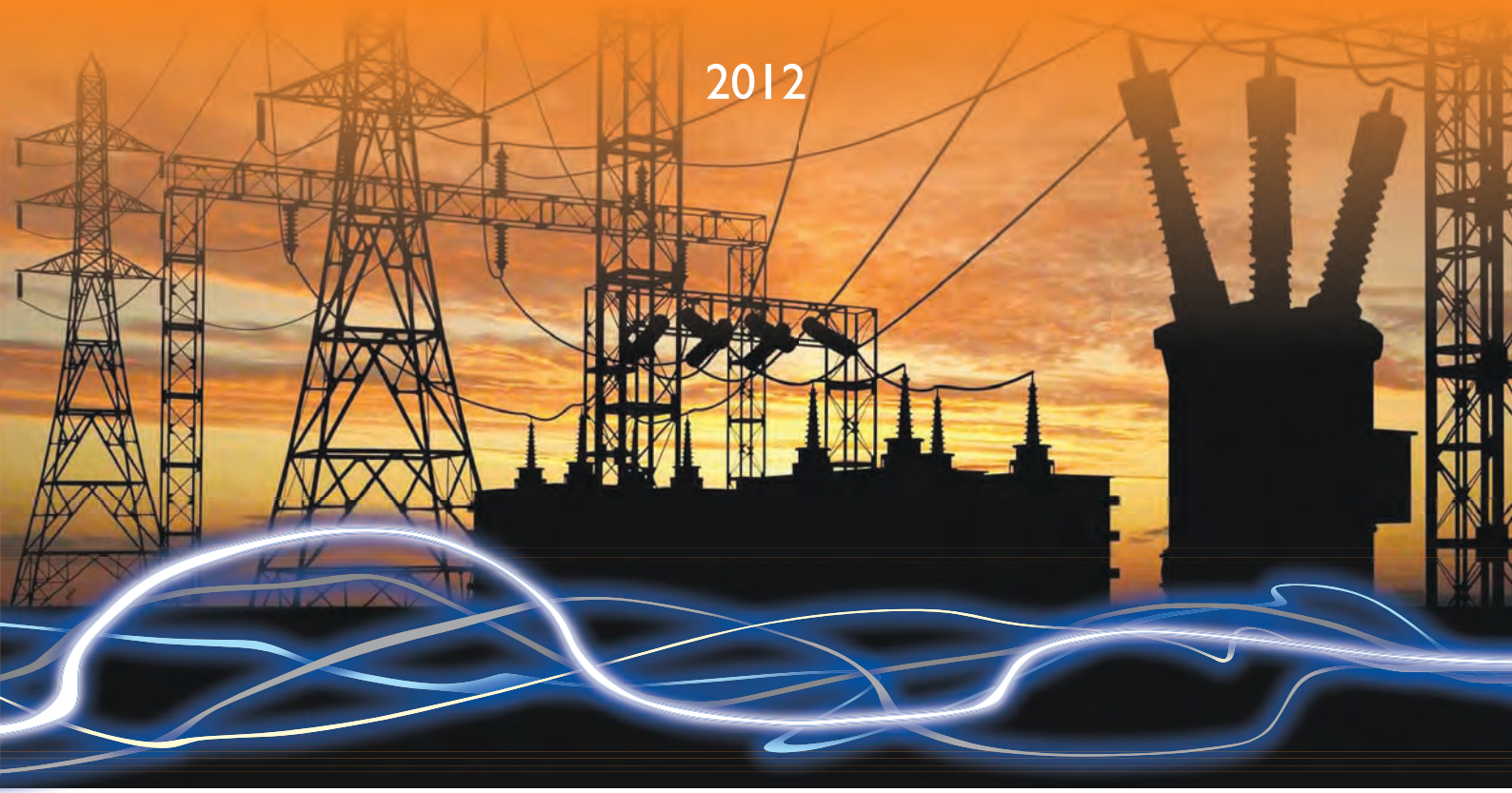
A survey of energy-related behaviour and perceptions in South Africa

The Residential Sector

2012



energy

Department:
Energy
REPUBLIC OF SOUTH AFRICA

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The Residential Sector

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Minister's Foreword

When the newly-elected government of South Africa assumed office in 1994, it was faced with a myriad of infrastructural and service delivery backlogs. Prior to 1994 the minority white population were the main beneficiaries of the government's energy investments in the residential sector. Since democracy, however, access to electricity by urban and rural households across class and racial categories has become a core priority of the state. A famous quote says that *"Discipline is the bridge between goals and accomplishment"* Government's discipline and clear vision to ensure that all South Africans have universal access to modern energy is evident in the progress from 1994 to 2012 whereby government successfully increased the proportion of households that have access to energy from 30% to 87%. It is now striving to realise 92% by 2014. In striving towards universal access to energy and quality services it was imperative to conduct a residential sector survey gathering information about energy- related perception and behaviour in South Africa.

South Africa has one of the highest rates of public protest in the world. Since 2005 the number of protests have escalated dramatically and reached an all time high in 2010/2011 and can therefore be said to be escalating. These protests are usually referred to as service delivery protests in the media and it is evident that there is growing unhappiness with service delivery. Some commentators have also been stating that service delivery protests are part of a broader Rebellion of the Poor.

In relation to these copious service delivery protests that have been happening countrywide this survey explored understanding and perceptions of households towards energy related protests. The ultimate aim of the survey was to provide the Department of Energy with valuable empirical evidence that would assist the Department to deliver on its mandate, understand, determine, monitor, measure and evaluate the impact of the type of service rendered. The survey further explored multiple energy use and energy poverty in South African households. A representative sample of all households in South Africa was used in this survey.

The execution of the actual survey provided temporary job opportunities to the unemployed in the sampled areas and also provided training opportunities. This was done in a bid to improve people's chances of getting employment of a similar nature in future.

The outcome and results of this survey, together with the recommendations, are cited in detail in this report.

Ms. Dipuo Peters, MP
Minister of Energy

Deputy Minister's Foreword

As was mentioned by the Minister of Energy in her 2012 Budget Vote Speech, we will be embarking on an Electrification Roadmap with the intent of accelerating access to energy to all households in South Africa. This survey which reflects the perceptions, attitudes and behaviour of South African households will be a crucial tool in assisting us to provide Sustainable Access to Energy for All.

Poorer households in South Africa are carrying an enormous energy burden. Remarkable strides have been accomplished by the Department in cushioning the poor against high energy costs. Policies such as the FBE, FBAE and IBT have been developed and offers welcome relief to ensure that these households do not get trapped even deeper into poverty and vulnerability. Currently, the FBE policy allows electrified households up to 50kWh of electricity free of charge. Non-electrified households benefit from the Free Basic Alternative Energy (FBAE). In April 2010 the Inclined Block Tariff (IBT) was also introduced, implying that lower-consuming customers benefit from a lower tariff rate. All of these policies are designed to assist poor households.

On average, South African households spend 14% of their total monthly household income on energy needs which is higher than the international benchmark of 10% for energy poverty. Furthermore results show that close to half of all South African households are energy poor. Almost three quarters (74%) of households in the poorest quintile are energy poor. Even high income households are suffering under the burden of higher electricity prices and even among the richest quintile, 13% of households are energy poor. As illustrated, increasing electricity prices are a threat to all South Africans.

Going forward, as guided by this study, the Department will examine an official definition of energy poverty for the country. This will be used as a baseline to monitor and track energy poverty levels in South Africa. As was mentioned in the 2012 Budget Vote speech, energy price reviews are also being examined to ensure that households do not get further entrapped in energy poverty. As a matter of urgency, residential energy pricing models and tariff structures will be reviewed.

We wish to have an energy-literate South Africa, who would make well-reasoned decisions about energy options and who would use the national resources more optimally.

The outcome and results of this survey, together with the recommendations, are cited in detail in this report.

Ms. Barbara Thompson, MP
Deputy Minister of Energy

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Acronyms

49M	49 Million Campaign
AgriSA	Agriculture South Africa
Amps	Amperes
DME	Department of Minerals and Energy
DoE	Department of Energy
EA	Enumerator Area
EC	Eastern Cape
EMI	Electricity Morality Index
EPI	Electricity Pricing Index
EQI	Electricity Quality Index
ESI	Electricity Satisfaction Index
ESKOM	South African Electricity Supply Company
FBAE	Free Basic Alternative Energy
FBE	Free Basic Electricity
FS	Free State
GP	Gauteng Province
GW	Gigawatts
HSRC	Human Sciences Research Council
IBRT	Inclined Block Rate Tariff
INEP	Integrated National Electrification Programme
IRP	Integrated Resource Plan
KZN	KwaZulu-Natal
LP	Limpopo Province
LSM	Living Standard Measurement
MOS	Measurement of Size
MP	Mpumalanga Province
NERSA	National Energy Regulator of South Africa
NC	Northern Cape
NW	North West
PAI	Protest Action Index
SABRE-GEN	South African Bulk Renewable Energy Generation
SASAS	South African Attitudes Survey
SECC	Soweto Electricity Crisis Committee
Stats SA	Statistics South Africa
TWh	Terawatt hours
WC	Western Cape

Concepts

Ampere
A unit of electrical current consisting of an electric charge per unit time, in coulombs per second.

Decile
A decile is one tenth or 10% of a given amount or number.

Energy poverty
Expenditure-based approach: A household that spends more than 10% of their net income on energy is regarded as energy poor or in energy poverty.

Subjective approach: a household is considered energy poor if it is characterised by one or more of the following attributes: (i) the amount of energy the household uses is reported as being less than adequate for its needs; (ii) the amount of energy the household uses for lighting is reported as being less than adequate for its needs; (iii) the amount of energy the household uses for cooking is reported as being less than adequate for its needs; (iv) the amount of energy the household uses for heating rooms and keeping warm is reported as being less than adequate for its needs.

Thermal inefficiency approach: Another measure of energy poverty relies on assessments of the condition of one's place of residence, focusing particularly on thermal comfort levels relative to social needs. In essence, this involves rating the thermal efficiency of dwelling units, since this influences the amount of energy required to heat the home to an acceptable standard and typically represents a notable determinant of domestic energy costs.

Low income and thermal inefficiency: a household is considered energy poor if it has less than 60% of South Africa's median per capita monthly income, and meets one or more of the following conditions: (i) the household reports that it is dissatisfied or very dissatisfied with its accommodation; (ii) the state of repair of the household is described as "poor"; (iii) one or more of the following problems are reported with the accommodation: lack of adequate heating, a leaky roof, damp walls, floor or foundations, or damaged or broken windows or doors; (iv) the health of a household member has deteriorated due to the housing conditions.

Living Standard Measure (LSM)
A wealth indicator which uses assets or basic services to determine a living standard measure. The measurement is classified from LSM 1 to LSM 10. For the purpose of this study we created three LSM categories:
Low LSM: This group comprise LSM 1-LSM 3 categories.
Medium LSM: This group comprise LSM 4-LSM 6 categories.
High LSM: This group comprise LSM 7-LSM 10 categories.

Living Standards Measure	2001/02 Imputed avg monthly	2003/04 Imputed avg monthly	2005/06 Imputed avg monthly	2007/08 Imputed avg monthly	2009 Imputed avg monthly	2010 Imputed avg monthly
LSM1	R 804	R 878	R 999	R 1 080	R 1 386	R 1 448
LSM2	R 963	R 1 076	R 1 214	R 1 401	R 1 564	R 1 859
LSM3	R 1 200	R 1 412	R 1 521	R 1 795	R 2 116	R 2 153
LSM4	R 1 596	R 1 792	R 1 940	R 2 536	R 2 580	R 2 966
LSM5	R 2 239	R 2 436	R 2 681	R 3 122	R 3 627	R 3 965
LSM6	R 3 625	R 4 057	R 4 404	R 5 386	R 5 990	R 6 573
LSM7	R 5 662	R 6 437	R 6 841	R 8 677	R 9 694	R 10 081
LSM8	R 7 537	R 8 429	R 9 252	R 12 337	R 13 188	R 13 979
LSM9	R 10 234	R 11 499	R 12 558	R 16 296	R 17 809	R 18 860
LSM10	R 15 072	R 18 643	R 19 817	R 23 054	R 26 602	R 28 038

Source: Developmental Indicators (2011:25)

Household monthly income

The amount of income accruing to a household per month.

Kish Grid

It is a technique/grid used in equal-probability SAMPLING for selecting cases at random when more than one case is found to be eligible for inclusion when the interviewer calls at a sampled address or household.

Measurement of Size (MOS)

The Measurement of Size used for sampling households in this survey was a function of the number of households in the enumerator areas.

Per capita monthly income

Household monthly income divided by household size.

Quintile

A quintile is one fifth or 20% of a given amount or number.

Poorest per capita quintile

The poorest quartile represents the lowest fifth of the data (1-20%).

Quintile 2 (Q2)

The second quartile represents the second fifth (21% - 40%) of the data.

Quintile 3 (Q3)

The third quartile represents the third fifth (41% - 60%) of the data.

Quintile 4 (Q4)

The fourth quartile represents the fourth fifth (61% - 80%) of the data.

Richest per capita quintile

The richest quartile represents the highest fifth (81% - 100%) of the data.

Universal household access to energy

All households to have access to modern energy sources which includes electricity and a range of renewable energy sources while it excludes health and environmental hazardous energy sources such as paraffin, candles, firewood.

Acknowledgements

The Department of Energy and the HSRC collaborated closely on the study of energy related behaviour and perceptions in South Africa. The Department would like to express its appreciation to the following individuals who contributed to the successful completion of this study.

- Ms Machwene Molomo from the Department of Energy who conceptualised and guided the project through the various phases, from inception to completion.

- The Human Sciences Research Council (HSRC) team, consisting of Mr Benjamin Roberts and Ms Jarè Struwig, for conceptualising the study design, as well as analysing the quantitative data and drafting the report, and Ms Sihle Dumisa for assisting with the contextual material.

- The 3004 South African households who participated and made time available to answer the questions.

- The HSRC's provincial supervisors, sub-supervisors and data collectors who traversed the country - often under difficult circumstances - to ensure that high quality information was collected from all those who were interviewed.

- Thanks are also due to Ms Anneke Jordaan of the HSRC's Data Curation unit, who ensured that the data used for analysis was of high quality, as well as Professor Dawid Stoker for weighting the data and Ms Mercy Ngungu for all the data edits and data cleaning. Also thanks to Mr Gift Molefe and Ms Deirdre Geldenhuys for coding open questions, preparing the questionnaire for data capture and also for quality control.

- The role played by the HSRC project administrator, Ms Busisiwe Mamba, who worked tirelessly to ensure that all contractual and logistical issues were in place before, during and after the survey period. Also thanks to Ms Annemarie Booyens and Ms Hermien Bolton who assisted with administrative issues.

Executive Summary

The primary overall objective of this survey was to gather information about energy- related behaviour in South Africa. The survey intended to explore multiple energy use and energy poverty in South Africa. In addition, it also wanted to explore satisfaction with electricity provisions, perceptions about the quality of electricity and pricing of electricity. The survey also gathered views on Free Basic Electricity (FBE) as well as electricity-saving strategies. Views on policy preferences were also explored. Three thousand and four South Africans participated in the survey, a sample representative of the country's population.

In this national study on attitudes and perceptions about energy, **84% of households indicated that they are electrified**. This figure is very similar to the Integrated National Electrification Programme of 87% by March 2012. This correspondence indicates that results can be viewed as reliable and valid, and a true reflection of the views of South African households.

Looking at household **energy sources**, it is evident that considerable patterns of difference exist between electrified and non-electrified households in the range of energy sources that they employ to meet their basic needs. Those with electricity all reported that they used this source either for lighting, cooking or heating, though it is apparent that other sources such as candles, paraffin, firewood and gas continue to be relied upon in at least a fifth of cases. Conversely, in the absence of a domestic connection, non-electrified households rely primarily on candles, paraffin and firewood, with more nominal shares reporting the use of coal and gas. The use of dry cell and car batteries, a solar system, or generator hardly features for electrified and non-electrified households alike, being reported in fewer than 5% of cases.

In terms of **lighting**, households that have been electrified almost exclusively use electricity for lighting purposes (97%), with a marginal contingent specifying that they continue to rely on candles (1%). By contrast, two-thirds of non-electrified households (67%) rely on candles as the main source of lighting, with paraffin accounting for the predominant energy source for this purpose in most of the remaining cases (26%). Other energy sources hardly feature, and no single option is mentioned in more than 5% of cases.

Cooking represents one of the most energy-intensive applications and it is unsurprising that slightly more than three-quarters (76%) of households use electricity as the main energy source for cooking. The 2011/12 South African Social Attitudes Survey (SASAS) statistics show that only around a tenth (8%) of electrified households continue to depend on firewood as a main cooking source, with marginal shares reporting gas, solar electricity, paraffin and coal. For non-electrified households, firewood and paraffin predominate as the main energy source for cooking purposes (40% and 50% respectively). Again, gas, coal, solar electricity and electricity from generators are used in a small percentage of households as the primary source to meet their cooking needs.

Apart from cooking, another energy-intensive thermal application is **domestic space heating**. On aggregate, two-thirds of South African households (65%) use an energy source to heat spaces and keep warm, with the remaining third not using energy sources but opting mainly to wear warm clothing and to use blankets. When the main energy source for space heating was examined by electrification status, it was found that in electrified households, 44% primarily use electricity, with nominal shares reporting firewood, paraffin and other energy sources (8%, 7% and 6% respectively). A considerable share of electrified households (34%) use no energy source for heating, choosing instead to make use of blankets, warm clothing or nothing at all. In non-electrified households, firewood is the primary form of energy relied on for space heating, present in two-fifths (40%) of homes. The share using paraffin is double the national average (18%), with 'other sources' consisting mainly of coal (4%).

The study provides a profile of **energy poverty** among South African households using three different approaches: namely, the commonly-applied energy poverty ratio based on household energy expenditure relative to income, a

subjective approach, and an approach based on the energy (thermal) efficiency of households. The profile of energy poverty using the expenditure approach, compared with that generated by the subjective and thermal efficiency approaches, provides differences in terms of both the overall incidence of energy poverty, as well as the identification of sub-groups as energy poor. The expenditure approach classifies 47% of households as energy poor (spending more than 10% of household income on energy), the subjective approach and thermal inefficiency approach identifies 42% as energy poor. The incidence of energy poverty using a low income and thermal inefficiency concept is 22% of households. The most notable and recurrent findings at the subgroup level across all three approaches are: (i) the greater incidence of energy poverty among households located in the Eastern Cape, Limpopo or Mpumalanga, or in a rural traditional authority area; and (ii) the increased likelihood of being energy poor if a household has a lower living standard level or falls in the lowest per capita income quintiles.

The majority (64%) of South Africans were **satisfied with electricity** provision in their neighbourhoods, with 19% being dissatisfied. The rest were neither satisfied nor dissatisfied (15%) or unsure (2%). In order to determine who was most likely to be satisfied or dissatisfied, an Electricity Satisfaction Index (ESI) was constructed. Results from the ESI revealed that people who have a low living standard or who live in informal settlements are the least satisfied with electricity provision, whilst people with a high living standard and whites are most satisfied.

In order to further the analysis about the quality of electricity in South Africa, an explicit question about the **quality of electricity** was included. Just under half (47%) rated the quality of electricity in their area as "very high" or "good". A further third (35%) rated the electricity as acceptable. The rest felt the quality was either poor (13%) or very poor (2%). In order to determine who were most or least satisfied with the quality, an Electricity Quality Index (EQI) was created. The EQI showed that people with a low living standard, residing in urban informal or traditional authority areas, in the Northern Cape or Eastern Cape were most likely to state that their electricity is of a poor quality. By contrast, people with a high living standard, residing in the Western Cape, Indians or whites were much more likely to rate the quality of electricity as "very high" or "good".

In order to understand **perceptions about the current pricing of electricity** in South Africa, households were asked if they felt that electricity prices were far too high, too high, about right or too low. Given the price increases, asking people about their perceptions of the pricing of electricity was therefore extremely important. South Africans generally feel they pay too much for electricity. More than a quarter (27%) of households felt that they pay "far too much" for what they receive, with another 43% saying they pay "too much". Just under a quarter (24%) felt they pay "about the right amount" for what they receive. Very few (2%) said they "pay too little" and 5% were uncertain.

In order to gauge **how South Africans handled the last electricity price increase**, they were asked to indicate which of the following strategies they employed to deal with the last price increase. The options were (a) continue to use the same level of electricity and pay the extra amount for it (b) reduce the amount of electricity used (c) use other energy sources such as paraffin, gas, coal, wood or candles (d) other strategies. The strategy employed by most South Africans in the past year to cope with the rising electricity costs was to reduce the amount of electricity used. More than two-fifths of South Africans (41%) employed this strategy. A further 29% continue to use the same level of electricity and pay the extra amount for it. More than a quarter of South Africans (26%) had to use other energy sources to cope with increasing electricity prices, thus encouraging energy switching and multiple energy use.

A question about **electricity price increases in the future** revealed that 44% of South Africans would reduce the amount of electricity used, 30% would revert to energy switching or multiple energy use, 21% would continue to use the same levels of energy, "if electricity prices were increased tomorrow". These results clearly show that future energy price increases will have a bearing on the types of energies used and would encourage more

energy switching. Further analysis revealed that it was mostly households with a medium and high living standard that stated they would reduce the amount of energy used. Energy switching was the preferred strategy for households with a low living standard, households in rural traditional authority areas or in Limpopo and North West.

The **energy-saving measures** that South Africans are most aware of are: (i) switching off lights when leaving the house (75%), (ii) using energy-saving light bulbs (67%) and (iii) switching off appliances at the wall when not in use (59%). South Africans are not only most aware of these energy-saving measures, but they are also most likely to undertake these measures. Awareness of energy-saving measures is lowest among blacks, among lower educated people, among people with a low living standard, and people residing in Limpopo.

As was found by other national surveys, South Africans are generally not aware that they receive **Free Basic Electricity**. On aggregate, approximately a quarter (24%) of South Africans indicated that their households receive Free Basic Electricity, with 68% stating that they do not receive FBE. Awareness of FBE is lowest among North West residents, Indians, whites, people living in KwaZulu-Natal, 50-59 year olds and people with either a low or high living standard. Asked where they found out about FBE, the majority of households indicated the source of information as their municipalities, followed by friends and family, or the local media.

National results indicate that there is strong opposition to **illegal connections** and the stealing of electricity cables. Nine in ten people (91%) indicated that it is always wrong to steal electrical cables. A further 7% had a conditional response, saying that it was almost always wrong. Insignificant proportions (2%) said it was not wrong at all or did not know (1%). The same trend was noted with regards to connecting to electricity without paying for it. Eight in ten people (84%) said it was always wrong, 8% said it was almost always wrong and the rest either said it was wrong only sometimes (4%) and not wrong at all (3%). Despite this negative sentiment, illegal connections remain a reality, with this study showing that 2% of un-electrified households are using electricity without paying for it, implying illegal connections.

Protesting about energy services (price and access) was a much more acceptable activity. Almost half (49%) of people felt it was not wrong at all to protest about the price of electricity, with more than a fifth (21%) of respondents stating that it was "wrong only sometimes". Just over a quarter (27%) was of the opinion that it was mostly wrong to protest about the price of electricity. The rest (2%) were undecided (stating "Don't knows"). Similarly, a large proportion of South Africans (44%) felt that it was acceptable to protest about access to electricity. Slightly more than a fifth (22%) conditionally accepted protest action about access to electricity, stating that "it was wrong only sometimes". Conversely, 9% said it was almost always wrong and 22% said it was always wrong. A small percentage (2%) did not have an opinion about the matter.

In terms of **preferences regarding government policy priorities**, three-quarters of all adult South Africans stated that the priority of the Department should be to keep electricity prices low. Economical considerations outweighed other priorities by a considerable margin. The second priority, mentioned by just more than half (52%) of the population, was that the Department should ensure that load-shedding and power cuts are minimised. A further priority, shared by almost half of South Africans (49%), was that the department should help poor households by giving more free electricity. These were the top three priorities listed by South African people.

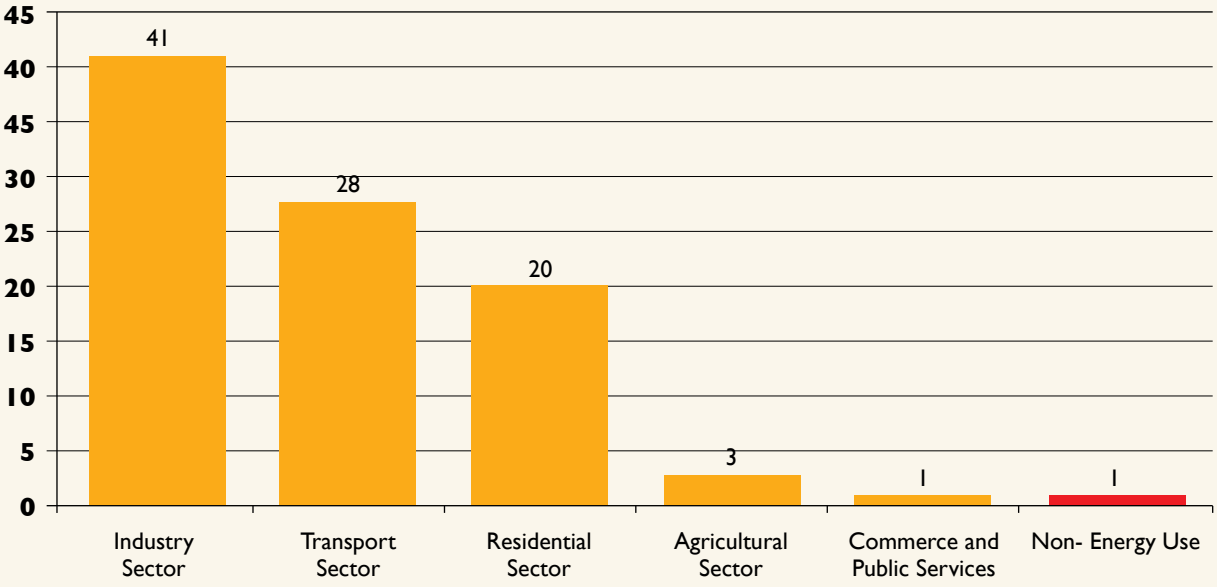
In choosing **future sources for electricity generation**, South Africans are clear that economic imperatives are the most important, hence the response by 30% stating, "It does not matter which source, as long as it is the cheapest". Having said this, a sizeable quarter of South Africans also support renewable energy sources, such as solar wind and water, with a further 11% explicitly placing emphasis on sources that are not damaging to the environment. Economic and environmental considerations are thus important to South Africans when considering future energy sources. Less than a tenth supported other energy sources such as coal and oil (9%), natural gas (5%), nuclear power (4%) and fuels made from crops (2%).

The most preferred **government policy interventions to ensure energy-saving at a national level** was for government to spend money on campaigns encouraging people to use less energy (82%) and to replace electric geysers with solar geysers (75%). Less than half (46%) were in favour of the option of taxing households who use a lot of energy.

1. Background

When the newly-elected government of South Africa assumed office in 1994, it was faced with a myriad of infrastructural and service delivery backlogs. The apartheid government's deliberate neglect in not providing basic services such as electricity to most of the population had resulted in paraffin, gas and wood serving as the main sources of domestic energy in the country well into the twentieth century. Whilst the rest of the developing world continues to be primarily dependent on fuel wood (Madubansi and Shackleton, 2007), the case of South Africa cannot be treated in the same way, given the efforts and funds which have been injected into infrastructural development. South Africa has put a lot of effort into effectively providing sufficient energy to the mining, chemical and agricultural industries, which have formed the backbone of the country's energy-intensive economy since apartheid (Malzbender, 2005; and Davidson, 2006). As illustrated by the Department of Minerals and Energy (DME, 2009) demand for energy remains highest for the industry sector (41%), followed by the transport sector (28%) and then residential sector (20%).

Figure 1: Energy demand by economic sector for 2006 (percent)



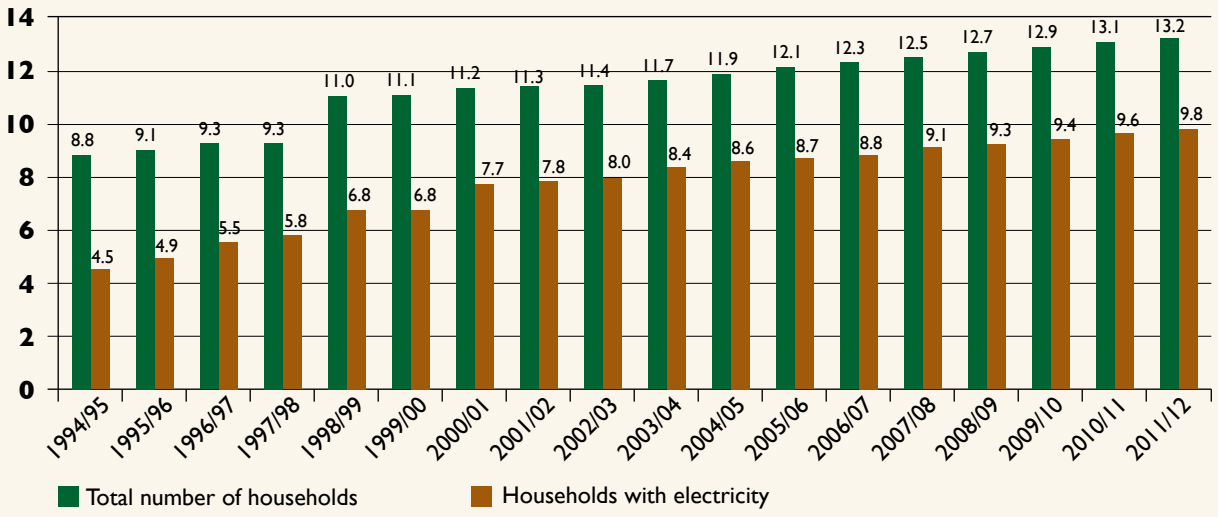
Source: DME 2009

Prior to 1994 the commercial sector and the minority white population were the main beneficiaries of the government's energy investments. Since democracy, however, access to electricity by urban and rural households across class and racial categories has become a core priority of the state (Malzbender, 2005).

Whereas from 1994 to 2003, government had successfully doubled the proportion of citizens who have access to electricity from one-third to two-thirds of the populace (Winkler, 2005), in 2006 the national backlog (with growth) was still sitting at 3.4 million households. Initially, the state sought to realise universal access by 2012 but it was amended to 92% by 2014. Although the cost per connection was lower in 2006 than it had been in the early 1990s, there were still several challenges hindering the progress of the Integrated National Electrification Programme (INEP). These revolved around the proper use of tools and infrastructure, as well as taking care to increase "municipal capacity without negatively impacting on [ongoing] service delivery". It should also be noted that an increasingly large part of the backlog lies within the rural areas of the country, many of which have never had any electricity infrastructure at all (Integrated National Electrification Programme, 2007: 8). In addition to this, the trend of rural urban migration, stemming from historical spatial inequalities, which has not abated, continues to place increased pressure on already-strained power supplies in the urban regions.

Apart from these infrastructural and practical challenges, the factor of growth also needs to be considered. Since 1994, the numbers of houses supplied have also increased, which challenges universal access, since the backlogs as well as the new developments need to be serviced. All of these factors pose challenges to the attainment of universal energy access. It was these challenges that saw government conceding in 2007 that it would take another 25 years before universal access to energy could be achieved in light of the pace of progress (Integrated National Electrification Programme, 2007).

Figure 2: Total number of households and electrified households in South Africa (millions)



Source: DoE 2012

The pricing of electricity has become a critical topic in national dialogue, following the introduction of significant price increases in an effort to circumvent the occurrence of rationing, which is commonly known as load-shedding (Altman et al, 2008). In 2008, the Department of Minerals and Energy announced that South Africa was faced by serious electricity difficulties, which related to capacity, supply, and maintaining an appropriate reserve margin. The state electricity company, Eskom, thus needed increased financial resources to resolve these problems. "While these [were] related, they [had] different prime causes and . . . require[d] different responses" (Altman et al, 2008: 11). Eskom's solutions included increasing the price of electricity, the implementation of load-shedding, and acquiring a loan from the World Bank to improve old infrastructures and build new power plants, viz Medupi and Kusile (Energy, 16 April 2012). In a report entitled, "National Response to South Africa's Electricity Shortage" (2008:1), the government argued that these measures were necessary "to prevent a collapse of the national electricity supply system . . . as the country was faced with an emergency situation".

In 2010 National Energy Regulator South Africa (NERSA) subsequently approved an average tariff increase of 25.5% over the next three years, using a Multi-Year Price Determination (MYPD 2) system. However, residential tariffs are subsidised and therefore home owners pay an increase of only 14.3% and 16% for 2010/11 and 2012/13 respectively. Furthermore, in terms of the 2008 Electricity Pricing Policy which introduces an inclining block rate structure for billed customers, consumers who use more are charged a higher average price. These are effectively punitive charges which protect lower usage customers and ultimately deter electricity wastage.

It is also important to note that the government provides FBE of 5-6 kWh per month to all South African households (Madubansi, and Shackleton, 2006) as a direct response to the needs of the poor. The FBE is provided on the understanding that people cannot live without energy, as it is a basic necessity needed for many tasks such as lighting, cooking, heating and cooling (Cecelski, 2000), whilst also recognising the poor economic and social conditions of many citizens. "Under the slogan, 'Access to electricity for all,' the new government made the provision of electricity to the disadvantaged one of the cornerstones of its development policies". (Malzbender, 2005: 4). Even so, studies

such as in Madubansi and Shackleton (2006) have noted that very poor households continue to depend partially on other energy sources, regardless of being connected to the electricity grid. They do this as a means of survival, as they cannot afford to pay high electricity tariffs to cover their overall consumption needs.

