffin, coal and wood continue to be widely used by low income households (Muller et al., 2003; Panday & Mafu, 2007). The relatively low cost of paraffin in comparison to other energy types, the

ACCORDING TO THE HUMAN SCIENCES RESEARCH COUNCIL, 57% OF SOUTH AFRICANS LIVE BELOW THE POVERTY INCOME LINE (HSRC, 2004).

minimal setup costs, the higher cost of electrical appliances, and the indirect expenditure associated with electricity use promote paraffin consumption within households (Muller et al., 2003; Truran, 2004; Panday & Mafu, 2007; Roberts & Wentzel, 2006).

A review of household energy expenditure reveals the disproportionate energy expenditure between affluent and poor households. Evidence indicates that low income households spend as much as 25% of their monthly income on energy, while higher-income households spend as little as 2% of income on energy (Balmer, 2007).

### 2.3 Multiple fuel use

One perspective asserts that access to electricity reduces paraffin usage; however, evidence suggests that while households incorporate electricity into their energy mix, many continue to use paraffin and other energy sources (Panday & Mafu, 2007; Roberts & Wentzel, 2006; Truran, 2004; Winkler et al., 2006; Visagie, 2008). In addition, following electrification many low income households discover electricity use to be costly and revert to more affordable fuels (Rukato, 2002).

Evidence suggests that socioeconomic status largely influences the extent of multiple fuel use (Panday & Mafu, 2007). It suggests that indigent households are more likely to use wood and coal for thermal household tasks, and accompany these fuels with paraffin for lighting. Slightly higher on the energy ladder are households who use paraffin for cooking and heating, and

use electricity for lighting purposes. Highest on the ladder are households who use electricity exclusively as their primary household energy source (Panday & Mafu, 2007).

## **2.4 Paraffin appliances**

Paraffin has developed a reputation as a dangerous energy source (Lloyd & Truran, 2008). This reputation is largely due to malfunctioning paraffin appliances, unsuitable placement and storage locations, the use of contaminated paraffin, as well as the improper circumstances in which the fuel is sometimes used (Annegarn, 2008; Lloyd & Truran, 2008; Schwebel et al., 2009). Until recently, the paraffin market had seen an influx of unsafe paraffin stoves, which resulted in countless harmful incidents such as injury, death, and property damage. Paraffin-related incidents cost the economy billions of rand in externalities annually (Palmer Development Group, 2003).

Wick-based stoves and pressurized stoves are the two types of paraffin stoves dominating the market. Wick-based stoves are widely used given its affordability, reduced noise levels, convenience, and ease and safety of ignition. Alternately, pressurized stoves are sturdier, generally last longer, and are considerably more expensive than wick-based stoves (Panday & Mafu, 2007).

### **2.4.1 Paraffin appliances and safety**

The use of unsafe and unreliable paraffin appliances is associated with poor health outcomes, property damage, and financial loss. This is primarily due to the inherent design flaws of available appliances and the inappropriate use of paraffin. Burn injuries are one of the leading causes of childhood morbidity and mortality globally (WHO, 2008). A similar trend is present in South Africa; burn injuries are one of the foremost causes of non-natural deaths for children younger than 14 years (Burrows et al., 2001), and are closely associated with paraffin stoves (Eyal et al., 2007; Van Niekerk et al., 2009).

Unsafe stoves are associated with 40 000 – 80 000 household fires annually (Kruger, 2006). A review of fire incidents in Joe Slovo settlement in 2000 demonstrated that exploding/malfunctioning gas/paraffin appliances initiated 26% of fires (MRC/UNISA, 2003). A Markinor study conducted in 2001 reported that an estimated 46, 517 domestic paraffin-related fires had occurred the previous year. Furthermore, it estimated that approximately 50, 000 households had experienced a paraffin-related burn and that 63% of these burns is due to exploding paraffin stoves (Markinor, 2001). Data collected by PASASA's Injury Surveillance

System indicated that 29% of injuries treated at participating healthcare institutions<sup>1</sup> are related to paraffin; 66% of these injuries are burn injuries.

The use of paraffin appliances is commonly associated with an unpleasant smell of paraffin burning which permeates everything. PASASA has often been informed that children who come to school smelling of burnt paraffin are teased and accused of being poor. Very few realise that this unpleasant smell is not inevitable but rather a function of an appliance not operating optimally - a result of incomplete combustion of the fuel. If paraffin is at room temperature, it is relatively innocuous. Unlike liquefied petroleum gas, paraffin has to be raised to a temperature above its flashpoint, usually over 43 degree Celsius, before it becomes highly flammable and a direct fire hazard. Some of the illegal appliances allow paraffin in the reservoir (fuel tank) to heat up to 80°C where it becomes gaseous and explosive. Consequently, compulsory specifications (SANS1906:2006) have been developed for paraffin appliances to address the primary shortcomings;

- Prevention of leakage of fuel
- Self extinguishing if knocked over
- Ensuring the fuel tank does not get too hot (Fuel flash-point)
- The prevention of harmful emissions to the atmosphere
- Stability of the appliance
- Sufficient strength to support the pot/pan
- Cannot be filled when in use
- Will not burst into flames(conflagration)
- Will not burn the user when controls touched
- Safety instructions and pictograms

#### **2.4.2 Paraffin appliances and energy efficiency**

The availability and use of energy efficient paraffin appliances has numerous benefits. Household energy expenditure savings could be achieved by switching from energy that is more expensive (such as electricity) or from more wasteful paraffin appliances. The same reasoning should lead to reduced carbon emissions. Lastly, if paraffin appliances reduced peak electricity consumption at the right scale, the reduction in peak demand would assist with shortage of peak electrical generation capacity.

---

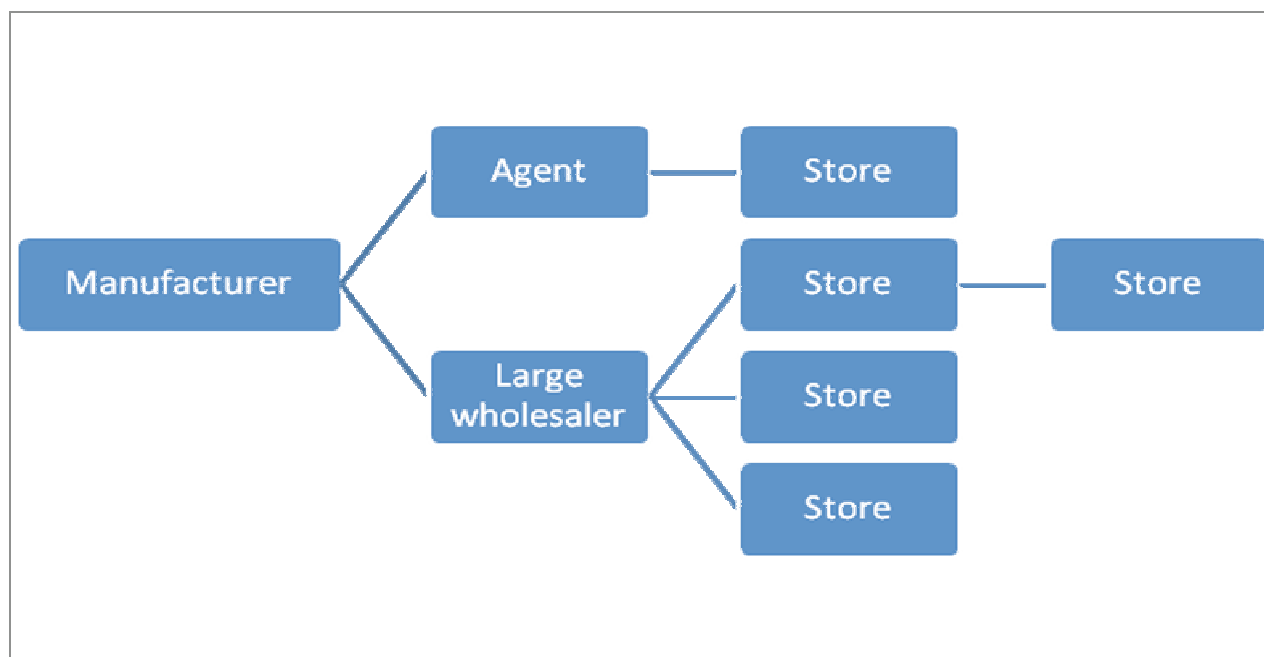
<sup>1</sup> Chris Hani Baragwanath Hospital, Dora Nginza Hospital, Edendale Hospital, Frere Hospital, Gompo A Clinic, Inkhosi Albert Luthuli Central Hospital, Kabokweni Clinic, Kimberley Complex Hospital, Pelonomi Hospital, Phola Nsikazi Clinic, Prince Mshiyeni Memorial Hospital, St Aidan's Hospital, Umlazi U Clinic.

In terms of the current energy efficiency of paraffin appliances, pressurized stoves are more efficient when measured on pure heat output, because less energy goes into vaporizing the paraffin. However, they are less efficient in cooking, because it is difficult to simmer on these stoves.

### 2.5 Distribution of paraffin appliances in South Africa

The distribution of paraffin stoves takes place primarily across two network structures. The first progresses from the manufacturer to the agent, and from the agent to retail outlets. In this network, manufacturers depend exclusively on agents within major areas to distribute appliances. The second network structures progresses from the manufacturer to large wholesalers and from there to retail outlets. It is not unlikely for retail outlets to distribute paraffin stoves to other retail outlets. The costs associated with the distribution of paraffin stoves are *“slightly higher than for other stoves...due to the size of the stoves once boxed and the inability to stack them one inside another”* (Palmer Development Group, 1998: 34).

