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# Electricity Conservation: Factors influencing sustainable energy efficient consumer behaviour in the South African household.

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## ABSTRACT

The primary focus of this body of research is to understand the drivers of consumer behaviour, towards electricity conservation in South African households. The underlying rationale is to influence a reduction in energy consumption by stimulating energy efficient behaviours, thereby reducing the impact of energy use on the environment. The outcomes shall be of benefit to policy makers who need to introduce the most effective interventions, and businesses that are engaged in the design and manufacture of energy efficient technologies and services.

Owing to the limited research in South Africa on the subject of electricity conservation behaviour, the study applied a qualitative research methodology to validate the existing theory on energy efficient consumer behaviour, as well as to establish new insights from South African residential electricity consumers.

The research findings are consistent with that of past research conducted in the US and Europe with the major difference noted on the level of environmental consciousness. While South Africans are conscious of the concepts of climate change and environmental degradation, they do not readily perceive domestic consumption of electricity as having a detrimental impact on the environment. Their foremost motivation to conserve electricity is inspired by the personal financial

savings or potential savings, rather than to appease their conscience with regard to environmental impact.

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## DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfillment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in this or any other University.

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Devan Pillay

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## GLOSSARY

Definitions of terms and acronyms

| | |
|---|---|
| • CFC's | Chlorofluorocarbons - non toxic, non flammable substance used as propellants in spray cans and medium for refrigeration |
| • CFL's | Compact Fluorescent Lights |
| • $CO_2$ | Carbon Dioxide |
| • DME | Department of Minerals and Energy |
| • Fossil Fuels | Crude oil, natural gas, coal and coal |
| • Greenhouse gases | Gases that emit and absorb radiation |
| • IEA | International Energy Association |
| • kWh | Unit of Measure (electricity consumption) |
| • Load Shedding | A process of turning off electrical load in to prevent demand overrunning supply |
| • LPG | Liquid Petroleum Gas |
| • LSM | Living Standards Measure |
| • OECD | Organisation for Economic Co-operation & Development |
| • TJ | Tera Joules $10^{12}$ – Unit of Energy |
| • UNFCCC | United Nations Framework Convention on Climate Change |
| • WECD | World Commission on Environment and Development |

# CHAPTER 1. INTRODUCTION TO THE RESEARCH PROBLEM

## 1.1 Introduction

Chapter One introduces the research topic and directs the reader to the research problem. After an examination of the research problem, the research objectives are outlined, whereupon the format of the study concludes the chapter.

## 1.2 Research title

Electricity Conservation: Factors influencing sustainable energy efficient consumer behaviour in the South African household.

## 1.3 Background to the research problem

The research is based on a review of South African households' energy consuming behaviours and how those behaviours can be influenced with the goal of reducing the associated environmental degradation associated with domestic electricity use. The most obvious environmental impact is greenhouse gases emissions in coal fired power plants, particularly carbon dioxide ($CO_2$). The other dilemma is that coal, being a fossil fuel is a non-renewable energy source, hence having a finite lifespan. The indiscriminate and gluttonous consumption of coal

could eventually obliterate this natural resource. The research also delves into the instruments used to influence energy efficient consumer behaviour, and looks at the efficacy of each instrument as well as combination of instruments that could be relevant in the South African context. The climate of South Africa is affected by the changes in global climate; however South Africa is itself a contributor to the global climate change problem. In 1990, South Africa was responsible for about 1.2% of the total global warming effect which placed it within the top ten contributing countries in the world. The carbon dioxide equivalent emission rate per person in South Africa is about 10 tons of $CO_2$ per person per year (pppy) is above the global average of 7 tons pppy - although this is still considerably below that of developed countries such as the United States - 20 tons pppy (IEA, 2001).

The Department of Environmental Affairs and Tourism RSA (2005) asserts that the burning of fossil fuels in South Africa is the primary source of carbon dioxide. In 2004, coal accounted for 93.2% of the primary sources of energy in the generation of electricity in South Africa. (Digest of South African Energy Statistics, 2006). As countries come under pressure to meet the conflicting demands to improve the quality of life of its population and conform environmentally by limiting emissions associated with power generation, more attention is focussing on energy conservation and efficiency as a means to achieve these goals.

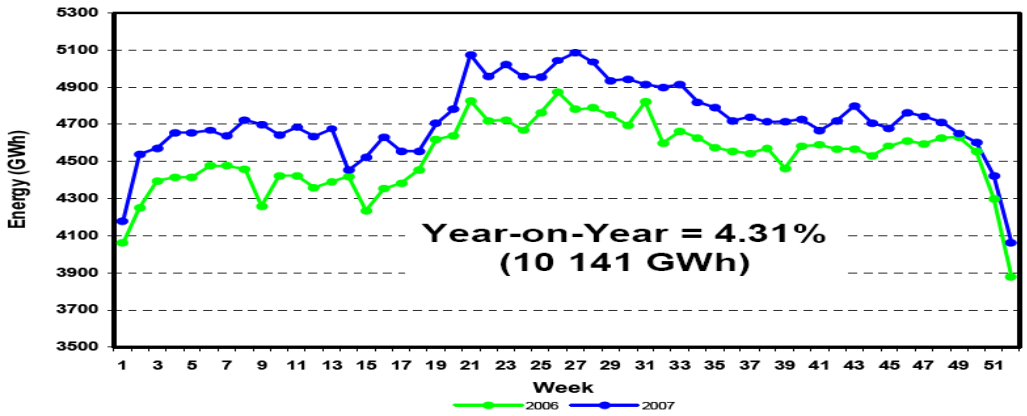
Of the 424 million metric tons of energy related carbon dioxide, coal constitutes 82%, while oil constitutes 17% and Natural Gas 1%.

Relating this to the electricity production, 966 grams of carbon dioxide is emitted for 1 KWh of electricity produced. If we take the average monthly electricity consumption of an urban family of four to be 2,000 KWh, this translates to 1,932 kg of carbon dioxide emission per family per month.

The South African government's intervention in the conservation arena has been insignificant, owing to the more dire challenges facing a new democracy coupled with the onerous challenges of uplifting the lives of the millions of impoverished South Africans. Further to this, the historically low price of electricity in South Africa did not pose a compelling need for government to constrain consumption. Government's agenda instead, was to have more people enjoy access to electricity.

South Africa's electricity consumption and level of demand has seen significant levels of growth. Fig 1. Illustrates that 4.31% more energy was consumed in 2007 as compared to 2006 ( DME, 2008).

**Fig 1 - 2006 vs 2007 Week-on-Week Net Energy Consumed in South Africa**




Source: DME(2008)

Economic growth, social reforms viz. rural electrification and a rapidly emerging middle class are just some of the contributing factors to the increased electricity consumption in South Africa.

Rolling blackouts characterised the lives of South Africans during the first quarter of 2008. Owing to the inconveniences experienced by South Africans during the recent black outs, it is expected that society can changes the way they perceive electricity – a scare resource rather than an infinite supply of energy. Goldman's et al (2002) research into human and social dimensions in energy use after the California electricity crisis, confirmed that society changes its behaviour to contribute to energy savings during a power crisis, but no sooner as the crisis abates they revert to old inefficient behaviour.

Energy efficiency has numerous benefits to societies and countries, yet the major barrier to effective implantation is the change of behaviour

and mindset. Behaviour change is of central importance in bringing about the significant reductions in energy end-use. Governments and associated agencies try to achieve behavioural change through a number of interventions and activities with varying degrees of effectiveness. In this study, it is intended to review some of the mechanisms that could contribute to sustainable behavioural change.

Although the purpose is clear, the task of understanding energy-consuming behaviours presents substantial complexities. The complexities are centred on the factors that influence energy-consuming behaviours i.e. climatic conditions, house characteristics, household demographics, attitudinal variables, education levels and degrees of consciousness to the environment. The nature of influence includes relationships that predispose, circumscribe, enable, or mediate energy consuming behaviours.

For example, positive attitudes toward the environment and conservation would be expected to predispose to lower energy consumption. On the other hand, climate would circumscribe the extent to which energy conservation is practical, and income would enable possible energy conserving capital investments. Further, there are family decisions, such as family size, that mediate energy consumption in the sense that although they influence consumption, the decisions are made

with no direct consideration of energy consumption consequences (Ajzen, 1985).

For the purposes of the study, it was intended for the sample population to be as homogenous as possible, so as to limit the variability of climatic conditions, house characteristics and education levels.