In addition to the FBE policy, the Department of Minerals and Energy also introduced a Free Basic Alternative Energy (FBAE) policy as a parallel intervention strategy specifically aimed at servicing indigent households (i.e. those who suffer from energy poverty) in un-electrified areas. Subsidised alternative sources of energy include paraffin, liquefied petroleum gas, coal, and bio-ethanol gel (Free Basic Alternative Energy Policy 2007). In assessing energy policies for a sustainable South Africa, Winkler (2006) found that alternative energy sources such as these generated one-third of the energy consumed by the residential sector. Off-grid electrification was also approved to be concurrently provided by private companies using technologies such as photovoltaics, diesel generators, and micro-hydro schemes (Winkler, 2006). These interventions now all fall under the DoE's 2010 Integrated Resource Plan (IRP) which, over the next 20 years, aims to guarantee secured access to energy, promote multiple fuel use in the country, and ultimately reduce carbon emissions (Energy, 16 April 2012).

It must be reiterated that the inadequate supply of electricity to the population has had the worst effects on the poor who cannot afford the cost of electricity. They have expressed their desperation to access electricity through copious service delivery protests. Irate citizens endeavour to realise socio-economic justice by holding the government responsible for the hardships they endure, when their electricity is disconnected due to their inability to pay for electricity usage. The illegal reconnecting of electricity supplies has become a nationwide survivalist tactic for the poor, after it gained popularity through the mobilising of the Soweto Electricity Crisis Committee (SECC), according to Egan and Wafer (2004).

In promoting a sense of shared responsibility for the country's development with general citizens, Eskom also embarked on campaigns to educate society about the importance of saving energy whenever possible. The latest drive for energy-saving tips, dubbed the "49 Million Campaign," was launched by Deputy President, Kgalema Motlanthe, in March 2011. It calls upon all 49 million South Africans to embrace energy-saving as a culture and to join the global movement towards ensuring a sustainable future (website of the 49 Million Campaign). These strategies target the demand side of the dilemma as a short-term response, whilst supply side improvements are simultaneously pursued on a more long-term basis.

From a more optimistic perspective, however, the need to invest in new power-generating capacity has been regarded as an opportunity for transition to the use of more sustainable energy sources, moving away from traditionally coal-fired plants (Winkler, 2007). Options for producing sustainable electricity include locally-available sources such as renewable energy technologies and nuclear power, as well as hydro-electricity and combined-cycle gas turbines which are importable from other countries on the continent. In 2005, South Africa had a total capacity of 668 MW of hydro-electricity, in addition to a wind turbine of 660kW power installed by Eskom in 2002. This was done under the company's South African Bulk Renewable Energy Generation programme (SABRE-Gen) (Winkler, 2007). Moreover, since 2008 the Department of Energy has strongly supported the conversion to subsidised solar home systems and solar water heaters (SWHs). This latter project is not only cost effective – as it can save a household "approximately 200kWh per month" – but it also contributes towards the widespread use of clean energy sources (Eskom Energy Efficient Demand Side Management, 2009 and Integrated Demand Management, 2011). In addition to these initiatives, government also plans to spend R1 trillion rand on three nuclear sites across the country (Energy, 16 April 2012).
It should be borne in mind that balancing supply and demand for a resource as crucial to human life as energy is an intricate and continual process. In 1994, as the new South Africa embarked on the twin goals of democracy and development, navigating its way through historical inequalities and underdevelopment, as well as through sometimes adverse global imperatives, it could only have been expected that challenges will be faced along the way. These challenges require innovative responses from both the government and its citizens who jointly have to pave the way towards universal access to energy, and the socio-economic benefits thereof.

2. Introduction

The primary overall objective of this survey was to gather information about energy- related behaviour in South Africa. The survey intended to explore multiple energy use and energy poverty in South Africa. In addition, it also wanted to explore satisfaction with electricity provisions, perceptions about the quality of electricity and pricing of electricity. The survey also gathered views on Free Basic Electricity (FBE) as well as electricity-saving strategies. Views on policy preferences were also explored.

2.1 Primary study objectives

The primary objective of the study was to gather information on energy-related behaviour and perceptions in South Africa. More specifically, the survey intended to:

- Explore multiple energy use in South Africa
- Explore levels of energy poverty
- Explore satisfaction with electricity provisions, perceptions about the quality of electricity and pricing of electricity
- Gather views on Free Basic Electricity (FBE)/ Free Basic Alternative Energy (FBAE) as well as electricity-saving strategies
- Explore views on policy preferences of current and future energy issues

The ultimate aim of the study was to provide the Department of Energy with valuable empirical evidence that would assist the Department to deliver on its mandate.

2.2 Structure of the report

The first part of the report deals with the research methodology employed and discusses the research universe and how the sample was designed. It examines the survey protocols in terms of area, household and individual selection procedures. It gives a brief description of how the questionnaire was designed and the training that took place prior to the data collection. Procedures employed to ensure quality control are also discussed, together with data capturing and data cleaning measures. This is followed by a section on sample realisation and weighting of the data. The next section (Section 3) is the first section that discusses results. This section deals with electrification status of households, specifically looking at access to electricity and the type of supply (in terms of Amperes) that households have. Section 4 deals with energy consumption and poverty. It discusses the energy sources that households generally use and then details the main energy sources for lighting, cooking and heating. A detailed section on single and multiple energy use follows, which gives an assessment of the variety of energy sources that households use for lighting, cooking and heating. This discussion is followed by a section on energy poverty, making use of three definitions of energy poverty: namely, energy poverty as a percentage spending (more than 10% of income); subjective energy poverty and energy poverty due to thermal inefficiency. Section 5 discusses satisfaction with the provision of electricity, the quality of electricity and the pricing of electricity. It also discusses strategies that households employ to cope with increasing electricity prices. Section 6 deals with energy saving, more specifically awareness of various energy-saving measures and also whether households undertake any of the energy-saving measures. Section 7 goes on to discuss awareness of FBE and also interrogates the sources of information regarding FBE. Section 8 is a section on civic actions that might impact on electricity provision. We interrogate perceptions about the stealing of electricity cables, illegal connections, protest actions about the price of electricity and access to electricity. The last section of the report deals with policy issues and interrogates people's perceptions about what government's priorities should be in supplying energy to the people, what sources of energy supply should be considered for future supply and which government policies should be implemented to ensure that the amount of energy used is reduced.

3. Research Methodology

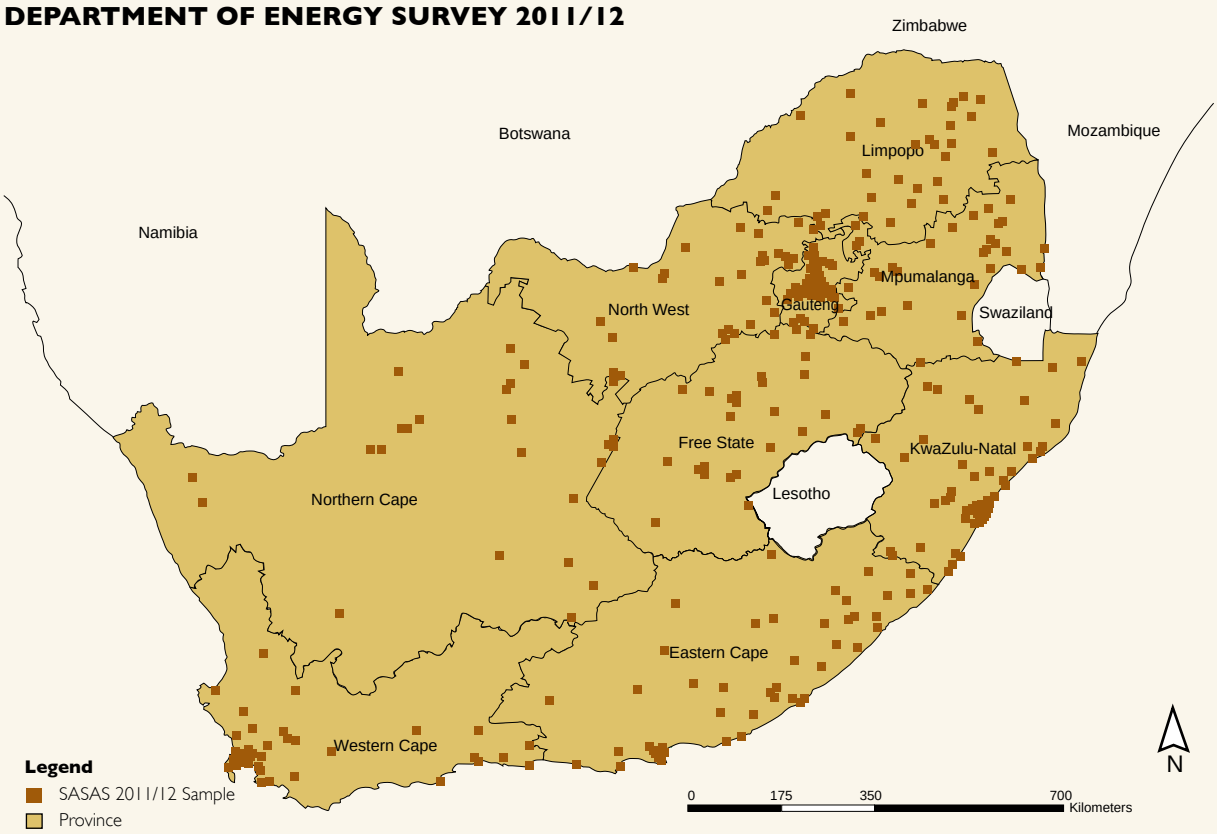
3.1 The Research Universe

The target population for the survey is individuals aged 16 and over who live in South Africa. Specifically, the target population comprised people living in households, hostels and other structures. People living in special institutions such as hospitals and prisons were excluded from the sample. The inclusion of people from these institutions would have compromised the random selection procedure. Also, past experience has shown that access to people in these institutions is extremely difficult, since obtaining permission can be cumbersome and complex.

3.2 The Sample design

The research universe thus includes all South African citizens 16 years and older. In order to achieve a national representative sample, a sample was designed that ensured that all people in South Africa, 16 years and older, were represented, regardless of race, class, residential status etc. A complex sample design was used that included stratification and multi-stage sampling procedures. The explicit stratification variables that were used in the sample were provinces, urban/rural population and people living in different types of areas (e.g. formal urban, informal urban, rural traditional authority areas and farms). To ensure that the sample was also representative in terms of the ethnic and cultural diversity of South Africa, the HSRC's geo-demographic categories, which have been developed from the Statistics South Africa (Stats SA) 2001 census data, were used as the implicit stratification variable. These geo-demographic categories reflect the diversity of the South African population based on their rural/urban, income, education, "ethnicity" and geographic characteristics.

Figure 3: A graphical representation of 500 selected Enumeration Areas



Enumerator areas (EAs) from the 2001 Census formed the primary sampling unit (PSU). Five hundred EAs were selected throughout South Africa. Within each PSU or EA, a total of seven visiting points or households were selected for interviewing, using random sampling. A total of 3500 visiting points or households were thus sampled for this study. A graphical representation of the 500 selected EAs is presented in Figure 3.

3.3 Navigation to the selected areas

Once the sample was selected, a navigational toolkit was developed to assist the field teams in finding the correct areas. These kits assisted the supervisors and fieldworkers to locate the exact EA where the interviews were to take place. The navigational kits included:

- Route descriptions, to assist the teams to navigate their way into the selected enumerator areas.
- Maps that, using aerial photographs as a base, identified the exact geographic location of the enumerator areas to be sampled throughout the country.
- More detailed maps that identified the exact area, pinpointing street names and places of interest such as schools, clinics, hospitals etc. selected by the office-based sampling team, within the EAs where respondents were interviewed (Figure 4).

Figure 4: An example of an EA map used to assist the field teams to navigate to the correct areas

3.4 Introduction of the project to the communities

Prior to starting the actual interviewing process, supervisors were instructed to visit the local police stations, iNdunas, chiefs or other role players in the various areas to ensure that the authorities were aware of the project and to inform the communities of their intent. Official letters described the project and its duration and relevant ethical issues were distributed to the authorities. This was done not only as a form of research and ethical protocol, but also to ensure the safety of the field teams.

3.5 Selecting a household and individual

After driving through the EA and introducing the project to the local authorities, supervisors had to select seven households in each EA. This was done in a random way in order to ensure equal selection probability. The first visiting point (household) was selected randomly anywhere in the EA by the supervisor. Once the random starting point had been selected, the field team needed to select the next household by counting an interval and using a serpentine way of systematically moving through the EA. The interval was calculated by dividing the total number of households in the EA by seven (the number of households required in each EA).

Once a household had been selected, a household member needed to be selected randomly as a respondent. This household member (respondent) needed to be 16 years or older. For the purpose of this survey, the KISH grid was used to randomly select the respondent in the household. (See Kish Grid on Page 92 of the Questionnaire – Appendix A)

3.6 Data collection protocol

The HSRC subscribes to a strict internal Code of Ethics and this research project underwent a formal review by the HSRC Research Ethics Committee before being implemented. The project was conducted in a confidential manner and information was only discussed with designated representatives and participants. At all times confidentiality of information was adhered to.

The following general protocol guidelines for data gathering were implemented:

- Fieldworkers and supervisors were required to notify the relevant local authorities that they would be working in the specific area. The purpose was to assist with their own safety and to reassure respondents, especially the elderly or suspicious, that the survey was official.
- Supervisors were advised to inform the iNkosi or iNduna in a rural traditional authority area, whilst in urban formal or urban informal areas a visit to the local police and, if possible, the local councillor was done prior to commencing work in the area.
- Supervisors were further advised that farms should be entered with caution and that they should report to the local AgriSA offices before doing so. Field supervisors were issued with 'Farm letters' which contained information on the purpose of the study and contact details in case they had queries.
- Consent forms needed to be completed upon successfully finishing each interview. While verbal consent was to be secured from the respondent before beginning with the interview, a written consent form had to be signed afterwards.
- Fieldworkers were issued with name tags and letters of introduction to be used in the field.
- The introduction letter was translated into different languages.
- Fieldworkers and supervisors had to present their identity cards when introducing themselves.

3.7 The questionnaire

A draft pilot questionnaire was developed by the Department of Energy. The HSRC commented on the draft pilot questionnaire and gave the feedback to the Department. The questions were formatted to fit the South African Social Attitude Survey (SASAS) format and piloted in a rural and urban set-up. Subsequent to the pilot, feedback was given to the Department of Energy and a final questionnaire was designed. (Appendix A). A training manual was also developed that explained difficult concepts in the questionnaire. The questionnaire was translated into six languages - namely, isiZulu, isiXhosa, Tshivenda, Xitsonga, Setswana and Afrikaans. Fieldworkers were issued with hard copies of the translated templates to ensure consistency of translations for the various languages.

3.8 Training

A one-day training session was held in various provinces. The main training session took place in Pretoria and covered the following provinces: namely, Gauteng, Limpopo, Mpumalanga and North West. All relevant remarks and instructions discussed during the training session were included in the training manual. Other training sessions were held in Port Elizabeth, Durban, Kimberley and Western Cape.

The training session included sessions on selection and sampling of households; fieldwork operating procedures; research protocol; and ethical considerations. The questionnaire was discussed in detail. As far as possible, the training was designed to be participatory, practical and interactive, and gave fieldworkers the opportunity to seek clarification on questions. A training manual was also developed as part of the training toolkit.

The fieldwork commenced in September 2011 and ended in October 2011. A network of locally-based fieldwork supervisors in all parts of the country assisted in data collection. A total of 166 fieldworkers, 33 sub-supervisors and 11 supervisors were employed by the HSRC as freelance employees for a period of six weeks. These fieldworkers and supervisors had a thorough understanding of the local areas where they were deployed and could speak the local languages.

3.9 Quality control

HSRC researchers conducted random visits to selected areas and worked with the fieldworkers for a period of time, to ensure that they adhered to ethical research practices and that they understood the intent of the questions in the questionnaire. HSRC researchers also made sure that the fieldworkers correctly selected the identified households and respondents in the household. The researchers also checked on procedures followed in administering the research instrument. Field back checks were also conducted in eight of the nine provinces. Telephonic back checks were done on 10% of the total sample.

3.10 Data capturing and cleaning

The data-capturing function was outsourced to an external company. The process was, however, carefully monitored by the HSRC's Data Management Centre and the HSRC required 100% verification of the data from the data-capturing company. This meant that all variables were captured twice to ensure 100% verification. After receiving the data, the Data Management Centre embarked on a data-cleaning exercise.

Table 1: Sample realisation

	Number of replaced EAs	Ideal sample (N Households)	Realised sample (N Households)	% Realisation
Eastern Cape	0	420	337	80
Free State	0	252	225	89
Gauteng	0	721	591	82
KwaZulu-Natal	0	595	579	97
Limpopo	0	280	270	96
Mpumalanga	1	266	232	87
North West	0	266	220	83
Northern Cape	0	203	157	77
Western Cape	0	497	393	79
Total	**1**	**3500**	**3004**	**86**

Data were checked and edited for logical consistency, for permitted ranges, for reliability on derived variables and for filter instructions. After the data-cleaning exercise, the analytical team received the realisation rates of the survey. As can be seen from Table 1 above, a realisation rate of 86% was achieved. This is a high realisation rate and was partly achieved due to the fact that communities were well informed about the survey and also because of the data collection methodology –namely, face-to-face interviews.

3.11 Data weighting

The final data set was given to the statistician for benchmarking and weighting purposes. As indicated in Table 2, a total of 3004 people were interviewed during this study. Since the purpose of the study was to look at households, the interviews were weighted up to represent households in South Africa. After weighting, this study is representative of 14, 043 671 households in South Africa. The households were calculated by using data from Statistics South Africa. The final data set (unweighted and weighted) are disaggregated below by key demographic variables.

Table 2: Sample (Unweighted and Weighted)

	Number of interviews (Unweighted)	Percent	Number of Households (Weighted)	Percent
Total	3 004	100	14 043 671	100
Living standard level				
Low	258	9.3	1 508 342	11.6
Medium	1 339	48.5	7 129 326	55.0
High	1 163	42.1	4 334 373	33.4
Population group				
Black African	1 883	62.7	10 903 446	77.7
Coloured	473	15.8	1 231 951	8.8
Indian or Asian	259	8.6	340 551	2.4
White	387	12.9	1 562 133	11.1
Province				
Western Cape	393	13.1	1 778 421	12.7
Eastern Cape	337	11.2	1 796 343	12.8
Northern Cape	157	5.2	266 628	1.9
Free State	225	7.5	896 382	6.4
KwaZulu-Natal	579	19.3	2 360 916	16.8
North West	220	7.3	1 003 390	7.1
Gauteng	591	19.7	3 569 734	25.4
Mpumalanga	232	7.7	962 810	6.9
Limpopo	270	9.0	1 409 047	10.0
Geographic location				
Urban, formal	1 888	62.8	7 758 187	55.2
Urban, informal	243	8.1	1 490 940	10.6
Rural, trad. auth. areas	627	20.9	3 779 946	26.9
Farms	246	8.2	1 014 599	7.2

4. Electrification Status

Between 1994 and 2003, the government had been successful in doubling the proportion of citizens who have access to electricity from one-third to two-thirds of the populace. Despite this, in 2006 the national backlog (with growth) was still sitting at about 3.4 million households. In March 2011, the Department of Energy presented its progress on the Integrated National Electrification Programme (INEP) to the parliamentary monitoring group. During this discussion, the Department communicated that its new drive was to increase access to 92% by 2014. According to the report, the biggest chunks of areas that had not been electrified were in Kwazulu-Natal, the Eastern Cape and Gauteng. In total, the backlog of un-electrified households was 3.4 million. In the Eastern Cape, the biggest backlog was in the formal settlement sector. However, in Gauteng it was in the informal sector (Table 3). Independently, this report established similar findings which speak to the reliability and validity of the study.

Table 3: Electrification backlogs (with and without growth) in the various provinces in South Africa

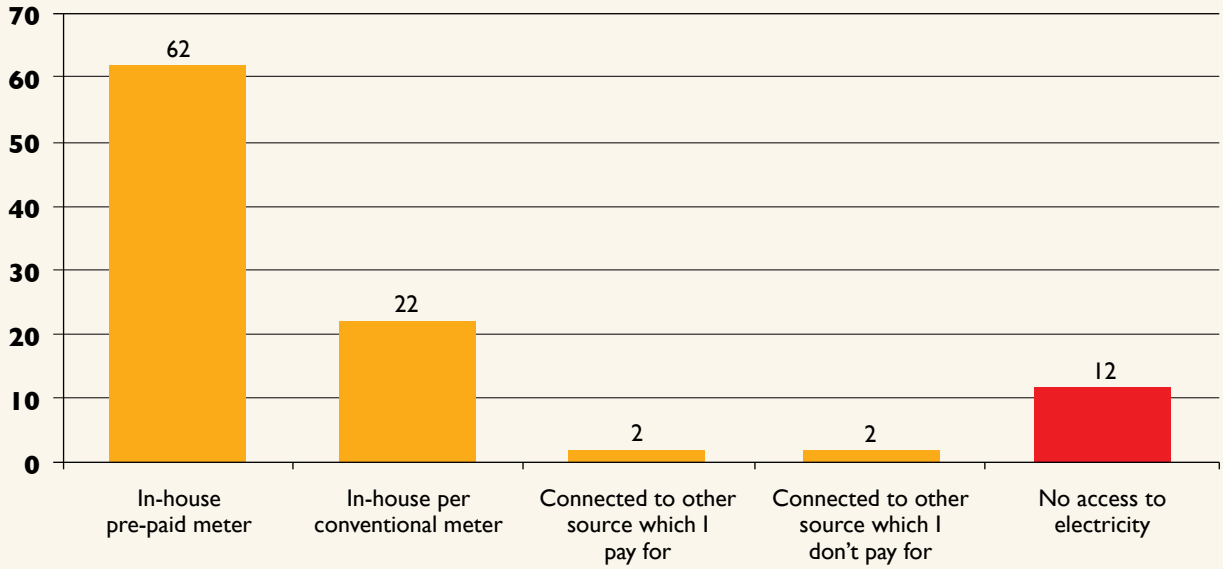
Province	Projected Households	Backlog (Formal Houses)	% Access on Formal Houses	Backlog (Including Informal Houses)	% Access on Informal Houses
Eastern Cape	1 725 713	437 874	74,65	613 113	64,47
Free State	855 508	107 043	87,49	200 435	76,57
Gauteng	3 370 177	412 816	87,75	878 725	73,93
Kwazulu Natal	2 510 605	527 997	78,97	829 737	66,95
Mpumalanga	910 505	124 467	86,33	214 409	76,45
Northern Cape	283 663	23 255	91,80	44 397	84,35
Limpopo	1 293 462	157 807	87,80	270 877	79,06
North West	879 888	73 942	91,60	157 419	82,11
Western Cape	1 401 279	42 178	96,99	212 552	84,83
TOTAL	**13 230 800**	**1 907 379**	**87,04**	**3 421 664**	**76,52**

(DOE March 2012)

4.1 Access to electricity

For this national study, people were asked if they have access to electricity in their households. Eighty four percent indicated that they have access to electricity. This figure is very similar to national projections by the INEP which proclaims that 87% of households in South Africa are electrified. This independent finding bears testimony to the accuracy of the survey in representing national electrification data on South Africans.

Figure 5: Access to electricity (percent)



During the 1980s, the majority of households had conventional metering systems, but due to payment boycotts and difficulties in collecting arrears, a pre-paid metering system was introduced and promoted, inter alia, as part of the "Electricity for All" campaign. This campaign was successful, with the result that the majority of electrified households in South Africa currently use a pre-paid metering system (62%). With this system, households purchase tokens in the form of cards or printed payment slips to activate an amount of electricity. People thus pay upfront for their electricity. Less than a quarter (22%) of households in South Africa currently have a conventional metering system where consumption is recorded and bills issued on the basis of a metered or estimated consumption. Very few households (2%) are connected to electricity without paying for it. In order to profile access to electricity, it was disaggregated by select socio-demographic variables.

Table 4: Access to electricity by select socio-demographic attributes (percent)

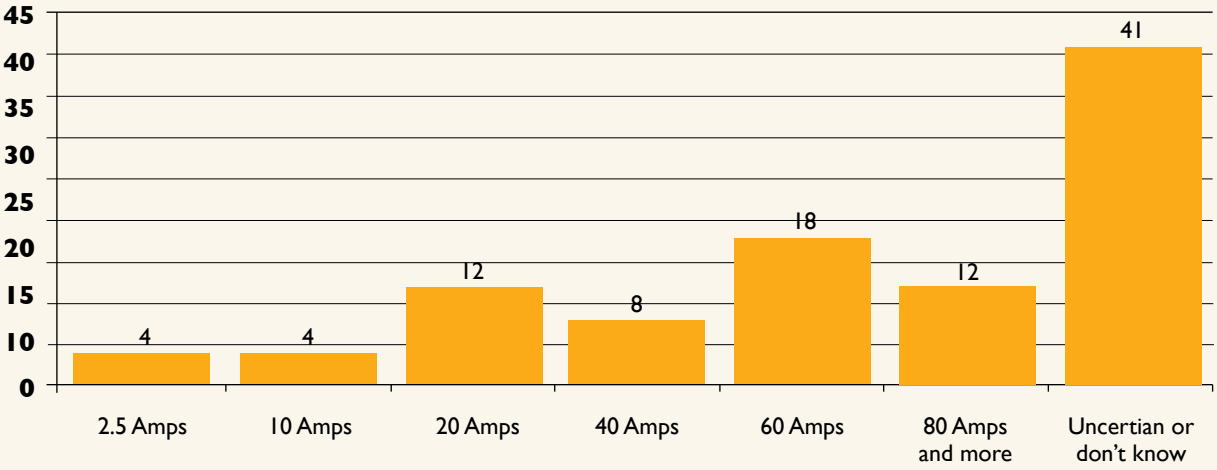
	In-house pre-paid meter	In-house conventional meter	No access to electricity	Connected to other source- pay for	Connected to other source- do not pay for	Uncertain/ Don't know
South Africa	62	22	12	2	2	0
Population group						
Black African	67	14	15	2	2	0
Coloured	68	25	7	0	0	0
Indian Asian	29	70	0	0	0	0
White	30	70	0	0	0	0
Living standard level						
Low	22	2	72	1	3	0
Medium	76	12	7	3	2	0
High	53	46	0	1	0	0
Geographic location						
Urban formal	61	34	2	2	1	0
Urban Informal	55	4	30	6	6	0
Rural, trad. auth. areas	72	5	21	1	1	0
Farms	43	23	31	0	3	0
Province						
Western Cape	70	23	1	5	1	0
Eastern Cape	65	12	22	1	0	0
Northern Cape	64	30	2	1	3	0
Free State	64	26	4	5	0	0
KwaZulu-Natal	52	24	20	1	3	0
North West	69	16	14	1	0	0
Gauteng	52	33	11	2	1	0
Mpumalanga	71	16	12	0	0	0
Limpopo	80	6	8	1	5	0

As could be expected, the highest proportion of non-electrified households is among the households with a low living standard (72%), in farms (31%) and urban informal (30%) areas. Consistent with national backlog figures the Eastern Cape and KwaZulu-Natal has the highest proportion of non-electrified households.

4.2 Type of connection

The Ampere, in practice often shortened to Amp (singular) or Amps (plural), is a unit of electrical current consisting of an electric charge per unit time, in coulombs per second. According to the DME (2003), low levels of supply (10 amps) are suited to municipalities with lower capacity and large proportions of poorer consumers. However, government acknowledges that 10 amps supply will not be suitable for households with many members and that frequent tripping of the control systems will be experienced (Ruiters, 2009). In order to gain an understanding of types of electricity supply, households were asked to indicate their electricity supply in terms of Amps. More than two-fifths (41%) of households were uncertain and could not answer the question. Since such a large proportion of households did not know what Amps they were serviced with, the answer to this question should not be regarded as factual information, representing types of connections in South Africa, but rather as indicative of knowledge about Amps.

Figure 6: Type of connections that households have (percent)



Households which were most likely to be uncertain about the type of connections they have were found in the Eastern Cape and Northern Cape, where 85% and 50% respectively did not know what type of connection they had. Households in urban formal areas (45%) were least likely to know their type of connection, followed by households in urban informal areas (42%), farms (36%) and rural traditional authority areas. Almost half (49%) of households with a low living standard measure were also uncertain about their Amps connections.

A fair assumption was that households with low Amps would be less satisfied with electricity provision. An analysis of satisfaction and the Amps per household revealed that this assumption was true to some extent. Households with 2.5 Amps and 20 Amps had the largest proportion of dissatisfied people, with more than a quarter of these households being dissatisfied with electricity provision. The largest proportions of satisfied households were found among those households that have 60 or 80 Amps connections.

Table 5: Amps in households and satisfaction with electricity provision (percent)

	Satisfied	Neither nor	Dissatisfied	Don't know	Total
2.5 Amps	59	15	26	0	100
10 Amps	65	15	18	1	100
20 Amps	59	14	27	0	100
40 Amps	59	26	15	0	100
60 Amps	67	19	13	0	100
80 Amps and more	71	7	21	1	100
Uncertain or Don't know	65	15	20	0	100
Total	**65**	**16**	**20**	**0**	**100**

5 Energy Consumption and Poverty

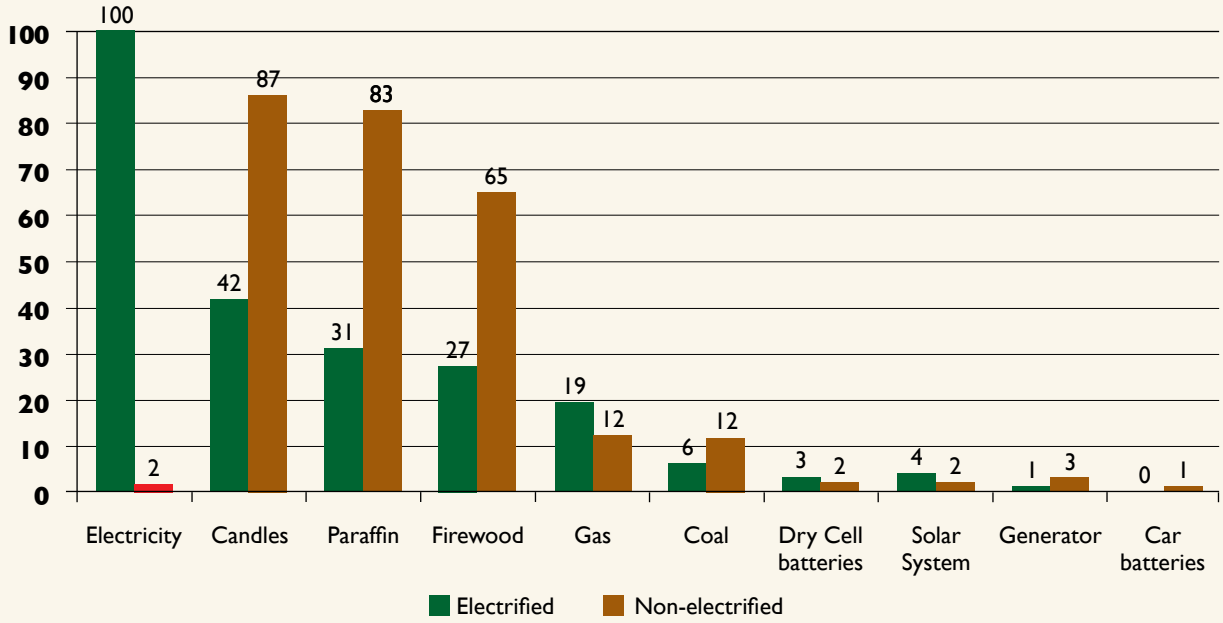
The Department of Energy's Integrated Electricity Resource Plan (IRP) for 2010 -2030 (DoE, 2011) was promulgated by Cabinet in March 2011. It outlines the preferred scenario in relation to medium- to long-term options for increasing the electricity supply and managing demand over a 20-year period between 2010 and 2030. It is premised on estimates that electricity consumption over the interval will increase by three-quarters from 260 terrawatt hours (TWh) in 2010 to 454 terrawatt hours by 2030. Similarly, peak electricity demand is predicted to increase from 39 gigawatts (GW) to 68GW over the two decades. The Policy-Adjusted IRP 2010 scenario proposes a reduction in the share of coal in the country's electricity generation and a corresponding increase in the share represented by low-carbon technologies. The IRP acknowledges the twin challenges of energy security and climate change and how these need to be accounted for and inform the choices that government and citizens make in relation to energy consumption and the energy mix in coming years. In such a policy context, it is important to understand current energy use patterns, and to this end this section of the report examines and profiles energy consumption and patterns of energy poverty among South African households.

5.1 Household energy sources

There has emerged a relatively consistent pattern of evidence from energy use studies conducted during the last two decades which suggests that South African households, most especially those exhibiting higher levels of material deprivation, tend to rely on multiple energy sources in order to ensure that their day-to-day energy requirements are adequately met. Importantly, this phenomenon has been shown to characterise households, irrespective of their electrification status. This contradicts prevailing energy transition theories and the 'energy ladder' model, which have typically assumed a straightforward, uni-directional shift from traditional to modern energies and appliances once households are provided with an electrical connection.

From Figure 7, it is evident that considerable patterns of difference exist between electrified and non-electrified households in the range of energy sources that they employ to meet their basic needs. Those with electricity all reported that they used this source either for lighting, cooking or heating, although it is apparent that other sources such as candles, paraffin, firewood and gas continue to be relied upon in at least a fifth of cases. Conversely, in the absence of a domestic connection, non-electrified households rely primarily on candles, paraffin and firewood, with more nominal shares reporting the use of coal and gas. The use of dry cell and car batteries, a solar system or generator hardly features for electrified and non-electrified households alike, being reported in fewer than 5% of cases. It is nonetheless likely that there is some degree of under-reporting of dry-cell and car batteries, especially among non-electrified households, which is likely to be attributable to the fact that energy sources for the running of appliances was not asked for in the survey.