Figure 1 Distribution of paraffin stoves



Source: PDG, 1998

### **3. Data from the National Household Energy Surveillance System**

Data from the National Household Energy Surveillance System was examined to develop a baseline understanding of domestic energy consumption in low income households, particularly with regard to paraffin, and to determine the market appeal of safe paraffin appliances.

PASASA initiated the National Household Energy Surveillance System in 2007 to collect data on the energy consumption patterns of households in PASASA's Area Specific Intervention (ASI) sites. More specifically, data was collected on the purchase, use and storage of paraffin; knowledge of the appropriate responses in the event of paraffin incidents; and the incidence of paraffin incidents in the home. A total sample of 5,614 households was surveyed. This section will provide a short summary on this data.

#### **3.1 Demographics**

This section summarizes household and socio-economic data. Most households have between 1-5 members (86%), earn a monthly household income of R1, 500 or less (83%), and live in houses constructed out of zinc or corrugated iron (85%). In terms of access to electricity, 64% of households are not electrified and 36% have access to electricity [22% are officially electrified and 14% are unofficially electrified].

#### **3.2 Domestic energy consumption**

The findings indicate that 94% of households used paraffin in their household energy mix. Candles, electricity and wood were other widely used energy sources. Households used paraffin primarily for cooking (85%), lighting (39%), and heating (37%). Two-thirds of households described their frequency of paraffin use as 'often'. On average, households use three to four different energy sources to meet their domestic energy requirements. This is consistent with research findings that suggest high rates of multiple energy usage in low income households. In addition, the data revealed that electrified households continued to use other energy sources in addition to electricity; 92% of electrified households continue to use paraffin and 60% of electrified households continue to use candles.

### **3.3 Paraffin purchase and consumption**

The majority of households purchased paraffin at spaza shops (78%). Seventy-six percent of households spent between R5-7.50 on a litre of paraffin; the average cost of a litre of paraffin was R6.89. In terms of weekly paraffin consumption, households use an average of 4.6 litres of paraffin weekly.

Households were questioned about whether they would continue using paraffin for cooking if supplied with electricity. Thirty-seven percent of households reported that they would continue using paraffin and cited its affordability (55%) as the primary reason. Other reasons included being familiar with cooking with paraffin (15%) and preferring the taste of food cooked using paraffin (11%).

### **3.4 Paraffin appliances**

This previously collected data highlights the remarkable popularity of the Panda brand; 89% of households reported using this brand of paraffin stove. "Panda" is used in the generic sense; any wick stove resembling the Panda brand is often assumed to be Panda, but in many cases is not. This creates challenges in identifying popular paraffin stove brands. In terms of expenditure on paraffin stoves, 95% of households had not spent more than R150 on their current paraffin stoves; of which 22% spent R10-50, 39% spent R51-100, and 35% spent R101-150. Appliance data collected by PASASA on paraffin appliances sold in retail outlets reveals that the average cost of a paraffin stove is R109. Wick-based stoves were used by 90% of households. In terms of stove age, 47% of paraffin stoves were used for longer than a year. Households were questioned on their willingness to purchase safe paraffin stoves and seventy percent agreed that they would. Of this group, 37% would pay an additional R50+ for such an appliance, while others were willing to spend an additional R10-49 (63%).

## 4. Methodology of Market Study

The nature of the study required a quantitative understanding of paraffin consumption and the market appeal of safe paraffin appliances. A cross-sectional survey was deemed most appropriate for the study. Data was collected in January 2010 in 18 low income communities in seven of the nine provinces in South Africa. In total, 4,427 households were interviewed.

A survey design was undertaken as it “is probably the best method available to the social scientist interested in collecting original data for describing a population too large to observe directly” (Babbie & Mouton, 2006:232).

### 4.1 Population and sampling

Households in 18 pre-selected low income areas were randomly selected for participation. The communities were chosen for the study as paraffin consumption is typically highest within these households. The motivation for selecting the areas includes 1) it forms part of PASASA's area specific intervention sites; 2) extensive knowledge, existing data and established networks in these areas; and 3) the combination of urban, peri-urban, and rural low income communities. The sampling process included random sampling within all subsections of the chosen areas. The sampling method was chosen to ensure that the data was representative of the entire area and not of only a subgroup of households.



Prior to data collection, two criteria for participation were identified: 1) participants needed to be older than 18 years and 2) needed to be involved in household decision-making. The



fieldworkers involved in the study were equipped to collect data by undergoing a training session offered by PASASA staff. During training, fieldworkers were educated on the process of data collection, the questionnaire, and the ethical considerations involved in data collection. The training ensured that fieldworkers were well informed and familiar with the questionnaire and were able to administer the questionnaire to participants. It was also important that fieldworkers were conversant in the languages spoken in the areas visited. This was necessary in the event that questions had to be explained to facilitate a better understanding of what was being asked.

Table 2 List of areas and sample sizes

	Area	Sample size
Western Cape	Site C, Khayelitsha	253
	Dunoon	226
	Masiphumelele	252
Eastern Cape	Duncan Village	240
	Walmer Township	251
Free State	Marabastad	247
	Bloemfontein	239
Mpumalanga	Mhluzi	200
	Kabokweni	249
Gauteng	Alexandra	261
	George Gogh	251
	Ivory Park	252
	Phomolong	254
North-West	Sunrise Park	249
	Wonderkop	250
	Luka	251
Kwazulu-Natal	Swapo	251
	Umlazi	251
N= 4,427		

## **4.2 Questionnaire design**

The questionnaire was designed to determine household energy consumption and the appeal of safe paraffin appliances to the market. The questionnaire was loosely based on previous questionnaires developed by PASASA, and included sections on demographic and socio-economic characteristics, household energy use and expenditure, the use of paraffin appliances, and the demand for improved paraffin appliances. In total, 32 questions were asked to participants. The majority of the questions were multiple choice questions, and many questions also allowed participants to add their own response if they felt an appropriate answer was not present. In designing the questionnaire, it was imperative that the language style was easy to read and understand. In addition, each fieldworker was given a document which explained each question and provided appropriate definitions for words or phrases that may have needed to be clarified to participants.

A pilot study was undertaken to test the questionnaire among a small group of households in Khayelitsha, Cape Town, Western Cape (n=20). The completed pilot questionnaires were reviewed to determine level of understanding of the questions, the presence of superfluous questions, and non-response to personal questions. The questionnaire was adjusted accordingly.

See Appendix 1 for questionnaire.

## **4.3 Data collection and analysis**

Two types of data were collected: primary and secondary data. Fieldworkers collected primary data. When visiting a household to be surveyed, the fieldworkers introduced themselves to the participants, explained the nature of the research and the participant's role, and the ethical considerations pertaining to participation. The questionnaire took approximately 30 minutes to complete. The data was captured into a database and analysed using statistical analysis techniques.

Secondary data was collected by undertaking a literature review and analyzing data previously gathered by PASASA (National Household Energy Surveillance System). The purpose of this secondary data was to develop a baseline understanding of domestic energy consumption in low income households, particularly with regard to paraffin, and to determine the market appeal of safe paraffin appliances.

#### **4.4 Ethical considerations**

It is important to PASASA that research is conducted in accordance with the ethical considerations applied to research. Participants were informed prior to participation that 1) their participation was voluntary, 2) they could discontinue the interview at any time, 3) the information they provided would remain anonymous and confidential, and 4) there was no risk in choosing not to participate. Participants who agreed to join the study were asked to sign consent forms highlighting these key ethical considerations.

## 5. Results of the Market Study

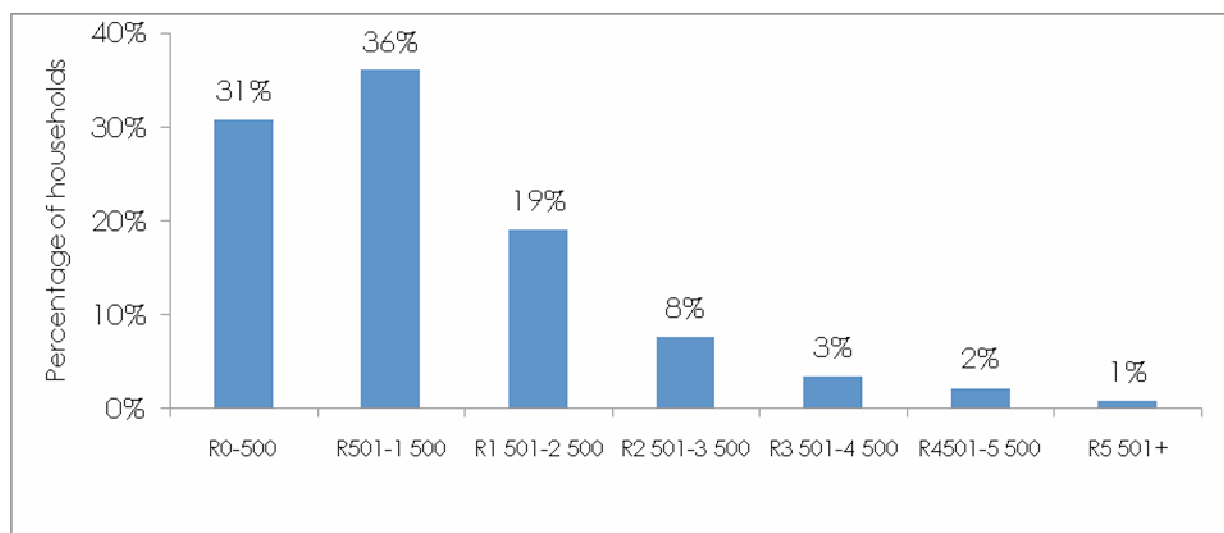
### 5.1 Demographics

This section provides a description of the sample (N=4,427). It reports on the gender of participants, number of household members, monthly household revenue and sources of income, as well as household condition and construction.