There are a number of factors that might influence energy efficient behaviours. The research follows a growing body of literature that seeks an understanding of these complexities, so that the appropriate interventions are devised and deployed.

### 1.4 The research problem

Electricity efficiency and consumer behaviour have been a source of great intrigue for researchers for the last 35 years and still are.
The consequences of household energy, particularly in South Africa, have not changed much. While the agenda has remained similar, a new dilemma relating to the impact on climate has arisen. Earlier studies found that people tended to be concerned about climate change, but failed to link their everyday behaviour such as domestic electricity use to increased emissions and consequently climate change.

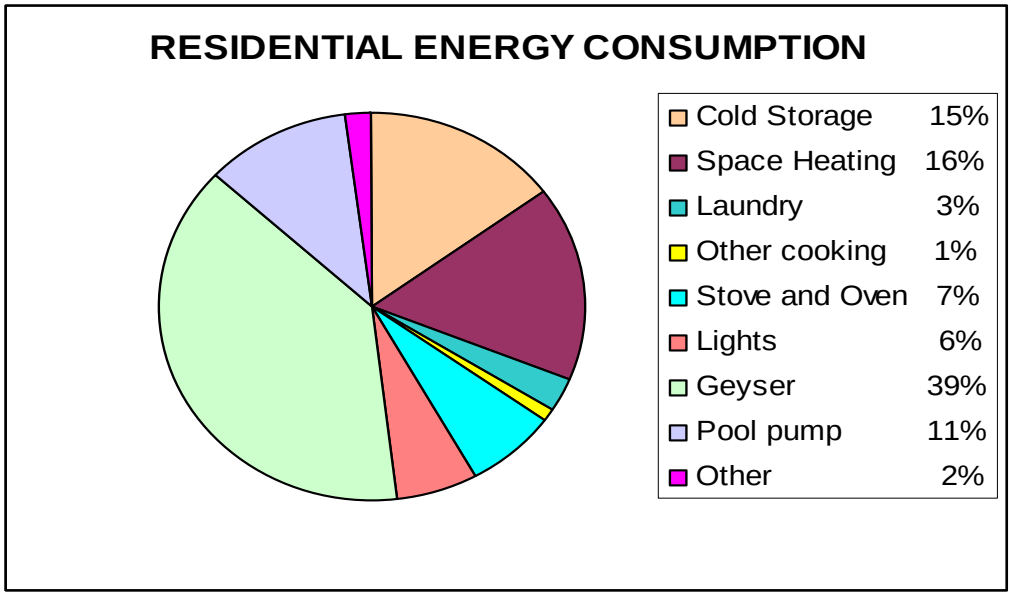
According to Smith (1976), "Consumption is the sole end purpose of all production". Goods and services offered in the market serve to satisfy a demand which according to assumptions increases individual utility. The consumer has to continually make a decision on whether to enjoy the utility offered by electricity or sacrifice that for appeasing a pro-environment conscience. It is these difficult choices that make electricity conservation a difficult behaviour for consumers to readily adopt.

Energy use in the home is not visible and therefore the majority of the energy consuming behaviours are habitual and based on routine. We turn on the lights without actually needing light, leave televisions and other entertainment devices on standby and boil kettles without having to think about how these actions are executed or where the energy to power these modern-day conveniences come from or what the environmental consequences are.

These behaviours are complex and difficult to alter, partly as they are shaped by the characteristics of the buildings and energy consuming appliances, but more importantly they are influenced by factors like our beliefs, values, norms and attitudes, other people's behaviours, cultural settings as well as incentives and penalties.

South Africa's residential sector consumes 17% of the electrical energy production the 2nd highest consuming sector after the Industrial sector. South Africa's middle and upper income residential consumers are responsible for the consumption of the highest amount of electrical energy. This is owing to the affordability of luxuries in the form of appliances and their dwelling sizes which are normally larger, requiring more energy to heat and cool, as well as the capacity to house a large number of people who consume electrical energy. A typical middle to upper income household shall have consumption patterns per appliance in a month as per Fig 2.

**Fig 2 Energy usage across most common household appliances in SA**




**Source: DME(2006)**

It is widely recognised that global climate change and environmental problems associated with energy consumption are largely "invisible" to people in industrialised countries. People often do not understand the production cycle of energy, the impact of consuming non-renewable energy sources, the impact of energy conservation actions, as well as the connections between energy consumption and GHG emissions (Shove, 1998). With this lack of knowledge, it is little wonder that society perpetuates indiscriminate consumption of electricity.

### 1.5 Significance of the study

For authorities and business to introduce the appropriate mechanisms to instil discipline in consumption and energy efficient behaviour, an understanding of consumer's behaviour is paramount. The South African government has produced a white paper on energy efficiency, but without the rigours of understanding the factors that drive energy efficiency amongst domestic consumers, the document shall remain conjectural.

## 1.6. Research Objectives

One of the foremost purposes of this study is to identify those factors which influence the behaviour or the household members in energy conservation. Energy is defined by many fuel types, but in the context of this research, energy refers to electrical energy derived from power plants distributed to the household. The desire is that a greater understanding of the situation will help to bring about some of the attitudinal changes which are necessary to reduce electrical energy consumption in the domestic sector.

Naturally each household shall have different energy needs depending on a number of variables e.g. (age of house, number of occupants, location, and occupancy level throughout the day). This research shall concentrate on the behaviours which relate to households' direct energy requirements, electricity for lighting, appliances, heating, cooking, refrigeration, laundry, water heating as well as swimming pools and other recreational installations that may operate with electrical energy. The research also discusses sustainable consumer behaviours, which are closely linked to purchasing decisions such as the buying of energy efficient devices.

The understanding of how to conserve energy is dependent on the consumer's knowledge and understanding of the consumption behaviour of the various appliances, as well as mechanisms available to control and monitor savings on the electrical bill.

The research aims to establish amongst other issues:

- The level of awareness of electricity generation.
- The level of awareness around the impact of electricity production and consumption on the environment.
- The awareness of energy conservation mechanisms, both behavioural and technical.
- The awareness of consumption characteristics of electrical appliances in the household
- The most appropriate set of policy instruments to foster sustainable energy relevant consumer behaviour.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 Introduction

The following chapter shall review the current literature on energy related consumer behaviour and attitudes to sustainable consumption. This section of the research also reviews the trends of previous research conducted on domestic energy use. The chapter shall finally delve into some of the instruments used to affect energy efficient consumer behaviour, as well as the effectiveness of one or a set of instruments.

There have been varying motives as to why research has focussed on domestic energy conservation. The overarching theme has been on the reduction in energy consumption, whether for economic, energy security or environmental reasons. Much of the research emanated in the 1970's during the oil price crisis where researchers worked frenetically to encourage households to reduce their energy consumption.

From the 1970's onwards the research was partly driven by an environmental agenda, with the main interest in pollution control, energy conservation and recycling (Dwyer *et al,* 1993). An important aspect of the 1970's energy conservation research was the use of various intervention measures such as education and information on energy

conservation (information campaigns), feedback on energy use (in-house meters). Several studies conducted between 1970 – 1980 included behavioural intervention studies, to modify environmentally conscious behaviour (Dwyer *et al,* 1993).

## 2.2 Behaviour in context

Becker *et al* (1981) contend that energy consumption in itself is not behaviour, but rather a consequence of behaviours, such as turning the lights off or lowering thermostat levels. Researchers have divided household energy saving behaviours to two different groups tabulated in table 1.

**Table 1 : Energy saving behaviours**

| BEHAVIOUR TYPE | EXAMPLES |
|---|---|
| **Efficiency behaviours** | One shot behaviours – investment<br>• Ceiling insulation<br>• Geyser (water heater ) insulation<br>• Double glazing<br>• Energy efficient lights<br>• Energy efficient appliances |
| **Curtailment behaviours** | Repetitive efforts – operational<br>• Turning lights off<br>• Closing curtains<br>• Turning appliances off<br>• Aggregating laundry ( full loads )<br>• Drying clothes on a line rather than using a tumble dryer<br>• Dress appropriately instead of turning on air-conditioning |

**Source: Dwyer et al (1993)**

Whether our energy behavioural patterns are based on one-off investment efforts or continuous efforts, our behaviours are influenced by wider societal and personal factors (McMakin *et al*, 2002).

