

## Finally Breaking the Barriers: South African case study on LPG use by low-income urban households<sup>1</sup>

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### **(1) Abstract**

The year 2006 saw the beginning of electricity power cuts in South Africa which took the country by surprise and saw many households and businesses suffer as they could not meet their basic energy needs. Since the country relies mostly on coal-generated electricity because of its cheap nature, it was hard to adjust and find alternative and sustainable ways of providing energy services, especially for households. During this time, the Western Cape Province suffered the worst of times due to a number of reasons such as a mechanical failure of a major power station which made it clear to the Government and the state electricity utility company (Eskom), that urgent action was needed.

The paper will discuss energy services provided to people living in low-income households and communities of South Africa. It will further show that in most cases, people living in such conditions do not often have a choice of the type of fuel to use, especially when living in an urban area. They are often subjected to fuel and electricity price increases, unregulated fuel supply chain and the high cost of capital investment on appliances that could make their lives easier.

Improving energy efficiency was identified as the main strategy to be introduced to all electricity consumers. Compact Fluorescent Lamps (CFLs) were distributed free of charge in exchange for incandescent light bulbs in most urban households in a project funded by Eskom and Government.

A Liquefied Petroleum Gas (LPG) programme was rolled-out in low income urban areas. LPG 2-plate burners with 5kg gas cylinder and fittings were offered in exchange for electric hot-plate stoves (2-plate stoves) at no charge. Those living in high-income areas were encouraged to buy LPG appliances although prices were subsidized by Eskom and Government.

A year after the implementation of the programme, 89% of the surveyed households reported that they still used LPG for cooking, albeit not everyday. The study explored how this was achieved.

**Key words: South Africa, Khayelitsha, Liquefied Petroleum Gas (LPG), Paraffin, Electricity, Blackouts, Power cuts, Low-income households, Eskom, Department of Minerals and Energy (DME)**

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## **(2) Study Objectives**

The study's main objective was to deliver on the following results:

- An update based on primary data of fuel switching in urban areas
- An analysis of the impact of power outages on small and micro businesses in Khayelitsha
- An analysis of the impacts of LPG intervention with regards to perceptions, behaviour change and finances on low-income households in Khayelitsha
- Recommendations regarding the type of infrastructure needed to support consistent energy supply in low-income areas.

## **(3) Methods**

The field study was carried out in Khayelitsha Township in Cape Town, South Africa in 2007 as a result of the electricity power cuts that the country was experiencing, and for the first time, the problem was very severe in Cape Town. Khayelitsha was chosen because of its uniqueness in terms of population and settlement growth since its establishment in 1983 as a residential area for "Africans" under the then apartheid segregation policy (McDonald and Pape, 2002: 101). It is also a place that is affected the most by urbanization as people from the rural areas of the Eastern Cape Province first settle when they arrive in Cape Town to search for employment. Due to this, Khayelitsha has a variety of dwellings ranging from shacks built with a mix of corrugated iron, wood and other materials to free-standing brick houses provided through the governments' low-cost housing subsidy scheme and some bought by people through bank loans. This also means that there are a variety of households ranging from poor (mostly in shack areas) to well-off<sup>2</sup>.

Qualitative and quantitative data was collected with use of questionnaires and interview schedules with households and main stakeholders. Six fieldworkers were employed to conduct the surveys with the help of two supervisors. In total, 282 respondents representing households were interviewed to explore the type of fuels they were using, the impacts of electricity power cuts and particularly the use of LPG in their livelihoods. Three focus group discussions were conducted with people that did not participate in the LPG exchange programme, those that participated and those that have small home-based businesses which were affected by the power cuts.

The particular area in Khayelitsha where data was collected is referred to as Municipal Ward number 97 and is divided into three locations; namely: Mandela Park where 88 households were interviewed, Town Two where 107 households were interviewed and Makhaza with 87 households interviewed. These three locations have a mix of both formal (brick homes) and informal houses (shacks). The breakdown of the type of households interviewed is as follows: 214 formal homes, 50 informal homes provided with services such as electricity,

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<sup>2</sup> Very few households in Khayelitsha can be categorized as well-off. These are households that may be earning more than R10 000 or more per month with more than one household member employed. Education levels amongst these households are usually higher than in those earning lower incomes with earnings of less than R1600 (US\$257.23) per month (City of Cape Town, 2006:13-14).

sanitation and water and 18 informal homes without service provision<sup>3</sup>. The informal homes without services usually get their electricity connection informally by using extension cords which they connect to homes that may be across the road and have formally metered electricity connections. In turn, these households charge a fee to the informal homes, which is usually very high. To illustrate the level of service delivery amongst interviewed households, Table 1 shows the different electricity supply mechanisms and housing types within the sample.