Two-thirds of the sample were female (66%). With regard to household composition, the majority of households comprised of five or fewer household members (80%), while 11% comprised seven or more household members. The average number of household members was three to four members.

Figure 2 illustrates the distribution of monthly household income. The income level of the sample was low; 86% of households earned less than R2, 500 monthly (2/3 earned R1500 or less per month) and 1% earned more than R5, 500 monthly. Households also reported on the sources of earnings contributing toward household income. Formal employment (27%), part-time work (25%) and welfare allowances and grants (24%) were identified as the leading sources of household income. Zinc or corrugated iron sheeting (65%) was the most widely used material in dwelling construction, while brick (17%), wood (8%), and mud (5%) were less extensively used. In terms of quality or standard of housing, most were described as moderate (43%) or poor (37%) in quality.

Figure 2 Distribution of monthly household income

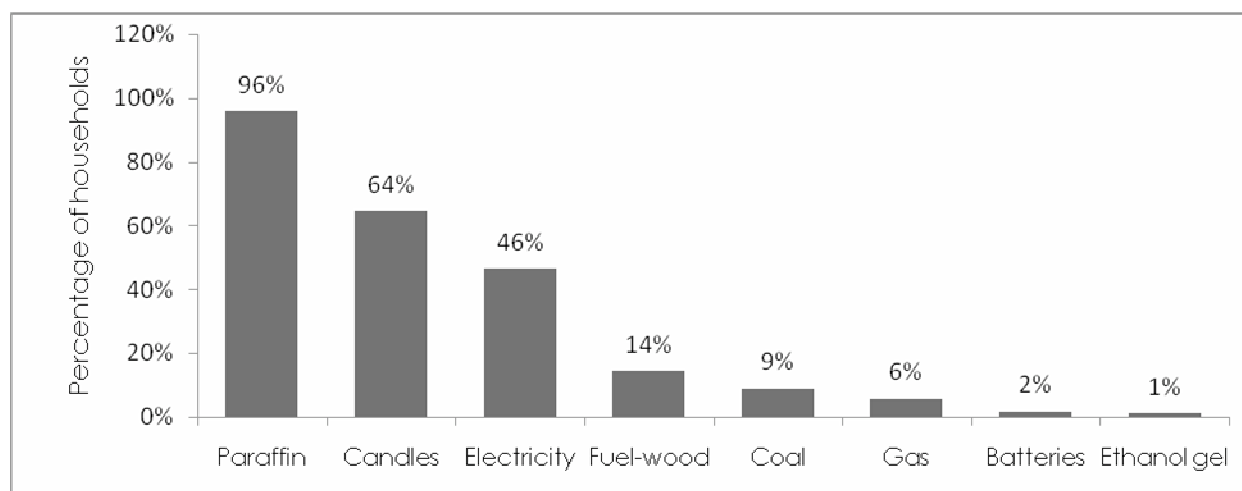


In addition, the results indicate that 52% of households do not have access to electricity; 30% are officially electrified and 18% are unofficially electrified. The proportion of households with access to electricity increased considerably from the baseline data (36%) to the current data (48%).

## 5.2 Domestic energy consumption and expenditure

Households were asked to identify the types of domestic energy sources used, as well as report on the purpose and frequency of use. Figure 3 illustrates the types of energy sources used by the sample.

Figure 3 Types of energy sources used



The data reveals the multiple energy types used by the sample. Paraffin, candles and electricity were popular energy types, while fuel wood, coal, gas, batteries and ethanol gel were less widely used. Paraffin is used primarily for cooking (85%), lighting (41%) and heating (32%). This finding differs from the Census 2001 and Community Survey 2007 data that reveals more paraffin users use paraffin for heating, rather than lighting (Statistics South Africa, 2007). The frequency of paraffin use is described as often (62%) or occasionally (33%).

Conversely, electricity-users reported using electricity for lighting (85%), cooking (73%) and heating (38%). The data revealed that many households used multiple fuel types to meet their energy requirements for cooking, heating and lighting. This data is illustrated in Figure 4.

Figure 4 Mixed energy use for cooking, heating and lighting

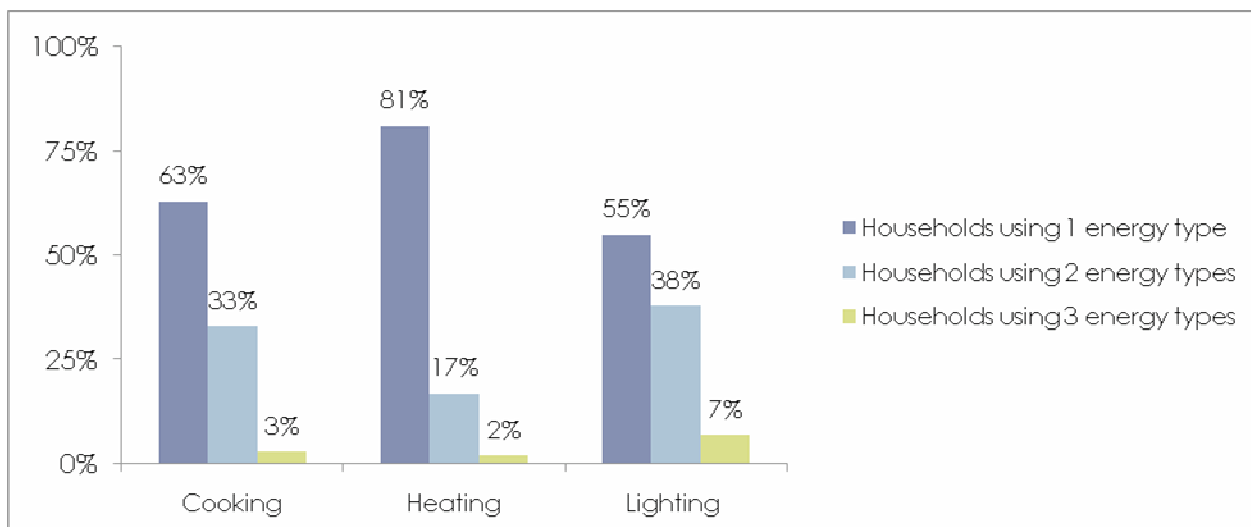
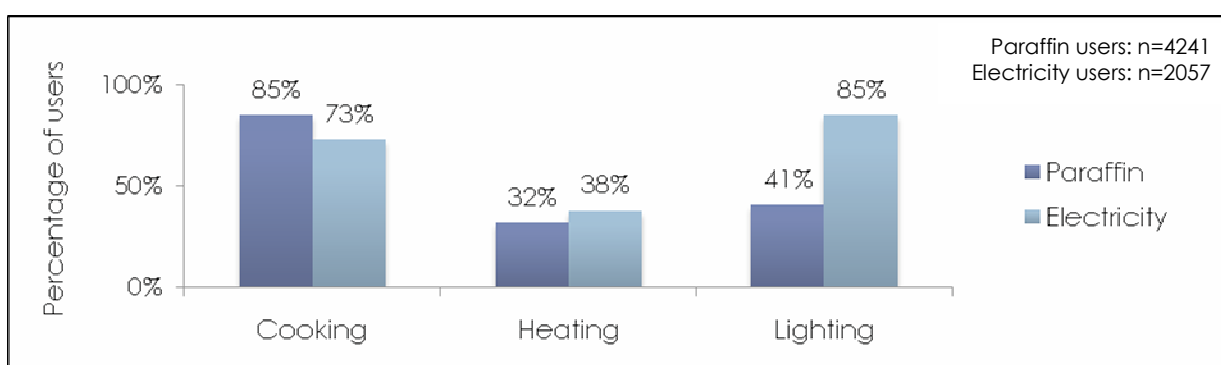


Figure 4 illustrates that while the majority of households used one energy source to meet their cooking needs, heating needs, and lighting needs, a considerable proportion used more than one energy source to meet these needs.

Figure 5 illustrates the energy consumption differences between paraffin-using households and electricity-using households. The mixed energy matrix incorporated by households denotes that many households may also be using both paraffin and electricity to meet their cooking, heating and lighting requirements.

Figure 5 Paraffin and electricity use among users



Households were asked to provide details on monthly household expenditure on energy during summer and winter. Paraffin, candles and electricity have been identified as the most widely used energy sources within the sample and therefore constitute the focus on this review. Table 3 illustrates the classification of these three energy sources by average monthly household expenditure in summer and winter.