Macro factors such as technological developments, economic growth, demographic factors, and institutional factors influence our behaviour at the broader level, while micro-level factors such as motivation, ability and opportunity shape our behaviour at the individual level (Abrahamse *et al*. 2005). Our behaviour is also influenced by habits and routines which people undertake without much thought, a consistent finding by most researchers. Jackson (2005) goes further and divides these influencing factors into internal (attitudes, values, beliefs, norms) and external factors (regulations, institutions). Gärling *et al* (2002) argue that in order to change people's environmental behaviour, both macro and micro level factors need to be considered.

### 2.2. Energy and the Consumer

The consumer can no longer simply strive to consume to a point of unlimited satisfaction, without causing problematic consequences, which are not accounted for in the market. The absolution granted to consumers by Adam Smith's market economy as an unfailing machine, has become groundless. Market economies are formed to fulfil the

satisfaction of human needs as comprehensively as possible. According to Smith (1976) "Consumption is the sole end and purpose of all production". A consumer's self interest does not equate to the welfare of the larger society. The neoclassical consumerism model suggests that an individual shall consume to a point of utility maximisation. This assertion supports that argument of those who believe that if they can afford to pay for electricity which is available for consumption, then they should be allowed to consume it at their own free will and discretion.

Experience shows that affecting change in the behaviour of individuals or groups can only be successful if they are setup systematically and according to a plan (Stern P.C, 1994). In more developed countries, environmental consciousness is at a fairly sophisticated level and one would expect that this would contribute to responsible practices, particularly in the case of the consumption of non-renewable energy.

Critics like Stern(1992), however suggest that the public's environmental knowledge and consciousness remain superficial, symptom-oriented, and divorced from a holistic understanding of the real "environment" its condition and societal drivers for its decline. The relationships between environmental knowledge and environmental consciousness, action and associated social processes are particularly complex.

Stern's (1992) model of the causes of environmentally conscious behaviour is often cited as a particularly good illustration of structural and institutional constraints on energy oriented ecological behaviour. Stern (1992) describes energy consumption influences in a pyramid typology, Table 2. Stern (1992) calls the highest, most indirect level of influences, *policy choices*: "Decisions by manufacturers of appliances on whether to produce highly energy-efficient products are energy policies in that they constrain consumers' technology choices" (Stern,1992). While

Tax rebates for energy conservation, is also a similar government policy. They provide consumers and companies with overarching incentives, disincentives, opportunities, or non-opportunities. Stern (1992) emphasises that influencing business and government policy makers is more effective than individual behavioural change at addressing energy conservation and many other environmental problems. Technology choices and policies should be targets of energy conservation efforts over and above everyday energy efficient behaviour, according to the prevention principle of pollution and energy use. Individuals can influence what happens at the end of the pipe, but significant changes in energy use are bounded by the "upstream" systems they are plugged into.

**Table 2 - Stern's Causal Model of Resource Use**

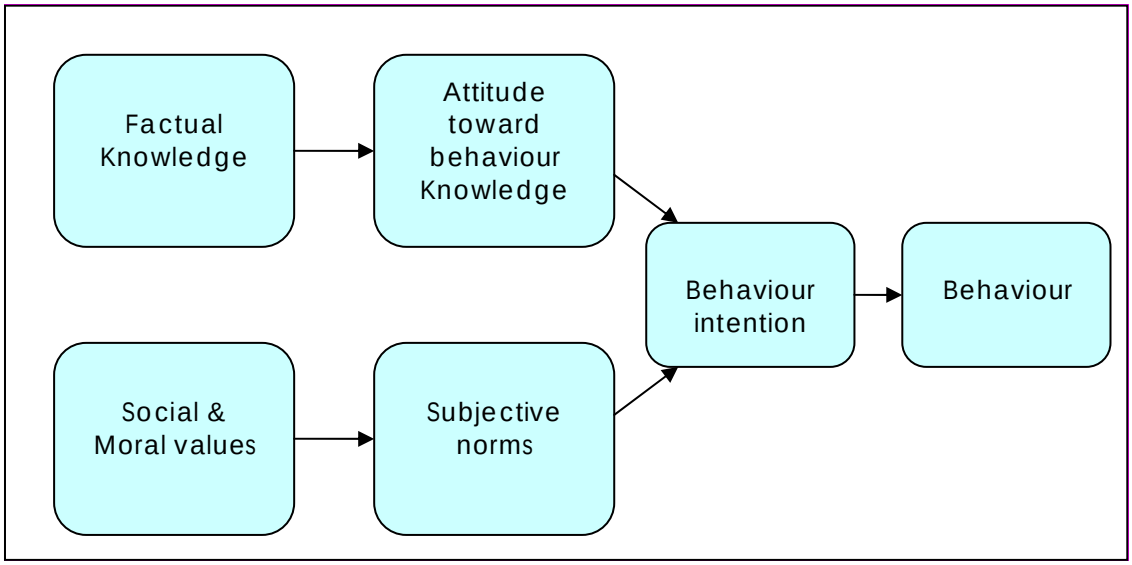
| LEVEL OF CAUSALITY | TYPE OF VARIABLE | EXAMPLES |
|---|---|---|
| 8 | Background factors | Income, education, number of household members, local temperature conditions |
| 7 | Institutional factors | Owner/renter status, direct or indirect payment for energy |
| 6 | Recent events | Difficulty paying energy bills, experience with shortages, fuel price increases |
| 5 | General attitudes | Concern about national energy situation |
| | General beliefs | Belief households can help with national energy problem |
| 4 | Specific attitudes | Sense of personal obligation to use energy efficiently |
| | Specific beliefs | Belief that using less heat threatens family health |
| | Specific knowledge | Knowledge that water heater is a major energy user |
| 3 | Behavioral commitment | Commitment to cut household energy use by 15% |
| | Behavioral intention | Intention to install a solar heating system |
| 2 | Resource-using behavior | Length of time air conditioner is kept on; Insulating attic, lowering winter thermo-stat setting |
| 1 | Resource use | Kilowatt-hours per month |
| 0 | Observable effects | Lower energy costs, elimination of drafts, family quarrels over thermostat |

**Source : Stern (1992 )**

Research by (Meijnders, 1998) found that the public did not understand the potential role of energy efficiency in reducing GHG emissions, and more importantly they failed to grasp the connection between fossil fuel combustion and climate change. In open format questionnaires, $CO_2$ generation as a result of fossil fuel consumption was seldom mentioned as a cause of global warming. Reducing energy consumption evoked notions of sacrifice and loss of amenities, which led them to conceptualise alternative energy sources more easily than energy efficiency.

To guide people's behaviour in an environmentally favourable direction, the provision of knowledge, information and motivation is necessary. Environmental-oriented behaviour is however, not exclusively dependent on knowledge and information but also largely reliant on attitudes, values and norms (Kaiser, 1999).

**Fig 3- Theory of Reasoned Action**




**Source : Kaiser (1999)**

Research conducted in the 1990's – 2000's has also found that people generally care about climate change, but do not always link their everyday lifestyle as a contributor to the problem. There exists a perception amongst people that climate change is complex and far in the future conjuring feelings of disempowerment and that they themselves cannot do anything to address the problem (Moser & Dilling, 2004). Recent research in energy saving has highlighted the need for a

practical combination of behavioural intervention and social marketing measures to ensure that behavioural change is sustainable (Geller 2002).

## 2.4 Interventions to change consumer energy-efficinet behaviour

### 2.4.1 Introduction

Research conducted on domestic energy behaviours has focused on evaluating several different types of intervention measures. This chapter discusses these options in more details, reflecting on previous research findings.

### 2.4.2. Information and education

The objective is to examine the variety, potential utility and the operation of “knowledge” in directing and impacting the optimisation of resources and conservation of energy. The theory of reasoned behaviour (above) suggests a complex process in which several variables intervene between knowledge and behaviour (Kaiser, 1999). This means that several mediators closer to behaviour, convey and attenuate the influence of knowledge on behaviour. These intervening variables may include incentives, intentions, attitudes, values and other factors.

Kaiser, 1999 contends that a unit of knowledge must converge with other types of knowledge and often a wide array of other variables, both concurrent and distal, to exert a behavioural influence, and it is the proper convergence and not the quantity of knowledge that determines its effectiveness in promoting ecological behaviour. Information or knowledge alone does not account for a very large portion of ecological or energy-related behaviour.

The shortcomings of informational programs are as a consequence of assumptions based on psychological or economic rational actor theories that people will act on information about what steps that they can take to save energy and money. Stern (1992) argues that such programs fail to concentrate on the attractiveness, clarity, simplicity, or relevance of the message and/or the credibility of the sources.