**Table 1: Electricity connections in formal and informal houses**

Electricity	Formal House		Shacks	
	Frequency	Percentage	Frequency	Percentage
Metered	193	91%	58	85%
No electricity at all	13	6%	0	0%
Extension cord	7	3%	10	15%
<b>Total<sup>4</sup></b>	<b>213</b>	<b>100%</b>	<b>68</b>	<b>100%</b>

Source: Annecke et al, (2008: 07)

The main questionnaire was divided into three sections. The first section explored issues of household energy use prior to widespread electricity blackouts in 2006. These questions relied on the respondents' memory in recalling their energy use activities of a previous year. The second section of the questionnaire explored people's energy use during the electricity blackouts in 2006 where the main aim was to assess how LPG (and other fuels) was used by households in Khayelitsha. The third section then looked at households' current energy use patterns and expenditure on fuels.

#### (4) Results

Paraffin, candles, wood, LPG and electricity have always been fuels and energy sources associated with the energy mix of households in South Africa. Households living in low-income areas do not necessarily use all these fuels at the same time but have managed to assess their living and economic conditions and select the fuels that satisfy their basic energy needs. For instance, in a low-income rural household with an electricity connection, energy is used differently to a low-income household with an electricity connection in an urban area. Households in rural areas tend to use wood, plant residues and paraffin for their thermal energy needs such as cooking and heating. Electricity in these households is mostly used for lighting and entertainment such as providing power for a radio or a small television set (Cowan and Mohlakoana, 2004). In low-income urban areas wood use is not very common, except when the winter season is very harsh and households prepare braziers<sup>5</sup> often used to heat the homes or in cases where households are running home-based informal small businesses where they use wood for cooking. Households in low-income

<sup>3</sup> Informal homes without services are usually built in areas not approved by the municipality for people to settle or build houses. These structures are usually temporary but due to backlog in housing delivery and over population in urban areas, they may last up to ten years. In order to discourage people from building in these areas, the municipal authorities do not usually provide services to such households but due to the need and health hazards, they are sometimes provided with communal services, such as water and sanitation facilities.

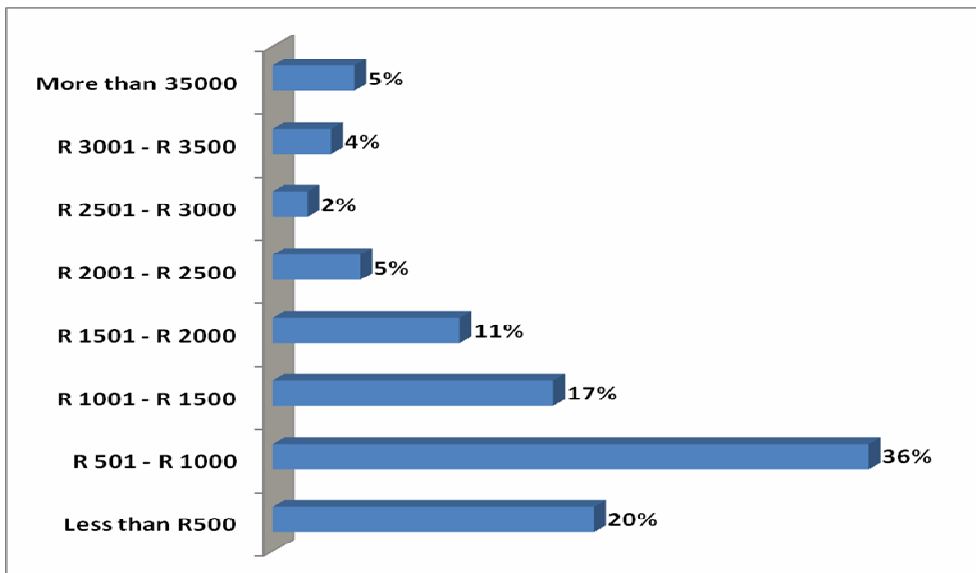
<sup>4</sup> One of the households did not respond to the "type of electricity service" question, hence the overall total is 281 instead of 282.