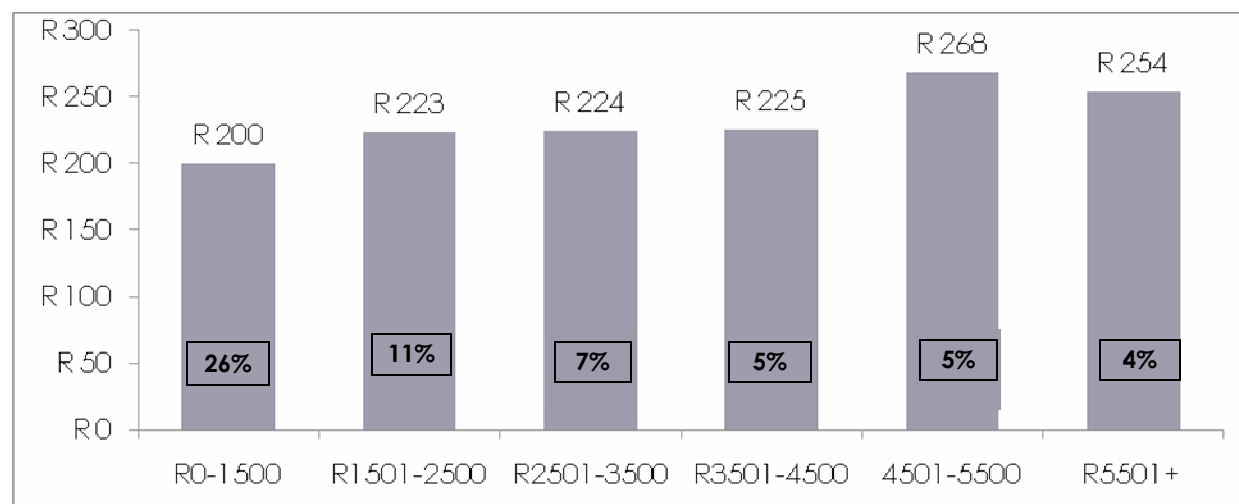
Table 3 Monthly household expenditure on candles, electricity and paraffin

	Summer	Winter	Percentage increase
Candles	R34	R41	21%
Electricity	R132	R170	29%
Paraffin	R94	R139	48%

Household expenditure on all three energy types increased from summer to winter. The table illustrates the largest percentage increase was for paraffin (48% increase). It suggests that household needs for paraffin increase considerably in winter, possibly due to increased heating.

Figure 6 illustrates average monthly expenditure across numerous income categories. It indicates that while household expenditure on energy is somewhat similar across most income categories, the percentage of income expended on energy is not. Lower-income households are spending an average of 26% of income on energy, while higher-income households are spending an average of 4% of income on energy.

Figure 6 Distribution of energy expenditure by monthly household income



### 5.3 Paraffin purchase and consumption

The results indicate that households purchase paraffin primarily at spaza shops (83%), while wholesale stores (8%) and retailers (5%) are less widely used. In terms of household expenditure on paraffin, 32% of households spent less than R20 weekly, 44% spent R20-39, and 24% spent

more than R40 weekly. The data also reveals that the average weekly consumption of paraffin is 4 litres in summer and 6.2 litres in winter.

Table 4 distinguishes between the costs of paraffin per litre across provinces. It illustrates that households in the Eastern Cape are paying less for a litre of paraffin than those in Mpumalanga.

Table 4 Distribution of paraffin prices across provinces

PROVINCE	PRICE PER LITRE	SAMPLE SIZE
Eastern Cape	R6.16	470
Kwazulu-Natal	R6.72	461
Free State	R6.95	462
Western Cape	R7.07	692
North-West	R7.08	670
Gauteng	R7.66	993
Mpumalanga	R8.19	421
MEAN	R7.17	4169

Table 5 illustrates the cost of paraffin per litre when purchasing from different paraffin retailers. It indicates that households that purchase paraffin at petrol stations and wholesalers pay less per litre than households that purchase paraffin from spaza shops, retail outlets, and neighbours. The number of households in the sample that purchase paraffin from petrol stations and neighbours is low; therefore, the findings should be used cautiously.

Table 5 Distribution of paraffin prices (per litre) across paraffin distributors

PARAFFIN RETAILERS	PRICE PER LITRE	SAMPLE SIZE
Other – Petrol Station	R5.90	81
Wholesaler	R6.86	319
Spaza shop	R7.20	3462
Retailer	R7.37	217
Neighbour	R7.82	62
MEAN	R7.17	4141

#### 5.4 Frequency of paraffin use

The study also investigated the frequency of paraffin use for cooking. The results indicate that 61% of paraffin users use this fuel daily for cooking, while others use it less frequently: few times



a week (14%), once a week (3%), few times per month (15%), once a month (2%), or a few times per year (5%).

### **5.5 Motivating factors for paraffin use**

Households were questioned on their reasons for using paraffin and cited the shortage of other energy options (53%), affordability (28%) and ease of purchase (27%) as leading motivators. Many households also considered paraffin a safe (21%) and versatile (19%) fuel, both of which contributed toward its widespread use.

### **5.6 Paraffin appliances**

The type of paraffin stove most popular is the wick-based stove (86%). The brand of paraffin stove most widely used is the Panda brand (79%). As mentioned earlier, "Panda" is used in the generic sense; any wick stove resembling the Panda brand is often assumed Panda, but in many cases is not. Households purchased paraffin stoves at wholesale stores (46%), retailers (27%) and spaza shops (25%). The data reveals that 75% of households spent less than R100 on their current paraffin stove, 20% spent between R101-150, and 6% spent more than R150.

The motivation to purchase new paraffin stoves is often dependent on the old stove's level of functioning (48%) and excessive smoking (31%), and is less dependent on the age of the stove (14%). Most households replace their paraffin stoves after more than a year of use (58%), while others claim to do this more frequently (42%).

Table 6 presents the overall importance of each attribute as ranked by the sample. It illustrates that 94% of households perceive quality to be most important when purchasing a new paraffin stove. Other important attributes include safety (92%), affordability (84%), and energy efficiency (76%). Brand (65%), durability (55%) and stability (49%), availability (48%) and appearance (39%) were considered less important qualities.

Table 6 Paraffin stove attributes ranked according to importance

ATTRIBUTE	% OF HOUSEHOLDS
Quality of stove	94%
Safety	92%
Affordability	84%
Energy efficiency	76%
Brand	65%
Durability	55%
Stability	49%
Availability	48%
Appearance	39%

### 5.7 Willingness to purchase safe, energy efficient paraffin appliances

Eighty-eight percent of households agreed that they would pay more for safe, energy efficient paraffin stoves. When probed on the amount they would spend on safe paraffin stoves, 66% of households were willing to spend up to R100, 26% were willing to spend between R101-150, and 9% were willing to spend more than R150. Households were also probed on the amount they would spend on energy efficient paraffin stoves, and 62% were willing to spend up to R100, 28% were willing to spend between R101-150, and 10% were willing to spend more than R150. The data reveals that while predicted expenditure on safe, efficient stoves will increase from present expenditure on these appliances, this increased expenditure is slight. It highlights the disparity between consumers' needs for improved paraffin appliances and their inability to afford the elevated costs of high quality appliances. A review of the data revealed no significant differences between income categories and interest in safe, energy efficient stoves.