Nevertheless, information remains a popular policy tool in the public's eye. In focus groups with Swiss citizens, subjects were asked to rank the relative acceptability of policy instruments – including information provision as different means of achieving reductions in general energy use. Subject's ranked information the highest for low and moderate reductions and equally high as other means for securing high reductions (Dahinden, 1997).

Research alone has shown that energy saving information is not enough to alter households' energy consuming behaviour (Abrahmse *et al*.2005). Research by Geller (1981) found disparities in between what people say and their execution thereof; hence information on its own may not be enough to change behaviour even though the respondents may imply so. A combination of measures such as feedback on energy use, may contribute to behavioural change (Abrahamse *et al*. 2005)

Henryson et al. (2000) found that consumers were confused over the amount of information on energy efficiency and energy saving technologies. On the one hand households have enough information, but on the other hand do not know how to use this information for their own benefit. Households were also found to be energy conscious but not energy knowledgeable. This means that they may be aware of the benefits of reduced energy use, but do not know how to carry out energy efficient measures. Other research has also concluded that consumers prefer personalised information, rather than generic information to make a positive impact on their own consumption habits.

### 2.4.3 Feedback

Feedback measures take on different forms, with some of the measures such as providing respondents either daily, weekly, or monthly feedback

on their energy consumption and using methods such as postcard prompts, comparative monthly bills, or technologies such as direct displays or smart meters (Abrahamse *et al*. 2005). Based on self perception theory, if an individual is given information indicating he is saving energy, he may develop a positive attitude toward doing so and actually become an energy conserver (Katzev et al.1983). Table 2, provides a list of feedback measures available regarding domestic energy consumption.

**Table 3 - Summary of the types of feedback on domestic energy consumption**

| TYPE OF FEEDBACK | EXAMPLE |
|---|---|
| **Direct Feedback**<br>Available on demand | • Self-meter reading<br>• Direct displays<br>• Interactive feedback via a PC<br>• Pay as you use meters<br>• Ambient devices<br>• Meter reading as part of energy advice |
| **Indirect Feedback**<br>Data processed by utility and sent to the customer | • More frequent bills<br>• More frequent bills based on either comparative, historical, or disaggregated feedback, or annual/quarterly reports. |
| **Inadvertent feedback** | • Microgeneration<br>• Community projects such as Dutch Eco Teams |
| Utility controlled feedback<br>Learning about the customer | • Smart meters |

**Source: Darby (2006)**

Research on feedback mechanisms suggest that direct feedback has generally resulted in 5-15% energy savings, while indirect feedback (via a bill) has normally seen savings of 0-10% (Darby, 2006).

Dwyer *et al* (1993) suggests that continuous feedback on energy and costs has proven useful as it deals with current behaviour rather than past behaviour. Feedback can reduce electricity consumption by 10-20%, however, there is still little evidence on which feedback measure or a combination of measures is the most effective (Katzev *et al*. 1980-1981). Once again feedback may not necessarily contribute to sustainable behaviour change, as once the feedback is removed households tend to revert to old habits and behaviours.

### 2.4.4 Energy Labelling

Energy labelling of appliances is an internationally tried and tested tool to build awareness and raise capacity about energy consumption. In a study published by the DME (2008), the projection of energy savings in South African through the introduction of appliance labelling is estimated at 3PJ by 2012.

For appliance manufacturers and suppliers, labelling programs may increase business opportunities. For consumers, labelling program is

expected to provide additional product information and result in better product choices and higher consumer satisfaction. The primary purpose of an energy labelling program is to provide information and improve consumer awareness of energy efficiency. The effectiveness of energy labels can only be evaluated based on an understanding of consumer behaviour.

Knowledge is a basic underpinning to most explanations of consumer behaviour. Knowledge of the product stimulus means acquaintance with an understanding of the product. Simple notice of the existence of an energy label without any further thought process on the part of the consumer is not likely to result in any impact on the consumer's response. Understanding the stimulus and use of information for the individual's purchasing decision will be important (Huh, K 1998)

Energy labelling often assumes a strong link between knowledge of the energy implications, consumer goods and services, which consequently leads to changes in consumer choice (Shove, 1997). It is a common misunderstanding that all lay people are well informed over the energy characteristics of their appliances. The efficacy of this intervention depends on the presentation of the message, interaction between the sender and receiver and trust in the sources.

The unintended consequence of using energy labels that implicitly encourage or even condone purchasing larger, or larger numbers of , electronic appliances, or even using them more freely, perhaps in part because they are promoted as relatively energy efficient, may not serve the efficiency goals of the larger socio-technical system. Without a broader message ( a constructive “shared understanding” ), labels may validate symbolic or even counter-productive actions like purchasing relatively more efficient models and provide psychological salves instead of actually contributing to reducing overall environmental insults (Moezzi, 1998).

Despite claims by some appliance manufacturers that "efficiency won't sell", a significant percentage of respondents said they were willing to pay a higher price for highly energy efficient appliances (Huh, K 1998). Governments, appliance manufacturers and markets should pay attention to this emerging trend in purchasing behaviour. Although initial cost is still the primary determinant in the purchase decision, monetary value is not the only attractive factor. When consumers feel it is worthwhile, they are willing to pay more. Though energy efficiency may not always be the sole contributor to a premium price, the results of this review suggest that energy efficiency and related environmental issues can act as a strong tie-breaker and provide a source of differentiation and added value in the purchasing decision (Huh, K 1998).

### 2.4.5 Incentives

Internationally, government incentives aimed at influencing energy conservation behaviour has had significant success, particularly in countries where energy costs are high, and the incentives made a real impact on cost saving. These incentives can be either monetary or other free energy efficiency appliances. Eskom offers consumers a discount on the purchase and installation of solar water heaters from approved vendors. Incentives need to be coupled with feedback mechanisms, so that households can determine whether they are saving energy or not.

One of the first studies in the US on the efficacy of incentives was conducted on 1,811 households who were given energy conservation advice and a free shower control flow device from the Department of Energy (Hutton & McNeill, 1981). The study concluded that those households which received the information brochure and installed the accompanying free shower flow control device, adopted more energy savings tips than the control group.

In another study which analysed the effect of tax credits on energy saving behaviour (Pitts & Wittenbach, 1981), researchers found that tax credits had little impact on the decision to purchase home insulation. 39% were unaware of the tax credits while 62% did not consider them to make a difference on their purchasing decisions.

Rewards can be effective if designed well however, research has shown that the effects of rewards and incentives are not always maintained for the long term, but last for the duration of the intervention (Dwyer *et al*. 1993). The more effective option is to combine incentives and rewards with social pressure techniques, such as rewarding a group or community setting. Even in this setting, forbidden behaviour is presented, as a rebellion to being forced into doing something.

### 2.4.6 Social influences

A good example of social influences is the Dutch Eco Team Program (ETP). EcoTeams are voluntary groups usually 6 to 10 neighbours or friends where acquaintances already exist (Staats *et al*. 2004). These teams meet regularly to share personal experiences, ideas and achievements related to environmental household behaviour. A three year study of 150 EcoTeams participants found that after the ETP program, participants had made significant reductions in their gas, electricity, and water use, compared to a group representative of the Dutch population ((Staats *et al*. 2004). Further to this, a two year follow up study revealed that the behaviour of the members of these groups had been maintained (See Table 4).

**Table 4 - Behaviour change in EcoTeams**

| Eco Teams | Consumption after ETP program (compared to control group) | Two year follow up (compared to control group) |
|---|---|---|
| **Gas Use** | -20.5% | -16.9% |
| **Electricity Use** | -4.6% | -7.6% |
| **Water Use** | -2.8% | -6.7% |
| **Waste** | -28.5% | -32.1% |

**Source: Staats *et al.* 2004**

The success of the "EcoTeam" programs was in the sustainability of the behaviour, which may be partly due to the holistic approach to environmental issues.

## 2.5 Conclusions on interventions

One of the challenges regarding energy consuming behaviours and selecting the right type of intervention is that there is not enough evidence to support the linkages between the measures and the behavioural change. More robust research is required in determining the most effective interventions in changing consumer behaviour.

Even though some of the evidence may lack reliability, it does indicate that behaviour can and does change.