Figure 7: Use of energy sources among South African households, by electrification status (percent using)



In discussing multiple energy use, it is important to consider the different end-uses or purposes for which households are employing energy sources, such as lighting, space heating, cooking, heating water, and the powering of appliances (radios and hi-fis, televisions, etc.). For electrified households, the relatively widespread use of candles (42% of cases) is probably part of an energy substitution strategy in which candles are relied on to light homes in instances of electricity service interruptions or if the household exhausts its budgeted expenditure in the case of prepaid electricity meters. Furthermore, a third (31%) of electrified households indicate that they use paraffin and slightly more than a quarter (27%) use firewood, most likely for cooking and possibly for lighting, too, in the case of paraffin. These statistics point starkly to the existence of barriers to energy-switching, a topic that is discussed in depth later in the report. In non-electrified households, the use of candles (87%), paraffin (83%) and firewood (65%) remains pronounced, obviously for lighting, cooking and heating. A fuller analysis of energy sources used for different end-uses and how it varies according to location and other household characteristics will be provided later in this section of the report.

5.1.1 Living standard differences

With regard to socioeconomic differences in this pattern of domestic energy use, Figure 8 reveals that marginally more than a quarter (28%) of households with low living standards make use of electricity, compared with near-universal usage among medium and high living standards (93% and 100% respectively). By contrast, candles, firewood and paraffin are each present in more than 70% of low living standard households, and between a third and a half of medium living standard households. From a multiple energy use perspective, it is also important to highlight that even those with a high living standard rely on a range of energy sources other than electricity to meet their energy needs, albeit to a lesser degree in most instances than those with greater material disadvantage.

Figure 8: Use of Energy Sources for lighting, cooking or heating, by living standard level (percent using)

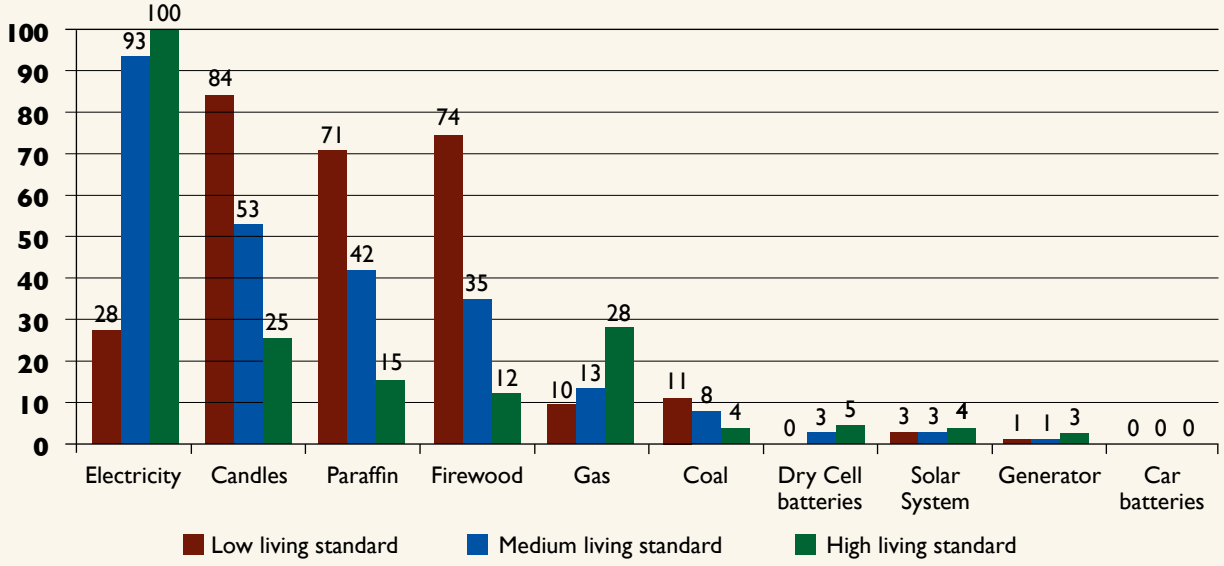
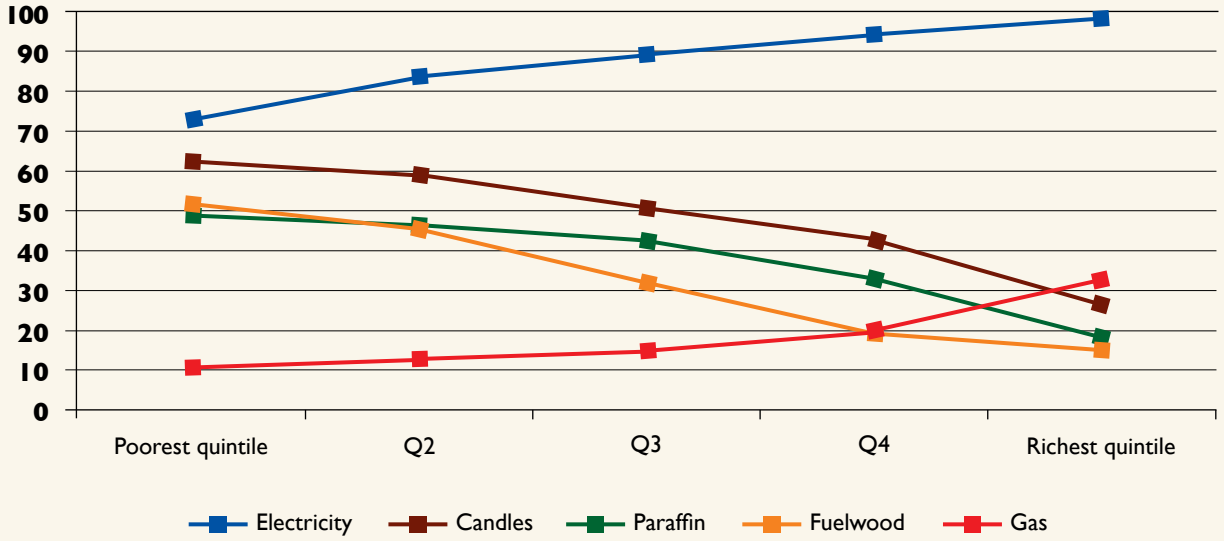


Figure 9: Use of select energy sources, by quintiles of per capita monthly income (percent using)



5.1.2 Geographic differences

Another well-established trait of energy consumption patterns in the country pertains to the salience of the geographic location of households. Traditionally, three factors have proven especially significant: namely, rural-urban location, climatic conditions and the associated space heating requirements in winter months, and proximity to the country's coalfields (North West, Gauteng, Free State, Mpumalanga, Limpopo and northern KwaZulu-Natal) (Eberhard and Van Horen, 1995). The extent to which such factors emerge as important in the 2011/12 survey is discussed below.

In Table 6, the statistics on multiple energy use are further disaggregated by the geographic location of the sampled households. The purpose of the table is to illustrate all energy sources used by households. Households could therefore report various energy sources and therefore the percentages do not sum up to 100%.

Rural households are clearly substantially more reliant on biomass resources, especially firewood, than those residing in small towns and metropolitan cities. An estimated three-quarters (74%) of households in rural traditional authority areas and 58% of rural farm dwellers were using firewood as an energy source, compared to only 11% of households in formal urban areas and 17% in informal settlements. Other forms of non-commercial biomass resources such as dung and crop residue hardly feature at all in domestic energy consumption patterns.

Table 6: Households reporting use of energy source, by geographic location and province (cell percent, multiple response table)

	Electricity	Candles	Paraffin	Firewood	Gas	Coal	Drycellbatteries	Solar system	Generator	Car batteries	Base N
South Africa	88	47	37	32	19	7	3	3	1	0	3000
Geographic location											
Urban formal	98	30	25	11	22	5	4	4	2	0	1885
Urban informal	70	51	62	17	12	12	4	2	2	0	243
Rural, trad. auth. areas	79	77	50	74	15	7	2	2	1	0	626
Farms	70	66	45	58	17	13	2	5	3	0	246
Province											
Western Cape	99	24	26	14	19	0	2	1	0	0	393
Eastern Cape	78	48	72	48	16	5	2	3	2	0	337
Northern Cape	98	52	16	37	25	4	3	4	2	1	157
Free State	96	35	66	19	26	6	7	11	5	1	224
KwaZulu-Natal	80	57	37	37	26	9	3	3	1	0	579
North-West	85	77	42	51	18	6	6	5	1	0	218
Gauteng	89	30	28	8	19	7	5	3	2	0	590
Mpumalanga	89	70	23	45	12	26	1	3	1	0	232
Limpopo	91	75	20	70	6	1	2	1	0	0	270

Candles and paraffin appear to be fairly common in both rural and urban households, though to different degrees. Candles are employed by three-quarters (77%) of rural traditional authority households and two-thirds (66%) of rural farm households. They are also present in half of the households in informal settlements, though paraffin is a more common energy source than candles, being used in 62% of households. This is in spite of the rapid rise in the price of paraffin alongside petrol costs in recent years. There is near-universal usage of paraffin among non-electrified households in informal settlements. Paraffin is used in around half of households in rural traditional authority areas and farms (50% and 45% respectively). The domestic use of gas is reported by a fifth (19%) of surveyed households, and tends to have a greater presence in formal urban areas, most especially higher income electrified households, relative to informal settlements and rural locations. On aggregate, no other energy source had a prevalence exceeding 10%, including batteries, coal, solar system and generator electricity. It is nonetheless worth mentioning that coal is more prevalent in informal settlements and on farms.

Notable variation in the profile of energy consumption patterns also emerges when one examines energy sources by province (Table 6). In Limpopo, Mpumalanga and Northern Cape, relatively high electricity usage (91%, 89% and 98% respectively) coexists with notable shares using candles and firewood. In Mpumalanga, the prevalence of coal, at 26%, remains the highest of any of the nine provinces and stands at nearly four times the national average (7%). This is a reflection of the proximity to some of the country's major coalfields which are situated around the towns of Ermelo, Witbank and Secunda. In KwaZulu-Natal and Eastern Cape, the provinces with relatively lower electrification rates, a broader range of energy sources are being used. In the Eastern Cape, firewood usage is above average, while paraffin is found in nearly three-quarters of homes (a figure that exceeds the average by more than 30%. In Gauteng and the Western Cape, traditional non-commercial energy sources are used in a small share of households. Transitional energy sources such as paraffin are common in slightly over a quarter of households. Electricity, however, remains the dominant energy source that is used by households in these two provinces. Above-average use of gas as a domestic energy source is evident in KwaZulu-Natal, Free State and Northern Cape in particular, as well as in Gauteng and the Western Cape.

5.2 Main uses of energy sources

The preceding analysis provides an overview of the different energy sources that South African households employed, irrespective of purpose, in late 2011. We now direct attention to the main energy source that is being used for three specific domestic end-uses: namely, lighting, cooking and space heating.

5.2.1 Main energy source for lighting

As Table 7 convincingly demonstrates, households that have been electrified almost exclusively use electricity for lighting purposes (97%), with a marginal contingent specifying that they continue to rely on candles (1%). By contrast, two-thirds of non-electrified households (67%) rely on candles as the main source of lighting, with paraffin being the predominant energy source for this purpose in most of the remaining cases (26%). Other energy sources hardly feature, and no single option is mentioned in more than five percent of cases. Compared to the main energy sources used for lighting nationally in electrified and non-electrified households included in Statistics South Africa's General Household Survey of 2010, the observed differences for households are not particularly pronounced.

As one would intuitively expect, there is discernible variation in the energy sources used for lighting, based on levels of material deprivation. Households characterised by low living standards are more likely to approximate the pattern evident among non-electrified households, given the probability of lower levels of access to mains electricity for the disadvantaged. By contrast, households with a medium or high living standard rely almost entirely on electricity, with nominal shares dependent on other sources for their lighting requirements. This trend is again present when examining energy use patterns by income quintiles.

These class-based differences remain relatively consistent when one examines the results for rural-urban location and province (Table 7). In formal urban areas, electricity is again almost exclusively used for lighting homes, while in informal urban settlements, rural traditional authority areas and farms, candles and paraffin are relatively more common, due to the lower shares reporting access to electricity from the mains. The use of paraffin is more typically used for lighting in informal settlements and in rural areas than in formal urban localities and on farms. Nonetheless, candle use remains a more widespread energy form for lighting. It is worth mentioning that the use of energy sources such as paraffin and candles in the household pose significant health risks, in that they have the potential to cause accidents that result in injury or death - for instance, the poisoning of children who drink fluid fuels or when a large block of shacks is razed after a paraffin stove triggers a fire in a single household (Howells et al., 2006).

Electricity is generally viewed as the cleanest energy source for households, thereby reducing health risks, but also bringing other gains such as providing a more efficient lighting source for children to perform homework tasks. At the provincial level, electricity is used by more than 80% of households as the main source of energy for lighting in seven of the nine provinces, with the figure increasing to more than 90% of households in Western Cape, Northern Cape and the Free State. In KwaZulu-Natal and Eastern Cape, marginally over three-quarters of sampled households rely on electricity, with candles representing an important main source in the former province and paraffin in the latter. Only in Eastern Cape does more than a tenth of households use paraffin for lighting on aggregate, regardless of electrification status.

Table 7: Main energy source used for lighting, by socioeconomic characteristics (cell percent, multiple response table)

	Electricity	Candles	Paraffin	Dry cell batteries	Gas	Solar system	Generator	Total	Base N
South Africa	86	9	3	1	1	0	0	100	2967
Electrification status									
Electrified	97	1	0	1	0	0	0	100	2688
Non-electrified	1	67	26	1	4	1	1	100	269
Living standard level									
Low	27	52	17	0	2	1	1	100	253
Medium	91	5	2	1	0	0	0	100	1323
High	98	0	0	1	0	1	0	100	1152
Per capita income quintiles									
Poorest quintile	71	19	7	1	1	1	0	100	497
Quintile 2	81	13	4	1	1	0	1	100	506
Quintile 3	88	7	3	1	1	0	0	100	557
Quintile 4	92	5	2	1	0	0	0	100	649
Richest quintile	95	0	1	2	1	1	0	100	795
Geographic location									
Urban formal	96	1	1	1	0	0	0	100	1867
Urban informal	70	17	10	1	0	1	1	100	238
Rural, trad. auth. areas	76	15	6	2	1	0	0	100	621
Farms	67	26	3	0	3	1	0	100	241
Province									
Western Cape	98	0	1	0	0	1	0	100	392
Eastern Cape	77	8	14	0	0	0	0	100	334
Northern Cape	92	4	0	1	0	3	0	100	157
Free State	92	3	4	1	0	0	0	100	223
KwaZulu-Natal	77	18	1	2	2	0	0	100	578
North-West	82	15	2	0	0	2	0	100	213
Gauteng	87	7	3	2	1	0	0	100	580
Mpumalanga	88	10	1	0	1	1	0	100	221
Limpopo	89	8	0	3	1	0	0	100	269

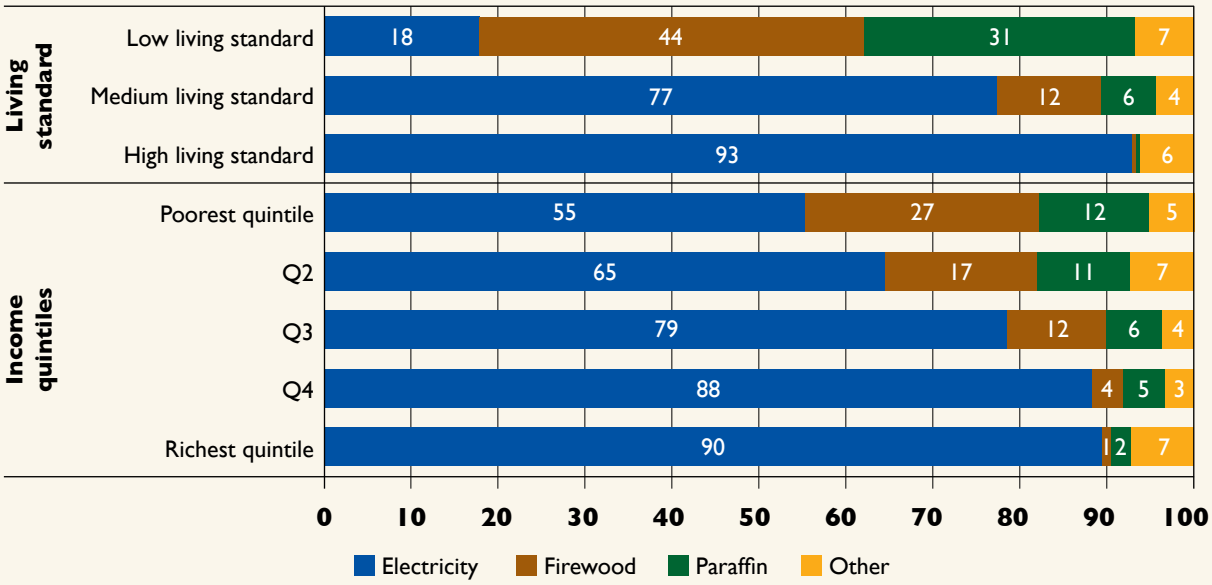
5.2.2 Main energy source for cooking

Cooking represents one of the most energy-intensive applications (Howells et al, 2006) and, as such, it is unsurprising that slightly more than three-quarters (76%) of households use electricity as the main energy source for cooking (Table 8). Previous research has shown that the usage of electricity for cooking has been increasing, but at a slower rate than for lighting and media uses (Bekker et al, 2008). A complex set of factors is said to govern the decision not to adopt electricity for thermal applications once a household has been electrified, ranging from cultural inertia to change to the perceived lack of affordability of electricity (White et al, 1997; Sebitosi and Pillay, 2005; Bekker et al, 2008). Nonetheless, the 2011/12 statistics show that only around a tenth (8%) of electrified households continue to depend on firewood as a main cooking source, with marginal shares reporting gas, solar electricity, paraffin and coal. For non-electrified households, firewood and paraffin predominate as the main energy source for cooking purposes (40% and 50% respectively). Again, gas, coal, solar electricity and electricity from generators are used in a small percentage of households as the primary source to meet their cooking needs.

Table 8: Main energy source used for cooking, by electrification status (cell percent, multiple response table)

	Electricity	Firewood	Paraffin	Gas	Solar System	Coal	Generator	Other	Total	Base N
South Africa	76	11	7	3	2	1	0	0	100	2970
Electrified	86	8	1	3	2	1	0	0	100	2687
Non-electrified	2	40	50	4	1	2	1	0	100	271

Figure 10: Main energy source for cooking, by living standard level and quintiles of per capita monthly income (percent using)



The socioeconomic gradient of difference in terms of main energy source for cooking is quite stark, especially when one examines the patterns by living standard measure and income level (Figure 10). Households with a low living standard and ranking among the poorest income quintiles are considerably more inclined to report the use of firewood and paraffin relative to better-off households. Of note is the fact that a considerable proportion of the low-income, electrified households included in the study are likely to be relying on firewood and less on electricity. This suggests the existence of barriers or practices among poorer households that inhibit a fuller transition from firewood to electricity for this end use.

As for geographic variation, more than 90% of households use electricity for cooking in the Western Cape, while the figure exceeds 80% in Free State, Gauteng and the Northern Cape (Table 9). Only in Limpopo, Mpumalanga and the Eastern Cape is the share of households using electricity for cooking purposes below the national average. Firewood is relied on in a majority of provinces as the second most common main energy source for cooking. The case of Limpopo is somewhat atypical in that two-fifths (40%) of households use wood as the main energy source for cooking compared to 55% using electricity. In Mpumalanga, firewood continues to be used by nearly a quarter (23%) of households as the main energy source relied on for cooking.

Table 9: Main energy source used for cooking, by socioeconomic characteristics (cell percent, multiple response table)

	Electricity	Firewood	Paraffin	Gas	Solar System	Coal	Generator	Other	Total	Base N
South Africa	76	11	7	3	2	1	0	0	100	2970
Geographic location										
Urban formal	91	1	2	3	2	0	0	0	100	1873
Urban informal	68	1	27	0	2	1	1	0	100	239
Rural, trad. auth. areas	53	36	8	3	0	0	0	0	100	619
Farms	62	18	11	3	1	4	0	0	100	239
Province										
Western Cape	94	0	1	3	1	0	0	0	100	393
Eastern Cape	65	18	10	4	2	0	0	0	100	330
Northern Cape	81	10	1	7	0	0	0	1	100	155
Free State	87	2	5	2	4	0	0	0	100	223
KwaZulu-Natal	72	14	9	4	1	0	0	0	100	575
North-West	75	11	10	2	1	1	0	0	100	217
Gauteng	84	0	10	2	2	1	1	0	100	583
Mpumalanga	62	23	4	1	2	7	1	0	100	224
Limpopo	55	40	3	1	0	0	0	0	100	270

Paraffin is used as the primary source for cooking in around a tenth of households in North West, Gauteng, Eastern Cape and KwaZulu-Natal. Gas is hardly used in any of the provinces, apart from Northern Cape (7%). In Mpumalanga, a larger than average share of households (7%) indicate that they continue to rely on coal as the predominant energy source for cooking. Other sources are hardly mentioned as main energy sources for cooking.

An equally significant variation in main cooking energy patterns is found when disaggregating by type of location. In formal urban areas, electricity has become the energy source of choice for cooking, being used in 91% of cases. In informal urban settlements, two-thirds are using electricity (68%), but a sizeable 27% rely on paraffin. This reflects the distinction between electrified and non-electrified households in informal settlements, with the former opting to use electricity whereas the latter, left with constrained choices in the absence of electricity, are dependent on paraffin to meet their cooking requirements. In rural traditional authority areas, just over half of households (53%) use electricity for cooking, with slightly over a third (36%) using firewood, with less than 10% reporting other energy sources. On farms, around three-fifths (62%) use electricity for their cooking needs, with close to a fifth (18%) using wood and barely a tenth (11%) relying on paraffin.

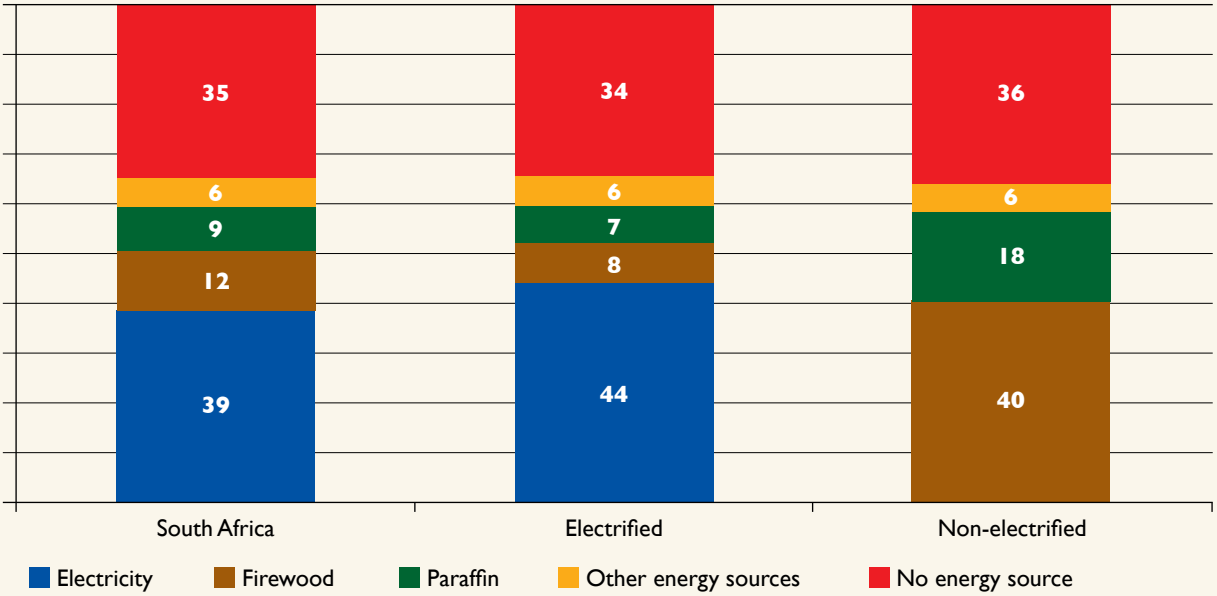
5.2.3 Main energy source for heating spaces and keeping warm

Apart from cooking, another energy-intensive thermal application is domestic space heating. On aggregate, two-thirds of South African households (65%) use an energy source to heat spaces and keep warm, while the remaining third do not use energy sources but opt mainly to wear warm clothing and use blankets (Table 10). More specifically, around two-fifths (38%) use electricity as the main source for space heating, while 12% use firewood and 9% paraffin. Coal, gas and other sources are mentioned in less than 5% of cases in general.

Examining the main energy source for space heating by electrification status (Figure 11) we find that in electrified household 44% primarily use electricity, with nominal shares reporting firewood, paraffin and other energy sources (8%, 7% and 6% respectively). A considerable share of electrified households (34%) use no energy source for heating, choosing instead to make use of blankets, warm clothing or nothing at all. In non-electrified households, firewood is the primary form of energy relied on for space heating, present in two-fifths (40%) of homes. The share using paraffin is double the national average (18%), with 'other sources' consisting mainly of coal (4%).

Those with a low living standard exhibit a very similar pattern as non-electrified households in terms of main energy source used for space heating. A marginal 5% use electricity, while 43% employ firewood and 12% paraffin (Table 10) while 36% use no energy source. Higher electricity usage (34%) for space heating is evident in households classified with a medium living standard, with wood and paraffin serving as the primary source for heating in around a tenth of cases (12% and 10% in turn) and a similar share again indicating no energy source (37%). For households with high living standards, close to three-fifths (57%) use electricity for space heating, with other energy sources hardly featuring. A third reportedly use no energy source, with an even split between warm clothing and blankets (16% and 15% respectively). A similar positive association is discernible in relation to income status and electricity usage for heating purposes. Poor households have a greater likelihood of using wood and paraffin for space heating, while the top two income quintiles in particular are more inclined towards electricity usage for this end-use. Similar levels of 'no energy source' are present across the income distribution.

Figure 11: Main energy source for heating spaces and keeping warm, by electrification status (percent using)



At a provincial level, slightly more than a third (36%) of households in Limpopo rely on firewood for heating, with this energy source being used by around a fifth of households in North West and Eastern Cape (Table 10). In Eastern Cape and the Free State, paraffin is particularly more common relative to the national average and other provinces, being present in nearly a quarter of households (24% in both instances). Coal continues to be more commonly used than average for heating in Mpumalanga (15%), again reflecting closeness to coalfields.

The energy needs for end-uses such as space heating are likely to be influenced by prevailing climatic conditions, especially during winter months. The 'no energy source' category provides a sense of this relationship, given that it generally consists of those who do not heat spaces. The province with the largest share of households declaring that they use no energy source is the Western Cape (51%), which is somewhat surprising given that mid-winter in the province can become especially cold. It seems that the main response is to use blankets (33%) instead of electricity (32%). The higher than average share of respondents in Limpopo, Mpumalanga and KwaZulu-Natal stating they do not use an energy source heat spaces in their homes is more in line with expectations, given the relatively favourable winter weather along the KwaZulu-Natal coast and Lowveld of Mpumalanga and Limpopo.

Table 10: Main energy source used for heating rooms and keeping warm, by electrification status, living standard and location (row percent)

	Energy source								No energy source							
	Electricity	Firewood	Paraffin	Coal	Gas	Dry cell batteries	Solar System	Generator	Warm clothing	Blankets	Hot water bottle	Other	None of these	(Don't know)	Total	Base N
South Africa	39	12	9	2	2	1	0	0	18	15	1	0	1	0	100	2919
Electrification status																
Electrified	44	8	7	2	2	1	1	0	17	15	0	0	1	0	100	2636
Non-electrified	1	40	18	4	0	1	0	1	19	13	1	0	2	0	100	271
Living standard level																
Low	5	43	12	4	0	0	0	0	20	15	1	0	0	0	100	251
Medium	34	12	10	3	1	1	0	0	19	16	0	0	2	0	100	1304
High	57	1	4	1	3	1	1	0	16	15	1	0	1	0	100	1130
Per capita income quintiles																
Poorest quintile	26	26	10	2	0	0	1	0	18	14	0	0	1	0	100	497
Quintile 2	29	18	11	4	1	1	0	0	19	15	0	0	1	0	100	506
Quintile 3	35	11	12	3	2	1	0	0	19	14	0	0	2	0	100	557
Quintile 4	43	6	8	2	2	1	1	0	19	18	1	0	2	0	100	649
Richest quintile	58	2	4	0	4	1	1	0	14	13	1	0	1	0	100	795
Geographic location																
Urban formal	50	2	7	2	3	1	1	0	17	16	1	0	1	0	100	1838
Urban informal	35	5	20	5	0	2	0	1	16	10	1	1	3	1	100	237
Rural, trad. auth. areas	20	34	8	2	0	0	1	0	20	14	0	0	1	0	100	605
Farms	31	21	9	4	1	0	1	0	16	17	0	0	0	0	100	239
Province																
Western Cape	32	1	12	0	1	0	0	0	17	33	0	0	1	0	100	381
Eastern Cape	20	18	24	3	1	0	0	1	6	26	0	0	0	0	100	327
Northern Cape	53	9	7	4	3	0	1	0	13	7	0	1	3	0	100	154
Free State	45	4	24	0	3	1	1	1	10	11	1	0	1	0	100	223
KwaZulu-Natal	42	15	2	2	0	0	1	0	22	16	0	0	0	0	100	571
North West	47	19	3	0	1	1	0	0	9	14	1	0	4	0	100	207
Gauteng	57	2	6	2	4	2	1	0	18	6	1	0	2	0	100	569
Mpumalanga	26	16	2	15	4	0	0	1	16	15	1	0	4	1	100	222
Limpopo	18	36	1	0	0	0	1	0	38	3	1	0	1	0	100	265

As with other end-uses, the energy use patterns for heating exhibit distinct location differences. The largest share of households in rural traditional authority areas (34%) use wood as the main source of heating, followed to a lesser extent by electricity (20%) and paraffin (8%), while other non-energy sources such as blankets are used in around a third of cases (35%). On farms, electricity is somewhat more prevalent than wood (31% versus 21%), with paraffin again playing a subsidiary role (9%) and non-energy sources used by 30% of households. For households in formal urban areas, electric heating is more common (50%), with very little reliance on other energy sources. Non-energy sources (blankets, warm clothing) are used mainly for space heating in 35% of cases. Those situated in urban informal areas are most likely to use paraffin for heating (20%) while only 5% use wood, which is a reflection of the limited availability of biomass in many informal settlements. A third (35%) use electricity while 30% use no energy source.

5.3 A closer examination of multiple energy use

Earlier in this section of the report, it was shown that multiple energy use remains an enduring feature of the energy consumption patterns of both electrified and non-electrified households in South Africa. This issue will now be further examined by providing a more detailed assessment of the variety of energy sources that households are using for the three different end-uses included in the survey.

5.3.1 Lighting

With respect to energy choice and preferences for lighting homes, the survey shows that 46% of South African households on average rely on a single energy source, with the majority share (54%) characterised by multiple energy use (Table 11). Two-fifths (40%) use electricity to meet all their lighting requirements, with small shares depending solely on candles (5%) and paraffin (1%). As one might anticipate, the main energy mix used for lighting is a combination of electricity and candles (25%), while relatively small shares rely on paraffin, candles and electricity (7%) or paraffin and electricity (6%). No other combination exceeds 5% of cases.

Electrified households are most likely to be exclusively using electricity for their domestic lighting needs (45%), while close to a third (29%) use a combination of electricity and candles, the latter forming a critical secondary source in times of interruption of service, whether for technical reasons or due to cut-offs for reasons such as prepaid vouchers running out or non-payment. As with the national results, a minority of electrified households report the use of paraffin, candles and electricity (8%) or paraffin and electricity (6%) as the energy combinations used in lighting their homes. Non-electrified households rely foremost on a combination of candles and paraffin (41%) for lighting purposes. The sole use of candles occurs in a further 37% of cases, while paraffin is used as a single energy source in 9% of non-electrified households.

In terms of class-based differences, households with a low- or medium-living standard tend to exhibit a greater reliance on multiple energy sources than those with a high living standard (Table 11). Households with a low standard of living primarily employ candles (32%) for lighting, while a further 29% use both candles and paraffin. Slightly more than a tenth (13%) use a mix of electricity and candles. Paraffin and electricity is used singly by around 5% of these households. Among households with medium living standards, there is a considerably higher share using electricity as the sole source for lighting (36%), with an almost equivalent share (33%) using both electricity and candles. Paraffin is used most in combination with other energy sources, with 10% using it together with candles and electricity, 7% in combination with electricity only, 3% with candles, and 2% with different combinations, including gas. Finally, three-fifths (60%) of high living standard households use electricity only for lighting, with 17% using electricity and candles, with a significantly lower presence of paraffin and a modestly higher than average use of gas combinations alongside electricity.

Table 11: Energy choice for lighting, by electrification status and living standard (column percent)

Multiple energy sources for lighting	South Africa	Electrified	Non-electrified	Low	Medium	High
Single energy use	***46***	***45***	***49***	***43***	***39***	***61***
Electricity only	40	45	1	4	36	60
Candles only	5	0	37	32	2	0
Paraffin only	1	0	9	5	1	0
Gas only	0	0	1	1	0	0
Solar system only	0	0	1	1	0	0
Dry cell batteries only	0	0	0	0	0	0
Other source only	0	0	0	0	0	0
Multiple energy use	***54***	***55***	***51***	***57***	***61***	***39***
Candles & electricity	25	29	0	13	33	17
Paraffin, candles & electricity	7	8	0	5	10	2
Paraffin & electricity	6	6	0	3	7	3
Paraffin & candles	5	0	41	29	3	0
Gas & electricity	2	3	0	0	1	5
Gas, candles & electricity	2	2	0	0	1	3
Paraffin, gas & electricity	1	1	0	0	1	1
Paraffin, gas, candles & electricity	1	1	0	0	1	1
Other energy combinations	5	4	10	5	3	7
Total	**100**	**100**	**100**	**100**	**100**	**100**

Provincially, only in the Western Cape and Gauteng are more than half of households reliant on a single source of energy for lighting purposes, most of which is accounted for by the use of electricity (Table 12). In KwaZulu-Natal, nearly half of households (48%) utilise a single energy source for lighting, which is accounted for by a below-average share reporting electricity (36%) coupled with a higher than average share using candles (11%). Comparatively low levels of single energy use are observed in Limpopo and North West (both 26%), Eastern Cape (32%), Mpumalanga and Free State (both 33%). This is related to the comparatively low use of electricity by households in these provinces as a sole source for lighting.