<sup>5</sup> Braziers are often referred to as imbawula in local languages and are prepared using wood, coal or any inflammable waste materials. This is usually prepared in a 25 litre metal container with holes all around. Once the fire is ready or has "stopped" emitting high amounts of smoke, the container is moved into the house to provide warmth.

urban areas often have almost all basic electrical appliances needed such as a two-plate stove, refrigerator, kettle, radio and television sets. These households often make sure that they have paraffin appliances such as the one-burner wick stove<sup>6</sup> and / or heater which are used when they are saving on their electricity supply or when they are cooking slow cooking meals.

In order to show the type of low-income households that were selected for this study, it is important to illustrate their incomes. Although, it is difficult for researchers to completely rely on income figures as they are often underestimated or exaggerated; when collected, these figures provide an indication of earnings for these households. Many households living in poverty in South Africa depend on social grants such as child grant, state pensions, welfare grants for people taking care of orphans, disability grants and grants given to people with terminal illnesses and HIV/AIDS. This study's sample was no different to the country's reality as 73% (205 households) of households interviewed (Figure A below) relied on such government social grants to survive and for some households, this is the only form of income that they receive.

**Figure A: Total income of the household per month**



Source: Annecke et al, (2008: 09)

Figure A shows that 36% of households surveyed in this Khayelitsha area earn an income between R501 (US\$80.5)<sup>7</sup> – R1000 (US\$160.7) per month and 20% live on an income of less than R500 (US\$80.3) per month which is below the poverty measure of R1200 (US\$193).

<sup>6</sup> The one-burner paraffin wick stoves available in South Africa for households to use are mostly unsafe and do not conform to the safety standards set by the South African Bureau of Standards. In 2007, the Government's DME with the assistance of the Paraffin Safety Association, recalled the unsafe stove and new and safe stoves are being manufactured.

<sup>7</sup> These figures are based on the July 2007 SA Rand / US Dollar exchange rate during the survey period i.e. US\$1 = R6.22 cents

The following sections will show the amount of money that people spend on household fuels given the amount of money they earn per month. The sections will also reveal the need for an urgent intervention for energy subsidies in order for people to better afford energy services that they need for basic household needs.

#### (4.1) Pre- Blackouts

The surveyed households revealed that before they experienced blackouts in 2006 they used very little LPG. In fact, out of all the surveyed households, only nine out of 282 said that they had used LPG regularly before the electricity blackouts. For cooking purposes before the blackouts, 87% of the surveyed households used electricity. Paraffin was also highly used for space heating by 84% of the households and by 12% of the households for water-heating.

During this time, households used a high amount of money on fuels for different end-uses. According to Table 2 below, the surveyed households used most of their income on paraffin than on any other energy sources such as electricity, LPG and candles.

**Table 2: Average amounts paid for energy per month per household size**

Average Energy used per Month	Size of the household		
	1 to 4 People	5 to 8 People	9 to 12 People
Paraffin	R 248.37	R 287.11	R 205.21
Electricity	R 70.55	R 93.00	R 80.23
LPG	R 5.41	R 3.14	R 3.14
Candles	R 4.53	R 11.11	R 6.80

Source: Annecke et al, (2008: 09)

For a number of years many people living in South African low-income households were persuaded to switch from cooking with paraffin and wood to LPG because it is a cleaner fuel and was a cheaper alternative, until the high oil price influenced the market. According to Integrated Energy Solutions (IES, 2007), cooking with LPG has a number of benefits for households. These are as follows (IES 2007: 4):

- “Gas is an acclaimed and preferred cooking fuel internationally,
- Gas is clean, controllable, fast and efficient,
- The hob heating settings on Gas appliances are more precise compared to low-standard electrical hobs,
- With Gas, one pays for what they use, they is no loss of heat unlike with other fuels,
- Gas is safe and has an international safety record unlike electricity and other commercial energy sources,
- It is portable and can be stored safely, and,
- Gas appliances generally last longer if used correctly”.

Previous studies in household energy research (Mehlwana and Qase, 1998) showed that people perceived LPG to be a dangerous fuel, saying that unlike paraffin, it poses a greater

danger to the household as there are chances of it “exploding”, if used incorrectly (Cowan and Mohlakoana, 2004). Surprisingly, as a result of electricity power cuts in 2006, people in low-income communities, readily accepted LPG stoves in high numbers and a year later, up to 89% of the households surveyed, reported still using LPG for cooking.

The results from the households surveyed in Khayelitsha showed that prior to the electricity power cuts, 84% of the surveyed households used paraffin for space-heating, 12% for water-heating and 10% for cooking. During this time, an average household with 1-4 people spent R248.37 (US\$39.93) per month on paraffin which was much higher than other fuels available at that time.