Figure 7 Households' interest in safe paraffin appliances

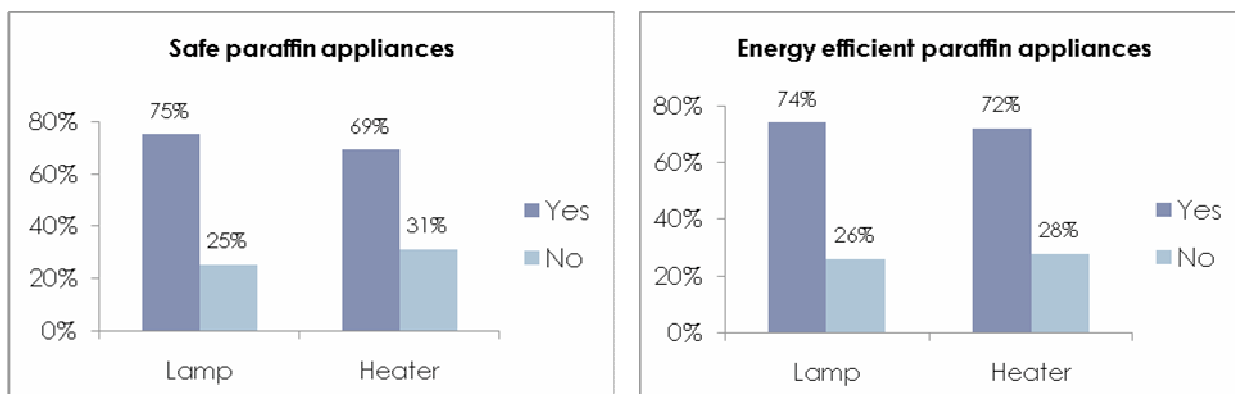


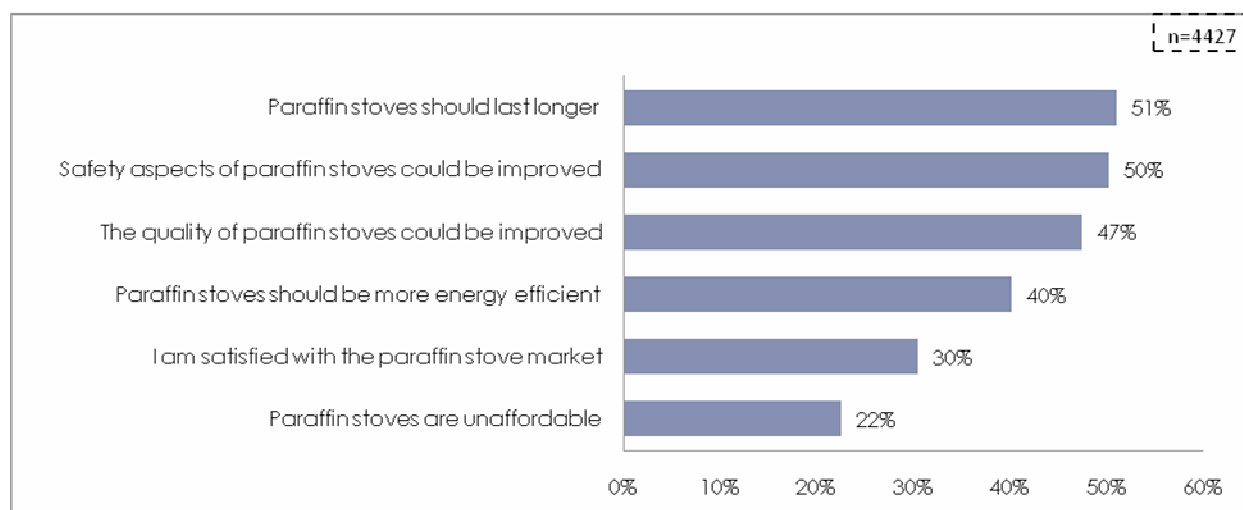
Figure 7 illustrates households' interest in safe, energy efficient paraffin lamps and heaters. Households were questioned on the appeal of safe, energy efficient paraffin appliances and asked to identify whether they would purchase such appliances.

Safe and energy efficient lamps garnered slightly higher interest than heaters. While this difference is not significant, it is consistent with the finding that more households are using paraffin for lighting than for heating. Projected expenditure on safe, energy efficient paraffin heaters reveals a similar trend to paraffin stoves. Most households are willing to spend up to R150 on an enhanced paraffin heater.

### 5.8 Perceptions of the paraffin stove market

Figure 8 illustrates households' perceptions of the paraffin stove market. It demonstrates that households are equally concerned about the durability (51%) and safety (50%) of paraffin stoves. The quality of paraffin stoves (47%) is another theme that consistently emerges.

Figure 8 Views on the paraffin stove market



### 5.9 Comparison of key findings

Table 7 illustrates the differences between PASASA's National Household Energy Surveillance System data and the current GTZ study data. The table demonstrates that the majority of variables have remained consistent. Noticeably, the percentage of unelectrified households has decreased, possibly as a result of the electrification programme. In addition, the average

weekly paraffin consumption has increased. It indicates that although more households have access to electricity, paraffin consumption has increased. Furthermore, the proportion of households that spends less than R100 on a paraffin stove has increased. This may be due to the impact of the economic recession on low-income households.

Table 7 Key findings from PASASA's National Household Energy Surveillance System data and current GTZ data

	Previous data*	Current data**
No access to electricity	64%	52%
% of paraffin users using paraffin stoves	85%	85%
% of households that purchase paraffin at spaza shops	78%	83%
Average cost for a litre of paraffin	R6.89	R7.17
Average weekly consumption of paraffin	4.6 litres	5.1 litres
% of households using wick based stoves	90%	86%
% of households that have spent less than R100 on paraffin stove	61%	75%

## 6. Discussion and conclusion

Previously, knowledge on the energy activities of households was limited. The study addresses this gap and expands understanding of, not only domestic paraffin consumption, but also domestic energy consumption as a whole. The objectives of the study was to 1) assess the potential size of the market for safe paraffin stoves, 2) determine the practices of households using paraffin stoves and establish the related costs, 3) identify the distribution chains for paraffin stoves and the associated consumer prices, and 4) determine consumers' willingness to purchase safe paraffin appliances.

### **Objective 1: To assess the potential size of the market for safe paraffin stoves**

This market survey was commissioned in order to assist potential entrepreneurs and investors in the paraffin appliance business to assess whether or not there is a market for paraffin appliances and who their customer is. Conducting surveys such as this one can provide only a limited view on the market potential in general. This is not same thing as the market potential for a particular safe paraffin appliance that is introduced by a particular manufacturer. Consumers identified in this survey will definitely buy paraffin appliances, but the survey will give you very little indication on whether or not they will buy a particular paraffin appliance.

This section will contextualise the information the survey provides in a broader range of information that investors will need before making specific paraffin appliance investment decisions. The investor will want to be as sure as possible that consumers will purchase the appliances in sufficient numbers and in a specific time period in order to receive a reasonable return on the investment. For this reason some basic business theory will be considered. Macleod (2001: 40) points out that an entrepreneur must first establish whether there is enough evidence that their product or service will survive in the face of competition. They must know for certain that it has features necessary for successful market penetration. They need to be sure that the market is large enough (market size) for their products (market share) as well as those of competitors. Furthermore, the entrepreneur should know where the market is in the product life cycle. Is it in a growth phase, has the market matured, or is it in decline?

The question is less about the size of the market, but rather how many sales entrepreneurs will be able to generate on an ongoing basis. Having a clear indication of the market size, product lifecycle and potential share of the market is nevertheless a key starting point.

## Market size

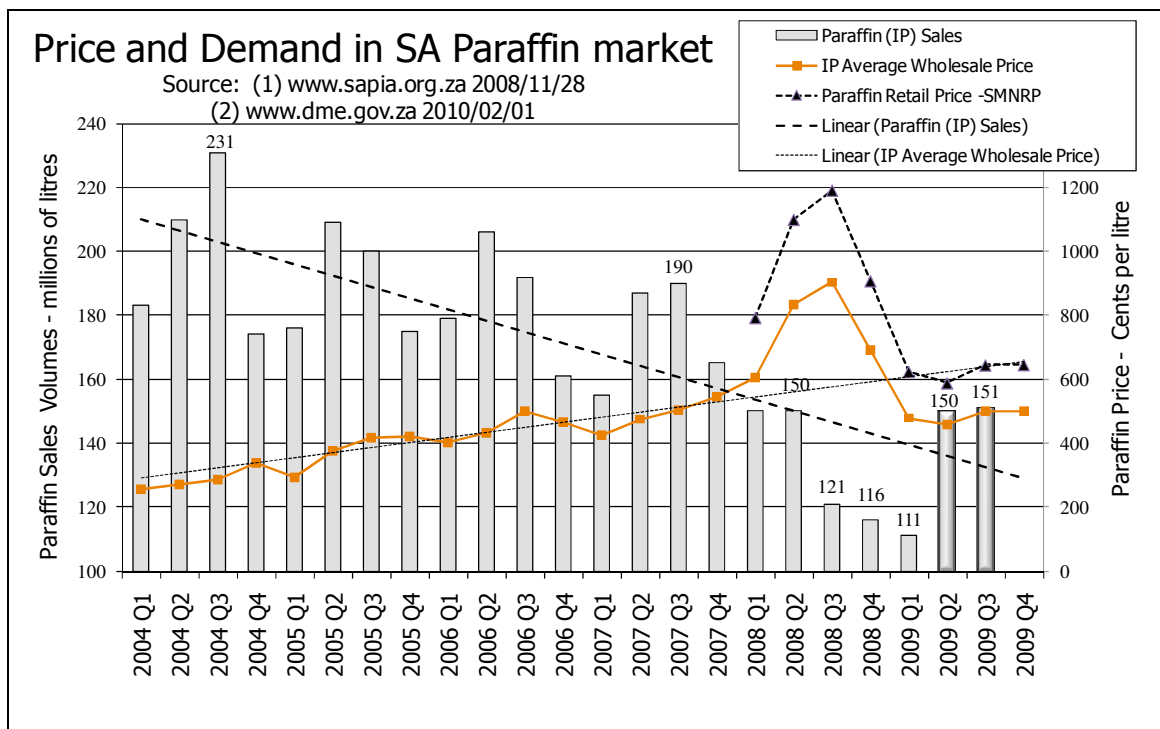
The sales of paraffin have been declining gradually in Southern Africa in the past decade. This could be attributed primarily to an increase in household living standards in general and increased electrification of low-income households in particular. Although most research indicates that many electrified households continue to use flame-based appliances for cooking and heating after electrification. Some researchers suggest that this decline in sales could have been exacerbated by the introduction of Free Basic Electricity (50kWh/month) on top of electrification in recent years. Illegal electrical connections (Bekker et al., 2008), government sponsored initiatives to exchange electrical appliances for LPG appliances, the introduction of compulsory paraffin appliance specifications and the subsequent clamp down on illegal appliances could also have contributed to the decline. What is irrefutable, however is that the recent sharp liquid fuel price increases has had a direct impact on paraffin consumption.

These factors, together with data from the Statistics South Africa (2007) suggest that the market is in the region of 2 million households. While such views are supported by the Community Survey data (Statistics South Africa, 2007) and energy experts such as Prof Philip Lloyd, PASASA assumes that the market for paraffin appliances is in fact larger and will grow in the near future. The data gathered in this paraffin appliance survey (section 5) and in previous PASASA surveys (section 3) suggest a more widespread usage of paraffin, albeit it in low income communities. These are the reasons:

- 1997 Paraffin Appliance sales estimates, based mainly on the views of the manufacturers at the time, was just over 3 million (PDG, 1998). The low income and urban populations have grown substantially since then.
- Statistics South Africa (2007) investigated the primary energy sources used in households and did not account for multiple fuel use. The estimates of paraffin use therefore only includes households that use paraffin above any other energy type, and fail to include households that use paraffin as a secondary energy type. We can estimate that the percentage of households using paraffin in South Africa is higher than the Census 2001 and Community Survey 2007 (Statistics South Africa, 2007) data projection.