Multiple energy use is above average for households in six provinces: namely, in descending rank order, North West, Limpopo, Eastern Cape, Mpumalanga, Free State and Northern Cape. In the cases of Limpopo, Mpumalanga and Northern Cape, the most common multiple energy source combination is candles and electricity. In North West, a lower share report this electricity-candles mix (36%), with paraffin, candles and electricity forming an important second energy mix (19%). In the Eastern Cape and Free State, a greater spread of different multiple energy uses is apparent. In the former instance, roughly equivalent shares of households use candles and electricity (15%), paraffin, candles and electricity (14%), paraffin and electricity (17%), as well as paraffin and candles (13%). Households in the Free State are mostly likely to report paraffin and electricity (18%), with slightly lower shares mentioning candles and electricity, and paraffin, candles and electricity (10% in both cases).

Table 12: Energy choice for lighting, by province (column percent)

Multiple energy sources for lighting	WC	EC	NC	FS	KZN	NW	GP	MP	LP
Single energy use	***64***	***32***	***41***	***33***	***48***	***26***	***63***	***33***	***26***
Electricity only	64	27	39	32	36	15	58	24	19
Candles only	0	1	1	1	11	10	2	8	6
Paraffin only	0	4	0	0	0	0	2	1	0
Gas only	0	0	0	0	1	0	0	0	0
Solar system only	0	0	1	0	0	1	0	0	0
Dry cell batteries only	0	0	0	0	1	0	0	0	0
Other source only	0	0	0	0	0	0	0	0	0
Multiple energy use	***36***	***68***	***59***	***66***	***52***	***74***	***37***	***67***	***74***
Candles & electricity	20	15	43	10	27	36	11	48	61
Paraffin, candles & electricity	3	14	3	10	8	19	4	6	3
Paraffin & electricity	7	17	0	18	1	2	2	2	2
Paraffin & candles	0	13	0	1	6	4	6	2	2
Gas & electricity	4	1	4	3	1	2	3	1	2
Gas, candles & electricity	1	0	2	1	0	4	3	2	1
Paraffin, gas & electricity	0	3	0	5	1	1	1	0	0
Paraffin, gas, candles & electricity	0	2	0	4	1	1	1	1	0
Other energy combinations	1	3	7	13	5	6	6	5	3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Turning to type of geographic location, we find that urban areas are more likely to report a single energy source for domestic lighting needs, particularly in formal urban areas (58%), while households based in rural, traditional authority areas and on farms tend to demonstrate a substantially greater reliance on multiple energy combinations (77% and 62% respectively). Households in formal urban areas are most likely to use electricity as the sole energy source for lighting (56%) or electricity together with candles (18%), with the remainder accounted for mainly by different combinations of electricity, candles, paraffin and gas (Table 13). In informal urban settlements, although a greater share of households use multiple energy sources for lighting relative to single sources (52% versus 48%), the most common option is again the exclusive use of electricity (36%). Notable secondary categories are electricity and candles (15%) and paraffin and candles (14%). Other combinations of electricity, candles and paraffin account for a further 15% of cases, while the single use of candles and paraffin only is present in 8% and 4% of households in these localities respectively.

Table 13: Energy choice for lighting, by geographic location (column percent)

Multiple energy sources for lighting	Urban formal	Urban informal	Rural, traditional authority areas	Farms
Single energy use	***58***	***48***	***23***	***38***
Electricity only	56	36	13	16
Candles only	1	8	8	19
Paraffin only	1	4	2	0
Gas only	0	0	0	1
Solar system only	0	1	0	1
Dry cell batteries only	0	0	0	0
Other source only	0	0	0	0
Multiple energy use	***42***	***52***	***77***	***62***
Candles & electricity	18	15	42	32
Paraffin, candles & electricity	5	8	12	5
Paraffin & electricity	5	6	5	8
Paraffin & candles	1	14	10	7
Gas & electricity	3	2	0	1
Gas, candles & electricity	2	1	1	0
Paraffin, gas & electricity	2	0	1	1
Paraffin, gas, candles & electricity	1	0	1	1
Other energy combinations	5	5	5	7
Total	**100**	**100**	**100**	**100**

In rural traditional authority areas, two-fifths (42%) use a combination of electricity and candles, representing the largest share of households. The single use of electricity is present in a mere 13% of households, while 8% only use candles. Other notable multiple sources are paraffin, candles and electricity (12%) and paraffin and candles (10%). A broadly similar pattern is observed in relation to rural farm households, the most notable difference being that a greater proportion relies on candles exclusively for lighting (19%).

5.3.2 Cooking

For cooking, slightly over half of South African households (52%) employ a single energy to meet their daily needs, which is comprised mainly of the use of electricity (42%) with nominal shares using wood, paraffin or gas only (Table 14). Of the remaining 48% that use a range of energy sources to fulfil their domestic cooking requirements, electricity and firewood, as well as electricity and paraffin, are the two most common mixes of sources (each present in 11% of households). The combined use of electricity and gas was reported in nearly a tenth of households nationally (8%). The energy choices for cooking amongst electrified households is virtually identical to the national average, with the predominance of the single use of electricity (47%), with combinations of electricity together with wood, gas or paraffin assuming a subsidiary but nonetheless noteworthy role. Although the balance between single and multiple energy use for cooking among non-electrified households (50% each) does not differ substantially from that of electrified households, there are sizeable discrepancies in terms of the specific sources and combinations of these that are relied upon. Approximately a third (31%) use paraffin solely, 16% only use firewood, with a further third (33%) using a mix of these two sources.

Table 14: Energy choice for cooking, by electrification status and living standard (column percent)

Multiple energy sources for cooking	South Africa	Electrified	Non-electrified	Low	Medium	High
Single energy use	***52***	***52***	***50***	***41***	***47***	***65***
Electricity only	42	47	1	5	37	62
Firewood only	4	3	16	18	4	0
Paraffin only	4	0	31	16	4	0
Gas only	1	0	1	0	0	1
Solar system only	1	1	1	1	1	0
Coal only	0	0	0	1	0	0
Other source only	0	0	0	0	0	0
Multiple energy use	***48***	***48***	***50***	***59***	***53***	***35***
Firewood & electricity	11	12	0	7	16	4
Gas & electricity	8	9	0	0	5	16
Paraffin & electricity	11	13	0	4	16	6
Paraffin, firewood & electricity	4	4	0	4	5	1
Paraffin & firewood	4	0	33	30	1	0
Paraffin, gas & electricity	2	2	0	0	2	1
Gas, firewood & electricity	1	1	0	0	1	1
Coal & electricity	1	1	0	0	2	1
Paraffin & gas	0	0	3	2	0	0
Paraffin, gas & firewood	1	0	3	1	1	0
Other energy combinations	5	5	11	11	5	4
Total	**100**	**100**	**100**	**100**	**100**	**100**

The differences between electrified and non-electrified households in terms of the energy mix used for cooking are again evident when comparing energy-use patterns by household living standard level. The share that use a single energy source for cooking increases positively with living standards, which is a reflection of increasing sole use of electricity for this purpose. Only 5% of households with a low living standard employ electricity exclusively, relative to 37% among those with a medium living standard and 62% for those with a high living standard. For households with a low living standard, the most common trend is to use both paraffin and firewood (30%), with a further 34% accounted for by the single use of these two energy sources. Among medium living standard households, apart from the previously mentioned single electricity use, a further third (32%) use electricity combined with either firewood or paraffin. While three-fifths of those with a high living standard only use electricity, an additional 16% cook with gas and electricity.

Table 15: Energy choice for cooking, by province (column percent)

Multiple energy sources for cooking	WC	EC	NC	FS	KZN	NW	GP	MP	LP
Single energy use	***69***	***29***	***53***	***41***	***44***	***33***	***73***	***44***	***43***
Electricity only	66	21	47	36	36	22	63	26	22
Firewood only	0	3	3	0	5	5	0	13	19
Paraffin only	1	5	1	2	3	5	8	1	1
Gas only	1	0	2	0	0	1	1	1	0
Solar system only	1	0	0	2	0	0	1	0	0
Coal only	0	0	0	0	0	0	0	3	0
Other source only	0	0	0	0	0	0	0	0	0
Multiple energy use	***31***	***71***	***47***	***59***	***56***	***67***	***27***	***56***	***57***
Firewood & electricity	9	6	20	2	9	21	1	19	40
Gas & electricity	15	3	15	8	12	8	8	4	3
Paraffin & electricity	6	22	4	25	9	15	9	9	7
Paraffin, firewood & electricity	0	15	1	3	3	9	1	0	3
Paraffin & firewood	0	15	0	1	8	4	1	0	3
Paraffin, gas & electricity	0	2	0	8	4	1	1	1	0
Gas, firewood & electricity	0	2	5	1	0	3	1	0	1
Coal & electricity	0	0	0	1	0	0	1	11	0
Paraffin & gas	0	1	0	0	1	0	0	0	0
Paraffin, gas & firewood	0	1	0	1	1	0	0	0	0
Other energy combinations	1	4	3	9	10	5	5	12	1

At the provincial level, only in three of the nine provinces is there a greater share of households reporting single energy use for cooking than multiple energy use: namely, Gauteng, Western Cape and Northern Cape, an attribute that is again directly related to the share reporting exclusive use of electricity for this purpose (Table 15). In both Gauteng and the Western Cape, more than three-fifths (66% and 63% respectively) rely only on electricity, while nearly half of Northern Cape households (47%) share this characteristic. In Free State and KwaZulu-Natal, the single use of electricity remains the most highly ranked option (both 36%), followed by electricity with paraffin (25%) in the case of the former province, and electricity with gas (12%) for the latter. The same applies to Mpumalanga, with 26% using only electricity but a fifth (19%) also use electricity together with firewood, while electricity and coal is used in 11% of households – the highest of any province. In the North West, similar shares use only electricity and a combination of electricity with firewood (22% and 21% in turn). The combination of electricity and paraffin is reported by 15% of households in this province, with electricity, paraffin and wood by another tenth (9%). Limpopo and the Eastern Cape are the only two provinces where a form of multiple energy use is the main choice for cooking. In the case of Limpopo, 40% of households use a mix of electricity and firewood, with a fifth (19%) using wood only and 22% electricity only. Therefore, in this province it would seem that wood has not been displaced by electricity as the preferred energy source for cooking, with wood continuing to be used alongside electricity for this thermal application. In the Eastern Cape, the combination of electricity and paraffin is used by 22% of households, with the exclusive use of electricity present in 21% of cases. Also of note is the fact that close to a third (30%) use either a mix of electricity, paraffin and wood or paraffin and wood (15% each). Therefore paraffin usage for cooking purposes remains an important part of domestic consumption patterns of Eastern Cape households.

Table 16: Energy choice for cooking, by geographic location (column percent)

Multiple energy sources for cooking	Urban formal	Urban informal	Rural,traditional authority areas	Farms
Single energy use	***65***	***60***	***27***	***36***
Electricity only	60	37	12	20
Firewood only	1	0	12	12
Paraffin only	2	21	3	2
Gas only	1	0	0	0
Solar system only	1	1	0	1
Coal only	0	0	0	1
Other source only	0	0	0	0
Multiple energy use	***35***	***40***	***73***	***64***
Firewood & electricity	3	4	27	19
Gas & electricity	11	7	3	5
Paraffin & electricity	12	16	8	13
Paraffin, firewood & electricity	1	1	11	1
Paraffin & firewood	0	3	11	10
Paraffin, gas & electricity	2	0	3	1
Gas, firewood & electricity	1	0	2	1
Coal & electricity	1	1	0	3
Paraffin & gas	0	1	1	1
Paraffin, gas & firewood	0	0	1	3
Other energy combinations	4	7	7	8
Total	**100**	**100**	**100**	**100**

With respect to type of geographic location, there is a strong rural-urban divide in the balance between single and multiple energy use (Table 16). Three-fifths or more of households in formal urban areas or informal settlements use a single source for cooking, while multiple energy use is undoubtedly the norm in rural, traditional authority areas and on farms. In formal urban areas, households are predisposed towards the single use of electricity (60%), with close to a fifth using either electricity with paraffin (12%) or electricity with paraffin (11%). In informal settlements, close to two fifths (37%) use only electricity for cooking, while 21% use only paraffin and 16% a mix of electricity and paraffin. In rural traditional authority areas, electricity with wood combined is the predominant energy option for cooking (27%), while a quarter of households use these two sources independently (both 12%). Paraffin with wood as well as paraffin, wood and electricity are multiple energy options that are both occurring in 11% of these rural households. Finally, on farms, electricity and electricity with wood are the two dominant options, both present in a fifth of cases (20% and 19% in turn), with smaller shares reported for firewood only (12%), electricity with paraffin (13%), and wood with paraffin (10%).

5.3.3 Heating

In terms of space heating, a greater proportion (55%) of households are reliant on a single energy use than is the case with lighting and cooking (Table17). Nonetheless, households are moderately less reliant on electricity only (34%) than is the case with the other two end-uses. Open fires are still used by 12% of households, while the use of paraffin solely for heating purposes is found in under a tenth of households (6%). Slightly more than a quarter of households (27%) employs multiple energy sources for space heating, while 18% of households reported that they used no specific energy source for heating, opting instead either to wrap themselves up with warm clothing and blankets or to do without. Electrified households are marginally more inclined than average to use electricity only for heating (38%) and depend less on wood and paraffin exclusively. Little discernible difference can be found between electrified households and the national picture in terms of the share reporting multiple energy use and no energy source. Non-electrified households are most likely to use firewood only as the energy source for heating rooms (38%), with a further 16% solely reliant upon paraffin. The main multiple energy use reported is the combination of paraffin and wood (13%), while a fifth (22%) use no energy source, instead choosing to keep warm with warm clothes and blankets.

Table 17: Energy choice for heating rooms and keeping warm, by electrification status and living standard (column percent)

Multiple energy sources for heating	South Africa	Electrified	Non-electrified	Low	Medium	High
Single energy use	***55***	***55***	***57***	***58***	***50***	***62***
Electricity only	34	38	1	3	27	54
Firewood only	12	9	38	43	13	2
Paraffin only	6	4	16	9	7	2
Gas only	1	2	0	0	1	2
Coal only	1	1	2	3	2	0
Dry cell batteries only	1	1	1	0	0	1
Solar system only	0	0	0	0	0	0
Generator only	0	0	0	0	0	0
Multiple energy use	***27***	***27***	***21***	***24***	***28***	***23***
Paraffin & electricity	7	8	0	2	9	4
Firewood & electricity	4	5	0	1	5	4
Gas & electricity	3	3	0	0	1	7
Paraffin & firewood	3	1	13	12	2	0
Paraffin, firewood & electricity	2	2	0	2	3	0
Paraffin, gas & electricity	1	1	0	0	1	1
Coal & electricity	1	1	0	0	2	1
Other energy combinations	5	5	8	7	5	5
No energy source used for space heating and keeping warm	***18***	***18***	***22***	***18***	***22***	***15***
Blankets, warm clothing & hot water bottles	17	17	20	17	20	15
None of the above	1	1	1	0	2	1
Total	**100**	**100**	**100**	**100**	**100**	**100**

When comparing households with low, medium or high living standards, we again see an increasing switch towards electricity for space heating. Households with low living standards are most likely to use wood only to heat rooms (43%), with paraffin only used in 9% of cases and a mix of wood and paraffin in 13% of households. A fifth (18%) of these households uses no energy source. A quarter of households (27%) with medium living standards use electricity exclusively, with 7% using paraffin and 9% a combination of the two. A similar share (22%) reports no energy use. As in high living standard households, more than half (54%) use electricity only, 7% use electricity with gas, and 15% report no energy use.

At the provincial level of analysis, at least 60% of households in three of the nine provinces (Gauteng, Northern Cape, and Limpopo) use a single energy source for space heating, with KwaZulu-Natal following closely behind (Table 18). There is, however, some variation in the type of single energy that predominates. In Northern Cape, Gauteng and KwaZulu-Natal, electricity is the main exclusive energy source used for heating, while in Limpopo it is wood (43%). Electricity also dominates as the single energy used among households in the Western Cape, North West and Mpumalanga, though to a lower extent than the previously-mentioned provinces due to a relatively high reliance on firewood in the latter two cases, as well as no energy source in the Western Cape (34%). Among households in the Eastern Cape, the single energy sources used are split evenly between those using electricity, firewood or paraffin (14%, 13% and 13% respectively), while equivalent shares again report electricity with paraffin (14%), paraffin and wood (12%) and no energy source (14%). In the Free State, a fifth of households (22%) use electricity only and 13% paraffin solely, though the most common energy mix is the coupling of these two sources (24%). In the Western Cape, Limpopo and Mpumalanga, higher than average shares forego reliance on energy sources, preferring instead to keep warm by means of warm clothing and blankets. In the latter two cases, this is probably a function of prevailing climatic conditions, with poor households able to make do with wearing warmer clothing during inclement months or cold spells.

Table 18: Energy choice for heating rooms and keeping warm, by province (column percent)

Multiple energy sources for heating	WC	EC	NC	FS	KZN	NW	GP	MP	LP
Single energy use	***46***	***43***	***69***	***38***	***59***	***49***	***67***	***51***	***62***
Electricity only	35	14	51	22	38	27	53	24	18
Firewood only	2	13	10	0	17	19	2	16	43
Paraffin only	7	13	3	13	2	3	6	1	1
Gas only	1	0	2	2	1	1	3	1	0
Coal only	0	3	2	0	1	0	1	9	0
Dry cell batteries only	0	0	0	0	0	1	2	0	0
Solar system only	0	0	0	1	0	0	0	0	0
Generator only	0	0	0	0	0	0	0	0	0
Multiple energy use	***20***	***43***	***16***	***55***	***24***	***36***	***20***	***26***	***14***
Paraffin & electricity	13	14	3	24	3	6	4	1	1
Firewood & electricity	4	2	6	3	5	8	1	6	9
Gas & electricity	1	1	1	3	2	5	6	2	1
Paraffin & firewood	0	12	1	5	2	2	0	1	1
Paraffin, firewood & electricity	0	8	0	2	3	5	0	0	0
Paraffin, gas & electricity	0	1	0	5	3	1	1	0	0
Coal & electricity	0	1	0	0	1	1	2	6	0
Other energy combinations	2	4	5	13	5	9	6	10	0
No energy source used for space heating and keeping warm	***34***	***14***	***15***	***7***	***17***	***15***	***14***	***23***	***24***
Blankets, warm clothing & hot water bottles	33	14	12	6	17	11	13	19	23
None of the above	1	1	2	1	0	4	1	4	1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

From Table 19 it is evident that single energy use is more prevalent in formal urban areas relative to other locations, due to the fact that around half of households (48%) in these areas use only electricity to heat rooms. A further 22% of households in formal urban areas use multiple energy sources, with the highest shares reportedly using either electricity with paraffin (8%) or electricity with gas (5%). Around a fifth (19%) use no energy source. Households based in informal urban settlements, the single use of electricity still accounts for the largest share of responses (24%), which is equal to the share indicating that no energy source is employed for space heating. Paraffin is also more common, either exclusively (16%) or coupled with electricity (10%). In rural, traditional authority areas and on farms alike, the single use of firewood for space heating predominates, followed by the exclusive use of electricity. Multiple energy sources are used in a third of cases, while no energy sources are used in around 15% of rural households.

Table 19: Energy choice for heating rooms and keeping warm, by geographic location (column percent)

Multiple energy sources for heating	Urban formal	Urban informal	Rural, traditional authority areas	Farms
Single energy use	***59***	***49***	***52***	***49***
Electricity only	48	24	12	20
Firewood only	2	4	34	23
Paraffin only	5	16	4	5
Gas only	2	0	0	0
Coal only	1	3	1	1
Dry cell batteries only	1	2	0	0
Solar system only	0	0	0	0
Generator only	0	0	0	0
Multiple energy use	***22***	***28***	***33***	***35***
Paraffin & electricity	8	10	5	6
Firewood & electricity	2	2	8	6
Gas & electricity	5	1	0	3
Paraffin & firewood	0	2	7	6
Paraffin, firewood & electricity	0	1	7	1
Paraffin, gas & electricity	1	0	1	1
Coal & electricity	1	2	1	1
Other energy combinations	5	8	4	11
No energy source used for space heating and keeping warm	***19***	***24***	***15***	***16***
Blankets, warm clothing & hot water bottles	18	21	14	15
None of the above	1	2	1	0
Total	**100**	**100**	**100**	**100**

5.4 Energy expenditure and energy poverty

In this section, we direct the focus away from energy consumption patterns per se to energy expenditure among the households included in the survey. The emergent patterns unequivocally reaffirm the prominent place of energy-spending in household budgets to ensure that basic energy needs are satisfied (Eberhard and Van Horen, 1995). Measuring energy poverty in the South African context is important in order to (i) understand the extent and depth of the challenge, (ii) monitor trends and better understand the determinants of change, and (iii) identify the attributes of those affected so that policy responses and interventions can be suitably designed, targeted and evaluated. However, there remains much ongoing international conceptual debate about which indicator is best able to capture the energy poverty phenomenon. For instance, in the United Kingdom, a country that has been concerned with this social problem for several decades, a recently completed independent review of energy poverty commissioned by the government identified seven different options for measuring fuel poverty, each with its own strengths and weaknesses (Hills 2011, 2012).

In this report, we analyse energy poverty based on three approaches: an energy poverty ratio method based on household energy expenditure relative to income, a subjective measure of energy poverty, and an energy-inefficient dwelling approach. This multi-method approach serves as the basis for promoting a larger discussion on energy poverty, its measurement and appropriate policy responses.

5.4.1 Expenditure-based approach

Perhaps the most common indicator of energy poverty relates to the share of total household income or expenditure that is devoted to energy. In the mainstream literature, the threshold for determining energy poverty is between 10-15% of income spent on energy, in order to ensure domestic energy needs satisfactorily, with 10% being the norm (Boardman, 1991; Sefton, 2002; Lamech & O'Sullivan, 2002; Buzar, 2006; Fankhauser & Tepic, 2007). Households with energy expenditure exceeding this threshold are considered to be energy poor and in consequence are likely to be confronted with difficult choices between meeting energy requirements on the one hand and sacrificing other important competing spending priorities on the other. As such, the indicator is often linked conceptually to the measurement of affordability (WHO, 2004).

In applying the expenditure method to the 2011/12 SASAS data, we classify a household as energy poor if more than 10% of their total monthly household income is devoted to energy expenditure. A version of this measure has been used to inform the energy poverty strategies of Northern Ireland and Great Britain. There were certain measurement challenges that had to be overcome in constructing the measure, most notably handling item non-response on the household income variable, which accounted for 26% of cases. Ultimately, univariate imputation was conducted using the STATA application, which is a commonly-used simulation-based technique for handling missing data. Another issue is the choice of the 10% threshold as the basis for determining the energy poor. According to Statistics South Africa's 2005/06 Income and Expenditure Survey, expenditure on 'electricity, gas and other energy sources accounts for 2.4% of annual consumption expenditure on average for households in the country (Statistics South Africa, 2008:46). Therefore, assuming a 10% energy expenditure threshold for poor households seems a reasonable assumption, given that it is approximately four times the national average.

Table 20: Energy expenditure as a percent of total monthly household income (mean scores)

	Mean score	Oneway ANOVA results		Base N
		Significance	Post-hoc Scheffe test	
South Africa	14	...	...	2671
Electrification status				
Electrified	14	n.s.		2441
Non-electrified	16			228
Living standard level				
Low living std.	15	**	• Low, medium > high	212
Medium living std.	17			1221
High living std.	10			1073
Per capita income				
Poorest quintile	27	**	• All mean scores are significantly different	367
Quintile 2	17			492
Quintile 3	14			528
Quintile 4	11			615
Richest quintile	6			660
Geographic location				
Urban formal	13	**	• Rural, trad. auth. areas > urban formal, farms	1669
Urban informal	16			205
Rural, traditional authority areas	16			592
Farms	12			205
Province				
Western Cape	11	**	• EC, MP, LP, GP > WC	352
Eastern Cape	16			297
Northern Cape	12			139
Free State	13			182
KwaZulu-Natal	13			548
North West	15			184
Gauteng	16			505
Mpumalanga	17			209
Limpopo	16			255
Dwelling type				
Formal dwelling or brick structure	14	*	• No sub-group mean scores are significantly different	2222
Traditional dwelling or hut	14			198
Informal dwelling or shack	17			201

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.
n.s. means that the scores are not statistically significant.

In Table 20 we present the mean share of income that households devote to energy expenditure and disaggregate these results by a range of socio-economic and geographic attributes. On average, South African households spend 14% of total monthly household income on energy needs. There is not a statistically significant difference in the energy expenditure shares based on electrification status and type of dwelling. However, we do note some significant differences based on material disadvantage. Households with low and medium living standards typically report higher energy expenditure shares than those with high living standards. There is a strong gradient based on quintiles of per capita household income, with those in the poorest quintile possessing energy expenditure shares that are on average more than four times higher than those in the richest quintile (27% versus 6%). Households in rural, traditional authority areas are more likely to spend a greater share of income on meeting energy needs compared to those in formal urban areas and on farms. Finally, households based in the Eastern Cape, Mpumalanga, Limpopo and Gauteng possess a significantly higher mean energy expenditure share relative to households in the Western Cape.

Having established which types of households are more likely to be spending considerable proportions of their material resources on securing domestic energy needs, we now turn attention to the energy poverty rate based on this expenditure approach. Specifically, we profile the share of households that are classified as energy poor using this definition (i.e. spending more than 10% of income on energy). The results presented in Table 21 show that close to half of all South African households are classified as energy poor, based on this indicator. Again, there is little variation based on electrification status and dwelling type, while material deprivation is clearly associated with energy poverty. Around a third (31%) of high living standard households are energy poor, compared with 45% of households with a low living standard and 56% of those with medium living standard. As for income status, three-quarters (74%) of households in the poorest quintile are energy poor, compared to barely a tenth of households (13%) in the richest quintile, which is more than a five-fold difference. Slightly over half (53%) of households in rural traditional authority areas are energy poor compared with a slighter lower share (44%) in formal urban areas. Again, households in the Western Cape are less likely to be energy poor (33%) than those in the Eastern Cape, Mpumalanga, Limpopo and Gauteng provinces.

Table 21: Energy poverty among South African households, by household attributes (percent)

	Energypoverty rate (% spending more than 10% of net income on energy)	Oneway ANOVA results		Base N
		Significance	Post-hoc Scheffe test	
South Africa	47	...	...	2671
Electrification status				
Electrified	47	n.s.		2441
Non-electrified	47			228
Living standard level				
Low living std.	45	**	• All mean scores are significantly different	212
Medium living std.	56			1221
High living std.	31			1073
Per capita income				
Poorest quintile	74	**	• Poorest quintile, Q2 > Q3 > Q4 > Q5	376
Quintile 2	65			492
Quintile 3	51			528
Quintile 4	38			615
Richest quintile	13			660
Geographic location				
Urban formal	44	**	• Rural, trad. auth. areas > urban formal	1669
Urban informal	49			205
Rural, traditional authority areas	53			592
Farms	43			205
Province				
Western Cape	33	**	• EC, MP, LP, GP > WC	352
Eastern Cape	52			297
Northern Cape	42			139
Free State	43			182
KwaZulu-Natal	45			548
North West	48			184
Gauteng	51			505
Mpumalanga	55			209
Limpopo	52			255
Dwelling type				
Formal dwelling or brick structure	47	n.s.		2222
Traditional dwelling or hut	44			198
Informal dwelling or shack	50			201

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.
n.s. means that the scores are not statistically significant.

5.4.2 Subjective approach

Apart from the 10% ratio indicator discussed above, another possible way of examining and measuring energy poverty would be to rely on subjective indicators to survey questions concerning whether households are experiencing difficulty in affording the cost associated with meeting their basic energy requirements. In this instance, the classification of households and by extension individuals as energy poor was determined by the pattern of responses provided to the following four questions:

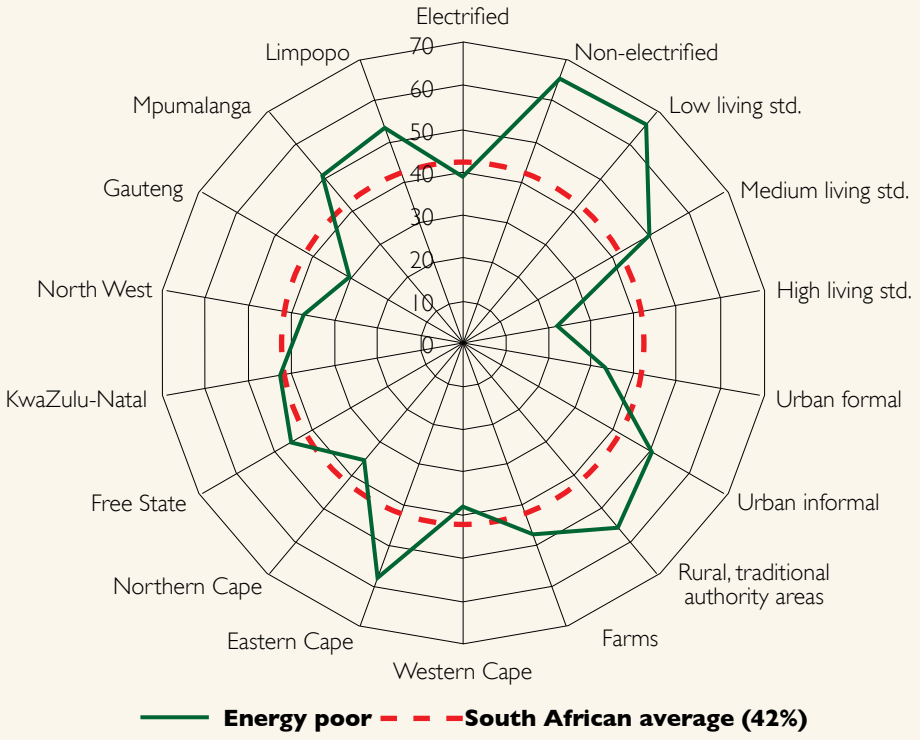
> Is the amount of energy your household has less than adequate, just adequate or more than adequate for your household's needs?
>
> And are the following inadequate, just adequate or more than adequate for your household's needs? ...
> ...the amount of energy for lighting?
> ...the amount of energy for cooking?
> ...the amount of energy for heating rooms and keeping warm?
>
> For each of the four items, the response codes were: 1=it is not adequate for your household's needs; 2=it is just adequate for your household's needs; 3=it is more than adequate to meet your household's needs.

The responses provided by each respondent were used to create a set of dummy variables, where 1=inadequate for household needs and 0=just or more than adequate for needs. These were then added together into a five-point summated scale ranging from 0 (adequate on all four items) to 4 (amount of energy deemed inadequate on all items). For the descriptive analysis presented in this section, we have classified anyone with a value of 1 or higher on the scale as energy poor and those with a value of 0 as energy secure. [3]

Using this subjective approach to measuring energy poverty, it becomes clear that non-electrified households rate much higher than electrified households on the subjective energy poverty scale and can therefore be considered as more energy poor than electrified households. A relationship between material disadvantage and subjective energy poverty is clearly evident when one examines the results by living standard. For instance, people with a low living standard rate much higher on the subjective energy poverty scale than those with a medium or high living standard, indicating that households with a low living standard are more energy poor. In terms of geographical area, people residing in rural traditional authority areas have the highest energy poverty score, followed by people residing in urban informal areas. Provincially, people from the Eastern Cape, Mpumalanga and Limpopo have the highest subjective energy poverty scores, indicating that of all the provinces, these three are the most energy poor, considering the subjective approach to energy poverty. By contrast, residents of the Northern Cape and Gauteng are least energy poor.

[3] By considering the full 0-4 rating scale, as opposed to the collapsed version employed here, it would be possible to provide some additional insight into the depth of energy poverty by commenting on how consistently household respondents report that the amount of energy used in general and for different end-uses is inadequate for their needs. This is an area requiring follow-up investigation.

Figure 12: Subjective energy poverty, by household attributes (percent)



To determine whether the observed sub-group differences are statistically significant, Analysis of Variance (ANOVA) tests, together with post hoc Scheffe tests, were conducted. Table 22 confirms that differences in subjective energy poverty on the basis of electrification status, living standard level, income quintiles, geographic location, province and dwelling type are all significant at 95% confidence level. As anticipated, non-electrified households consistently report higher levels of energy poverty than electrified households (65% versus 39%). There is a strong socio-economic gradient in levels of subjective energy poverty. Those with low living standards are more likely to indicate they are energy poor compared to households with medium or high living standards, while the level of self-rated energy poverty progressively declines as per capita income quintile increases. As for the spatial patterns of subjective energy poverty, those in rural traditional authority areas, informal urban settlements and on farms have significantly higher levels than households residing in formal urban areas. The highest provincial rate of self-reported energy poverty is evident among households in the Eastern Cape, which is significantly higher than in Gauteng, Northern Cape, North West, Western Cape and KwaZulu-Natal. The subjective energy poverty rate in Limpopo (54%) is also significantly higher than in Gauteng and Western Cape, while the level of energy poverty is also notably higher in Mpumalanga and KwaZulu-Natal than Gauteng. Finally, we find that those residing in traditional or informal dwellings tend to report higher self-reported energy poverty relative to those in formal structures.