#### **(4.2) During Blackouts**

Although electricity power-cuts are still an everyday experience for South Africans with planned load-shedding taking place everyday in order to reserve electricity supply. In 2006 when the blackouts were first experienced in the Western Cape, government was under pressure to provide alternative energy services for households and businesses. Households in low and high income areas experienced power failures and businesses lost large amounts of money, especially those dealing with perishable products (O’ Connor, 2006) The Governments’ Department of Minerals and Energy (DME), Eskom and various local municipalities embarked on a strategy to rectify the problem. In 2006, a government funded initiative driven by Eskom’s Demand Side Management introduced CFL’s to all households in the Western Cape Province to reduce electricity demand in the area. According to Eskom, this initiative in one province only managed to save 131 MW, enough to power 81 875 average homes (Eskom 2008). This would also ensure that electricity was distributed accordingly and that there would be enough for the province especially during the winter period. The CFLs were distributed to households in exchange for incandescent light bulbs. The CFLs are three to four times the price of incandescent and this was “not” at any cost to the households. The programme was well received by households as this was seen as a national emergency and people felt the need to play a role in conserving electricity. However, the sustainability of the programme is still questionable especially in low-income areas where households still find it difficult to purchase CFLs because of their high costs. After their CFLs have fused or can no longer be used, these households eventually go back to using incandescent light bulbs as they are still available on the market at a much cheaper price.

Another initiative spear-headed by the national electricity utility, Eskom in 2006 to reduce the electricity load and peak demand was to introduce at least 100 000 households in low-income areas of Cape Town to LPG use for cooking during peak times. This was done through appointing service providers that collected two-plate electricity stoves in exchange for two-burner gas stoves including a 5kg or 5,2 kg cylinder, three vouchers<sup>8</sup> worth R30 each and all the required fittings. When this process was initiated it was with the belief that most households use electricity for cooking during evening peak times, which according to Eskom is around 18h00 when people get home from work.

Table 3 below shows that the cooking times for households surveyed changed after the LPG intervention with 84% of the households cooking their main evening meals later than what they used to. The main reason given by the surveyed households for the change in cooking times is that they found it easier and quicker to cook when using LPG.

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<sup>8</sup> Vouchers were given to households to encourage them to use LPG and to help them pay towards the costs of refilling their cylinders. At the time of research a kilogram of LPG cost around R10 (US\$1.60).

**Table 3: If the cooking time changed, did you cook earlier or later than usual?**

How did the time changed?	Count	Percentage
Earlier	24	16%
Later	129	84%
<b>Total</b>	<b>153</b>	<b>100%</b>

Source: Annecke et al, (2008: 09)

During the electricity power cuts, 51% of households surveyed used paraffin for various energy end-uses. Some of the households used LPG and electricity (when it was available). It did not help much that during the power cuts, there was also a shortage of LPG caused by an “unplanned breakdown” in one of the refineries which supplies bulk commercial buyers. At the same time there was a maintenance shutdown of a fuel refinery in Cape Town. This caused a significant increase in the price of LPG and it was most difficult for low-income households to adjust.

### **(4.3) Post 2006 Blackouts**

The use of LPG by these households continued even after the severe power cuts. When asked why they had continued using LPG, households said that they now prefer LPG because it is clean and quick to use. There were no fears of using it anymore as they mentioned that they were given sufficient training on how to use it and were careful with it at all times, including not letting children operate the stoves.

Up to 49% of the surveyed households said that their energy expenditure had become more compared to the time before they had started using LPG for cooking in their homes. This can be attributed to the fact that these households continued using other energy sources such as paraffin and electricity whilst using LPG. Only 23% of the households said that their energy expenditure was the same as prior to blackouts and 27% reported that they were spending less money.

As far as the price of LPG is concerned, the trends show that respondents’ experience of gas has taught them that it is expensive. In 2006, 47% of respondents thought LPG was expensive and 22% thought it was very expensive (69% altogether). In 2007, 44% thought gas was expensive and 30% thought it was very expensive (74% altogether). That is, the number of people who think gas is expensive has increased by 5% since they started using it. Conversely, of the same group, in 2006, 29% thought gas was cheap while in 2007, fewer, 26% thought LPG was cheap. Table 4 below shows peoples’ perceptions of LPG prices in 2006 when they were not using the fuel for cooking and after they had started using it during and after the electricity blackouts. It shows that most of the surveyed households thought and still think that LPG is an expensive fuel compared to what they are used to for cooking such as paraffin and electricity.