- Urbanization in South Africa is rapidly escalating and is expected to lead to increases in informal, unplanned and substandard housing. This should increase the demand for affordable and safe paraffin appliances.

Figure 9 Paraffin sales and average prices by Quarter from 2004-2009



- Figure 9 shows that the average quarterly price of paraffin is steadily increasing after having plummeted to the levels seen in the first quarter of 2009. The IP average wholesale price trend line illustrates this clearly. However, the present average increase is far more gradual than it was and is increasing from a lower base than was the trend before price hike in the second quarter of 2008. Paraffin is therefore relatively “cheaper” than it was in the real and actual terms. This must make it more attractive as an energy option when other energy is escalating rapidly. This is evidenced by the marked rebound in paraffin sales recorded in 2<sup>nd</sup> and 3<sup>rd</sup> quarter of 2009. Given what we have learnt in this survey about household income, there is overwhelming evidence of a correlation between price and consumption in low income households. Demand should increase.
- At the same time, the cost of electricity has grown and will continue to grow exponentially (31% in 2009, 24.8% for 2010, 25.1% for 2011, and 25.9% for 2012). Electricity is becoming increasingly unaffordable for poor households.

- Eskom has acknowledged that it will not be able to meet the 2011 electricity demand without a focus on energy efficiency (Bloomberg, 2010). The Department of Energy may therefore be forced to take drastic steps to address the shortage of electricity generating capacity, including supporting the widespread introduction of safe paraffin stoves and heaters in order to reduce peak demand.

Based on the above factors the market potential could grow to 4-5 million households if safe appliances are introduced that people genuinely want to buy and can afford. The potential could even be larger if paraffin becomes a last resort strategy by government for demand side management in an electricity supply crisis.

### **Market Share**

“Market share” refers specifically to the share of the market by one appliance. No distinction is made between whether the appliance has a wick or pressure system or any other form of technology. Each manufacturer, according to Macleod (2001), must be sure that their appliances have the necessary features for successful market penetration. The obvious features are affordability and compliance with national regulations / standards – which specify safety and quality standards. These features **qualify** an appliance to compete in the market. Additional features will be required to ensure a profitable share of the market. Market share will be determined by differentiators such as;

- Efficiency (savings on fuel)
- Functionality (what else can the appliance do beside cook or heat air?)
- Ease of use (a pleasure to operate, compact to suite a small household environment)
- Aspiration – the stylish brand that everyone wants in their home because it looks good or says something positive about the home owner

Further market research will be necessary to identify which “differentiators” matter the most.

### **Product Life Cycle**

Product life cycle theory, according to Wikipedia (2010), has to do with the life of a product within a market with respect to business costs and sales volumes. The theory assumes that products have a finite lifetime. Sales volumes go through various stages during which profitability will rise and fall. Different strategies are needed in each phase in order to succeed in the prevailing conditions.



While recognising that this is simply a model with limitations whose validity for reality can be questioned, it is never the less useful as a description rather than a predictor. Product Life Cycle theory has been mentioned here because an understanding of which stage of the cycle paraffin appliances are in will help potential investors and manufacturers with a range of investment decisions.

Table 8 Product Life Cycle

Stage	Characteristics
<b>1. Market introduction stage</b>	<ol style="list-style-type: none"> <li>1. costs are high</li> <li>2. slow sales volumes to start</li> <li>3. little or no competition - competitive manufacturers watch for acceptance/segment growth losses</li> <li>4. demand has to be created</li> <li>5. customers have to be prompted to try the product</li> <li>6. makes no money at this stage</li> </ol>
<b>2. Growth stage</b>	<ol style="list-style-type: none"> <li>1. costs reduced due to economies of scale</li> <li>2. sales volume increases significantly</li> <li>3. profitability begins to rise</li> <li>4. public awareness increases</li> <li>5. competition begins to increase with a few new players in establishing market</li> <li>6. increased competition leads to price decreases</li> </ol>
<b>3. Mature stage</b>	<ol style="list-style-type: none"> <li>1. costs are lowered as a result of production volumes increasing and experience curve effects</li> <li>2. sales volume peaks and market saturation is reached</li> <li>3. increase in competitors entering the market</li> <li>4. prices tend to drop due to the proliferation of competing products</li> <li>5. brand differentiation and feature diversification is emphasized to maintain or increase market share</li> <li>6. Industrial profits go down</li> </ol>
<b>4. Saturation and decline stage</b>	<ol style="list-style-type: none"> <li>1. costs become counter-optimal</li> <li>2. sales volume decline or stabilize</li> <li>3. prices, profitability diminish</li> <li>4. profit becomes more a challenge of production/distribution efficiency than increased sales</li> </ol>

This table shows the "Product life cycle management" concept and outlines the implications. In order to decide which stage paraffin appliances are in, it is helpful to make a distinction between old generation (substandard) and new generation appliances where new generation appliances will be those that consistently meet the safety and quality standards set out by the SABS and by regulations enforced by the NRCS. Furthermore, "new generation" could imply appliances that meet consumer needs and desires in new ways that were previously not the case. Old generation appliances do not apply anymore and should not influence thinking on the maturity of the market for new generation appliances.

New generation appliances appear to have more in common with the description of stage one than any other phase where there is little or no competition and demand has to be created. The consumer has little understanding of the standards and regulations and does not or cannot truly distinguish between old, unsafe appliances and new generation appliances. Entry into the market now is unlikely to be profitable initially until customers have tried the products and realised that they do indeed improve their quality of life through the differentiators discussed in section 2.6 (if in fact the appliances in question do). The above statement may appear to contradict earlier statements about the demand for paraffin which is predicted to increase in demand. This means that the new paraffin appliance market, in a sense is an untested but very exciting market with huge potential.

The market potential for paraffin appliances is therefore vast and the potential for this market to grow is very likely but will depend on variables such as energy policy; fluctuations' in energy supply, demand and pricing; the improvement of competitiveness in the appliance market and supply chains; and improvement in the quality of paraffin appliances and the paraffin delivery system. The quality of appliances is possibly the most significant of these variables and is likely to play a major role in the demand for paraffin as a fuel. The second most significant variable will be the supply chain – it will have to be very lean to keep costs down because of the sensitivity to price of the particular market. While paraffin as a hydrocarbon fuel is a finite resource with a limited lifespan, it will play a major role in the meeting the thermal energy needs of households in developing nations for the next 30 years.

## **Objective 2: To determine the practices of households using paraffin stoves and establish the related costs**

The findings indicate that energy expenditure is substantial in low income households and disproportionate among the various income groups. Indigent households are spending much larger proportions of income on energy, while this proportion is substantially lower in higher-earning households. In addition, the percentage of households that use paraffin stoves older than a year has increased considerably. This may be the result of the impact of the economic recession on low income households. Unfortunately, the rising costs of energy will only exacerbate the financial burden on the poor.

The prominence of mixed energy usage in low income households indicates that energy consumption is not exclusive. Energisation or integrated energy provision refers to “*improving energy provision by using a combination of different fuels, rather than a single energy carrier such as electricity*” (Winkler et al., 2006:72). This new approach suggests a substitute to the

viewpoint that energy use should focus exclusively on electricity. While access to electricity has increased from the previously collected data to the current data, the proportion of households using paraffin remains consistent and weekly paraffin consumption has increased.

The findings indicate that households purchase paraffin predominantly at spaza shops within communities. The convenience, versatility, and proximity to the communities they serve augments the popularity of spaza shops. In addition, it limits additional expenditure on travelling. Purchasing paraffin at spaza shops is comparatively more expensive than purchasing at petrol stations or wholesale stores, but the convenience and diminished travelling costs make it the foremost choice. The high saturation of wick-based paraffin stoves may create challenges to increase the penetration of pressurized appliances. The "Diffusion of Innovations Theory" postulates that the decision to adopt technology is often dependent on perceived advantage, compatibility, complexity and observation. Consumers may be more inclined to change to pressurized stoves if they perceive it to be advantageous to their households, compatible with their needs, uncomplicated in usage, and can visibly observe the benefits of using these stoves above wick stoves. In addition to this, affordability of pressurized stoves plays a significant role in the adoption of these appliances.

### **Objective 3: identify the distribution chains for paraffin stoves and the associated consumer prices**

The selection of distribution chain for appliances will be a matter of strategic choice for marketers of appliances. Households may purchase paraffin at local spaza shops, but are more likely to purchase paraffin stoves at wholesale stores. While there is scope for small household energy entrepreneurs to emerge as energy advisors and suppliers of fuel and appliances, the existing channels are wholesale stores and retail outlets at taxi ranks. Carefully planned investments into paraffin appliances and paraffin delivery systems should pay handsome dividends in the long term. Such investment should also buy time for the inevitable development of renewable thermal technology for the needs of low income households.