Table 22: Subjective energy poverty among South African households, by household attributes (percent)

	Subjective energy poverty rate (%)	Oneway ANOVA results		Base N
		Significance	Post-hocScheffe test	
South Africa	42	...	...	3004
Electrification status				
Electrified	39	**	• Non-electrified > electrified	2712
Non-electrified	65			278
Living standard level				
Low living std.	66	**	• All mean scores are significantly different	258
Medium living std.	49			1339
High living std.	22			1163
Per capita income				
Poorest quintile	59	**	• Poorest quintile > Q3 > Q4 > Q5 • Q2 > Q4, Q5	497
Quintile 2	54			506
Quintile 3	46			557
Quintile 4	37			649
Richest quintile	19			795
Geographic location				
Urban formal	33	**	• Rural trad auth, urban informal, farms > urban formal	1888
Urban informal	50			243
Rural, traditional authority areas	55			627
Farms	47			246
Province				
Western Cape	38	**	• EC > GP, NC, NW, WC, KZN • LP > GP, WC • MP, KZN > GP	393
Eastern Cape	57			337
Northern Cape	35			157
Free State	45			225
KwaZulu-Natal	42			579
North West	38			220
Gauteng	30			591
Mpumalanga	51			232
Limpopo	54			270
Dwelling type				
Formal dwelling or brick structure	38	**	• Traditional dwelling, informal dwelling > formal dwelling	2428
Traditional dwelling or hut	65			213
Informal dwelling or shack	58			252

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.

The subjective approach is premised on a headcount measure that identifies the number of households as energy poor, which can be measured and monitored over time. The advantages of this method is its usefulness in cross-checking levels and trends in energy poverty determined by other measurement approaches, its focus on the problem where people themselves feel and acknowledge it as such, as well as its relative ease to administer without detailed questions on household income. Yet we find in the South African case that there is a considerable degree of variance in the households identified as energy poor, using this method relative to the previously discussed expenditure method. As Table 23 shows, a considerable share of households (20% of all households) are not designated as energy poor under the expenditure definition, but nonetheless self-report as energy poor. Similarly, we find that 24% of all households are not subjectively energy poor, but are classified as energy poor using the expenditure approach.

Table 23: Subjective energy poverty compared to the expenditure-based energy poverty among South African households (cell percent)

	Expenditure-based approach		
Subjective approach	**Not in energy poverty (%)**	**In energy poverty (%)**	**Total**
Not subjectively energy poor (%)	33	24	58
Subjectively energy poor (%)	20	23	43
Total	**53**	**47**	**100**

Furthermore, the subjective approach is limited by possible misreporting due to the possible stigma associated with declaring oneself to be in poverty, concerns about robustness of results based on the use of different subjective measures and the choice of household respondent. Based on an assessment of the relative strengths and weaknesses of the subjective method, the Hills Commission (2011: 132) concluded that "such questions are probably most useful as a way of complementing more objective approaches, giving a reality check on them". This makes intuitive sense in the South African context, where subjective measures could be used as a means of enhancing our understanding of the nature, extent and temporal dynamics of energy poverty in the country.

5.4.3 Thermal inefficiency approach

Another measure of energy poverty relies on assessments of the condition of one's place of residence, focusing particularly on thermal comfort levels relative to social needs. In essence, this involves rating the thermal efficiency of dwelling units, since this influences the amount of energy required to heat the home to an acceptable standard and typically represents a notable determinant of domestic energy costs. Most common in European countries, housing energy efficiency data are usually obtained through expert evaluations,[4] though in the case of the present survey, this was not feasible. Instead, we have used four survey questions on the physical state of dwellings to determine a thermal efficiency rating. The specific items and the associated response codes are listed below:

[4] For example, in the United Kingdom, use is made of the Standard Assessment Procedure (SAP), which is the Government-recommended measure used for assessing the energy performance of dwellings. The SAP rating of a dwelling is an indicator of energy consumption per unit of floor space and includes the costs associated with space heating, water heating, ventilation and lighting, minus any cost savings from self-generated energy. In Ireland, the Building Energy Rating (BER) is the measure used to assess the energy efficiency of residential and commercial buildings.

I would now like to ask you some questions about your accommodation.

How satisfied are you with your accommodation?
(1=very satisfied, 2=satisfied, 3=neither satisfied nor dissatisfied, 4=dissatisfied, 5=very dissatisfied, 8=do not know)

Would you describe the state of repair of your home as good, adequate or poor?
(1=good, 2=adequate, 3=poor, 8=do not know)

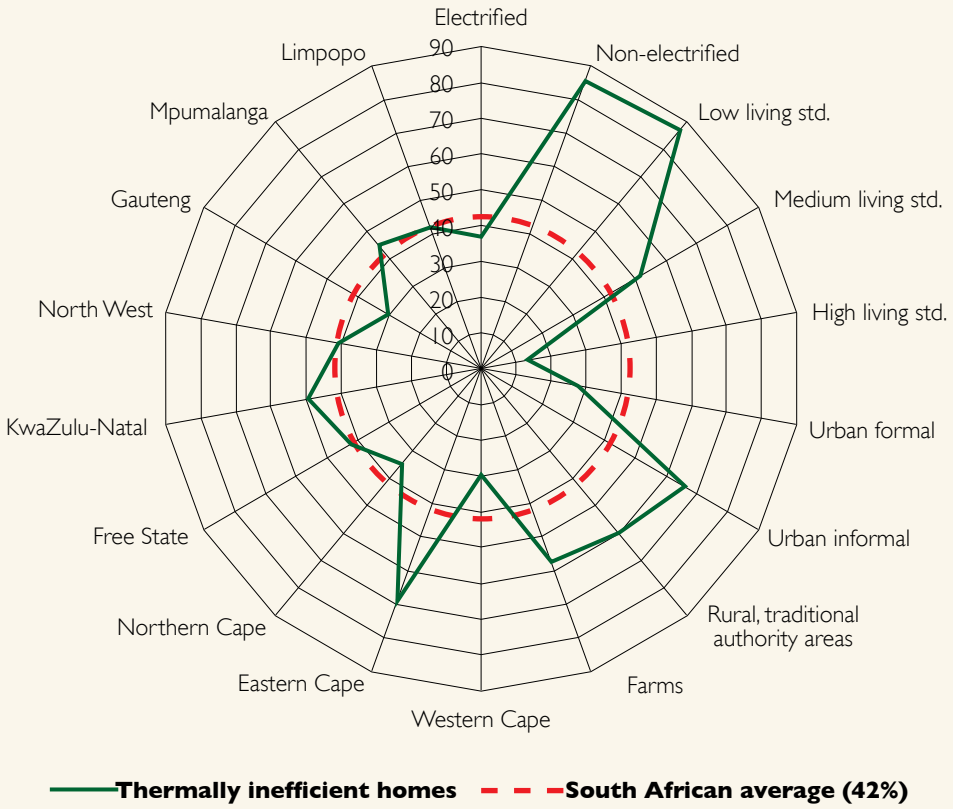
Do you have any of the following problems with your accommodation? (Code all that apply)
Shortage of space
Too dark, not enough light
Lack of adequate heating
Leaky roof
Damp walls, floors, foundations, etc.
Damaged or broken windows or doors
Other (specify)
None of these problems with accommodation

Has your health or the health of anyone in your household been made worse by your housing situation?
(1=Yes, 2=No)

A set of four dummy variables was created, based on responses to each of the four survey items. Firstly, households were assigned a value of 1 if respondents noted that they were dissatisfied or very dissatisfied (Code 4 or 5) with their accommodation, with all other responses being coded as zero. For the second variable, a value of 1 was assigned to cases where the state of repair of the home was described as "poor" (Code 3). The third dummy variable was coded as 1 if households reported one or more of the following: "lack of adequate heating", a "leaky roof", "damp walls, floors or foundations", or "damaged or broken windows or doors". The final dummy variable was created for those reporting that the housing condition had resulted in the deteriorating health of someone in the household. Based on these four items, a summated thermal efficiency scale was constructed by adding together the responses, so that the highest possible score was 4 (highest level of thermal inefficiency) and the lowest was 0 (lowest level of thermal inefficiency). In turn, a dummy variable was created where values of one or higher were recoded as 1 and zero values were retained. This was employed as the thermal inefficiency rating measure used for the analysis in this section.

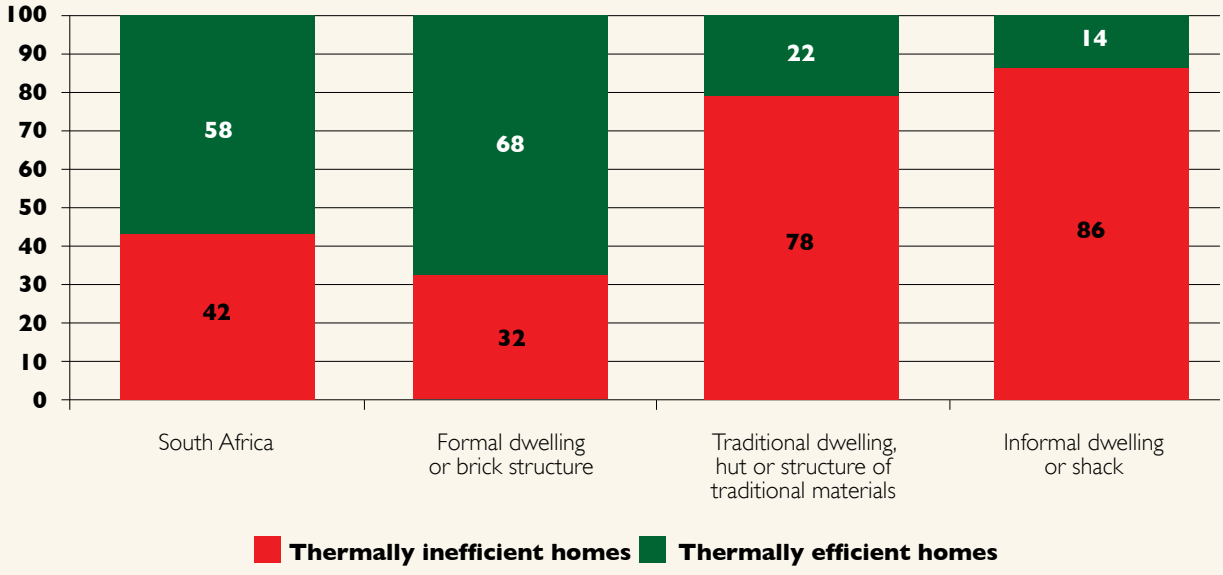
Based on this measurement approach we find that, on aggregate, 42% of households are categorised as thermally inefficient and 62% thermally efficient. In Figure 13, we present the incidence of residential thermal inefficiency by various household attributes. South Africans who live in households which are not electrified or who have a low living standard are the most likely to suffer thermal inefficiencies (85% and 86% respectively). Likewise, residents of the Eastern Cape (70%), people who reside in urban informal (66%), rural traditional authority areas (60%) or on farms (57%) are also likely to suffer from thermal inefficiency. As one would expect, people with a high living standard (13%) and formal urban areas (27%) are least likely to suffer such thermal inefficiencies.

Figure 13: Thermal inefficiency of homes, by household attributes (percent)



Since the thermal inefficiency classification is based on evaluating the physical conditions of a dwelling unit, one would expect a significant gradient of difference based on the type of dwelling that households occupy. In Figure 14 we test out this assertion, and find that there is substantial variation in level of thermal inefficiency.

Figure 14: Thermal inefficiency of homes, by dwelling type (percent)



Approximately a third (32%) of formal dwellings or brick structures are thermally-inefficient, based on this definitional approach. This is appreciably lower than informal dwellings or shacks, of which 86% are deemed thermally inefficient. Similarly, slightly more than three-quarters (78%) of traditional dwellings, huts or structures of traditional materials are not energy efficient.

Table 24: Thermal inefficiency among South African households, by household attributes (percent)

	Thermal inefficiency rate (%)	Oneway ANOVA results		Base N
		Signif.	Post-hoc Scheffe test	
South Africa	42	...	...	3004
Electrification status				
Electrified	37	**	• Non-electrified > electrified	2712
Non-electrified	85			278
Living standard level				
Low living std.	86	**	• All mean scores are significantly different	258
Medium living std.	51			1339
High living std.	13			1163
Per capita income				
Poorest quintile	68	**	• Q1> Q2, Q3 > Q4 > q5	497
Quintile 2	56			506
Quintile 3	48			557
Quintile 4	31			649
Richest quintile	15			795
Geographic location				
Urban formal	27	**	• Rural trad auth, urban informal, farms > urban formal	1888
Urban informal	66			243
Rural, traditional authority areas	60			627
Farms	57			246
Province				
Western Cape	30	**	• EC > all other provinces • KZN > WC, GP • MP > GP	393
Eastern Cape	70			337
Northern Cape	35			157
Free State	42			225
KwaZulu-Natal	50			579
North West	41			220
Gauteng	30			591
Mpumalanga	45			232
Limpopo	42			270
Dwelling type				
Formal dwelling or brick structure	32	**	• Traditional dwelling, informal dwelling > formal dwelling	2428
Traditional dwelling or hut	78			213
Informal dwelling or shack	86			252

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.

These aforementioned findings suggest a correlation between thermal inefficiency and material disadvantage. This is confirmed in Table 24, which presents ANOVA tests and post hoc Scheffe tests based on the mean thermal inefficiency scores based on household attributes. Thermal inefficiency is significantly more prevalent in non-electrified compared to electrified households, and is indirectly related to both living standard level and income quintile. Households outside formal urban areas, as well as in the Eastern Cape and KwaZulu-Natal, are also more greatly predisposed towards thermal inefficiency. Traditional and informal dwelling types are also significantly more thermally inefficient than formal structures.

The question from the above analysis is whether, as it stands, it constitutes a measure of energy poverty. Many non-poor households could be thermally inefficient out of choice, even though they possess the material resources to ensure that this is not the case. It is for this reason that the Hills Fuel Poverty Review in the UK (2011, 2012) considered as one of its energy poverty measurement options an approach that focuses on the households that have both low incomes and energy inefficient dwellings. This effectively classifies households as energy poor if they are surviving on a lower income and cannot be kept warm at a reasonable cost. For this reason, we have experimented further and refined the thermal inefficiency measure by combining it with a measure of lower income. For this report, we have chosen a threshold of 60% of median per capita monthly income (R600). This means that a household is energy poor if it is thermally inefficient and has a per capita monthly income of less than R600.

From Table 25, it is observed that 22% of households are energy poor, using this low income and low energy efficiency definition. A familiar pattern emerges in terms of the characteristics of households associated with a significantly higher level of energy poverty. Households that are non-electrified, and those with a lower living standard level and income status are predisposed towards being identified as energy poor. Households in rural traditional authority areas have a considerably higher incidence of energy poverty, while those in informal urban settlements and on farms are more inclined to be energy poor than those based in formal urban areas. Eastern Cape again stands out as possessing a worryingly high level of energy poverty, with Gauteng and Western Cape presenting the lowest provincial rates of energy poverty following this definitional approach. Finally, formal structures are less likely to be energy poor than informal dwellings, which in turn are less energy poor than dwellings constructed of traditional materials.

Table 25: Low income and thermal inefficiency among South African households, by household attributes (percent)

	Low income, thermal inefficient households (%)	Oneway ANOVA results		Base N
		Signif.	Post-hoc Scheffe test	
South Africa	22	...	...	3004
Electrification status				
Electrified	18	**	• Non-electrified > electrified	2712
Non-electrified	52			278
Living standard level				
Low living std.	53	**	• All mean scores are significantly different	258
Medium living std.	29			1339
High living std.	02			1163
Per capita income				
Poorest quintile	57	**	• Q1, Q2 > Q3, Q4, Q5	497
Quintile 2	56			506
Quintile 3	04			557
Quintile 4	00			649
Richest quintile	00			795
Geographic location				
Urban formal	11	**	• Rural trad auth > all • Urban informal, farms > urban formal	1888
Urban informal	28			243
Rural, traditional authority areas	42			627
Farms	30			246
Province				
Western Cape	09	**	• EC > all other provinces • LP, MP, KZN > GP, WC	393
Eastern Cape	50			337
Northern Cape	20			157
Free State	16			225
KwaZulu-Natal	26			579
North West	21			220
Gauteng	11			591
Mpumalanga	26			232
Limpopo	29			270
Dwelling type				
Formal dwelling or brick structure	16	**	• All mean scores are significantly different	2428
Traditional dwelling or hut	58			213
Informal dwelling or shack	41			252

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.

This section has attempted to provide a profile of energy poverty among South African households using three different measurement approaches: namely, a commonly-employed expenditure approach, a subjective approach, and an approach based on residence condition. These approaches each have their relative advantages and limitations. The results do show that the overall incidence of energy poverty does fluctuate somewhat and the identification of sub-groups as energy poor in not entirely consistent across all three methods. There are, nonetheless, some repeated findings.

These include the greater propensity to be categorised as energy poor if a household...
... is located in the Eastern Cape, Limpopo or Mpumalanga, is or in a rural traditional authority area;
... has a lower living standard level or falls in the lowest per capita income quintiles.

The subjective and thermal inefficiency measures, unlike the expenditure method, also commonly identify non-electrified households and those without a formal dwelling or brick structure as more likely to be energy poor.

Considering the evidence provided, two broad recommendations need to be made. Firstly, given the policy significance of this social phenomenon from a poverty, health and well-being aspect, as well as an environmental point-of-view, it is critical that the Department of Energy as a matter of urgency examine and decide upon an official definition of energy poverty for the country. Secondly, different options for measuring energy poverty need to be examined and a decision made regarding which of these alternatives is the preferred approach for classifying households and individuals as energy poor, in a manner that is consistent with the official definition that is chosen. This would not preclude the fielding of other supplementary measures for cross-validation purposes, but an official definition and measurement approach in respect of energy poverty is required for effective monitoring and policy making purposes.

6 Satisfaction, Quality and Pricing of Electricity

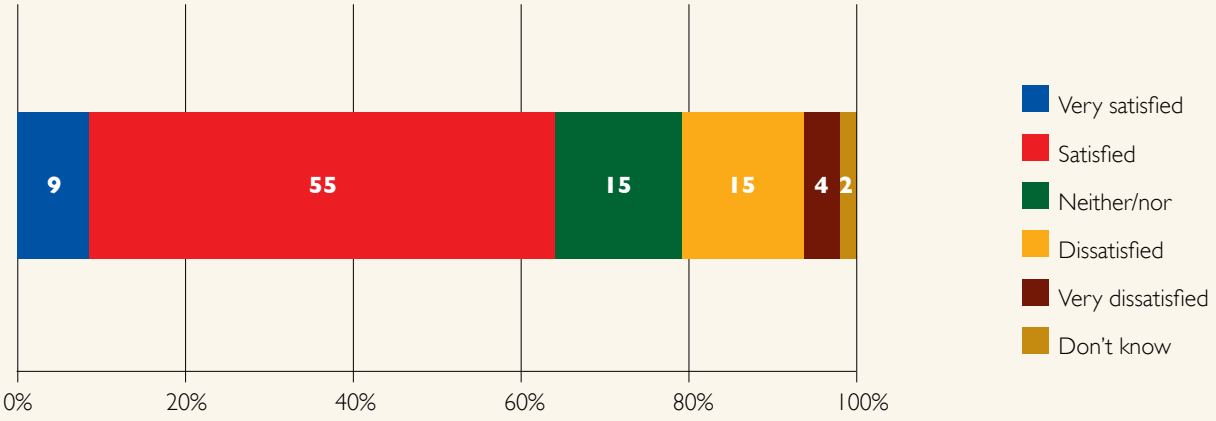
The Integrated National Electrification Programme (INEP), which has been operational since 2001, is mandated to address electrification backlogs in South Africa. It has to manage electrification planning, funding and implementation processes. The initial aim of the programme was to reach universal access by 2012, but this target has now been revised and the new aim is to increase access of electricity to 92% by 2014. According to the Department of Energy, this can be attributed to limited resources from Government and other funders, due to competing government priorities and a depressed economic climate.

The challenge, however, is not only to provide universal access but also to provide electricity that is reliable and acceptable to the people of South Africa. In order to determine attitudes around electrification, specifically the quality of electricity, South Africans were asked to rate electricity provision in terms of levels of satisfaction, quality of electricity and pricing of electricity. Only households with electricity were required to respond to questions about the quality and pricing of electricity.

6.1 Satisfaction with the provision of electricity in the neighbourhood

In order to determine satisfaction with electricity provision, South Africans were asked how satisfied or dissatisfied they are with the way electricity is being provided in their neighbourhood. They had to indicate whether they were very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied. In response to the question, just under a tenth (9%) indicated that they were very satisfied with electricity provision in their neighbourhood, 55% were satisfied, 15% stated neither satisfied nor dissatisfied, 15% were dissatisfied, 4% were very dissatisfied and 2% were unsure and did not venture an opinion.

Figure 15: Satisfaction with the provision of electricity in the neighbourhood (percent)



Furthering the analysis, the question was broken down by select socio-demographic attributes. The differences in perceived levels of satisfaction about electricity in the neighbourhood was found to vary significantly between people of different sexes, races, living standard measures, residential locations and provinces of South Africa. These differences are portrayed in Table 26. Also, in order to establish a comparative scale for this question, an Electricity Satisfaction Index (ESI) was developed which calculated a mean satisfaction score. The responses which varied from "very satisfied" to "very dissatisfied" were recorded to represent a satisfaction score ranging from 5 (very satisfied) to 1 (very dissatisfied). A high score therefore represented a higher satisfaction rating. "Don't know" options were coded as missing data. The score was then converted to a 0-100 scale. The higher the mean score, the higher the satisfaction with electricity provision in the neighbourhood. The percentages and mean satisfaction scores are displayed below.

Table 26: Satisfaction with the provision of electricity (percent; mean)

	Very Satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very Dissatisfied	Don't know	Electricity Satisfaction Index (ESI) Mean Score
South Africa	9	55	15	15	4	2	62.7
Gender							
Male	10	57	13	13	4	2	64.2*
Female	8	53	16	17	4	2	61.4
Age							
16-19 years	10	57	13	13	5	3	63.9 n.s
20-29 years	9	56	14	15	3	3	63.7
30-39 years	8	56	12	17	6	1	61.2
40-49 years	10	54	19	13	3	1	63.6
50-59 years	13	49	16	17	4	1	62.4
60-69 years	7	51	16	21	5	1	58.6
70+ years	8	60	20	9	2	2	66.0
Population group							
Black African	8	54	16	17	4	2	61.4*
Coloured	9	54	13	16	6	2	61.0
Indian / Asian	9	65	10	12	3	0	66.6
White	19	57	14	8	1	1	71.3
Living standard level							
Low	5	40	7	22	7	19	54.2*
Medium	7	53	16	20	4	1	60.0
High	14	59	15	9	3	0	67.5
Geographic Location							
Urban formal	11	55	16	14	3	1	64.1*
Urban Informal	5	45	18	22	7	2	54.6
Rural, trad. auth. areas	6	58	12	16	5	4	61.5
Farms	14	52	14	14	2	4	66.0
Province							
Western Cape	15	55	16	11	3	0	67.1*
Eastern Cape	5	60	12	12	3	9	64.4
Northern Cape	10	55	7	20	7	1	60.4
Free State	14	45	26	11	4	0	63.9
KwaZulu-Natal	7	61	16	13	4	0	63.5
North West	8	61	8	15	4	4	64.2
Gauteng	8	47	18	20	5	2	58.6
Mpumalanga	11	62	14	11	2	0	67.2
Limpopo	9	54	8	22	6	1	59.7

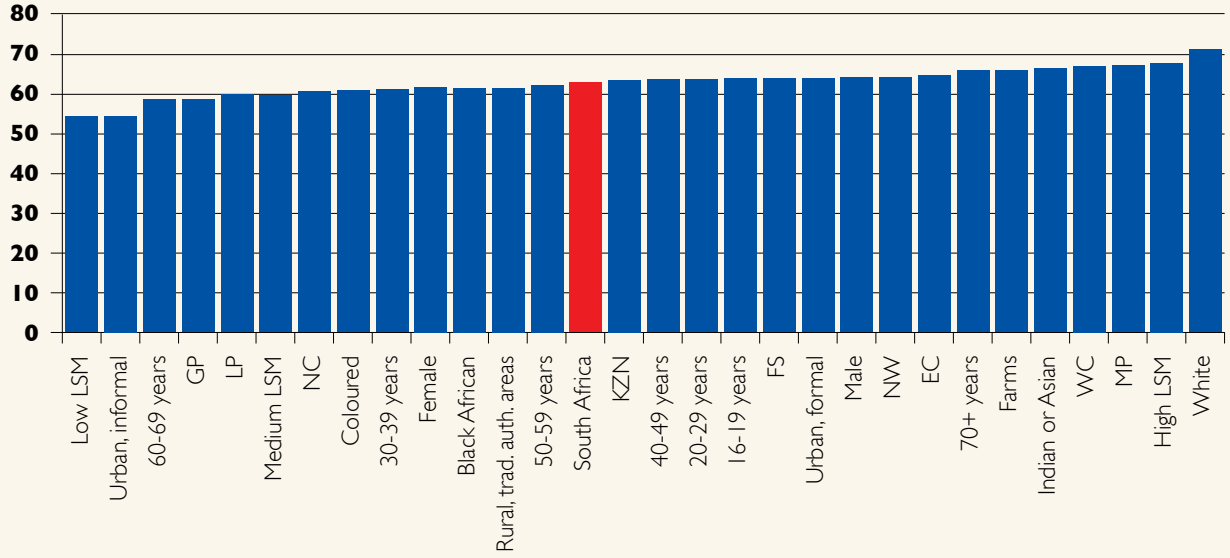
Mean of a five-point Likert scale, where 1='very dissatisfied', 2='dissatisfied', 3='neither satisfied nor dissatisfied', 4='satisfied' and 5='very satisfied' converted to a 0-100 scale. n.s. means that the mean scores are not statistically significant based on ANOVA testing, while * indicates that the mean scores are significant different ($p<0.05$

Statistically significant ($p<0.000$) differences in perceptions were identifiable across gender, race, living standard, location and province. A larger proportion of males (67%) than females (61%) was satisfied with electricity provision. This was confirmed by the mean scores that were higher for males (M=64.2) than females (M=61.4). An analysis of satisfaction of electricity provision by race revealed that whites and Indians were more satisfied with the provision of electricity than blacks and coloureds. Around three-quarters of whites and Indians (76% and 74% respectively) were satisfied with the provision of electricity, whilst smaller shares of coloureds (63%) and blacks (62%) were satisfied. This trend is confirmed by the mean scores, being highest for whites (M=71.3) and Indians (M=66.6), followed by coloureds (M=61.0) and blacks (M=61.4).

From the living standard analysis it is clear that an economic gradient is present with regards to satisfaction with electricity provision. Results showed that the higher the living standard, the higher the levels of satisfaction with electricity provision. Less than half (45%) of people with a low living standard were satisfied with electricity provision, followed by people with a medium living standard where 60% were satisfied. Among people with a high living standard, almost a quarter (73%) indicated satisfaction. This trend was also clearly portrayed in the analysis of the mean scores, with people in the low living standard measurement category recording low levels of satisfaction (M=54.2), followed by people in the medium living standard category (M=60.0) and high living standard category (M=67.5).

Half of the households in the urban informal areas (50%) were satisfied with the provision of electricity. This was much lower than residents in rural traditional areas (64%), farms and urban formal areas (both 66%). The mean scores also indicated that households in the urban informal areas were much less satisfied (M=54.6) than people in rural traditional areas (M=61.5), urban informal areas (M=64.1) and farms (M=66).

Figure 16: Electricity Satisfaction Index by select socio-demographic attributes (ranked means scores)



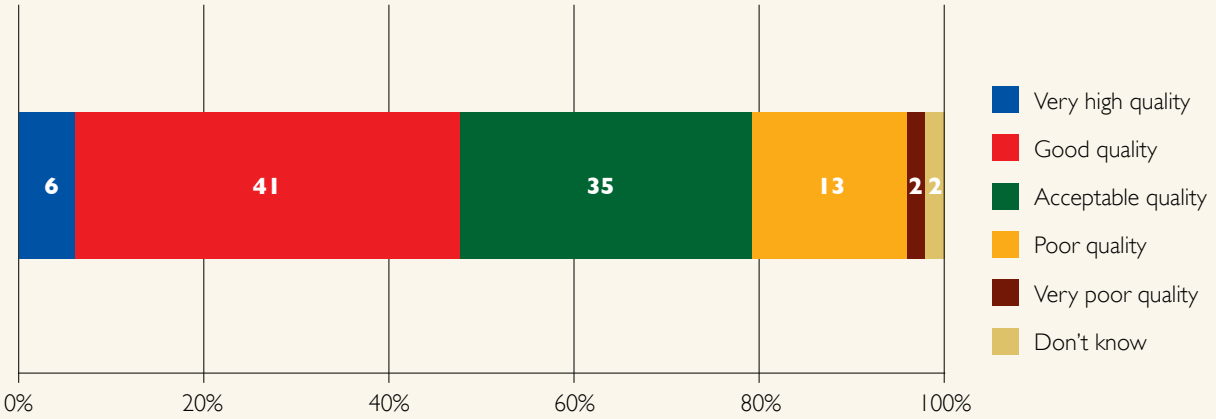
Turning to provinces, it was evident that the highest proportion of satisfied residents was found in Mpumalanga (73%) and Western Cape (70%). The highest proportion of dissatisfied residents was found in Limpopo (28%), Northern Cape (27%) and Gauteng (25%). Mean scores corroborated this finding, indicating that households in Gauteng were least satisfied (M=58.6) followed by Limpopo (M=59.7); Northern Cape (M=60.4); KwaZulu-Natal (M=63.5); Free State (M=63.9); North West (M=64.2); Eastern Cape (M=64.4); Western Cape (M 67.1) and Mpumalanga (M=67.2).

When the mean scores from the Electricity Satisfaction Index (ESI) are ranked, it becomes evident that South Africans are generally more satisfied than dissatisfied with the provision of electricity. However, an economic gradient is evident when the satisfaction levels are analysed. People who have a low living standard or who live in informal settlements have the lowest satisfaction levels. People with a high living standard and whites have the highest satisfaction levels.

6.2 Quality of electricity

In order to further the analysis about the quality of electricity in South Africa, an explicit question about the quality of electricity was included. South Africans were asked: "In your opinion, what is the quality of electricity in the area where you live?" Less than a tenth (6%) rated the quality of electricity in their area as very high. The majority, just over two fifths (41%), rated the electricity in their area as good, with more than a third (35%) rating the quality as acceptable. The rest felt the quality was either poor (13%) or very poor (2%).

Figure 17: Quality of electricity in residential areas (percent)



In order to determine who were more likely to rate the quality of electricity as low or high, the question was analysed by select socio-demographic attributes. The differences in perceived levels of quality in the various residential areas varied for race, living standard, residential location and province. These differences are portrayed in Table 27. Also, in order to establish a comparative scale for this question, an Electricity Quality Index (EQI) was developed which calculated satisfaction with the quality of electricity. The response options ranged from "very high quality" to "very poor quality" which was recoded to represent a quality score ranging from 1 (very poor quality) to 5 (very high quality). The score was then converted to a 0-100 scale. The higher the mean score, the higher the perceived quality of electricity in the area.

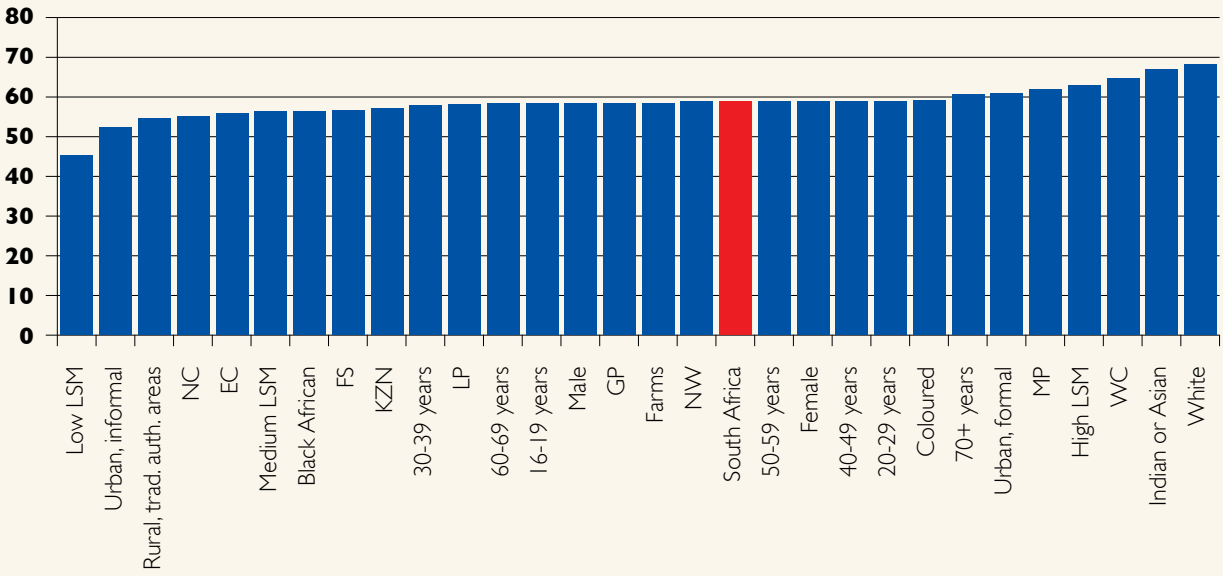
Table 27: Perception about the quality of electricity (percent; mean)

	Very high quality	Good quality	Acceptable quality	Poor quality	Very poor quality	Don't know	Mean Score Electricity Quality Index (EQI)
South Africa	6	41	35	13	2	2	58.9
Gender							
Male	6	41	35	13	3	2	58.6 n.s
Female	6	41	36	13	2	2	59.1
Age							
16-19 years	5	38	40	13	1	3	58.5 n.s
20-29 years	6	41	36	11	3	3	59.3
30-39 years	6	41	34	13	4	2	58.0
40-49 years	7	38	38	14	1	2	59.2
50-59 years	7	42	31	16	3	1	59.0
60-69 years	4	45	28	18	2	2	58.4
70+ years	3	45	39	8	1	3	60.7
Population group							
Black African	5	37	37	16	3	2	56.8*
Coloured	7	41	35	12	3	2	59.5
Indian or Asian	11	51	32	5	0	0	67.3
White	8	60	27	3	1	1	68.5
Living standard level							
Low	6	18	22	20	11	23	45.9*
Medium	5	37	39	16	2	1	56.7
High	8	49	31	10	1	1	63.2
Geographic location							
Urban formal	7	45	34	12	1	1	61.4*
Urban Informal	4	29	44	15	6	2	52.8
Rural, trad. auth.areas	3	37	35	17	4	3	54.8
Farms	9	29	41	12	1	9	58.8
Province							
Western Cape	10	49	32	7	2	0	64.9*
Eastern Cape	1	36	42	11	3	7	56.0
Northern Cape	4	37	31	20	3	5	55.5
Free State	10	27	44	14	2	2	57.2
KwaZulu-Natal	2	44	38	13	3	0	57.4
North West	5	40	37	12	2	5	58.9
Gauteng	7	40	32	16	2	2	58.6
Mpumalanga	11	38	37	11	1	2	62.1
Limpopo	6	45	26	18	4	0	58.0

Mean of a five-point Likert scale, where 1='very poor quality', 2='poor quality', 3=acceptable quality', 4='good quality' and 5='very high quality' converted to a 0-100 scale. n.s. means that the mean scores are not statistically significant based on ANOVA testing, while * indicates that the mean scores are significant different ($p<0.05$

No significant differences regarding the quality of electricity were found for gender and age groups. Statistically significant ($p<0.000$) differences were, however, found for race, level of living standard, geographic location and province. Black South Africans rated the quality of electricity much lower than other race groups, with only 42% stating that electricity is of a very high or good quality compared to coloured people (48%), Indians (62%) and whites (68%). The mean scores from the Electricity Quality Index (EQI) confirmed that among South Africans, blacks were least satisfied (M=56.8), followed by coloureds (M=59.5), Indians (M=67.3) and whites (M=68.5). More than half (57%) of people with a high living standard said that the quality of electricity in their areas was of a very high or good quality. This was much higher than people with a medium living standard (42%) or people with a low living standard (24%). The EQI mean scores confirmed this, with people with a low living standard being the least satisfied (M=45.9), followed by people with a medium living standard (M=56.7) and high living standard (M=63.2). Only a third of people in urban informal settlements were of the opinion that electricity in their areas was of a very high or good quality. This was significantly lower than ratings of people on farms (38%), rural traditional authority areas (40%) or urban formal areas (52%). Mean scores confirmed that people in informal areas were least satisfied (M=52.8); followed by people in rural traditional authority areas (M=54.8), farms (M=58.8) and urban formal areas (M=61.4). A provincial analysis revealed that perceptions about the quality of electricity were highest in the Western Cape (59%), followed by Limpopo (51%), Mpumalanga (49%), Gauteng (47%), KwaZulu-Natal (46%), North West (45%), Northern Cape (41%) and Eastern Cape and Free State (37% respectively).