To be effective, intervention measures such as feedback are ideally:

- Clearly presented and simple to understand
- Contains relevant information to the household
- Involves a goal or commitment

- Be visible, consistent and frequent

Information techniques are based on the notion that once people understand the nature of the problem and receive information on how to change their behaviour, they are likely to change their behaviour. A key element of the effectiveness of information is that the recipient of the information needs to trust the source. Direct feedback interventions (i.e. display or monitor) can result in an average of 5-15% energy savings, while indirect feedback (via a bill) has normally seen savings of 0-10% (Martiskainen, 2007).

There is however, little evidence on which type of feedback measure would show the most energy savings. Research has also suggested that more frequent feedback is better and continuous feedback is best on energy as it deals with current behaviour rather than past behaviour. In addition to direct displays and metering systems, better and more innovative billing is another measure which can solicit households to be more considerate of their energy use. More clearly presented bills would also give households an opportunity to see how much electricity they are saving.

**Table 5 : Summary of savings from selected intervention studies**

| Study | Intervention | Saving |
|---|---|---|
| Becker (1978) | Goal setting + feedback on electricity use:<br>• Easy (2%) or difficult (20%) energy saving<br>• Feedback 3 x a week on a postcard | • 20% goal – savings of 15.1%<br>• 2% goal – savings of 5.7% |
| Hutton *et al.* (1986) | Direct feedback monitor ( electricity use )<br>• Energy cost indicator | • Savings of 4-5% |
| Haakana *et al.*(1997) | Feedback and focused advise feedback had more effect<br>• Monthly feedback and focused energy saving advice (electricity) | • Heating consumption saving 17-21% |
| Brandon & Lewis (1999) | Comparative feedback on electricity use<br>• Comparison of consumption to previous year, energy use in kWh and equivalent monetary value | • Comparison to previous consumption saving 3.6% |
| Staats *et al.* (2004) | EcoTeams (with 2 year follow up)<br>• Monthly meetings which discuss energy, water & waste use | • Electricty savings 4.6% (after 2 years 7.6% saving ) |
| Darby (2006) | Various different feedback | • Savings of up to10-15% |

Positive motivational techniques generally involve either monetary or social support such as electricity tariffs which reward reduced consumption or social recognition for conservation behaviours. Interventions can have both positive and negative effects, and studies have found that following feedback, low energy users may increase their consumption. One of the issues facing energy consuming behaviours is

the trade off between comfort and expenditure with money commonly being identified as the main motivation for energy savings, rather than environmental issues.

# CHAPTER 3: RESEARCH PROPOSITIONS

## 3.1 Introduction

The literature review in chapter two highlighted a number of models and theories that have been constructed from the social science fraternity, to understand consumer behaviour, and more importantly energy efficient consumer behaviour. There is no such thing as consensus about which theories are appropriate and our insights in human social behaviour are still at best partial. Our knowledge of human behaviour within society is based on cumulated insights that have been obtained gradually during many decades of research in various disciplines, and therefore these insights help us to merely understand consumer behaviour, with the hope that we can respond to it with the appropriate interventions to ensure sustainable energy efficient consumer behaviour.

## 3.2 Research questions

A review of the literature on the subject of energy efficient consumer behaviour raised the following:

- There are a number of theories and models to describe consumer behaviour with respect to energy consumption, and how those behaviours can best be influenced with the goal of reducing

energy consumption, and consequently mitigating the impact of electricity production on the environment.

- Just as there are numerous models on consumer behaviour, there are equally a number of interventions that could be used to influence consumers to reduce their consumption, thereby contributing to the slow down in the depletion of non-renewable energy sources (coal, gas) as well as lowering the emissions of carbon dioxide and other environmentally damaging gases (GHG's).

Whilst extensive research exists on the topic internationally, there is very little or no research on energy efficient consumer behaviour in the developing countries, more importantly South Africa. Further to this, the available research is focused in the northern hemisphere where climate is fundamentally different to South Africa, and therefore where space heating is a major consideration in the northern hemisphere, South Africa's energy intensive installations consist of water heaters (geyser), cooking appliances, refrigeration and pool pumps.

Another disparity exists in the socio economic landscape of South Africa, versus European countries like Holland. South Africa's agenda is economic growth to alleviate poverty and create jobs, while the first

world countries in Europe and the US have less of a paradox to deal with, when addressing the impact of consumption on the environment.

### 3.3. Presentation of research questions

The following questions have been developed:

Question 1 : What is the extent of environmental awareness amongst the urbanised South African population?

Question 2: How is electricity perceived with respect to its impact on the environment?

Question 3: Which interventions or instruments are most likely to affect South African households' sustainable energy efficient behaviour?

### 3.4. Conclusions

From these research questions, the researcher held focus group sessions to engage samples of the population to offer insights into these research questions, thereby testing the applicability of the theory as well as

obtaining fresh perspectives from the South African consumer on their understanding and level of engagement in energy conservation.

# CHAPTER 4: RESEARCH METHODOLOGY

## 4.1 Proposed research design

Exploratory research was chosen as the appropriate methodology as there is limited knowledge on this research problem. Exploratory research provides a greater understanding of a concept or crystallises a problem, rather than providing precise measurement or quantification. It facilitates the narrowing of the scope of the research topic and transforms discovered problems into defined ones, incorporating specific research objectives. (Zikmund, 2003).

## 4.2 Pilot Studies for Qualitative Analysis

The research technique selected for the study was focus group interviews, aiming at recording and documenting a wide range of typical responses and reactions to the general topics of domestic electricity use, energy saving and efficiency practices, prices and environmental concerns, understanding of the production of electrical energy and the consequential environmental impact.

### 4.3 Focus Groups

Focus groups are a form of group interview that capitalises on communication between research participants in order to generate data. Although group interviews are often used simply as a quick and convenient way to collect data from several people simultaneously, focus groups explicitly use group interaction as part of the method. This means that instead of the researcher asking each person to respond to a question in turn, people are encouraged to talk to one another: asking questions, exchanging anecdotes and commenting on each others' experiences and points of view. The method is particularly useful for exploring people's knowledge and experiences and can be used to examine not only what people think but how they think and why they think that way. (Kitzinger. J, 2003)

South African research on sustainable energy consumption behaviour is limited. It is expected that the focus group shall provide a deep understanding of the mechanisms that drives energy conservation behaviour, the barriers to energy efficiency, the paradox of economic growth versus the reduction of energy consumption and the issues surrounding bounded rationality. It is intended that the focus group would provide further research opportunities into the specifics of energy efficient consumer behaviour.

The duration allocated to this research is short, and does not allow for extensive monitoring and testing of the impact of various efficiency initiatives. The cycle of extensive quantitative research to test the efficacy of behaviour altering mechanisms usually extend over a period of a year, to allow trending of energy consumption through different seasons of the year.

### 4.4. The Population

Owing to the recent spate of rolling blackouts in South Africa and intensive media coverage of the efficient use of electrical energy, it is expected that the proposed participants, would be reasonably knowledgeable on the relevant topics. By selecting focus group participants from a homogenous social standing, it is also expected that the education levels are similar and that a certain level of consciousness for the environment as well as broad understanding of the need for sustainability and the risks associated with irresponsible and indiscriminate consumption of non-renewable energy. Focus group interviews shall facilitate an open discussion around the perceptions of consumers and their behaviour towards energy conservation and sustainability.

A focus group interview is an unstructured, free-flowing interview with a small group of people (6-10). It is not a rigidly constructed question-and-answer session, but a flexible format that encourages discussion (Zikmund, 2003).

Three separate focus group sessions were held, so as to have diversity in group dynamics, but ensuring that the characteristics of the participants in each group were homogenous. Composing a group with highly different characteristics will decrease the quality of the data. Individuals will tend to censor their ideas in the presence of people who differ greatly from them in power, status, job, income, education, or personal characteristics. To get a cross section of views from a diverse population using focus group method, it is necessary to conduct multiple sessions (Krueger and Casey, 2000).

A housing estate in Sunninghill, north of Johannesburg (Santa Vitoria ) was chosen to provide a sample of houses of similar type, age and social setting, and to reduce the variations in construction type, electricity uses, LSM, family size. Most of the houses are 3 or 4 bedroom clusters of approximately 350m$^2$ under roof.

The housing development is approximately 8 years old, and none of the houses were built with any energy conservation device, viz. Geyser

control, geyser insulation, gas fireplaces. The population size was 15 which included adults of the household, as well as children fifteen years of age and older.