### **Objective 4: To determine consumers' willingness to purchase safe paraffin appliances**

Establishing the attributes of paraffin stoves important to consumers assists in answering questions such as: How significant is brand loyalty to consumers? Is affordability more important than safety? Is quality more influential than energy efficiency? Interestingly, the findings suggest that while households theoretically choose quality and safety above

affordability, this may not be accurate in practice. The high penetration of wick-based stoves and the low expenditure households' are willing to pay for safe, energy efficient appliances suggests that affordability may be a far more significant factor than paraffin-users acknowledge. It is clear that paraffin stoves should possess a combination of attributes including quality, safety, affordability, and energy efficiency to meet consumers' needs for affordable energy safety. The majority of paraffin-users are willing to pay more for improved paraffin appliances, but households' low income levels impose limitations on their ability/willingness to pay high costs for appliances. One perspective suggests the reluctance of households to pay significantly more for safe, efficient paraffin appliances is primarily due to their impoverished circumstances and inability to spend large proportions of income on high cost appliances. Another perspective suggests that consumers display a lack of realism. On one hand, consumers want safe, efficient stoves but ignore that these improvements come at a higher cost. The paraffin stove market is significantly governed by affordability given the low socioeconomic position of paraffin users in South Africa. Paraffin appliances failing to meet consumers' needs in this regard may find it difficult to prosper in this market. If paraffin appliances meet consumers' foremost needs of affordability, quality, durability, safety and efficiency, the market potential is immense.

In summary, it is projected that as urbanization and the rapid growth of informal, substandard housing increases, the demand for paraffin and paraffin-fuelled appliances will intensify. These population changes highlight the need for safe paraffin appliances. The availability of affordable, safe and energy efficient paraffin appliances could considerably transform the paraffin market and improve the energy needs of the indigent communities.

### **Limitations of the study**

The study has several limitations. The first relates to data collection. Due to time and resource constraints, the questionnaires were not translated into the vernacular languages of the surveyed areas, and may have interfered with participants' understanding of questions. To control for this limitation, recruitment of data collectors specified proficiency in the vernacular languages of the areas surveyed. The second limitation of the study also relates to data collection. A convenience sampling method was used to establish the areas to survey. While this sampling method is not ideal, it was controlled for by introducing random methods of selecting households to visit.

## 7. References

- Aitken, R. (2007). Household energy use: a comparison of household energy consumption and expenditure across three provinces. *Journal of Energy in Southern Africa*, 18(1), 20-29.
- Annegarn, H. (2008). Energy, poverty and shadow cities. *Discourse*, 36(1).
- Babbie, E. & Mouton, J. (2006). *The practice of social research*. Cape Town, South Africa: Oxford University Press.
- Balmer, M. (2007). Energy poverty and cooking energy requirements: the forgotten issue in South Africa energy policy? *Journal of Energy in Southern Africa*, 18(3), 4-9.
- Banks, L. (1997). The social life of paraffin. *African Studies*, 56(2), 157-179.
- Bekker, B; Eberhard, A; Gaunt, T. & Marquard, A. (2008). South Africa's rapid electrification programme: policy, institutional, planning, financing and technical innovations. *Energy Policy*, 36, 3115– 3127
- Bloomberg. (2010). "Eskom unable to meet South Africa's power needs from 2011", Business Report on March 2, 2010, <http://www.busrep.co.za/index.php?fArticleId=5375269> ).
- Burrows, S., Bowman, B., Matzopoulos, R. & Van Niekerk, A. (2001). *A profile of fatal injuries in South Africa 2000; Second annual report of the National Injury Mortality Surveillance System*. Tygerberg: MRC-UNISA Crime, Violence and Injury Lead Programme.
- Chirwa, P.W., Ham, C. & Maphiri, S. (2008). *Baseline study determining consumer behaviour with regard to kitchen management and efficient cooking habits in South Africa*. The Programme for Basic Energy and Conservation.
- Eyal. A.S., Kemp, M. & Luvhengo, T. (2007). A 10-year audit of burns at Kalafong Hospital. *Burns*, 33, 393-395.
- HSRC. (2004). *Fact sheet: poverty in South Africa*.

- Jones, S., Aitken, R., & Luckin, L. (1996). *Power, poverty and posterity: the social determinants of energy use in low income metropolitan households in Durban*. Department of Minerals and Energy Report Number EO9422.
- Kruger, G. (2006). *Firebomb kerosene stoves without social bounds: addressing energy poverty in South Africa*. Paper presented at the Domestic Use of Energy Conference 2006.
- Lloyd, P.J. & Truran, G. (2008). *Safe paraffin appliances and their contribution to demand side management*. Paper presented at The Domestic Use of Energy Conference 2008.
- Macleod, G. (2001). *Starting your own business in South Africa*. Cape Town: Oxford University Press.
- Markinor. (2001). *Project Energy*. Report prepared for the Paraffin Safety Association of Southern Africa.
- Markinor. (2004). *Project Energy 2*. Report prepared for the Paraffin Safety Association of Southern Africa.
- Martins, J. (2005). The impact of the use of energy sources on the quality of life of poor communities. *Social Indicators Research*, 72, 373-402.
- Matzopoulos, R., Jordaan, E. & Carolissen, G. (2006). Safety issues relating to paraffin usage in Eshane, Kwazulu-Natal. *Journal of Energy in Southern Africa*, 17(3), 4-9.
- MRC/UNISA. (2003). *A review of paraffin ingestion and burns and interventions for paraffin-related injury reduction*. Report prepared for PASASA.
- Muller, E; Diab, R.D; Binedell, M; & Hounsome, R. (2003). Health risk assessment of kerosene usage in an informal settlement in Durban, South Africa. *Atmospheric Environment*, 37, 2015-2022.
- Palmer Development Group. (1998). *Cost structure and distribution chain of non-electric stoves in South Africa*. Department of Minerals and Energy.
- Palmer Development Group (PDG) in co-operation with Science Consultancy Enterprises. "Review of the effectiveness of energy subsidies and related taxation policies in South

- Africa" Final report, December 2003. National Treasury and Department of Minerals and Energy, Pretoria, pp.18 – 19 and page 82.
- Panday, S. & Mafu, S. (2007). *Limited choices: an exploratory study on paraffin use in KwaZulu-Natal*. Human Sciences Research Council.
- Roberts, E. & Wentzel, M. (2006). Household paraffin consumption in four areas: Benoni, Galeshewe, Gugulethu and Lady Grey. *Journal of Energy in Southern Africa*, 17(2), 23-26.
- Rukato, H. (2002). *Gender and energy in the south: a perspective from Southern Africa*. Background paper for the Expert Workshop "Gender perspectives for the Earth Summit 2002: "Energy, transport, information for decision-making".
- Schwebel, D.C., Swart, D., Hui, S.A., Simpson, J. & Hobe, P. (2009). Paraffin-related injury in low-income South African communities: knowledge, practice and perceived risk. *WHO Bulletin*, 87, 700-706.
- Shepherd, J.E. & Perez, F.A. (2008). Kerosene lamps and cookstoves – the hazards of gasoline contamination. *Fire Safety Journal*, 43, 171-179.
- Statistics South Africa. (2007). *Community survey 2007*.
- Truran, G.B. (2004). *The poverty dynamics of paraffin: exploring strategic counter measures*. Paper presented at the Domestic Use of Energy Conference 2004.
- Truran, G. (2009). Household energy poverty and paraffin consumption in South Africa. *Boiling Point*, 56, 2-6.
- United Nations-Habitat report. (2008). *The state of African cities 2008: a framework for addressing urban challenges in Africa*. UN-Habitat, Nairobi.
- United Nations Population Fund. (2007). *State of World Population*. Demographic Indicators.
- Van Niekerk, A.; Laubscher, R. & Laflamme, L. (2009). Demographic and circumstantial accounts of burn mortality in Cape Town, South Africa, 2001-2004: an observational register based study. *BMC Public Health*, 9(374).

Visagie, E. (2008). The supply of clean energy services to the urban and peri-urban poor in South Africa. *Energy for Sustainable Development*, 12(4), 14-21.

WHO. (2008). *World report on child injury prevention*. Geneva, Switzerland: WHO/UNICEF.

Wikipedia (2010). Product Life Cycle management. Retrieved 10 February 2010, from [http://en.wikipedia.org/wiki/Product\\_life\\_cycle\\_management](http://en.wikipedia.org/wiki/Product_life_cycle_management)

Winkler, H. (2006). *Energy policies for sustainable development in South Africa's residential and electricity sectors: implications for mitigating climate change*. University of Cape Town: Doctoral Thesis. Doctor of Philosophy.

Winkler, H., Borchers, M., Hughes, A., Visagie, E. & Heinrich, G. (2006). *Policies and scenarios for Cape Town's energy future: options for sustainable city energy development*. *Journal of Energy in Southern Africa*, 17(1), 28-41.



## Appendix 1. Questionnaire

### MARKET POTENTIAL OF PARAFFIN APPLIANCES IN SOUTH AFRICA

#### SECTION A: REFERENCE INFORMATION

<b>FIELDWORKER:</b>	<b>PROVINCE:</b>	<b>METRO AREA:</b>
<b>DATE:</b>	<b>SUBURB:</b>	<b>WARD CODE:</b>
<b>House Reference Number:</b>		

#### SECTION B: INFORMED CONSENT

##### **Note to participant:**

This study focuses on the market potential of paraffin appliances in South Africa. The questionnaire should take approximately 30 minutes to complete. The information you provide is confidential and will not be divulged for any purposes. We have randomly chosen you as one of the households in this area to be interviewed. Please understand that you are not forced to take part in this study. However, we would appreciate it if you share your thoughts with us. If you choose not to take part, you will not be affected in any way. If you agree to participate, you may stop at any time and tell me that you do not want to complete the interview. The study will pose no risk to you or to any other member of the community. All information that you give to us will be kept confidential. If you would like more information about this study please feel free to contact our head office at 021 6715767.