Figure 18: Electricity Quality Index scores by select socio-demographic attributes (ranked means scores)



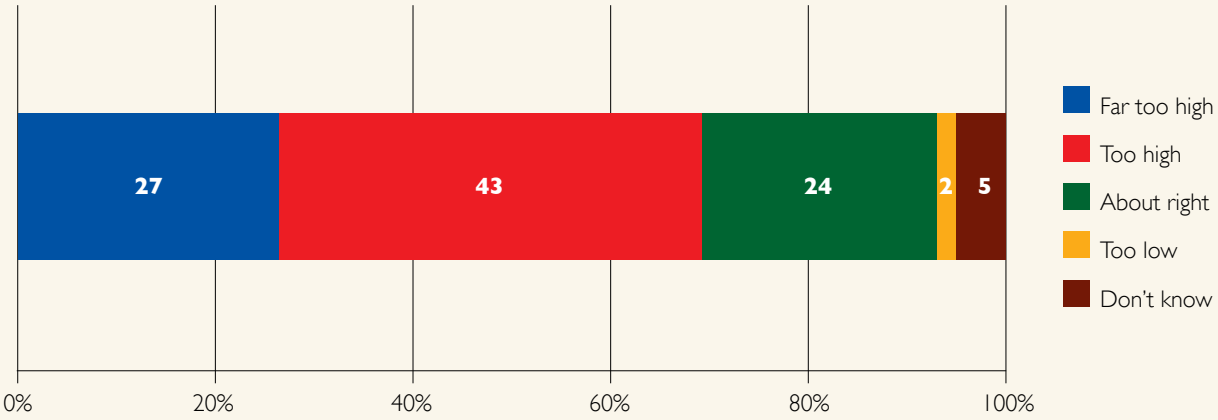
The ranked mean scores from the Electricity Quality Index (EQI) indicate similar findings to the preceding question about satisfaction with electricity provision in the neighbourhood. An economic gradient is notable, with people with a low living standard, specifically residing in urban informal areas, most likely to state that their electricity is of a poor quality. By contrast, people with a high living standard, residing in the Western Cape, Indians or whites are much more likely to experience electricity of a very high or good quality.

6.3 Pricing of electricity

In order to understand perceptions about the current pricing of electricity in South Africa, households were asked if they felt that electricity prices were far too high, too high, about right or too low. This question is particularly relevant, given price increases announced by The National Energy Regulator of South Africa (Nersa) which approved a nominal Eskom power tariff increase of 24,8% as from April 1, 2010, and subsequent increases of 25,8% and 25,9% for 2011/12 and 2012/13 respectively. The 2010 increase placed a huge burden on households and industry, to such an extent that President Jacob Zuma in his state-of-the-nation address in 2012 asked ESKOM to consider ways of lessening the electricity burden, ensuring cheaper electricity. A lower increase was subsequently announced by ESKOM. Despite this, households, especially poorer households, are likely to suffer under the electricity burden. As illustrated in the first section of the report, large shares of households are already considered as energy poor, spending more than 10% of their income on energy. Given the recent price increases, people's perceptions about the pricing of electricity is therefore extremely important.

As can be seen from Figure 19, more than a quarter (27%) of households felt they pay far too much for what they receive, with another 43% saying they pay too much. Just under a quarter (24%) felt they pay about the right amount for what they receive. Very few (2%) said they pay too little and 5% said they do not know. Clearly, people's perception about the price they pay for electricity is skewed towards the feeling that they are paying too much for electricity. On aggregate, almost three-quarters (70%) are of the opinion that they are paying too much for electricity.

Figure 19: Perceptions about the pricing of electricity (percent)



In order to determine who were more likely to rate the quality of electricity as being too low or too high, the question was broken down by select socio-demographic attributes. The differences in perceived levels of quality in the various residential areas vary between people of different genders, ages, races, living standards, residential locations and provinces of South Africa. These differences are portrayed in Table 28. Also, in order to establish a comparative scale for this question, an Electricity Pricing Index (EPI) was developed which calculated perceptions about the pricing of electricity. The response options ranged from "far too high" to "too low" which was recoded to represent a pricing score ranging from 1 (too low) to 4 (far too high). The higher the score, the higher people perceived the price to be. "Don't know" options were coded as missing data. The score was then converted to a 0-100 scale.

Table 28: Perceptions about the pricing of electricity (percent; mean)

	Far too high	Too high	About right	Too low	Don't know*	ElectricityPricing Index (Mean score)
South Africa	27	43	24	2	5	66.3
Gender						
Male	25	41	27	2	5	64.1*
Female	29	44	20	2	4	68.2
Age						
16-19 years	21	43	29	3	5	61.8*
20-29 years	24	42	24	3	7	64.4
30-39 years	28	42	24	3	3	66.1
40-49 years	25	45	25	1	4	65.7
50-59 years	36	40	19	1	4	71.8
60-69 years	36	42	19	2	1	70.9
70+ years	30	46	21	0	4	69.8
Population group						
Black African	23	43	26	3	5	63.7*
Coloured	45	32	18	0	4	75.7
Indian or Asian	40	44	16	0	1	74.8
White	33	44	17	0	5	72.3
Living standard level						
Low	20	27	20	4	29	63.3*
Medium	26	43	24	3	4	65.4
High	30	41	24	1	3	67.9
Geographic location						
Urban formal	30	42	23	2	4	67.8*
Urban Informal	19	54	21	1	5	65.3
Rural, traditional authority areas	25	41	26	3	5	63.7
Farms	22	37	22	5	14	62.7
Province						
Western Cape	41	41	16	1	2	74.8*
Eastern Cape	21	31	33	5	10	58.4
Northern Cape	44	25	24	4	3	70.4
Free State	17	54	22	5	2	61.5
KwaZulu-Natal	22	51	24	2	2	64.9
North West	31	34	23	2	10	68.2
Gauteng	22	43	28	1	7	63.8
Mpumalanga	31	45	20	1	4	70.0
Limpopo	37	41	15	4	2	71.2

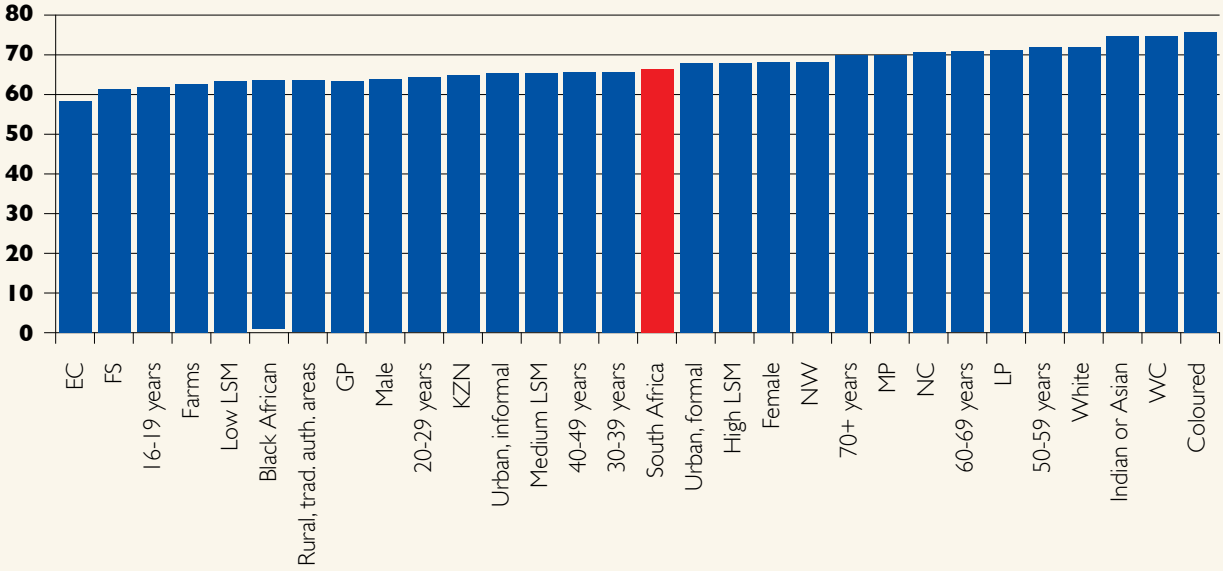
Mean of a four-point Likert scale, where 1='too low', 2=about right, 3='too high' and 4='far too high' converted to a 0-100 scale. n.s. means that the mean scores are not statistically significant based on ANOVA testing, while * indicates that the mean scores are significant different ($p<0.05$)

With regards to the pricing of electricity, statistically significant differences ($p<0.000$) were found for gender, with larger proportions of females (73%) than males (66%) being of the opinion that electricity prices are too high. This was corroborated by the mean scores: 64.1 for males and 68.2 for females. An increase in age also resulted in an increase in perceptions that electricity prices were too high. Very large proportions of Indians (84%), whites and coloureds (77% respectively) felt that the price of electricity was too high. Significantly fewer black South Africans (two-thirds) were of the opinion that electricity prices are too high. Mean scores confirmed the finding, with the EPI score for blacks at 63.7, followed by whites (72.3), Indians (74.8) and coloureds (75.7).

Large proportions of people with a high or medium living standard felt that electricity prices were too high (71% and 69% respectively). A significantly smaller proportion (49%) of people with a low living standard felt that electricity prices were too high. A very large proportion of people with a low living standard (29%) did not know if the price of electricity was too high, just right or too low. People in lower income households seemed uncertain about what they should be paying. This could be due to a lack of information about price benchmarking. Mean scores confirmed that people with a high living standard are more likely to think the price of electricity is too high (67.9) compared to people with a medium living standard (65.4) or low living standard (63.3). Residents in urban informal (73%) and urban formal areas(72%) were much more inclined to state that electricity prices are high, compared to residents in rural traditional areas (66%) or farms (59%).

People in the Western Cape (82%), Limpopo (78%) and Mpumalanga (76%) were more likely to think that electricity prices were too high. By contrast, people in the Eastern Cape were least likely to feel that they are paying too much (55%), with a third of households in this province indicating that electricity prices are "about right". This finding was also confirmed by the EPI.

Figure 20: Electricity Pricing Index scores by select socio-demographic attributes (ranked mean scores)

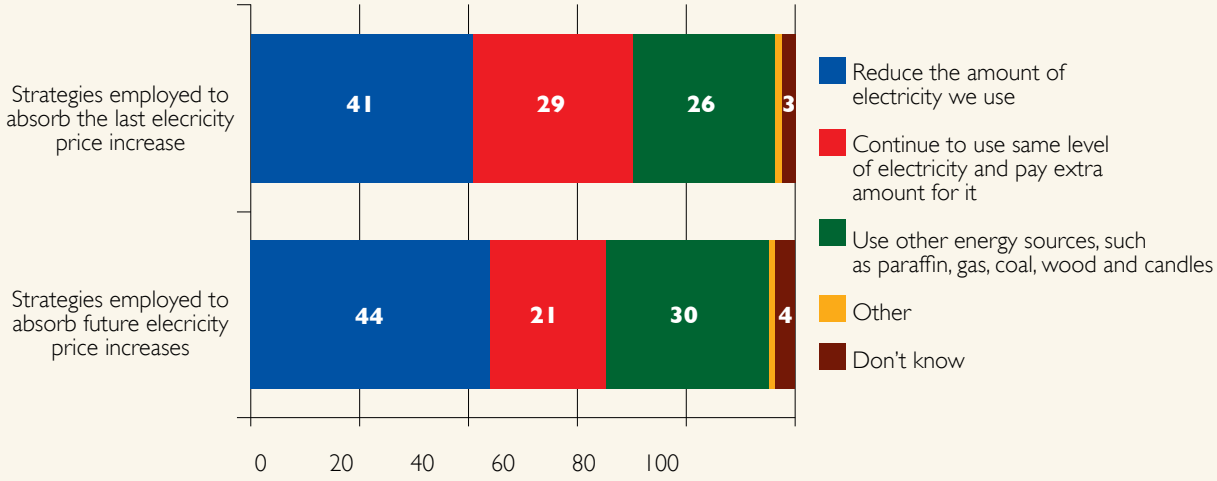


Eastern Cape or Free State residents, people aged between 16-19 years, people living on farms, people with a low living standard, black Africans or people living in traditional authority areas scored lowest on the Electricity Pricing Index, indicating that they were much less inclined than other groups to rate the price of electricity as too high. On the other hand, the 50-59 year old age group, whites, Indians, residents of the Western Cape and coloureds were most likely to state that the prices are far too high.

6.4 Strategies employed by households to cope with increasing electricity prices

In order to understand the strategies employed to manage increases in electricity prices, South Africans were asked which strategies they engaged to cope with the last electricity price increase. As a follow-up question, they were also asked what they would do if prices were to be increased tomorrow. Respondents had the opportunity to choose one of three options, namely: (a) continue to use the same level of electricity and pay the extra amount for it (b) reduce the amount of electricity used (c) use other energy sources such as paraffin, gas, coal, wood or candles. Respondents also had the option of specifying "other strategies" or to state "don't know". As evident from Figure 21, the strategy employed by most South Africans in the past year to cope with the rising electricity costs was to reduce the amount of electricity used. More than two-fifths of South Africans (41%) employed this strategy. The second strategy, embarked upon by 29% of South Africans, was to continue to use the same level of electricity and pay the extra amount for it. More than a quarter of South Africans (26%) had to use other energy sources to cope with increasing electricity prices. In a quarter of cases, energy price increases encouraged energy switching and multiple energy use. Very few people employed other strategies.

Figure 21: Strategies employed to cope with electricity prices in the past 12 months (percent)



Asking about future strategies, some interesting variations emerged. Larger proportions of people said they would reduce the amount of electricity used, whilst the share of people stating they would continue to use the same levels of energy shrank from 29% to 21%. A larger share also indicated that they would resort to energy switching - in other words, switching from electricity to paraffin, gas, coal, wood and candles. These results clearly show that future energy price increases will have a bearing on the types of energy used.

In order to understand which groups were more or less likely to implement certain strategies, the question was analysed by different socio-demographic groups.

Table 29: Strategies employed to cope with rising energy prices in the past 12 months -strategies employed by households (percent)

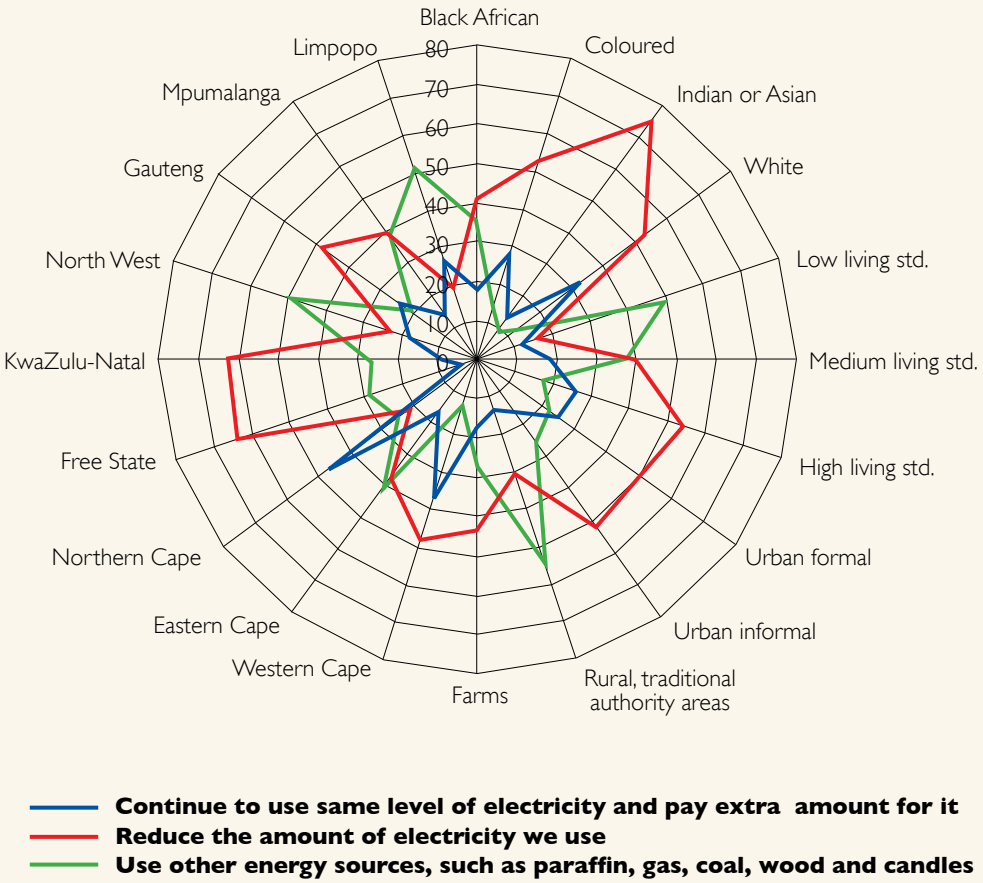
	Reduce the amount of electricity we use	Continue to use the same level of electricity and pay the extra amount for it	Use other energy sources, such as paraffin, gas, coal wood and candles	Other	Don't know	Total
South Africa	41	29	26	1	4	100
Population group						
Black African	38	26	31	1	4	100
Coloured	46	35	15	2	2	100
Indian or Asian	72	23	4	1	1	100
White	47	40	8	1	4	100
Living standard level						
Low	18	15	45	3	19	100
Medium	38	25	32	1	3	100
High	47	36	13	1	3	100
Geographic location						
Urban formal	45	34	16	1	3	100
Urban Informal	46	26	23	1	5	100
Rural, trad. auth. areas	30	15	50	0	4	100
Farms	29	27	31	3	9	100
Province						
Western Cape	36	49	13	1	1	100
Eastern Cape	31	22	41	0	7	100
Northern Cape	21	49	20	4	6	100
Free State	59	8	29	2	2	100
KwaZulu-Natal	64	14	22	1	0	100
North West	26	25	38	0	10	100
Gauteng	44	34	15	2	5	100
Mpumalanga	36	28	31	0	4	100
Limpopo	19	29	47	0	4	100

As was expected, different strategies were employed by different types of households. The strategy "to reduce the amount of electricity used" was most prevalent among Asian households (72%), households in KwaZulu-Natal (64%) or Free State (59%), households with a high living standard (47%), white households (47%), and households in urban informal (46%) or formal (45%) areas. Large shares of households in the Western and Northern Cape (49%), white households (40%) and households with a high living standard (36%) stated they continued to use the same level of electricity and paid extra for it. Energy switching - in other words, replacing electricity with other sources of energy such as paraffin, gas, coal, wood or candles - was most common among households in rural traditional authority areas (50%), in Limpopo (47%), in households with a low living standard (45%) and in the Eastern Cape (41%).

Turning to strategies that households will employ to cope with rising electricity costs in the future, it was evident from

Figure 22 that the largest share of households will reduce the amount of energy used (44%) or they will use other types of energy sources (30%). The rest, about a fifth (21%), would continue to use the same level of electricity and pay the additional amounts or did not know (4%) what they would do. In order to determine which groups were more or less likely to implement certain strategies, the question was analysed by different socio-demographic groups and is visually presented in the radar diagram below.

Figure 22: Strategies employed by households to cope with future electricity increases by select socio-demographic attributes (percent)



The most common strategy that would be employed if electricity were increased "tomorrow" was to reduce the amount of energy used. Indian households (75%), households in the Free State (64%) or KwaZulu-Natal (63%), households with a high living standard (54%), households in urban informal areas (52%) or urban formal areas (50%) were most likely to support this strategy.

Energy switching was the option that was mentioned most among people living in households in rural traditional authorities (54%), in Limpopo (51%), in North West (50%), who have a low living standard or households in the Eastern Cape.

Households that would continue to use the same level of electricity and pay the extra amount for it were mostly found in Northern Cape (47%) and Western Cape (37%). White and coloured households, as well as households with a high living standard, were also most likely to continue using the same amount of electricity.

From the above radar diagram, it is clear that reducing the amount of energy used is more of a strategy employed by households with medium and high living standard. As could be expected, retaining the same level of electricity and paying the extra amount is a much more viable option for households with a high standard of living. Energy switching is the preferred strategy for households with a low living standard. Alarming, though, is the finding that almost a fifth of households with low living standards stated that they did not know how they would cope if electricity prices were increased tomorrow.

7 Energy saving

Since 2007, Eskom has experienced a lack of capacity in the generation and reticulation of electricity which has resulted in regular electricity supply interruptions. Eskom argued that government's refusal to fund the expansion of the electricity capacity in the country was the main cause of the crisis and requested a multibillion rand budget to increase capacity and avoid similar problems in the future. This budget was approved by government and it was agreed that it would be implemented over a period of three years. This resulted in annual electricity increases of between 16% and 25% for households in South Africa. These substantive electricity increments and limited electricity supply lead to more awareness and consideration for energy-saving strategies. This resulted in the 49M campaign, launched in 2011, which was the country's biggest energy-saving movement, seeking to address the issue of the country's constrained power system. The idea behind the 49M, based on 49-million, the population of the country, was that each and every South African has a responsibility to exercise some saving in the supply and use of electricity so that there is a greater amount available to the country. In the light of this, it is important to focus on awareness and actioning undertaking of the various energy-saving measures. Very few studies have actually looked at the awareness and acceptability of energy-saving measures.

In the study, people were given a list of energy-saving measures and they had to indicate if they are aware of the specific measure and, if so, whether they actually undertake it. The results are portrayed in the Table 30 below. These questions were asked at household level and the answers are portrayed at household level.

Table 30: Awareness and performance regarding the various energy-saving measures (percent)

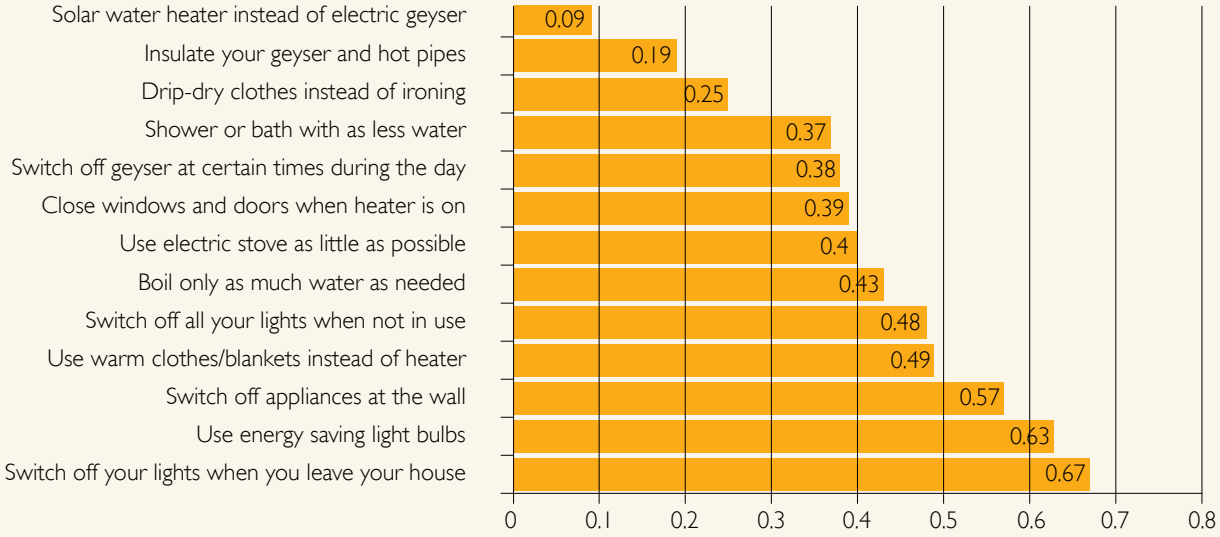
	Awareness	Often do	Ratio between awareness and doing
Switch off your lights when you leave you house	75	50	0.67
Switch off appliances (TV, radio, hifi) at the wall	67	38	0.57
Use energy-saving light bulbs	59	37	0.63
Switch off all your lights except security lights when not used	48	23	0.48
Use the plates of stoves and oven as little as possible	45	18	0.40
Boil only as much water with a pot or kettle that is needed	44	19	0.43
Use warm clothing or blankets instead of an electric heater	41	20	0.49
Switch off geyser at certain times during the day or at night	40	15	0.38
Close windows and doors when a heater is on	31	12	0.39
Take a short shower or bath with as little water as possible	30	11	0.37
Allow clothes to drip dry instead of ironing	24	6	0.25
Install a solar water heater instead of an electric geyser	23	2	0.09
Insulate your geyser and hot pipes	16	3	0.19

The energy-saving measures that households are most aware of are the switching off of lights when leaving the house (75%), followed by switching off appliances (67%) and using energy-saving light bulbs (59%). Not only are households most aware of these energy-saving measures, but they are also most likely to undertake these actions, with half of the households actually switching off the lights when they leave the house, 38% switching off appliances when not in use and 37% using energy-saving light bulbs. Fewer than half of the households in South Africa are aware of the following energy-saving measures: switching off lights in the home when not in use (48%), using stove plates and the oven as little as possible (45%), boiling only small amounts of water in a pot or kettle (44%), using warm clothes instead of

an electric blanket (41%) and switching off the geyser at certain times during the day or night (40%). Fewer than a quarter of South Africans undertake any of these energy-saving measures, with 23% switching off all lights in the homes when not in use, 18% using stove plates and the ovens sparingly, 19% boiling small amounts of water in a kettle or on the stove, 20% using warm clothes or blankets instead of an electric heater and 15% switching off the geyser at certain times during the day or night. Fewer than a third (31%) of people were aware that closing the windows and doors when a heater is on constitutes an energy-saving measure. Three in ten South Africans were aware that taking a short shower or bathing in little water would save energy. Just under a quarter (24%) was aware that drip drying of clothes rather than ironing would result in energy-saving measures. Similar proportions (23%) were aware that the installation of a solar water heater rather than electric geysers would result in energy saving. Fewer people (16%) were aware that the insulation of geysers and hot pipes would lead to energy saving. Very small proportions of people were undertaking any of these energy-saving measures.

In order to understand the ratio between knowledge and actioning of the energy-saving measures, the ratio between knowledge and undertaking was calculated for each energy-saving measure. The ratios are portrayed in Figure 23 below.

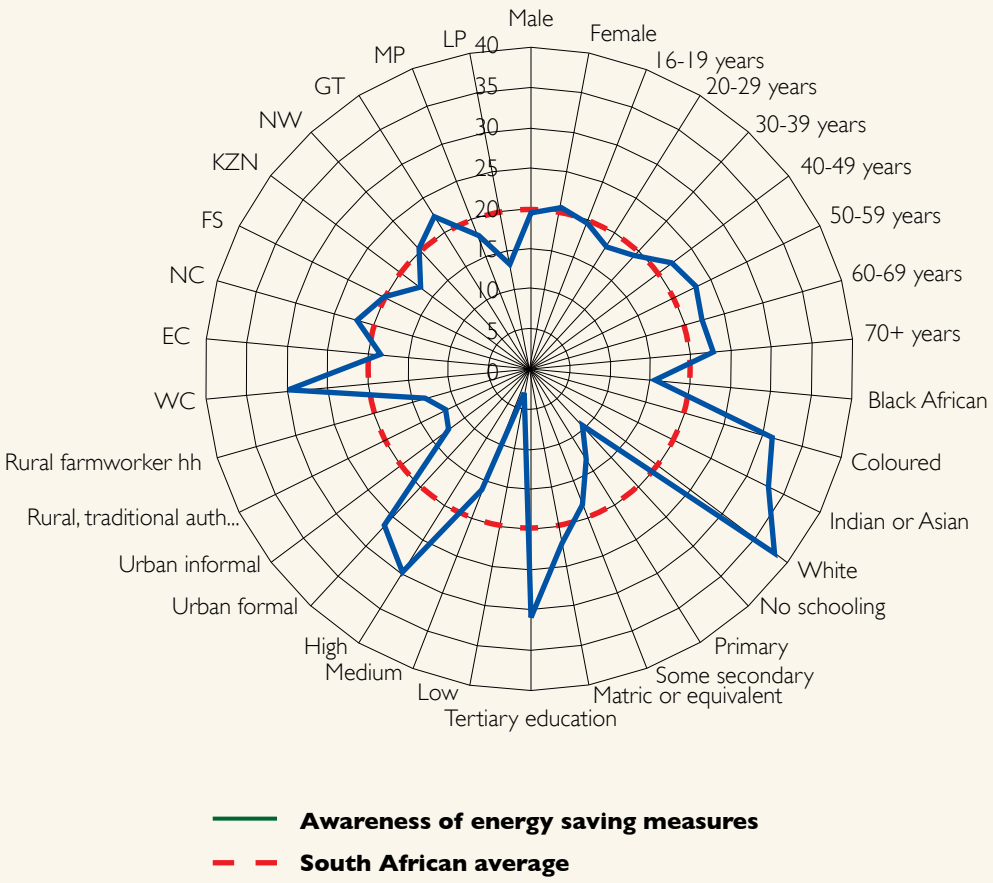
Figure 23: Ratio between awareness of an energy-saving measure and taking action



The highest ratios between awareness and undertaking were found for switching off lights when leaving the house, using energy-saving light bulbs and switching off appliances at the wall when not in use. More than half of South Africans that are aware of these energy-saving measures actually undertake them. Smaller ratios of between 0.49 and 0.37 were noted for the following energy-saving measures: using warm clothing or blankets instead of electric blankets; switching off all lights except security lights in home when not in use; boiling small amounts of water; using electric stoves and ovens sparingly; closing windows and doors when the heaters are on; switching off geysers; or taking a short shower or bathing with little water. This meant that between half and a third of South Africans that are aware of these energy-saving measures are actually undertaking them. The smallest ratios, 0.25 and lower, were found for allowing clothes to drip-dry instead of ironing; insulating your geyser and hot pipes, and installing solar water heaters instead of electric geysers. Fewer than 25% of people that were aware of these energy-saving measures were undertaking them.

In order to further the analysis on energy-saving measures and how it relates to various household characteristics, an Energy Awareness Index (EAI) was developed. Each energy-saving measure that households were aware of was coded as a 1 and then summed together to get a total score. Households could therefore score a minimum of a 0, implying they are not aware of any of the cost-saving measures, or a maximum of 13, implying they are aware of all the energy-saving measures. These scores were converted to a 0 -100 scale. The mean scores for various socio-demographic variables were calculated and are portrayed in the radar gram below.

Figure 24: Awareness of the different energy-saving measures by socio-economic attributes (mean)



8 Free Basic Electricity

In 1994 the South African government committed itself to a constitution which has strong socio-economic rights components. The intention of this commitment was, inter alia, to address historical imbalances by democratising access to basic services.

As part of its commitment, government made a promise that all poor South Africans would get a quantum of free basic services. In terms of water and electricity, this was quantified as a minimum of 6,000 litres of water a month and 50 kWh of monthly electricity per household. Government believed this to be a step in the right direction, trying to ensure a better quality of life for all in South Africa, yet being mindful of not becoming a welfare state, hence capping the free services at a low level. As illustrated in the table below 69% of indigent households in South Africa are currently benefitting from the free basic energy policies.