The ideal size of the focus group is six to ten individuals. If the group is too small, one or two members may intimidate the others. Groups that are too large may not permit adequate participation by each group member (Zikmund, 2003).

The second group comprised 13 participants from 3M South Africa, a company at which the researcher is employed. The selection of participants was randomly generated so as to ensure that a wide audience from various disciplines and residential areas were represented. The participants were selected from a pool of people who conform to LSM 8-10, as well as that representative of family occupied households, so as to understand the interaction and participation of a family over issues of energy conservation.

The third group comprised 12 members of a housing development called Kyalami Glen in Kyalami Johannesburg. This is a security estate with free standing houses built according to owner's specification. There is no uniformity constraint other than aesthetics of the property. Each homeowner has the freedom to decide on the specification of the

property and in particular can opt for energy saving devices, or alternative energy sources at their will. Sizes of the houses are varied (300 $m^2$ to 1000 $m^2$ under roof)

### 4.5 Sampling Method

Homogenous groups seem to work the best. Selecting homogenous groups allows researchers to concentrate on individuals with similar lifestyles, experiences and communication skills (Zikmund, 2003). However because the study was targeted at views emerging in discussions between different types of participants (thought to be more indicative of the dynamics of public opinion than a study of isolated segments of the population would have been), it was important the participants be diverse with respect to age, gender, and profession. The potential participants were carefully screened with quotas established for participants between the ages of 15 and 25, to ensure a representation of the younger generation. The screening was also specific in ensuring that the groups had a broad representation of professions.

### 4.6 Proposed data collection

The moderator of the focus group, requested a discussion on the general topic, but kept the discussion focussed to the research study. The moderator had a list of questions (Appendix B) to stimulate discussion around the relevant research areas. The entire proceeding was filmed, so that the information could be reviewed to compile the research report. The moderator controlled the proceedings and ensured that everyone got a chance to make a contribution. The moderator also ensured that no participants dominated the discussion or asserted their opinion over the group.

### 4.7 Data analysis

The interpretation and application of reasoning in qualitative research is highly subjective and intuitive, making it very difficult to identify the source of an insight (Zikmund 2003). The qualitative research method of analysis is not a perfect science; therefore a mixture of content analysis, narrative analysis and comparative analysis will be used (Patton, 1990). The key approach will be McCracken's (1998) five-phase approach which states that when analysing qualitative data one should move from a specific unit to broader themes.

## 4.8 Potential research limitations

### 4.8.1 Focus Groups ((Krueger and Casey, 2000))

- Owing to the small population of focus groups, findings may not represent the views of larger segments of the population.
- Requires good facilitation skills, including ability to handle various roles people may play ("expert", "quiet", "outsider', "friend", "hostile", etc.)
- Tough rich, data may be difficult to analyze because it is unstructured
- Possible conformance, censoring, conflict avoidance, or other unintended outcomes of the group process need to be addressed as part of the data analysis.

### 4.8.2 Representativeness

The sample is not fully representative of the population and therefore one might not be able to generalise from this.

# CHAPTER 5: PRESENTATION OF RESULTS

## 5.1 Description of the sample

Each focus group consisted of between ten and fifteen participants. All participants were encouraged to make a contribution and they took up the challenge. The groups were well represented with families from different walks of life, but presenting homogeneity insofar as education, LSM, types of dwellings, and education levels.

The intention of using focus groups was to observe the discussions of the group and record responses to specific questions aimed at establishing the groups understanding of the following:

1. Awareness of the intensity and impact of anthropogenic climate change
2. Awareness to the causes of anthropogenic climate change
3. Awareness and understanding of the impact that the burning of fossil fuels has on climate change linking and the link this has to domestic electricity consumption.
4. Awareness and understanding of how electricity is generated
5. Awareness and understanding of household appliance consumption characteristics.

6. Awareness of mechanisms to reduce the consumption of electricity.
7. Awareness of energy efficiency devices.
8. Awareness of governments / utilities energy efficiency policy
9. Awareness of policy instruments that could be used to affect energy efficiency or reduction of consumption.

The observations and results of the focus groups were used to assist the researcher to answer the following research questions:

Much of the research on energy efficiency and the contribution of energy use on anthropogenic climate have been conducted in the northern hemisphere, particularly in Europe, United States, and Canada. A significant amount of domestic energy is consumed for the purposes of space heating. Majority of these countries have a choice of energy sources other than electricity for the purposes of high energy consuming appliances like space heating. The other difference between Europe, US and Canada is the fact that these societies are relatively sophisticated in their consciousness to climate change and are considered to be more of a "conserver society" than South Africa. The environmental consciousness of these societies translate to a way of life characterised by recycling, investment in environmentally friendly products and energy efficiency.

**5.2 Research question 1:** *What is the extent of environmental awareness amongst the urbanised South African population, and does their awareness translate to behavioural change?*

### 5.2.1. Discussion points

5.2.1.1. What is your understanding of the greenhouse effect?

All the groups had a basic understanding of the greenhouse effect, drawing the association to the abnormal heating of the earth, similar to a "green house" used for agricultural purposes. Two of the three groups did not specifically understand the actual causes of the greenhouse effect, apart from the association of aerosol sprays and ozone layer depletion, as being the main causes.

"*The greenhouse effect is caused through the depletion of the ozone layer by gases contained in aerosols – CFC's"* **( Group 1)**

Only group three, thanks to a grade ten student, who had recently researched the subject for a school project, was able to provide a detailed and accurate understanding of the greenhouse effect.

The aim of the question was to ultimately establish whether the groups understood that the major contributor to the greenhouse effect and climate change was the emission of natural and man-made gases. The main culprit is $CO_2$ (Carbon Dioxide), a by-product of fossil fuels used as a primary energy source, to drive almost every human endeavour in industrialised nations.

5.2.1.2. What is your understanding of the term "carbon footprint"?

The researcher aimed to test whether the group realised the link between carbon emissions and the greenhouse effect.
The groups had a working knowledge of carbon dioxide production by humans and understood that it was detrimental to the environment.

*"Carbon footprint is human activity that is responsible for carbon dioxide emissions"* – Group 3

Similar to the first question the groups were unable to link carbon emissions to greenhouse gases and climate change.

*"Too much carbon dioxide in the atmosphere is detrimental to sustaining human and animal life on the planet, as it depletes oxygen"* – Group 2

The groups were able to provide a summary of the human activities that generate carbon dioxide, but stuck to the obvious direct activities like use of motor vehicles and aircraft, energy intensive factories and power stations.

5.2.1.3. Describe some of the consequences of climate change. Are these consequences of concern to you and your family, for you to want to change your lifestyle?

*"Climate change has to do with the planet's climate being altered through human activities like air pollution. A changing climate means that the weather patterns are changing. One of the results of the changes in climate is the unusual heating of the planet, which causes melting of the poles and glaciers, causing rising sea levels. One of the obvious threats of rising sea levels is flooding"*-Group 2

The responses and discussions around this question were centred on the broad aspect of "pollution" as the chief contributor to changes in climatic conditions. Acid rain, flooding, droughts as well as the melting of the polar cap were talked about, as being factors defined by climate change. Once again the groups skirted around the GHG emissions as being the key link to the creation of the greenhouse effect and consequently a contributor to climate change.

*"We do not hear or see the effects of climate change regularly enough to be concerned by it. The information supplied by scientists remains theories. Whenever a*

*natural disaster occurs, the issue of climate change becomes topical for that period, and everyone talks about it for a while until the next news item makes headlines"*

- Group 1

*"We do not know enough about the causes of climate change, and believe that the main contributors of climate change are large industrial plants and the growing number of motor vehicles. We do not believe that as individuals we are impacting the environment to the extent that we need to change our behaviour or lifestyle. As individuals we take the necessary measures to ensure that we behave responsibly by not littering and ensuring that we pay for municipal services. Anything further needs to be driven by the government through legislation or incentives to limit the number of vehicles or the engine and emissions capacity of each vehicle."* –Group 3

All groups echoed the same sentiment of climate change as being a phenomenon that would alter the planet over an infinitely long period of time, which would then demand a disruptive change to society's behaviour. For now, people realised that climate change is not desirable, but consider the threats of polluting industrial plants and motor vehicles to human health as being more serious rather that its impact on climate change. This underscored the inability of the focus groups to relate the causes of climate change to the average individual.

#### 5.2.1.4 So you talk of legislation / incentives as being a mechanism to affect appropriate societal behaviour conducive to environmental consciousness, please elaborate?