**Table 4: Affordability of LPG before and after blackouts**

Do you think LPG is...	Before	After
<b>Cheap</b>	<b>29%</b>	<b>26%</b>
<b>Expensive</b>	<b>47%</b>	<b>44%</b>
<b>Very expensive</b>	<b>22%</b>	<b>30%</b>
<b>Never thought about</b>	<b>1%</b>	<b>0%</b>

Source: Annecke et al, (2008: 09)

In the focus groups several people complained that it was very expensive to cook with LPG compared with electricity. They said those that still had their two plate stoves stopped using LPG and those that had exchanged their two-plates for the LPG stoves went to buy new ones. The price of refilling a LPG cylinder (5kg) is R55-R60 depending on where one refills it. The participants said that this did not last long and it also depended on how much one cooked in a month. One woman said that her cylinder lasted only a week because she has to cook for a family of six everyday. She said that when she buys electricity for R50, it lasts for two weeks and she uses it for cooking everything and rarely uses paraffin to supplement her electricity supply (Annecke et al. 2008).

Residents of Khayelitsha with formal electricity connections receive 50KwH of electricity once a month referred to as the Free Basic Electricity/Energy (FBE) subsidy. This is a subsidy given by Government and Eskom to electricity consumers to help them towards paying for their electricity consumption. At first, this subsidy was meant to serve poor households that could not afford to use their electricity because of lack of funds to pay for it. According to studies conducted to emphasize the need for this subsidy, it was concluded that this “free electricity” would “provide the energy necessary for basic lighting, ironing and use of TV and radio, as well as occasional use of an electric kettle or hotplate”, (University of Cape Town, 2002: 91). Due to administrative difficulties in implementing this subsidy to poor households only, it was decided by Eskom to roll-out the subsidy to all households in Khayelitsha<sup>9</sup>.

During a focus group discussion participants were asked if they preferred FBE for the electricity service or for LPG at subsidized prices. A young man in one of the focus groups expressed the general sentiment when he said that the advantage of using electricity was that they could get the 50 “free units” through the FBE programme. He said: ‘With LPG, not enough vouchers were handed out, so that now we have to use our own money to refill the cylinders. The other problem is that not everyone received the vouchers when the exchange of appliances took place.’ Everyone agreed that getting FBE helps a lot as not many people can afford to buy electricity every month.

When asked about what subsidies households would prefer, most of the respondents, 73% (or 205 households) said they would rather have Free Basic Electricity than an equivalent free basic gas, 27% (or 77 people) would rather have the subsidy for free basic gas. This is shown in Table 5 below.

**Table 5: Choice between Free Basic Electricity or LPG**

<b>Choice between free LPG or Electricity</b>	<b>Count</b>	<b>Percentage</b>
<b>Free basic electricity</b>	<b>205</b>	<b>73%</b>
<b>Free basic LPG</b>	<b>77</b>	<b>27%</b>
<b>Total</b>	<b>282</b>	<b>100%</b>

Source: Annecke et al, (2008: 09)

While the group acknowledged the benefit that people continue to get from Free Basic Electricity, they complained that the units seem to be getting fewer and fewer. This was explained by using the example of a loaf of bread which remains the same size but the price

<sup>9</sup> Households in the greater Cape Town areas also receive between 30KwH and 50KwH of electricity per month regardless of their income status and the amount of electricity they use.



goes up and up – or paying the same price for bread but the shop owner takes a few slices more off every few months so the customer gets less and less for her money. The group also complained that electricity vendors no longer sell electricity for R5 (US\$0.88), arguing that R5 is all they could afford and that in order to get the free units one has to buy some electricity. But this is illegal, and one woman pointed out their rights, insisting that customers must be able to get their free units without buying extra, but that they needed to be patient because the vendors serve those who have cash first.

When respondents in the survey were asked whether gas or electricity is cheaper to cook with (Table 6 below), most (77%) thought quite correctly, that electricity is cheaper to cook with than LPG, and 22% thought gas was cheaper than electricity.

**Table 6: Cost of LPG compared with electricity**

Is LPG cheaper to use or electricity?	Count	Percentage
Electricity cheaper	218	77%
LPG cheaper	63	22%
Both	1	0%
<b>Total</b>	<b>282</b>	<b>100%</b>

Source: Annecke et al, (2008: 09)

## **(5) Positive change in attitude to LPG use**

A year later, in July 2007, when asked about current energy use, a large majority, 89% of households, said they were still using LPG for cooking (although not necessarily every day), and only 11% said they had stopped using their stoves. This shows substantial loyalty to LPG. It also indicates that 11% of the stoves and cylinders are redundant in households and LPG stockists are urgently trying to retrieve the unused cylinders since they are needed to supply new and interested households.