Table 31: Households benefitting from FBE

PROVINCES December '11 FBE	Total Indigent Households (Census 2001)	Total Indigent Households (Municipal data)	Eskom	Municipality	Non-grid	Total household serviced	%
Eastern Cape	939,776	717,759	141,340	218,684	10,096	370,120	39
KwaZulu-Natal	1,162,490	220,269	130,498	143,129	34,202	307,829	26
Gauteng	967,539	233,776	389,358	428,344	0	817,702	85
Mpumalanga	444,112	197,305	84,948	114,273	4,100	203,321	46
Limpopo	744,676	525,959	190,674	104,123	21,928	316,725	43
North West	440,733	143,210	73,949	22,467	126	96,542	22
Free State	425,049	229,435	106,923	373,968	920	481,811	113
Northern Cape	118,194	95,736	43,587	47,186	300	91,073	77
Western Cape	290,213	204,821	182,508	441,718	301	624,527	215
Total	**5,532,782**	**2,568,270**	**1,343,785**	**1,893,892**	**71,973**	**3,309,650**	**69**

(Energy Parliamentary Portfolio Committee Presentation, February 2012)

Free Basic Energy Policies were introduced to:

- Enhance the well being of the poor, in particular, women and female children who are mainly responsible for carrying 'firewood';
- To maintain functional households;
- To have a positive impact on the 'health and safety' of the communities and;
- To reduce the need for fossil-based energy sources (for example, paraffin, which is used mainly for cooking and heating).

The Free Basic Electricity amount of 50 kWh per month per household was regarded as sufficient by government, stating that it is enough to ensure basic lighting and cooking. It would also allow for a television and radio. However, as shown in Table 32, this 50kWh would not be able to maintain a fridge running for 24 hours. Academics and quality-of-life specialists often praise government for the FBE initiative, but criticise it for being too little to ensure any quality of life improvements.

Table 32: Energy used by various appliances

Item	Watts	Hours used	Days used	kWh
1x energy-saver light	11	5	30	1.7
1x TV (B&W)	35	6.0	30	7.0
1 x iron	1000	4.0	6	24.0
1 x kettle	1000	0.5	30	15.0
1 x hotplate	1000	1.0	25	25.0
1 x regular light	100	5.0	30	15.0
1x refrigerator (small)	250	6.5	30	49.0

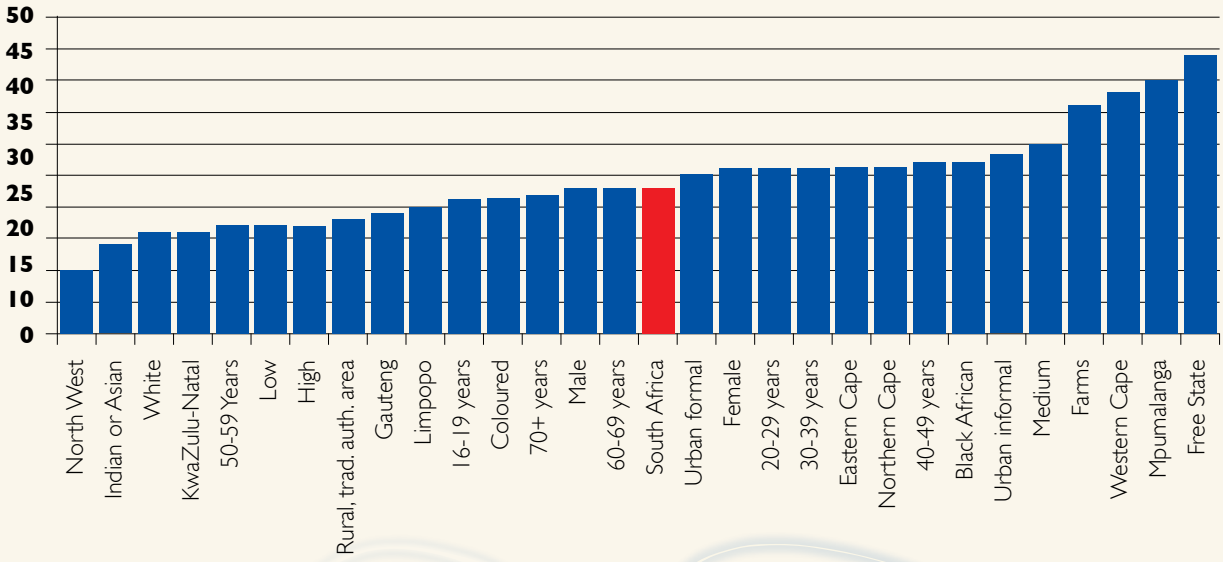
Source: DME: Free Basic Electricity Policy, (2003)

8.1 Awareness of Free Basic Electricity

In order to understand awareness of Free Basic Electricity (FSB), South Africans were asked if they receive FSB. As was found by other national surveys, South Africans are generally not aware that they receive Free Basic Electricity. On aggregate, approximately a quarter (24%) of South Africans indicated that their households receive Free Basic Electricity. More than two-thirds of households (68%) indicated that they do not receive it, with a further 8% being unsure.

Interestingly, males (23%) are slightly less aware of FBE than females (26%). The age groups 20-29 year olds and 30-39 year olds are most aware of FBE, whilst lowest awareness is found among the 50-59 year olds (17%). Large, significant differences of awareness are found among the different race groups. Awareness is highest for black South Africans, with more than a quarter (27%) aware of FBE. Significantly less proportions of coloureds (21%), whites (16%) and Indians (14%) are aware of FBE. Even more alarming is the fact that awareness is lowest among low LSM households (17%). This is concerning, since the FBE policy initiative is aimed at benefitting low income households. Turning to geotype, it is evident that people in rural informal and urban informal areas were most aware of receiving FBS. When awareness of FBE was disaggregated by province, it was evident that households from the Western Cape (41%), Free State (40%) and Mpumalanga (40%) had the highest proportions indicating awareness of FSB. Awareness of FSB was almost non-existent in North West (10%), KwaZulu-Natal (14%) and Limpopo (16%).

Figure 25: Awareness of Free Basic Electricity by socio-demographic attributes (percent)



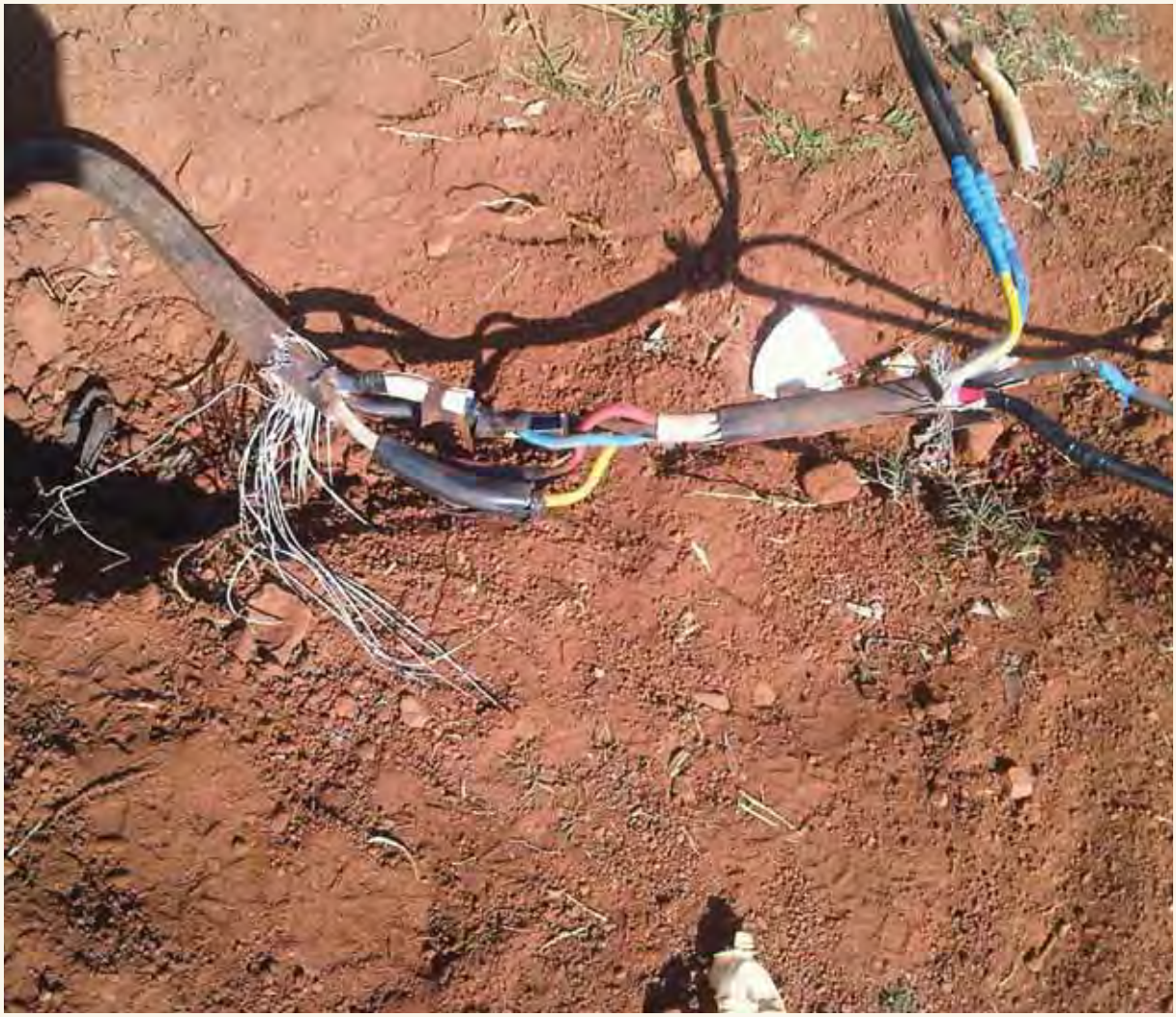
When awareness of FBE is ranked from lowest to highest, it is evident that the lowest awareness is among North West residents, Indians, whites, people living in KwaZulu-Natal, 50-59 year olds and people with a low or high living standard. People living in the Free State, Mpumalanga, Western Cape, on farms, who have a medium living standard or resident in urban informal areas, are most likely to be aware of FBE.

As a follow-up question, households were asked where they got their information about FBE. Overall, the majority of households found out about FBE from their municipalities. The rest were informed about FBE by friends and family or the local media. Few households enquired on their own about FBE. Less than five percent found out about FBE from the Department of Energy.

Table 33: Sources of information regarding FBE (multiple response percent)

	Municipality	Friends/ family	Local media	Enquire on my own	Department of Energy	Other
South Africa	69	21	9	7	5	3
Gender						
Male	71	19	12	6	8	3
Female	68	22	9	9	3	2
Age						
16-19 years	66	24	10	7	1	3
20-29 years	71	22	9	4	3	1
30-39 years	66	19	8	6	4	7
40-49 years	71	17	10	11	11	4
50-59 years	69	22	19	15	3	0
60-69 years	75	13	10	10	10	1
70+ years	65	51	7	2	0	2
Population group						
Black African	69	20	8	8	6	3
Coloured	58	32	11	9	3	3
Indian	93	0	44	4	3	1
White	83	23	24	1	1	2
Living standard level						
Low	71	22	0	0	4	3
Medium	68	22	7	8	5	3
High	72	17	19	6	5	1
Geographic location						
Urban formal	73	21	13	6	5	2
Urban Informal	82	9	0	7	8	9
Rural, trad auth. areas	56	20	6	13	6	2
Farms	59	32	5	5	2	1
Province						
Western Cape	70	28	18	4	4	4
Eastern Cape	81	24	5	8	2	0
Northern Cape	73	17	5	5	9	3
Free State	47	31	13	6	2	0
KwaZulu-Natal	48	21	16	25	9	7
North West	72	17	25	4	22	0
Gauteng	75	13	5	7	10	3
Mpumalanga	91	4	0	2	0	3
Limpopo	64	28	8	0	0	0

The majority of people found out about FBE through their municipalities. This was particularly true for Indians, with 93% getting their information on FBE from municipalities. Large shares of people in Mpumalanga (91%), whites (83%), people in informal areas (82%) or in the Eastern Cape also indicated the municipality as an information source. Friends and families were also a source of information, especially among the 70+ age group, coloured people (32%), people on farms (32%) and residents of the Free State (31%). Local media as a source of information was highest among the Indians (44%), or 50-59 year olds (19%). People from KwaZulu-Natal (25%), those between the ages of 50-59 years (15%) or living in rural traditional authority areas were most likely to have enquired on their own about FBE. Larger than average shares of people in North West (22%), people between the ages of 40-49 years (11%), people living in Gauteng (10%) or between the ages of 60-69 got their information from the Department of Energy.

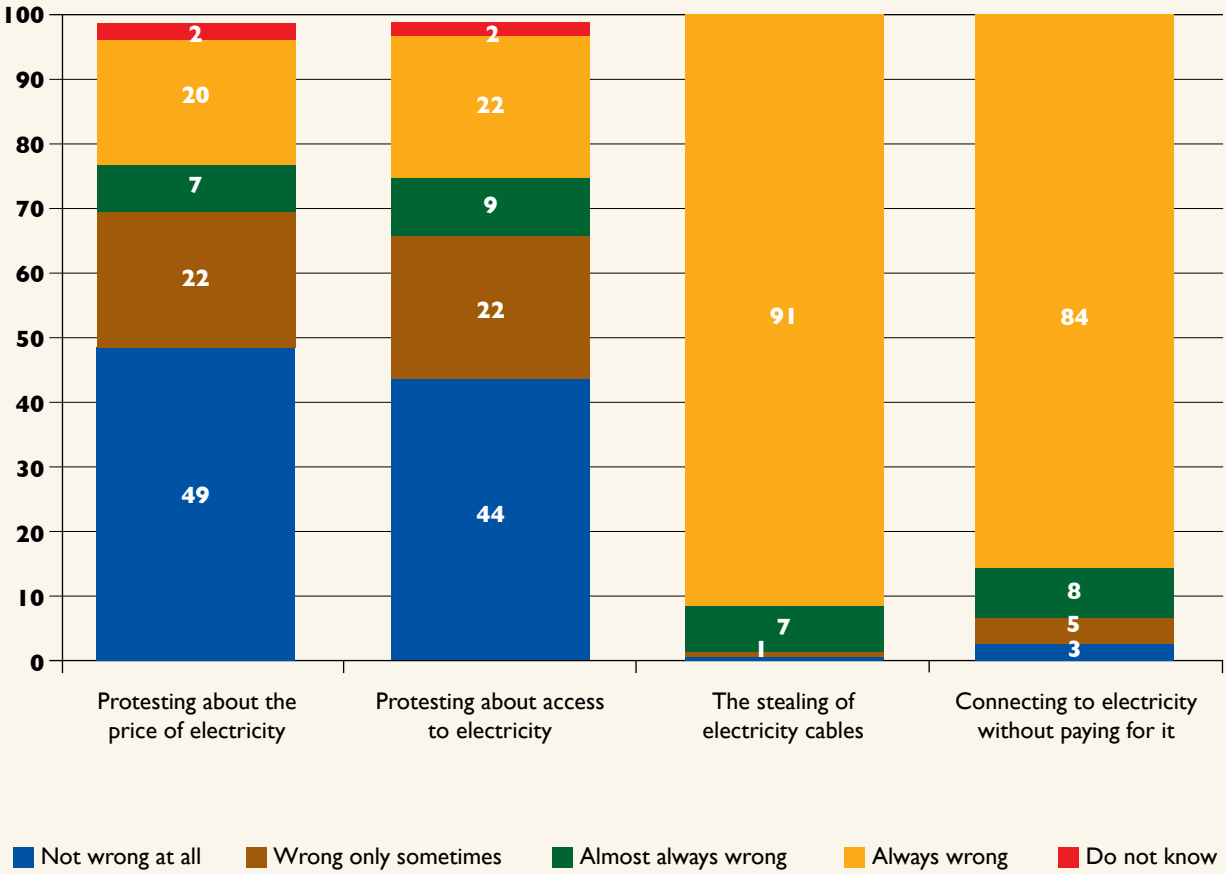


9. Support for different energy-related activities

South Africa has been dubbed "the protest capital of the world" (Rodrigues, 2010) since it has one of the highest rates of public protest in the world. During the 2004/05 financial year about 6,000 protests were officially recorded, approximately 1000 were illegally banned and an unknown number of protests went unrecorded. Since 2005 the number of protests have escalated dramatically and Heese and Allan (2011) reports that "2009 and 2010 together account for about two-thirds of all protests since 2004". The number of protests reached an all time high in 2010/2011 and can therefore be said to be escalating.

These protests are usually referred to as service delivery protests in the media and it is evident that there is growing unhappiness with service delivery. Zwelinzima Vavi, COSATU Secretary General, has described the increasing rate of popular protest as a "ring of fire" closing in on major cities that could result in a revolution. As these protests continue some analysts take the view that protests are also becoming increasingly radical. Some commentators have concluded that "a large majority of South Africans feel that conventional mechanisms of engaging the state are failing and that alternatives may be more effective (Pillay, 2011). Some commentators have also been stating that service delivery protests are part of a broader Rebellion of the Poor.

Figure 26: Support for different activities (percent)

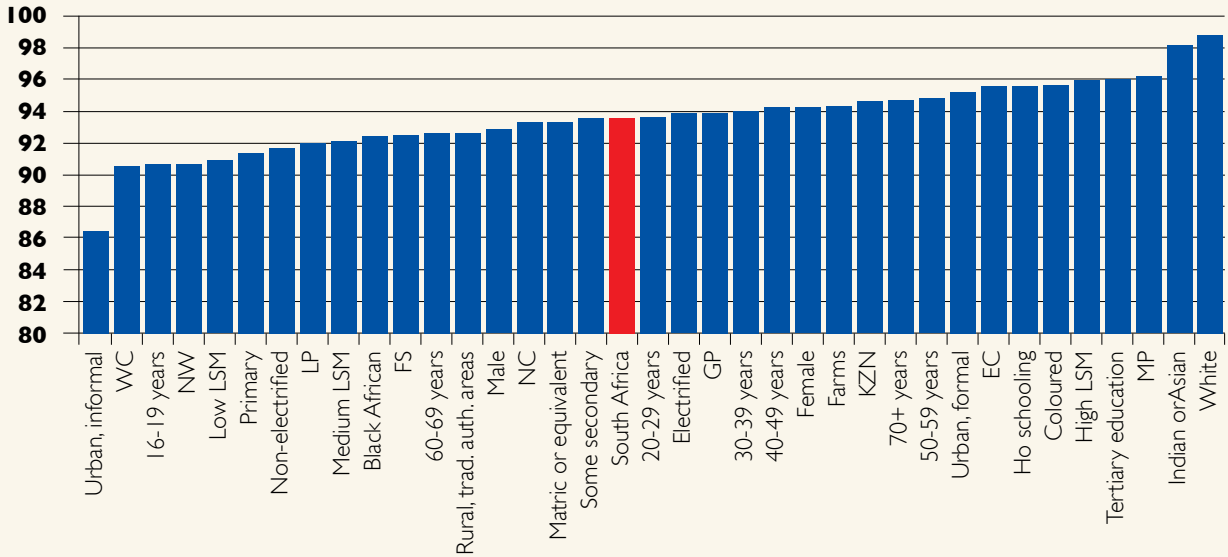


In line with commentary, the majority of South Africans felt that it was not wrong at all (49%) or wrong only sometimes (21%) to protest about the price of electricity (Figure 26). Just over a quarter (27%) was of the opinion that it was mostly wrong to protest about the price of electricity. The rest (2%) were undecided (stating "don't knows"). Similarly, a large proportion of South Africans (44%) felt that it was acceptable to protest about access to electricity. Just over a fifth (22%) conditionally accepted protest action about access to electricity, stating that "it was wrong only sometimes". Conversely, 9% said it was almost always wrong and 22% said it was always wrong. A small percentage (2%) did not have an opinion about the matter.

National results indicate that there is strong opposition to illegal connections and the stealing of electricity cables. Nine in ten people (91%) indicated that it is always wrong to steal electrical cables. A further 7% had a conditional response, saying that it was almost always wrong. Insignificant proportions (2%) said it was not wrong at all or did not know (1%). The same trend was noted with regards to connecting to electricity without paying for it. Eight in ten people (84%) said it was always wrong, 8% said it was almost always wrong and the rest either said it was wrong only sometimes (4%) and not wrong at all (3%).

Since there is a strong correlation between the questions about illegal connections and the stealing of electricity cables, an Electricity Morality Index (EMI) was created by combining the two questions. This index was created in order to enable the question to be disaggregated by a number of socio-demographic characteristics. The Index was created by recoding the scores to 4=Always wrong; 3=Almost always wrong; 2=Wrong only sometimes and 1=not wrong at all. Answers to the two questions were added together and a 0-100 scale was created. "Don't know" responses were eliminated from the calculation. A higher score showed a higher morality score, indicating that people would not support illegal connections or the stealing of electricity cables.

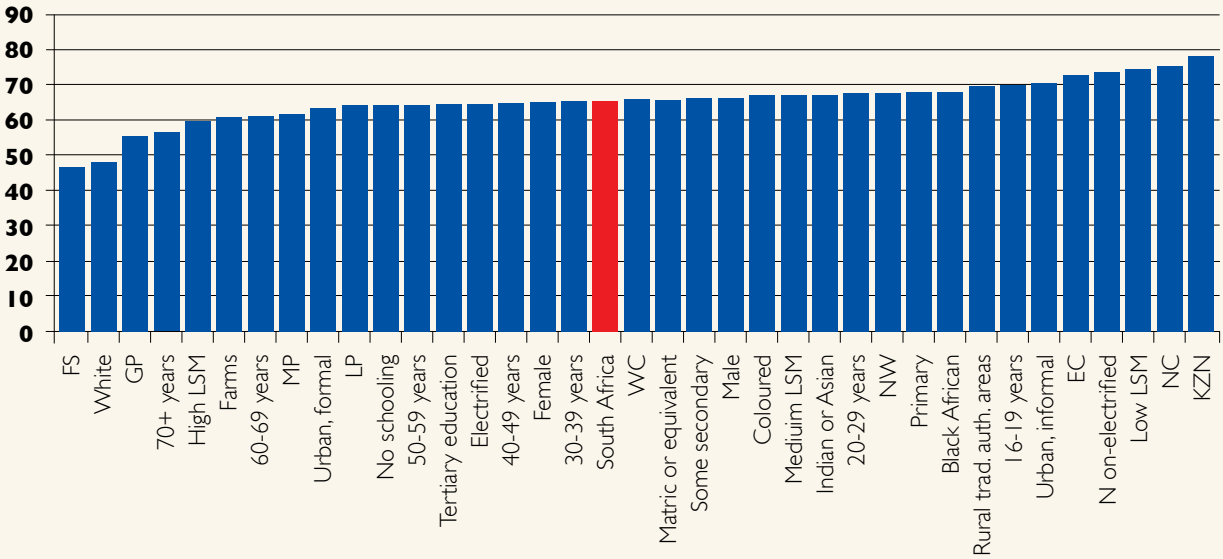
Figure 27: Electricity Morality Index (Ranked mean scores)



Ranking responses on the electricity morality score, it is firstly evident that South Africans are generally opposed to illegal connections and the theft of electricity cables. However, certain socio-demographic groups were more opposed to these actions than other groups. As can be seen from Figure 27, people from urban informal areas, people residing in the Western Cape, the youngest cohort (16-19 age group), residents from North West and people with a low living standard or with a primary education were least likely to oppose illegal connections or the theft of electricity cables. On the other side of the spectrum, people with no schooling, people from the coloured community, people with a high living standard, people with a tertiary education, people from Mpumalanga, Asians or whites were most opposed to illegal connections and the theft of electricity cables. This is an interesting finding, which might be interpreted as an economic necessity model, with people in informal areas least opposed to these actions. A further interesting finding is that an educational gradient is not evident, since people with no schooling rate high on this scale, suggesting that education is not necessarily a driver of these moral issues.

In order to understand who were most likely to support protest action against high electricity prices and issues regarding access, a Protest Action Index (PAI) was created. The Index was created by recoding the scores to 4=Always wrong; 3=Almost always wrong; 2=Wrong only sometimes and 1=not wrong at all. Answers to the two questions were added together and a 0-100 scale was created. "Don't know" responses were eliminated from the calculation. A higher score indicated a higher propensity towards finding protest action acceptable.

Figure 28: The Protest Action Index (Ranked mean scores)



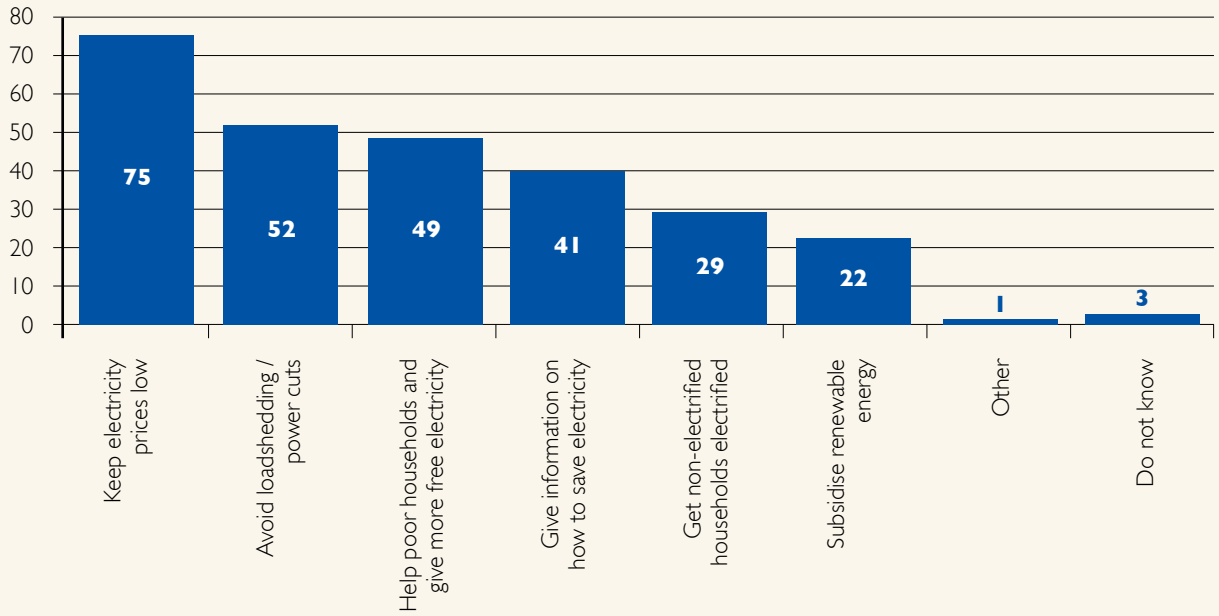
When scores of the various socio-demographic groups were ranked on the Protest Action Index, it was evident that people from the Free State, whites, residents from Gauteng, older people (those 70 years and older), people with a high living standard and people from farms were most likely to think that protest action was wrong. Contrary, people from KwaZulu-Natal, Northern Cape, people who have a low living standard, residents from the Eastern Cape, people who live in urban informal areas and youngsters (between the ages of 16-19 years) were least likely to think it is wrong to protest against high prices and access issues.

10 Policy Preferences

10.1 Government priorities in supplying electricity to the people

Government has various demands and priorities when it comes to providing people with electricity. In order to understand what mandate the people of South Africa would give government, some priorities were listed and the South Africans had to choose three top priorities that government should prioritise. These responses were combined and are listed below.

Figure 29: Policy preferences in terms of government priorities in the supply of electricity (multiple response - percent)



Three quarters of all adult South Africans stated that the priority of the Department should be to keep electricity prices low. Economical considerations outweighed other priorities by a considerable margin. The second priority, mentioned by just more than half (52%) of the population, was that the Department should ensure that load-shedding and power cuts are minimised. A further priority, shared by almost half of South Africans (49%), was that the department should help poor households by giving more free electricity. These were the top three priorities listed by the South African people. Fewer (41%) felt that the Department should prioritise dissemination of information about energy-saving measures. Smaller shares of people (29%) felt that the priority should be to get non-electrified households electrified or that renewable energy should be subsidised (22%).

Table 34: Policy preferences by select socio-demographic attributes (percent)

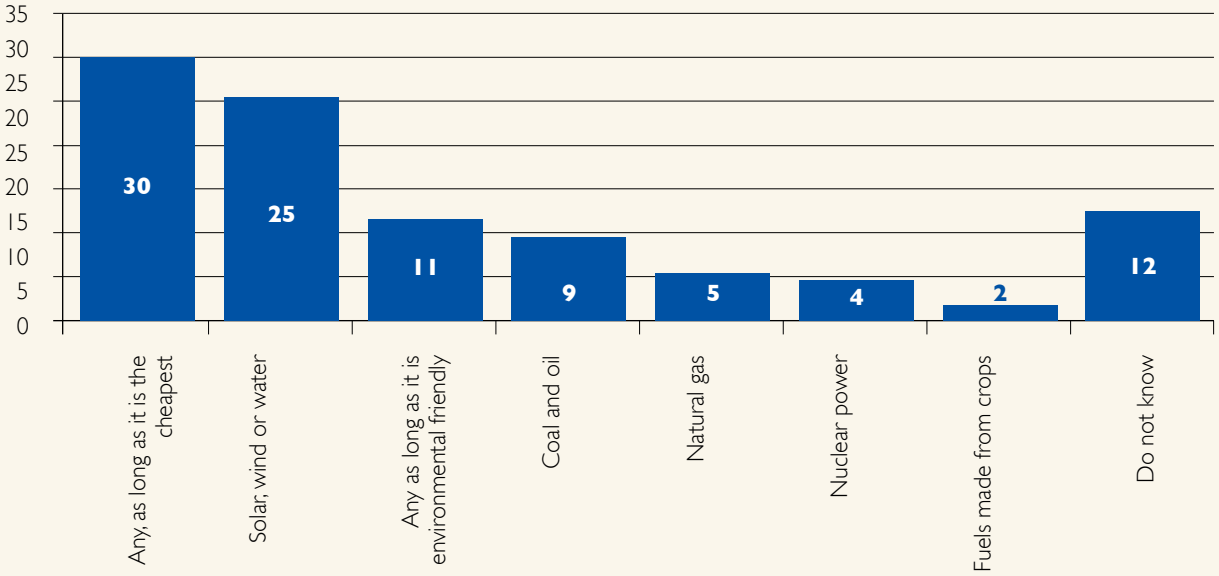
	Keep electricity prices low	Avoid load-shedding/ Power cuts	Give more free electricity and help poor hh	Give information about energy saving	Get non-electrified hh electrified	Subsidise renewable energy
South Africa	75	52	49	40	28	22
Electrification status						
Electrified	78	55	50	42	26	23
Non-electrified	47	28	47	32	53	12
Population group						
Black African	74	50	53	42	32	17
Coloured	78	54	51	32	23	29
Indian	86	52	39	50	21	27
White	80	67	24	35	14	44
Living standard level						
Low	59	32	54	36	48	11
Medium	76	50	57	41	29	17
High	80	63	36	41	20	33
Geographic location						
Urban formal	77	62	44	40	23	27
Urban Informal	67	49	47	43	34	14
Rural, trad. auth. areas	76	38	62	42	36	12
Farm	67	39	53	37	41	22
Province						
Western Cape	79	52	40	33	28	41
Eastern Cape	76	60	55	39	23	13
Northern Cape	72	31	44	50	18	35
Free State	67	49	43	48	13	32
KwaZulu-Natal	81	48	54	43	39	15
North West	79	43	62	33	39	20
Gauteng	73	67	41	42	23	21
Mpumalanga	66	41	57	36	40	20
Limpopo	74	35	59	49	31	10

A considerable majority of the South African public (75%) believes that the policy priority in terms of electrification should be to keep prices low. This conviction is mostly found among Indians (86%), residents of KwaZulu-Natal (81%), whites, people with a high living standard (both 80%), people in the Western Cape and North West (79%). People least concerned with pricing as a policy issue were among those not electrified (47%), people living in Mpumalanga (66%) or those living in urban informal or farms (67%). Avoiding load-shedding or power cuts was most important to whites (67%), people living in Gauteng (67%), people with a high living standard (63%) or residing in urban formal areas (62%). The redistributive policy "give free electricity to poorer households" was most important to people residing in North West, or rural traditional authorities (both 62%), people from Limpopo (59%), people in the medium living standard category (57%) or black South Africans (53%). Giving information on energy-saving measures was most supported by Indians (50%), people in the Northern Cape (50%) and Limpopo (49%). As could be expected, the highest preference for getting non-electrified households electrified were found among people living in non-electrified households (53%) or with a low living standard (48%). Highest support for subsidising renewable energy was found among whites (44%), residents of the Western Cape (41%), and people with a high living standard (33%).

10.2 Future sources of electricity supply

The 1998 White Paper on Energy Policy and the 2008 National Energy Act both promote a range of diverse sources to provide future energy supply. Future energy supply to South Africans would be sources from coal, solar, wind, water, natural gas, nuclear and biofuel. The intention is, however, to lessen the reliance on coal and to allow for corresponding increase in the share represented by low-carbon technologies (IRP 2010). In order to determine people's preferences in terms of the future sources of energy supply, people were asked which of the sources should be the main priority for meeting the future energy needs of South Africa.

Figure 30: Policy preferences in meeting South Africans' future energy needs (percent)



In choosing future sources for electricity generation, South Africans are clear that economic imperatives are the most important, hence the response "It does not matter which source, as long as it is the cheapest". Having said this, a sizeable quarter of South Africans also support renewable energy sources, such as solar wind and water, with a further 11% explicitly placing emphasis on sources that are not damaging to the environment. Economic and environmental considerations are thus important to South Africans when considering future energy sources. Less than a tenth supported other energy sources such as coal and oil (9%), natural gas (5%), nuclear power (4%) and fuels made from crops (2%).