The general consensus by the groups was that incentives and legislation would be a better way to ensure that people acted environmentally responsible. Left to the consciousness of society, the process would take too long. In South Africa particularly, owing to the disparities in society, climate change and responsible environmental behaviour ranked low in comparison to poverty and provision of services.

*"South Africans have so many more pressing concerns, and therefore to expect that we as a society act environmentally responsible seems absurd in the view that the majority of the population do not have access to basic services. On the one hand you may get a few people recycling bottles and paper, while the majority throw their rubbish into rivers and burn coal and wood for cooking and heating."* -Group 3

*"People in general and more specifically South Africans will only be driven to change their habits when tangible, meaningful monetary gain exists. Not even legislation will ensure total compliance as we have become a lawless and non conformist population"* - Group 1

5.1.2.5 What does non renewable energy sources mean to you?

Apart from the effects of GHG emissions through the combustion of fossil fuels, there is the other constraining issue of a limited availability of fossil fuels, hence the term non-renewable. The researcher aimed to gain an understanding of the focus groups' awareness of this limitation.

*"Energy cannot be renewed, as once it is consumed, it is lost forever"* Group 1.

*It has to do with the fact that fossil fuels are created over many millions of years through sedimentation and compression of organic matter, and therefore once consumed particularly at the rate of current consumption; the ecosystem may be unable to sustain current demand. In contrast, bio-fuels can be replenished by growing more soya bean or maize plantations."* – Group 3

## 5.3. Research question 2: *How is the domestic use of electricity perceived with respect to its impact on climate change?*

The discussions around this question required clarification, as people did not understand the relevance of domestic electricity consumption to climate change. Most of the thoughts were referred to the use of air-conditioning or refrigeration which was linked to CFC's.

### 5.3.1. Discussion points

5.3.1.2. How is domestic electricity use related to climate change?

*"How is domestic electricity use related to climate change, unless you are considering the impact of refrigerators or air-conditioners to the emission of greenhouse gases"* Respondent A - Group 2.

*"I guess you are referring to the origins of electricity, in cases where electricity is generated by plants that burn coal to make electricity. In that case, I do not believe that domestic use of electricity is as significant relative to industrial use. I am therefore of the opinion that while there is an impact, it is not where our attention should be focussed"- R*espondent B Group 2.

*"So during the recent shortage of electricity supply, why then were households also affected by load shedding if electricity consumption by households are not that significant"* - Respondent C Group 2.

Active debate and discussions characterised this point in all groups, but the most interesting observations were made in group 2, by individuals who had strong opposing views initially. Consensus was finally reached on the understanding that domestic consumption of electricity was significant enough to have a material impact on climate change.

#### 5.3.1.3 How is electricity generated in South Africa?

There was a myriad of responses on this question. Whilst there were a few in each group who were knowledgeable on this question, the majority did not have a clear understanding of the process of electricity generation.

*"I'm not sure, but electricity comes from the nuclear plant in Koeberg in Cape Town."* – Group 1

*"I know that electricity is generated in power stations concentrated around the Mpumalanga area, but I am not exactly sure how electricity is produced."* – Group 3

*"I am certain that coal is used in the production of electricity, as the issue of wet coal being the reason for the recent electricity shortages, appeared in the press. I am not certain of how it is used in the production of electricity. It must be a chemical reaction of sorts"* – Group 2

#### 5.3.1.4 How can domestic users reduce electricity consumption?

As expected, many of the participants were fairly knowledgeable on electricity efficiency practices, and also knew of devices that were energy efficient. The recent rolling blackouts in South Africa was followed by an excess of press campaigns to increase awareness towards energy efficiency.

*" Some of the ways to reduce electricity is to cover your geyser with an insulating blanket, turn down the thermostat setting to a lower temperature, I think the correct setting is fifty five degrees, and change your light bulbs to CFL's" – Group 3*

*"Changing light bulbs to energy efficient bulbs help, as well as keeping the use of heaters to a minimum. Rather dress warmly and close all windows and curtains early in the evening to reduce heat loss."* Group 2

*"Don't use the tumble dryer, rather hang clothes on the line"* – Group 1

*"When using a washing machine ensure that you wash full machine loads and don't leave cell phone chargers plugging in to the wall socket. Don't leave electronic devices like TV's and home theatre systems on standby mode"* – Group 3

*"Install a solar geyser, as this would free up electricity which would have been otherwise required to power the largest electricity consuming appliance in a household"*
–Group 2

*"Repair leaking taps, particularly hot water taps, take a shower instead of a bath, turn off your geyser when leaving your house for a number of day, and don't leave lights on in the rooms when unoccupied"* – Group 3

#### 5.3.1.4 Do you currently practice these electricity conservation methods you describe?

*"Yes, most of my family and friends switched to CFL's and some even purchased solar geysers, when the load shedding began"* Group 3

*"Yes we have implemented some of these energy saving practices like light bulb swop out, but the practices of turning off geysers and turning off lights is difficult to get used to. During load shedding, we were quite disciplined as a family, but since the electricity supply situation stabilised we eased off on the discipline"* – Group 3

*"There are so many conflicting arguments around the purchase of a solar geyser and other energy efficient devices. Some critics argue that the return on investment takes years to realise. Not many people can afford the high costs of swopping out your existing geyser with a solar unit."* – Group 1

*"I would like to practice electricity conservation, but I all I want to do when I get home after a difficult day, is to relax and enjoy the comfort of my house. I get annoyed when I see the alerts on TV, regarding the electricity supply situation. If I can afford to pay for electricity allow me to run my air-conditioning or my pool heater, as I depend on these comforts in my home"* – Group 2

*"There aren't energy alternatives available to South Africans. Should we want to switch to other renewable energy sources like bio fuels or electricity generated by wind, we do not have the option to do so unlike the citizens of the US or some European countries. So before the government imposes limits to consumption, they need to offer their citizens more cost effective alternatives. Even gas is not quite viable, as there are no piped gas services, which means that you as the consumer needs to ensure that you procure and store gas in cylinders."* Group 3

#### 5.3.1.5 Those of you who conserve electricity, are your actions motivated by your environmental conscience or are there other motivators?

*"During the load shedding situation, we tried a number of energy saving tips and later found that it had reduced our electricity bill substantially. This is the single biggest motivator for me, and if we are saving the planet at the same time- great"* (Group 1)

*"We began introducing quite a number of changes to our electricity consumption, moreover as a contribution to the electricity shortage crisis. Not having electricity was painful, so we find that our effort to save electricity is a small price to pay. We continually take up the call to switch off non essential appliances, when the alert comes up on TV"* (Group 1)

*"No definitely not out of concern for the environment as I had no idea that electricity consumption in the household caused environmental damage. My motivation for saving electricity is monetary as times are difficult and any opportunity to save money is pursued with determination"* – (Group 3)

**5.4. Research question 3:** *Which energy efficient interventions or instruments are you most likely to affect sustainable behaviour change?*

### 5.4.1 Discussion points

5.4.1.1 Of the energy efficiency interventions (Information & education, feedback, energy labelling, incentives, social influences) which do you believe would have the most impact on your behaviour towards energy efficiency.

*" This is a difficult question, as I think that all these interventions would contribute to changing my behaviour, but incentives and legislation would get me to change my behaviour sooner rather than later"* – Group 1

*"In our context, it would have to be incentives, and all other interventions exist as support to the incentive. As an example, for me to invest in purchasing a solar geyser or energy efficient washing machine, the monetary incentive in the form of a discount or reduction in my tariff must be quantifiable, and the energy rating on the appliance is a support mechanism to the incentive"* Group 3

*I installed a pre-payment electricity meter in my house, when I had the opportunity to do so, and it was the best decision I took. My family and I are continually aware of our consumption, and we are extremely disciplined about switching off lights and appliances. The real time display on the meter offers us a view of how much we are consuming, however incentives to adopt other energy efficiency appliances would motivate me the most, unless I could realise the benefit from the savings.* – Group 2

*"The electricity bills we get from Eskom or the council make no sense to me. They should be able to provide a tend line, with respect to my consumption. The fact that my meter*

*is only read one in three months and the other months are billed on average consumption, the trend line may not be possible. Having an electricity meter that is easy to read, and accessible inside my house, shall motivate me to use electricity more prudently. Owing to the averages and the inconsistency of my bill against my electricity usage from month to month, I don't really go out of my way to reduce my consumption."* Group 1

#### 5.4.1.2 Incentives and legislation are seemingly the preferred instruments to affect a change in consumption behaviour. Do you believe this behaviour change would be sustainable?