The researchers were interested in how and when the new customers used their gas and how their experiences shifted their perceptions and prior assumptions. Changes in attitudes to LPG were recorded as well as preferences with regard to LPG and electricity.

The respondents were asked about what energy source (paraffin, LPG, electricity and candles) they used in the mornings, during the day and in the evenings. They were also asked how often they bought each of these, and in what quantities. Not surprisingly primary consumption was in the late afternoon and evenings with some use in the mornings and, electricity, where available, was used during the day for radio/television and boiling water.

Strong negative perceptions of LPG were held prior to the exchange programme: 65% of respondents thought that LPG was dangerous or very dangerous and 60% thought it was difficult to use, 69% thought it was expensive or very expensive and 55% thought it was not easily available. Over half - 54% - of respondents recognized LPG as a clean burning fuel (although 43% thought it was smelly).

Perceptions of the dangers of gas changed virtually overnight as the respondents received instructions with their new gas stoves and were informed about the safety features – the auto-start and cylinder that can be turned off completely. The education campaign accompanying, the exchange programme, in combination with the experience of using gas,

rapidly changed people's minds. This was also accompanied by the prospect of not having anything else to use for cooking and seeing LPG as the only alternative available especially with appliances "given for free". Whereas only 35% of respondents said that they had thought gas was safe in 2006, a year later, in July 2007, 85% of respondents reported that they thought LPG was safe. Only 15% thought it was dangerous or very dangerous; 90% of respondents thought it was easy to use, and 86% thought it was a clean fuel.

**Table 7: Perceptions of safety of LPG before and after the blackouts**

Do you think LPG is ...	Before	After
Safe	35%	85%
Dangerous	40%	11%
Very dangerous	25%	4%

Source: Annecke et al, (2008: 09)

Once households started using gas, experience had shown that gas was less easily available than they had previously thought (Table 8 below): 29% of respondents said it was very scarce, 41% said it was not easily available, that is in 2007, 70% said gas is not readily available compared with 55% who thought gas was not available in 2006. This was also highly influenced by the LPG shortages that the country experienced during the electricity power cuts which was due to a shut-down in production at the refinery in the Western Cape.

**Table 8: Availability of LPG**

Do you think LPG is ...	Before	After
Easily available	43%	29%
Not easily available	33%	41%
Very scarce	22%	29%
Never thought about it	2%	0%

Source: Annecke et al, (2008: 09)

The category which showed the largest change was that of the user-friendliness of gas. Whereas prior to the intervention and education campaign, 60% of the respondents thought LPG was difficult to use, a year later, in 2007, 90% of respondents said LPG was easy to use. This result contributes a lot to new knowledge on gas use and people's perceptions which have clearly changed compared to previous years where households in low-income areas refused to use LPG (Table 9 below).

**Table 9: User-friendliness of LPG**

Do you think LPG is ...	Before	After
Easy to use	37%	90%
OK	2%	5%
Difficult to use	60%	4%

Source: Annecke et al, (2008: 09)

Respondents' perceptions of LPG also changed with regard to it being clean and odourless. The number of people who think LPG is clean increased from 54% to 86% and the number of people who think LPG is smelly decreased from 43% to 14%, indicating positive attitudinal shift about LPG.

## **(6) Conclusions**

The research showed that many people in low-income urban areas relied on “dirty” fuels such as paraffin, which in South Africa was accompanied by unreliable appliances that presented several hazards to many families that could not afford cleaner fuels. These included indoor air pollution and fire hazards. Some of these households still continue using such fuels due to high costs of alternative energy sources such as LPG, electricity and renewable energy technologies.

The LPG intervention resulting from power failures changed peoples’ perceptions about a fuel that they had previously seen as dangerous. This led to an improved quality of life for these households as they are now cooking with a cleaner and more reliable fuel. This also showed that with a well planned awareness raising and eradication drive on energy sources, people are open to change and can embrace fuels that are cleaner.

Despite LPG price increases, low-income communities still continued using LPG which shows confidence on the fuel. At the same time this shows that there is a need for change in policy making and implementation regarding service delivery such as implementation of free basic energy. Many poor households rely on commercial fuels but these are too expensive and this study has shown that if LPG was as subsidized as grid-electricity, willingness to use it as an everyday fuel would be much higher as its stigma of being dangerous has been removed.

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