##### **Participant Consent:**

I hereby agree to participate in this research. I understand that I am participating freely and I can stop this interview at any point should I not want to continue. This decision will not in any way affect me negatively. I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

\_\_\_\_\_  
**Signature of participant**

\_\_\_\_\_  
**Date (DD-MM-YY)**

## Section C: SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS

1. Total number of people living in household:

--	--

2. Gender of participant:

Female

Male

3. Total monthly household revenue (including income, grants, gifts,...):

	R0 – R500
	R501 – R1 500
	R1 501 – R2 500
	R2 501 – R3 500
	R3 501 – R4 500
	R4 501 – R5 500
	R5 501 +

4. Sources of household income (tick all that apply)

	Formal Employment
	Welfare Allowance or grants (child, foster, disability)
	Pension
	Selling Products
	Farming
	Part-time work (piece jobs)
	Remittances (cash contribution by employed family members)
	UIF
	Other ( please specify)

## Section D: HOUSE DETAILS (Observation Section)

5. House Structure:

Brick       Zinc       Plastic       Tent       Other (specify) \_\_\_\_\_

6. In which condition is the house structure?      Good       Moderate       Poor

7. Is the house electrified?      Yes, officially       Yes, unofficially       No

## **SECTION E: PARAFFIN USE IN HOUSEHOLD**

8. Complete Sections A) and B) of the House Energy Usage table, one row represents one energy type.

Table 1: Household Energy Usage

Energy Type	A) Energy Type Used For <i>(tick all that apply)</i>			B) Frequency of use <i>(tick the appropriate if used)</i>		
	Cooking	Heating	Lighting	Often	Sometimes	Rarely
Candles						
Coal						
Paraffin						
Fuel - wood						
Electricity						
Ethanol Gel						
Gas						
Batteries						
Other						

9. How much do you spend monthly on the energy types used in your household in both summer and winter?

*Use energy types identified in Q8 and ask question for both summer and winter months.*

Energy Type	Summer	Winter
	R	R
	R	R
	R	R
	R	R
	R	R

**10. Where do you usually buy paraffin?** *Tick the box next to the answer that applies*

<input type="checkbox"/>	Spaza shop
<input type="checkbox"/>	Retailer
<input type="checkbox"/>	Wholesale store
<input type="checkbox"/>	Neighbour
<input type="checkbox"/>	Other _____

**11. How much do you spend on a litre of paraffin?** R\_\_\_\_.\_\_\_\_ / litre

**12. On average, how much do you spend on paraffin per week?**

*Tick the box next to the answer that applies*

<input type="checkbox"/>	Less than R20
<input type="checkbox"/>	R20-R29
<input type="checkbox"/>	R30-39
<input type="checkbox"/>	R40-49
<input type="checkbox"/>	R50+

**13. On average, how much paraffin does your house use per week?** *Circle one answer for summer and one answer for winter*

Summer	1 Litr e	2 Litr e	3 Litr e	4 Litr e	5 Litr e	6 Litr e	7 Litr e	8 Litr e	9 Litr e	10Litre	10+Litre
Winter	1 Litr e	2 Litr e	3 Litr e	4 Litr e	5 Litr e	6 Litr e	7 Litr e	8 Litr e	9 Litr e	10Litre	10+Litre

**14. Why do you use paraffin for your household energy needs?** *Tick all boxes that apply*

<input type="checkbox"/>	I have no other option
<input type="checkbox"/>	It is affordable
<input type="checkbox"/>	It is safe
<input type="checkbox"/>	It is convenient e.g. speed of cooking
<input type="checkbox"/>	It is easy to buy
<input type="checkbox"/>	It is easy to transport
<input type="checkbox"/>	It is versatile – can be used for heating, cooking, lighting etc.
<input type="checkbox"/>	It can be bought in any amounts
<input type="checkbox"/>	Other _____

## **SECTION F: PARAFFIN APPLIANCES**

### **15. When do you decide to purchase a new paraffin stove?**

*Tick the box next to the answer that applies*

<input type="checkbox"/>	Once your stove has reached a certain age (e.g. after a year of use)
<input type="checkbox"/>	Once your stove does not function properly
<input type="checkbox"/>	Once your stove starts releasing lots of smoke
<input type="checkbox"/>	Once a better stove is on the market
<input type="checkbox"/>	Other _____

### **16. Where did you purchase your last paraffin stove?** *Tick box next to answer that applies*

<input type="checkbox"/>	Spaza shop
<input type="checkbox"/>	Retailer
<input type="checkbox"/>	Wholesale store
<input type="checkbox"/>	Neighbour
<input type="checkbox"/>	Other _____

### **17. What type of paraffin stove do you currently use?** *Tick box next to answer that applies*

<input type="checkbox"/>	Wick-based non-pressure stove
<input type="checkbox"/>	Pressurized stove

### **18. Which brand is your paraffin stove?** \_\_\_\_\_

### **19. How much did you pay for the last paraffin stove you purchased?**

*Tick the box next to the answer that applies*

<input type="checkbox"/>	Less than R50
<input type="checkbox"/>	R51-75
<input type="checkbox"/>	R76-100
<input type="checkbox"/>	R101-125
<input type="checkbox"/>	R126-R150
<input type="checkbox"/>	R151-R200
<input type="checkbox"/>	R201-300
<input type="checkbox"/>	R301+

**20. How frequently do you use your paraffin stove for cooking?***Tick the box next to the answer that applies*

<input type="checkbox"/>	Every day
<input type="checkbox"/>	Few times per week
<input type="checkbox"/>	Once per week
<input type="checkbox"/>	Few times per month
<input type="checkbox"/>	Once per month
<input type="checkbox"/>	Few times per year

**21. On average, how frequently is your paraffin stove replaced?***Tick the box next to the answer that applies*

<input type="checkbox"/>	Every 1-3 months
<input type="checkbox"/>	Every 4-6 months
<input type="checkbox"/>	Every 7-9 months
<input type="checkbox"/>	Every 10-12 months
<input type="checkbox"/>	After more than a year

**22. When purchasing a new paraffin stove, which of the following qualities are the most important to you?***Rank **three** qualities that are most important to the participant in order of importance (1=first, 2=second, 3=third)*

<input type="checkbox"/>	Quality of stove
<input type="checkbox"/>	Affordability
<input type="checkbox"/>	Safety
<input type="checkbox"/>	Appearance
<input type="checkbox"/>	Energy efficiency
<input type="checkbox"/>	Availability
<input type="checkbox"/>	Brand of stove
<input type="checkbox"/>	Stability
<input type="checkbox"/>	Durability

**23. Please rate the following qualities on how important they are to you when buying a new paraffin stove. Please choose one answer per quality.**

	Very important	Important	Somewhat important	Not very important	Not at all important
Quality of stove					
Affordability					
Safety					
Appearance					
Energy efficiency					
Availability					
Brand of stove					
Stability					
Durability					

**24. Would you pay MORE for a safer paraffin stove?**

Yes

No

**25. If there was a safer paraffin stove, how much would you be willing to pay for it?**

*Tick the box next to the answer that applies*

<input type="checkbox"/>	Less than R50
<input type="checkbox"/>	R51-75
<input type="checkbox"/>	R76-100
<input type="checkbox"/>	R101-125
<input type="checkbox"/>	R126-150
<input type="checkbox"/>	R151-200
<input type="checkbox"/>	R201-R300
<input type="checkbox"/>	R301+

**26. Would you pay MORE for an energy efficient paraffin stove?**

Yes

No

**27. If there was an energy efficient paraffin stove, how much would you be willing to pay for it? Tick the box next to the answer that applies**

<input type="checkbox"/>	Less than R50
<input type="checkbox"/>	R51-75
<input type="checkbox"/>	R76-100
<input type="checkbox"/>	R101-125
<input type="checkbox"/>	R126-R150
<input type="checkbox"/>	R151-200
<input type="checkbox"/>	R201-300
<input type="checkbox"/>	R301+

**28. What are your views on the current status of the paraffin stove market?***Tick all answers that apply.*

	I am satisfied with the paraffin stove market
	I feel that safety aspects of paraffin stoves could be improved
	I feel that the quality of paraffin stoves could be improved
	I feel that paraffin stoves are unaffordable
	I feel that paraffin stoves should be more energy efficient
	I feel that paraffin stoves should last longer
	Other (specify)

**29. Are you interested in buying a safe paraffin:**

- a) Lamp                      Yes                       No   
 b) Heater                    Yes                       No

**30. If there was a safer paraffin heater, how much would you be willing to pay for such an appliance?** *Tick the box next to the answer that applies*

	Less than R100
	R101-125
	R126-R150
	R151-200
	R201-300
	R301-400
	R401-500
	R501+

**31. Are you interested in buying an energy efficient paraffin:**

- a) Lamp                      Yes                       No   
 b) Heater                    Yes                       No

**32. If there was an energy efficient paraffin heater, how much would you be willing to pay for such an appliance?** *Tick the box next to the answer that applies*

	Less than R100
	R101-125
	R126-R150
	R151-200
	R201-300
	R301-400
	R401-500
	R501+