Table 35: Policy preferences in meeting South Africa's future energy needs by select socio-demographic attributes (percent)

	Any, as long as it is the cheapest	Solar, wind or water	Any, as long as it is environment friendly	Coal and oil	Natural gas	Nuclear	Fuels from crops
South Africa	31	24	12	9	5	5	2
Electrification status							
Electrified	30	25	12	9	5	5	2
Non-electrified	35	16	22	9	5	2	1
Population group							
Black African	33	21	10	10	6	5	1
Coloured	29	26	20	5	5	3	2
Indian	21	34	13	9	6	4	4
White	17	45	11	7	1	6	5
Living standard level							
Low	43	15	7	6	4	1	0
Medium	34	19	11	9	6	5	2
High	22	35	13	9	5	6	2
Geographic location							
Urban formal	26	30	13	8	5	5	2
Urban Informal	29	20	11	13	7	4	2
Rural, trad. auth. areas	38	15	10	9	5	4	1
Farms	36	23	11	8	5	2	2
Province							
Western Cape	29	27	12	3	7	7	6
Eastern Cape	31	21	11	6	2	1	1
Northern Cape	34	22	21	4	5	5	1
Free State	25	28	5	10	5	8	3
KwaZulu-Natal	31	26	7	7	9	9	1
North West	41	9	21	5	5	6	1
Gauteng	23	30	13	11	4	3	2
Mpumalanga	35	27	9	10	3	1	0
Limpopo	43	14	14	18	6	2	0

Of all the different socio-demographic variables that this preference was examined by, the highest proportion indicating a preference for the cheapest energy was found among people with a low living standard (43%), people from Limpopo (43%) or North West (41%). Preference for renewable energy such as solar, wind or water was highest among whites (45%), people with a high living standard (35%), Indians (34%), people living in urban formal areas (30%) or people residing in Gauteng (30%). People in non-electrified households (22%) were mostly in favour of environmentally-friendly solutions, followed by people in the Northern Cape (21%) or North West (21%). Coal and oil as sources of electricity were mostly favoured by residents of Limpopo (18%) and people living in urban informal areas. Residents of KwaZulu-Natal were particularly in favour of natural gas and nuclear energy. Whites and residents from the Western Cape were mostly in favour of fuel from crops.

10.3 Government policies to ensure that the use of energy is reduced

One of the priorities of government is to try to get people to use less energy. In doing this, there are various strategies that can be followed and have been followed internationally. South Africans were given three possible strategies and they had to rate to what extent they were strongly in favour, in favour, neither nor, against or strongly against the strategy.

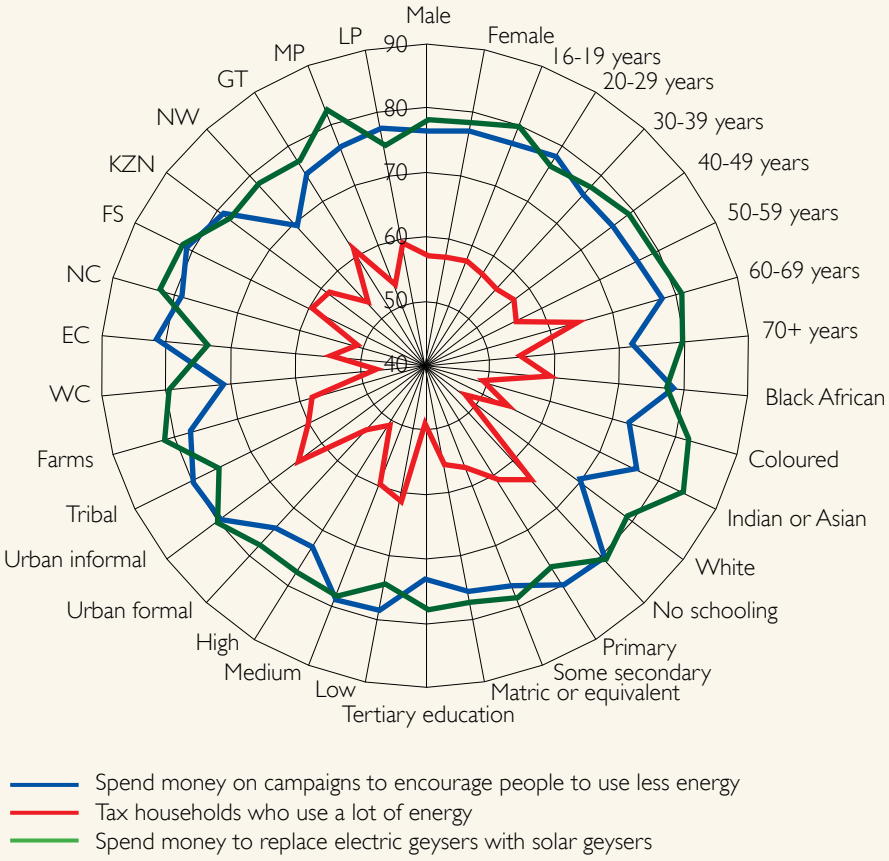
Table 36: Policy preferences with regards to energy-saving initiatives (percent)

The South African government should:	Strongly in favour	In favour	Neither in favour nor against	Against	Strongly against	(Do not know)	Mean score
Tax households who use a lot of energy	19	27	19	23	8	5	57
Spend money on campaigns to encourage people to use less energy	33	48	9	6	2	2	77
Spend money to replace electric geysers with solar geysers	37	38	13	5	1	6	78

The two most preferred initiatives in terms of energy-saving initiatives were to spend money on campaigns encouraging people to use less energy and to replace electric geysers with solar geysers. More than four-fifths (81%) of South Africans were strongly in favour or in favour of campaigns to encourage people to use less energy. Three quarters (75%) strongly favoured or favoured the option of replacing electric geysers with solar geysers. Less than half (46%) were in favour of the option of taxing households who use a lot of energy.

Also, in order to establish a comparative scale for this question, a mean score was calculated. Recoding was done: Strongly in favour =5; in favour=4; neither nor=3; against=2 and strongly against=1. "Don't know" options were coded as missing data. The score was then converted to a 0 -100 scale. The higher the mean score, the more it indicated stronger support for the initiative. The mean scores are portrayed below in a radar diagram.

Figure 31: Support for three government policies (mean)



Spending money on the replacement of electric geysers with solar geysers was most supported by people from the Indian community, people living on farms, people residing in the Northern Cape and residents from Mpumalanga. The need for campaigning to encourage people to use less energy was mostly articulated by people in the Eastern Cape, Free State, people with no schooling or primary levels schooling, people in urban informal and rural, traditional authority areas. Groups most in favour of households being taxed who use a lot of electricity are people with no schooling, residents of urban informal areas and people aged between 60-69years. Those least in favour are whites, residents from the Western Cape, coloured people and people with a tertiary qualification.

11 Conclusion and recommendations

After the democratic government took office in 1994, it committed itself to providing basic services to the poor and disadvantaged majority of South Africans. Modern energy sources were regarded as one of the primary components of basic services to be delivered to all citizens. This was not surprising, given that some literature regards adequate energy in itself as a basic survival need and access to modern energy sources (such as electricity, solar home systems and other renewables) as an important step in achieving socio-economic development. Currently, 87% of all formal households in South Africa (excluding households in informal settlements) are electrified. Although the electrification programme has been extremely successful in expanding the number of households connected to the national grid, significant challenges exist in connecting the remaining 13% of non-electrified households due to factors such as topography, sparse settlement patterns, high costs per connection and either a lack of or no bulk infrastructure. Yet, in spite of these difficulties, the Department of Energy has committed itself to a target of increasing access to energy to 92% of formal South African households by 2014. This is to be achieved largely through the provision of electricity and a range of renewable energy sources.

Despite greater levels of access, multiple energy use remains an enduring reality among households in South Africa, even after electrification. This is a result of affordability as well as possible constraints in the type of electric current received – particular to those households that receive a load-limited supply of 20 ampere. Poorer households use electricity mainly for lighting and cannot afford to use it for cooking or heating. Even in the case of lighting, 29% of the poorest electrified households are using candles as a supplementary energy source. Almost half of all electrified households in South Africa use electricity in combination with other energy sources such as firewood, paraffin and gas for cooking. This is also the case with heating, where wood and coal are widely used as a household heat source. rather than electricity.

The continued dependence on non-commercial energy has negative potential impacts in terms of health, environmental degradation and energy poverty. Poorer households might well be aware of the burden, inconvenience and health detriments of cooking over smoky fires, but their economic choices are very limited. Increasing commercialisation of energy - firewood in particular - creates additional challenges. If households are not able to pay for the firewood, further energy poverty and deteriorating livelihoods are imminent. For the forseeable future, multiple energy usage remains a certainty, especially in poorer households. An energy development strategy which seeks to benefit the poor can therefore not be restricted to electrification, but needs to include improved access to reliable, sufficient, sustainable, affordable, clean, safe, healthy and environmental friendly non-electric energy sources. This is critical if environmental impacts, health hazards and risks (such as accidents through poisoning of children who drink fluid fuels or shacks that are razed by candles and paraffin fire) are to be reduced.

Where there is extreme energy poverty, the direct effects can be malnutrition, disease and even death. There is little doubt that extreme energy poverty contributes to the plight of vulnerable households, and within these households to the survival prospects of the most vulnerable family members such as the elderly, the frail and the very young. This study used three approaches to measure energy poverty: namely, a household expenditure measure, a subjective measure and a low income, thermal inefficiency approach. The expenditure based approach is most commonly used of the three and defines a household as energy poor if it spends more than 10% of its income on energy. Households with energy expenditure exceeding this threshold are considered to be energy poor and are consequently likely to be confronted with difficult choices between meeting energy requirements and other basic competing spending priorities such as food. On average, South African households spend 14% of their total monthly household income on energy needs. Furthermore, almost half (47%) of households were found to spend more than 10% of income on energy, thus being classified as energy poor. Almost three-quarters (74%) of households in the poorest quintile were energy poor and results showed that even high income households are suffering under the burden of higher electricity prices and that even among the richest quintile, 13% of households are energy poor. Increasing electricity

prices are a threat to all South Africans and energy price reviews are urgently needed to ensure that households do not get further entrapped in energy poverty. This calls for a review of the current electricity pricing increase model and the current tariff structures.

The measure of energy poverty using the expenditure approach, compared with that generated with the subjective approach and thermal efficiency approach, provide differences in terms of both the overall incidence of energy poverty as well as the identification of sub-groups as energy poor. However, there were some recurrent findings, most notably (i) the increased likelihood of being energy poor if a household has a lower living standard level or falls in the poorest per capita income quintiles; and (ii) the greater incidence of energy poverty among households located in the Eastern Cape, Limpopo, Mpumalanga or in rural traditional authority areas.

Based on the findings pertaining to the energy poverty phenomenon, two recommendations need to be considered. Firstly, it is recommended that the Department of Energy should examine and decide upon an official definition of energy poverty for the country, especially given the policy significance of this social phenomenon from a poverty, health and well-being aspect, as well as from an environmental point-of-view. Secondly, different options for measuring energy poverty need to be investigated and a decision made regarding which alternative is the preferred approach for classifying households and individuals as energy poor in a manner that is consistent with the official definition that is ultimately chosen. This would not preclude the fielding of other supplementary measures for cross-validation purposes, but an official definition and measurement approach in respect of energy poverty is required for effective monitoring and policy-making purposes.

As illustrated by this report, poorer households in South Africa are carrying an enormous energy burden. Current energy subsidisation policies to electrified and non-electrified households such as Free Basic Electricity (FBE), Free Basic Alternative Energy (FBAE) and the Inclined Block Tariff (IBT) are a step in the right direction and a welcome relief to ensure that households do not get trapped deeper into poverty and vulnerability. At present, the FBE policy allows electrified households up to 50kWh of electricity free of charge. Non-electrified households benefit from the FBAE policy which was introduced as an intervention strategy specifically aimed at servicing those who suffer from energy poverty in un-electrified areas. Subsidised alternative sources of energy include solar home systems, paraffin, liquefied petroleum gas, coal, and bio-ethanol gel. In April 2010 the IBT was introduced, which implies that higher-consuming customers will pay higher tariff rates for electricity while lower-consuming customers will benefit from a lower tariff rate. In essence, higher-consuming customers are cross-subsidising lower-consuming customers. All of these policies are designed to assist poor households, but many scolars and analysts argue that this is still not enough. They argue that the wider socio-economic development benefits of electrification and other energy relief initiatives seemed disappointing, partly because poorer households are still not able to meet basic energy needs with the amounts subsidised by government. Consideration needs to be given to these issues and it is recommended that targeted interventions be made to municipalities with no or low revenues where a significant majority of households are poor. The recommendation is for government to increase the fiscal allocation to these types of municipalities. However, this fiscal increase should be done in a conditional grant manner, restricting this allocation to FBE and FBAE aimed at poor households.

It is evident from the report that the IRP should take economic imperatives seriously when planning for future energy choices. The majority of households indicated that they wanted the cheapest energy alternative, regardless of the energy source option, be it solar, wind, coal, oil, natural gas, nuclear power or fuels made from crops, etc. Ideological sentiment seems to vanish in the wake of economic realities. In addition, the study shows that South Africans are willing to pay for energy but request that the cost remain reasonable. This report reveals that the focus should be on the affordability of the energy source and that the option with the lowest direct and associated costs will be supported by the majority of South Africans.

On average, only 20% of households are aware of energy-saving measures, which leaves the majority of households, especially poorer households, virtually unaware of any of the energy-saving measures. This lack of energy-saving awareness contributes to unsustainable demand conditions. The energy-saving strategies that households suggests as preferred policy options to encourage energy saving measures is that government should spend money on campaigns encouraging people to use less energy (81% of South Africans strongly favoured this option) and replacing electric geysers with solar geysers (75% of South Africans favoured this option). Less than half (46%) favoured the option of taxing households who use a lot of energy.

In terms of creating awareness around energy saving measures, ESKOM's 49M campaign is a step in the right direction. Such a campaign is attempting to create an energy literate society, which would make well reasoned decisions about energy options and use the national resources more optimally. However, it is recommended that more needs to be done in terms of localised on the ground campaigns to assist with energy awareness and energy-saving strategies at a micro household level.

In conclusion, it is imperative that the Department of Energy examines and decides upon an official definition of energy poverty for the country. This could then be used as a baseline to monitor and track energy poverty levels in South Africa. In addition, as a matter of urgency, residential energy-pricing models and tariff structures need to be reviewed in order to relieve pressures on households in relation to the high levels of energy poverty shown in this study. A clear demand is also expressed by households for energy-savings and efficiency information awareness campaigns countrywide. This demand implies that households would be receptive towards information awareness campaigns and augers well for uptake by households.

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Appendix A

SOUTH AFRICAN SOCIAL ATTITUDES SURVEY
Questionnaire 2: September 2011

RESPONDENTS AGED 16 YEARS +

Good (morning/afternoon/evening), I'm _____ and we are conducting a survey for the Human Sciences Research Council (HSRC). The HSRC regularly conducts surveys of opinion amongst the South African population. Topics include a wide range of social matters such as communications, politics, education, unemployment, the problems of the aged and inter-group relations. As a follow-up to this earlier work, we would like to ask you questions on a variety of subjects that are of national importance. To obtain reliable, scientific information we request that you answer the questions that follow as honestly as possible. Your opinion is important in this research. The area in which you live and you yourself have been selected randomly for the purpose of this survey. The fact that you have been chosen is thus quite coincidental. The information you give to us will be kept confidential. You and your household members will not be identified by name or address in any of the reports we plan to write.

PARTICULARS OF VISITS

	DAY MONTH	TIME STARTED HR	TIME STARTED MIN	TIME COMPLETED HR	TIME COMPLETED MIN	**RESPONSE
First visit	/ / 2011					
Second visit	/ / 2011					
Third visit	/ / 2011					

**RESPONSE CODES		
Completed questionnaire	=	01
Partially completed questionnaire (specify reason)	=	02
Revisit		
Appointment made	=	03
Selected respondent not at home	=	04
No one home	=	05
Do not qualify		
Vacant house/flat/stand/not a house or flat/demolished	=	06
No person qualifies according to the survey specifications	=	07
Respondent cannot communicate with interviewer because of language	=	08
Respondent is physically/mentally not fit to be interviewed	=	09
Refusals		
Contact person refused	=	10
Interview refused by selected respondent	=	11
Interview refused by parent	=	12
Interview refused by other household member	=	13
OFFICE USE	=	14

STRICTLY CONFIDENTIAL

Name of Interviewer .....

Number of interviewer

Checked by

Signature of supervisor

FIELDWORK CONTROL

CONTROL	YES	NO	REMARKS
Personal	1	2	
Telephonic	1	2	
Name	SIGNATURE		
.....	DATE ..... / ..... / 2011		

RESPONDENT SELECTION PROCEDURE

Number of households at visiting point

Number of persons 16 years and older at visiting point

Please list all persons at the visiting point/on the stand who are 16 years and older and were resident 15 out of the past 30 days. Once this is completed, use the Kish grid on next page to determine which person is to be interviewed.

Names of Persons Aged 16 and Older	
	01
	02
	03
	04
	05
	06
	07
	08
	09
	10
	11
	12
	13
	14
	15
	16
	17
	18
	19
	20
	21
	22
	23
	24
	25

NAME OF RESPONDENT:
ADDRESS OF RESPONDENT:
.....
.....
.....
TEL NO.:

GRID TO SELECT RESPONDENT

NUMBER OF QUESTIONNAIRE				NUMBER OF PERSONS FROM WHICH RESPONDENT MUST BE DRAWN																							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	26	51	76	1	1	1	3	2	4	1	3	5	8	6	5	12	10	1	6	8	7	19	19	13	21	13	24	25
2	27	52	77	1	2	3	4	3	1	2	2	3	4	8	3	7	2	5	14	4	15	4	8	6	16	14	22	19
3	28	53	78	1	1	2	1	4	2	7	6	9	3	5	11	2	1	3	11	7	10	16	16	10	5	2	2	3
4	29	54	79	1	2	3	2	1	3	5	8	6	2	4	2	4	8	11	10	16	6	9	10	15	11	12	11	18
5	30	55	80	1	1	1	4	5	6	3	5	7	5	9	8	14	3	2	13	5	18	1	4	1	20	11	5	24
6	31	56	81	1	2	2	2	3	5	7	7	8	7	1	4	9	14	8	2	17	17	14	12	14	22	10	3	14
7	32	57	82	1	2	1	1	4	1	4	1	4	6	3	6	5	7	13	9	2	3	13	14	8	2	7	20	4
8	33	58	83	1	1	2	3	2	5	1	4	2	1	7	10	6	5	4	15	10	5	2	13	4	17	5	17	8
9	34	59	84	1	1	3	2	5	6	2	2	1	9	10	1	10	4	6	6	1	9	10	1	5	6	9	1	12
10	35	60	85	1	2	2	4	1	3	3	6	9	10	11	12	3	9	15	7	8	11	6	3	9	4	3	10	1
11	36	61	86	1	1	1	3	1	4	5	3	1	6	2	9	13	11	14	4	11	4	15	15	17	1	1	23	2
12	37	62	87	1	2	3	1	3	2	7	5	6	5	7	7	8	6	10	3	3	1	12	20	7	13	22	12	16
13	38	63	88	1	1	2	1	5	3	6	4	3	4	6	2	11	13	12	1	15	8	7	2	12	15	21	13	7
14	39	64	89	1	2	3	2	4	1	4	7	8	2	5	6	11	12	9	16	13	16	11	18	18	14	16	18	23
15	40	65	90	1	2	1	4	2	4	3	8	7	7	11	1	3	5	7	12	14	13	8	17	20	19	20	19	11
16	41	66	91	1	1	3	3	1	6	5	1	5	9	10	3	2	11	13	8	12	12	5	6	21	8	8	4	15
17	42	67	92	1	1	2	2	3	4	2	6	2	3	2	12	5	2	10	13	5	8	18	9	16	10	17	16	20
18	43	68	93	1	2	1	4	2	6	4	1	4	8	9	10	7	9	3	12	12	9	7	20	19	9	19	21	13
19	44	69	94	1	2	2	1	3	5	2	8	9	10	4	9	8	13	1	1	14	10	19	10	11	18	15	7	6
20	45	70	95	1	1	3	2	5	4	1	3	8	1	3	8	6	6	9	5	7	13	4	15	1	7	22	15	21
21	46	71	96	1	1	1	2	5	1	7	2	3	2	1	11	4	7	5	3	2	1	3	12	18	5	19	14	9
22	47	72	97	1	2	1	3	1	3	2	6	2	1	8	7	1	4	2	11	8	2	17	4	17	21	16	3	5
23	48	73	98	1	2	3	4	2	2	6	7	7	8	3	4	9	3	6	2	11	11	16	2	8	11	23	6	22
24	49	74	99	1	1	2	1	4	6	3	5	5	3	1	5	13	1	14	8	14	6	15	9	14	3	6	9	17
25	50	75	100	1	1	2	3	3	2	4	6	4	7	5	3	12	12	12	4	6	2	17	11	2	12	4	8	10




SASAS QUESTIONNAIRE 1: 2011

Number of persons in this household | | |

Number of persons 16 years and older in this household | | |

INTERVIEWER: PLEASE CIRCLE APPROPRIATE CODES

Household schedule	Write in from oldest (top) to youngest (bottom)	Person number	How old is [name]? (in completed years; less than 1 year =00)	Is [name] a male or a female? M=1 F=2	What population group does [name] belong to?	What is [name]'s relationship to the respondent
Please list all persons in the household who eat from the same cooking pot and who were resident 15 out of the past 30 days *Note: Circle the number next to the name of the household head.*		01				
		02				
		03				
		04				
		05				
		06				
		07				
		08				
		09				
		10				
		11				
		12				
		13				
		14				
		15				
		16				
		17				
		18				
		19				
		20				
		21				
		22				
		23				
		24				
		25				

Population Group
1 = Black African
2 = Coloured
3 = Indian or Asian
4 = White
5 = Other (specify)

Relationship to respondent codes
1 = Respondent
2 = Wife or husband or partner
3 = Son/daughter/stepchild/adopted child
4 = Father/mother/ step father/step mother
5 = Brother/sister/step brother/step sister
6 = Grandchild/great grandchild
7 = Grandparent/great grandparent
8 = Mother- or father-in-law
9 = Son- or daughter-in-law
10 = Brother- or sister-in-law
11 = Other relation (e.g. aunt/uncle)
12 = Non-relation

ENERGY

I would like to ask you some questions about the energy sources that you use in your household.

1. Do you have access to electricity in your household?

In-house conventional meter	1	
In-house pre-paid meter	2	
Connected to other source which I pay for (e.g. connected to neighbour's line and paying neighbour)	3	
Connected to other source which I do not pay for (e.g. connected to neighbour's line and not paying)	4	
No access to electricity	8	→ Skip to Q 3
(Uncertain/Don't know)	9	→ Skip to Q 3

2. What type of electricity supply that you have in your household?

2.5 Amps	1
10 Amps	2
20 Amps	3
40 Amps	4
60 Amps	5
80 Amps and more	8
(Uncertain/Don't know)	9

3. What sources of energy are used for lighting in this household?

4. What is the main source of energy for lighting in this household?

	3.(a)-(j) All sources used for lighting	**4. Main source for lighting**
a. Paraffin	01	01
b. Gas	02	02
c. Candle	03	03
d. Solar System	04	04
e. Electricity	05	05
f. Batteries	06	06
g. Car batteries	07	07
h. Generator (petrol/diesel)	08	08
i. Other (specify)	09	09
j. (Don't know)	98	98

5. What sources of energy are used for cooking in this household?

6. What is the main source of energy for cooking in this household?

	5.(a)-(i) All sources used for cooking	6. Main source for cooking
a. Paraffin	01	01
b. Gas	02	02
c. Coal	03	03
d. Firewood	04	04
e. Solar System	05	05
f. Electricity	06	06
g. Generator (petrol/diesel)	07	07
h. Other (specify)	08	08
i. (Don't know)	98	98

7. What sources of energy are used for heating rooms and keeping warm in this household?

8. What is the main source of energy for heating rooms and keeping warm in this household?

	7(a)-(o) All sources used for heating and keeping warm	8. Main source for heating and keeping warm
a. Paraffin	01	01
b. Gas	02	02
c. Coal	03	03
d. Firewood	04	04
e. Solar System	05	05
f. Electricity	06	06
g. Batteries	07	07
h. Car batteries	08	08
i. Generator (petrol/diesel)	09	09
j. Blankets	10	10
k. Warm clothing	11	11
l. Hot water bottle	12	12
m. Other (specify)	13	13
n. None of the above	14	14
o. (Don't know)	98	98

9. How much did your household spend on energy in the last month? This would include expenses on all energy sources (electricity and other fuels)

Amount (In Rands)	*(Don't Know)*	*(Refuse)*
R	**8**	**9**

On average, how much does your household spend each month on the following energy sources?

		Energy cost (Rands)
10.	Paraffin	
11.	Gas	
12.	Candle	
13.	Coal	
14.	Firewood	
15.	Solar system	
16.	Electricity	
17.	Batteries	
18.	Car batteries	
19.	Generator (petrol/diesel)	
20.	Other (specify)	

21. Is the amount of energy your household has less than adequate, just adequate or more than adequate for your household's needs?

It is not adequate for your household's needs	1	
It is just adequate for your household's needs	2	→ Skip to Q23
It is more than adequate for your household's needs	3	→ Skip to Q23
(Do not know)	8	→ Skip to Q23

22. What is the main reason why you feel that the amount of energy is inadequate to meet your household's needs?

Not enough money to pay for the energy we need	1
There are many electricity power cuts in my area	2
The supply of electricity to my household is limited	
Firewood is very scarce	3
Gas or paraffin not available in the shops	4
Other (specify)	8
(Uncertain/Don't know)	9

And are the following inadequate, just adequate or more than adequate for your household's needs?

		It is not adequate for your household's needs	It is just adequate for your household's needs	It is more than adequate for your household's needs	(Do not know)
23.	The amount of energy for lighting	1	2	3	8
24.	The amount of energy for cooking	1	2	3	8
25.	The amount of energy for heating rooms and keeping warm	1	2	3	8

26. In the last 12 months, has your household cut back on spending on energy for lighting, cooking or heating in order to make ends meet?

Very often	1
Often	2
Occasionally	3
Rarely	4
Never	5
(Do not know)	8

FIELDWORKER: SKIP TO QUESTION 37 IF HOUSEHOLD IS NOT ELECTRIFIED (CODE 8 IN Q1)

27. How satisfied or dissatisfied are you with the way that electricity is being providing in your neighbourhood? [Showcard 2]

Very satisfied	1
Satisfied	2
Neither nor	3
Dissatisfied	4
Very dissatisfied	5
(Do not know)	8

28. In your opinion, is the price you pay each month for electricity too high, too low, or about right for what you receive?

Far too high	1
Too high	2
About right	3
Too low	4
(Do not know)	8
(Not applicable – not electrified)	9

29. What did your household do as a result of the increase in electricity prices in the last 12 months?

Continued to use the same level of electricity and paid the extra amount for it	1
Reduced the amount of electricity used	2
Used other energy sources, such as paraffin, gas, coal, wood and candles	3
Other (specify)	4
(Do not know)	8

30. If electricity prices were increased again tomorrow, which of the following actions would your household do in order to meet its basic energy needs?

Continue using the same level of electricity and pay the extra amount for it	1
Reduce the amount of electricity we use	2
Use other energy sources, such as paraffin, gas, coal wood and candles	3
Other (specify)	4
(Do not know)	8

31. In your opinion, what is the quality of electricity in the area where you live?

Very high quality	1
Good quality	2
Acceptable quality	3
Poor quality	4
Very poor quality	5
(Do not know)	8

There are different ways of saving the amount of energy that is used in a household.

32. Which of the following energy saving tips are you aware of?

33. And which of the following things does your household do often to save energy?

FIELDWORKER: MULTIPLE RESPONSES ALLOWED

	Aware of	Does often
a. Switching off your lights when you leave you house	01	01
b. Using energy saving light bulbs	02	02
c. Switch off all your lights except security lights in home when not in use	03	03
d. Switch off appliances (TV, radio, hifi) at the wall (not the remote control) when not in use	04	04
e. Switch off geyser at certain times during the day or at night	05	05
f. Boil only as much water with a pot or kettle that is needed	06	06
g. Electric stoves use a lot of electricity, so use the plates and oven as little as possible	07	07
h. Take a short shower or bath with as little water as possible	08	08
i. Use warm clothing or blankets instead of a heater	09	09
j. Close windows and doors when a heater is on	10	10
k. Allow clothes to drip-dry instead of ironing	11	11
l. Install a solar water heater instead of an electric geyser	12	12
J. Insulate your geyser and hot pipes	13	13

34. To what extent have the things that your household is doing to save energy reduced your monthly energy costs?

Reduced costs a lot	1
Reduced costs a little bit	2
Made no difference to monthly costs	3
Costs have continued to increase	4
(Do not know)	8
(Not applicable – household not trying to save energy)	9

35. Do you receive Free Basic Electricity?

Yes	1	
No	2	→ Skip to Q 37.
(Do not know)	8	→ Skip to Q 37.

36. How did you find out about Free Basic Electricity?

FIELDWORKER: MULTIPLE RESPONSES ALLOWED

Municipality	1
Local media	2
Friends or family	3
Department of Energy employees	4
Enquire on my own	5
Other (specify)	6
(Do not know)	8

Please tell me for each of the following statements whether you think it wrong or not wrong. [Showcard X]

		Not wrong at all	Wrong only sometimes	Almost always wrong	Always wrong	(Do not know)
37.	Connecting to electricity without paying for it	1	2	3	4	8
38.	The stealing of electricity cables	1	2	3	4	8
39.	Protesting about access to electricity	1	2	3	4	8
40.	Protesting about the price of energy	1	2	3	4	8

41. What do you think should be the three top priorities for the Department of Energy in providing electricity?

Avoid loadshedding or power cuts	01
Keep electricity prices low	02
Help poor households by giving more free electricity	03
Get non-electrified households electrified	04
Give information on how to save electricity	05
Subsidise renewable energy	06
Other (specify)	07
(Do not know)	98

42. To which of the following should South Africa give priority in order to meet its future energy needs?

Coal and oil	01
Natural gas	02
Nuclear power	03
Solar, wind or water	04
Fuels made from crops (i.e. mielies, corn)	05
Does not matter, as long as it is the cheapest option	06
Does not matter, as long as it does not damage the environment	07
(Do not know)	98

There are various ways governments might try to get people to use less energy. To what extent would you be in favour or against the following options? The South African government should . . . . . [Showcard X]

		Strongly in favour	Somewhat favour	Neither in favour nor against	Somewhat against	Strongly against	(Do not know)
43.	Spend money on campaigns to encourage people to use less energy	1	2	3	4	5	8
44.	Tax households who use a lot of energy	1	2	3	4	5	8
45.	Spend money to replace electric geysers with solar geysers	1	2	3	4	5	8

46. How satisfied are you with your accommodation?

Very satisfied	1
Fairly satisfied	2
Neither satisfied nor dissatisfied	3
Slightly dissatisfied	4
Very dissatisfied	5
(Do not know)	8

47. Would you describe the state of repair of your home as good, adequate or poor?

Good	1
Adequate	2
Poor	3
(Do not know)	8

48. Do you have any of the following problems with your accommodation?

Shortage of space	01
Too dark, not enough light	02
Lack of adequate heating	03
Leaky roof	04
Damp walls, floors, foundations, etc.	05
Damaged or broken windows or doors	06
Other (specify)	09
None of these problems with accommodation	10

49. Has your health or the health of anyone in your household been made worse by your housing situation?

Yes	01
No	02

Appendix Table 1:

Energy expenditure as a percent of total monthly household income using income data where missing data have been treated using listwise deletion

	Mean score	Oneway ANOVA results		Base N
		Significance	Post-hoc Scheffe test	
South Africa	16	...	...	2013
Electrification status				
Electrified	16	n.s.		1812
Non-electrified	17			199
Living standard level				
Low living std.	15	**	• Low, medium > high	189
Medium living std.	17			1009
High living std.	12			674
Geographic location				
Urban formal	15	*	• Rural, trad. auth. areas > farms	1152
Urban informal	16			165
Rural, traditional authority areas	17			526
Farms	12			170
Province				
Western Cape	12	**	• EC, MP, GP > WC • EC > KZN	213
Eastern Cape	18			229
Northern Cape	13			122
Free State	14			132
KwaZulu-Natal	13			493
North West	17			126
Gauteng	18			304
Mpumalanga	19			155
Limpopo	16			221
Per capita income				
Poorest quintile	27	**	• Poorest quintile > Q2, Q3 > Q4 > Richest quintile	355
Quintile 2	17			407
Quintile 3	15			405
Quintile 4	11			456
Richest quintile	6			390
Dwelling type				
Formal dwelling or brick structure	16	n.s.		1626
Traditional dwelling or hut	15			171
Informal dwelling or shack	16			166

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.
n.s. means that the scores are not statistically significant.

Appendix Table 2:

Energy poverty among South African households using income data where missing data have been treated using listwise deletion

	Energy poverty rate (% spending more than 10% of net income on energy)	Oneway ANOVA results		Base N
		Significance	Post-hoc Scheffe test	
South Africa	51	...	...	2013
Electrification status				
Electrified	51	n.s.		1812
Non-electrified	51			199
Living standard level				
Low living std.	48	**	• Low, medium > high	189
Medium living std.	56			1009
High living std.	37			674
Geographic location				
Urban formal	51	n.s.		1152
Urban informal	49			165
Rural, traditional authority areas	54			526
Farms	43			170
Province				
Western Cape	40	**	• EC, MP > WC	231
Eastern Cape	58			229
Northern Cape	43			122
Free State	50			132
KwaZulu-Natal	46			493
North West	52			126
Gauteng	55			304
Mpumalanga	61			155
Limpopo	51			221
Per capita income				
Poorest quintile	73	**	• Poorest quintile, Q2 > Q3 > Q4 > Q5	355
Quintile 2	65			407
Quintile 3	51			405
Quintile 4	40			456
Richest quintile	12			390
Dwelling type				
Formal dwelling or brick structure	52	n.s.		1626
Traditional dwelling or hut	43			171
Informal dwelling or shack	50			166

Note: ** indicates significance at the 1 percent level. * indicates significance at the 5 percent level.
n.s. means that the scores are not statistically significant.

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ISBN: 978-1-920435-04-2

Design, Layout & Printing: Seriti Printing