*The incentive in this context would not necessarily apply to the once off purchase of an energy efficient appliance, but moreover an incentive that one would receive for consuming below a certain threshold. If that's the case, then I do see why not, for as long as the incentive remains in place, and is void of any administration bungles, then the behaviour should continue.* (Group 3)

*If legislation is accompanied by a punitive measure like a penalty or fine, then I believe the legislation would be an effective and sustainable intervention to affect energy efficient consumer behaviour"* Group1

# CHAPTER 6: DISCUSSION OF THE RESULTS

## 6.1 Introduction

This chapter draws on the research questions presented in chapter three and links the background of this research and the theoretical constructs contained in chapter 2 with the results in chapter five.

## 6.2 Key findings from the research

**6.2.1 Research question 1 –** What is the extent of environmental awareness amongst the urbanised South African population, and does their awareness translate to behavioural change?

The layperson's interpretation of climate change and the contributors to climate change are often very basic, influencing their inability to draw linkages to their everyday actions. As Bostrom *et al* (1994) posits, climate change is not perceived as the most important of all environmental problems.

The focus group discussions confirmed past research on the issue of society possessing a superficial knowledge and consciousness to the environment (Stern, 1992).

The focus group's lack of substance in their responses to the questions on their understanding of climate change, greenhouse effect and carbon foot print, demonstrated their shallow grasp of the concepts. Their poor knowledge on climate change was attributed to the fact that limited media attention is apportioned to this subject. It is inconceivable to expect an output of behavioural changes towards conservation, when there is limited factual knowledge at the input. Kaiser's (1999) Theory of reasoned action, validates this notion. Kaiser (1999) also stresses the proper convergence of knowledge rather than the quantity, to promote ecological behaviour.

As ordinary citizens, the groups absolve themselves from being contributors to climate change, by suggesting that industrial plants and governments are a lot more environmentally aberrant, where the attention should be focussed. They also commented on the problem of climate change being far larger than their own ability to make a difference. This is consistent with Moser & Diling (2004), who conceive that societies perception of climate change being a complex phenomenon, conjures feelings of hopelessness, resulting in their unwillingness to change behaviour.

The extent to which people are willing to go to be considered as acting socially responsible, was debated in the focus groups. The groups

believed that as responsible citizens they paid their taxes and utility bills for services, which meant that they were conforming and acting responsibly. They also argued that the government was not delivering on their expectations to drive policy's and enforce compliance, which would have rendered their efforts futile, had they invested time and effort in pro-environment behaviour. Further to this, the groups believed that should authorities wish to advance ecological behaviour amongst its citizens, incentives or policy attached to penalties, should be the preferred instrument. Stern (1992) supports this argument with the causal model of resource use.

There were many who believed that driving a pro-environment agenda in South Africa was out of context. They contend that largest segment of the populace were unable to contemplate environmental behaviour owing to their desperate need for social progression. This observation is seemingly consistent with the South African government's low priority on driving energy efficiency policies

**6.2.2 Research question 2 –** How is the domestic use of electricity perceived with respect to its impact on climate change?

It clearly emerged through the focus group discussions, that the link between the domestic consumption of electricity and climate change is not apparent. The analogy to water out a tap, conjures immediate images of a visible, tangible resource that is being consumed, unlike electricity. The broad cause and effect understanding of the indiscriminate use of water would lead to reduced dam capacity does not echo with the use of electricity. This could be attributed to the fact that electricity is invisible, and having a light bulb on, does not invoke a sense of wastage, unlike water down the drain.

Knowledge once again, plays a significant role in the understanding of the relationships between the production of electricity through burning fossil fuels and the consequent impact to the environment through the emission of GHG's. Even once the relationship between electricity generation and climate change or environmental degradation is accepted, there continues to be perplexity over the domestic consumption of electricity. It is only upon being exposed to the magnitude of the residential sectors relative consumption of electricity, do people acknowledge the validity and urgency of domestic electricity conservation.

An expected outcome of the group discussions was the heightened awareness to domestic energy efficiency practices and devices. This was attributed to the recent interruptions in electricity supply, caused through load-shedding initiatives. Whilst an intensive media campaign succeeded the electricity shortages, it was apparent that people made the special effort to reduce their consumption, through a combination of efficiency and curtailment behaviours (Dwyer et al, 1993).

The obvious conclusion to draw is people are more inclined to make the effort and investment to change to conservation behaviour if it contributes to a material gain. In the case of the South African energy crisis, people were extremely inconvenienced by not receiving electricity. Individually, they seemingly responded to calls for reduction in consumption just so they could benefit from the availability of electricity, albeit constrained. The tragedy of this was that no sooner had the supply situation stabilised people reverted to the old inefficient habits. Goldman et al (2002) confirms a similar pattern following the California electricity crisis.

A universal assertion made by Group 2 was the inability to trade off the utility of the need satisfaction that electricity contributed to a household, against the morality of consuming less for the sake of the preservation of our planet. Coupled with this, was the demand and supply construct,

where people argued that for as long as there is a supply stream, those who can afford to pay for electricity should be allowed to do so. This is the foundation of Adam Smith's (1976) maxim of "Consumption is the sole end purpose of all production".

Coal fired power stations produce 92% of South Africa's electricity requirements. The abundance of coal in South Africa coupled with power plant efficiencies are factors that have contributed to the low cost of electricity, and the resultant dependence on fossil fuel plants for South Africa's electricity needs. The focus group discussions raised the availability of alternative renewable energy sources as a constraint in South Africa. In developed economies, the move to produce electricity through renewable energy sources like hydro electric plants, wind turbines, and bio fuel plants have reduced the dependency on coal. While South Africa is investigating the viability of these options, the urgency to bring generating capacity on line to address the supply shortages, has prompted the Department of Mineral's and Energy to proceed with the return to service of three coal plants, as well as the construction of two new coal fired plants. These recent actions illustrate that carbon emissions will continue to beleaguer South Africa for a while to come. Whiston's (2000) research has revealed that individuals can influence what happens at the end of the pipe, but significant changes in energy use are bounded by the "upstream" systems they are plugged

into, referring to the alternative energy sources. Whiston (2000) found American city residents chose more expensive environmentally friendly power sources when given the option.

The South African electricity conservation and efficiency agenda should therefore become a top priority relative to the more developed economies.

There were a few instances in the focus group discussions, where people had taken the effort to investigate energy efficiency interventions during the supply shortages and continued these practices owing to the noticeable savings in their monthly electricity bills. So once again it was noted that people continue to act in their own interests, and their conservation actions are seldom or never motivated by environmental philanthropy.

It is clear that the linkages between electricity and environmental impact are not apparent in general society. It is therefore ambitious to expect that society would understand the implications of domestic use of electricity to the environment and sustainability. Meijnders(1998) grappled with the very same thoughts, where he found that the public did not understand energy efficiency's role in reducing carbon emissions. Even more fundamentally they failed to grasp the connection between

fossil fuel combustion and climate change. With these knowledge gaps, society is incapacitated insofar as changing their energy consumption behaviour on the account of environmental altruism.

When society's awareness and understanding of cause and effect is fragile, this should serve as a prompt for authorities to act with aggressive yet structured education campaigns. It is only through awareness and education that people may respond with the appropriate behaviour if they are able to identify with the communicator and the logic of the message.

South African authorities are faced with a dilemma in that they are unable to draw too much attention to the effects of coal fired power plants owing to the current dependency on this technology. Therefore education campaigns linking consumption of electricity to environmental degradation is limited. Unless South Africa is able to offer its citizens "greener" alternatives to fossil fuel power plants, they are wary of drawing too much attention to the ills of coal fired electricity generation.

**6.2.3 Research question 3 –** Which interventions or instruments are most likely to affect South African households' sustainable energy efficient behaviour?

Intervention measures were seemingly popular during the 1970 oil price shocks, were the need to reduce consumption was dire. Appealing to people's reasoned actions relative to sustainability and shortages were not considered appropriate. In South Africa too, we find some interventionist measures were introduced during the supply shortages. Load shedding was the extreme intervention however, providing social marketing and education on energy saving tips through media, was one intervention that was effective.

The focus group discussions revealed that of all the interventions practiced internationally, South Africans are only exposed to a few. Energy labelling and feedback mechanisms through smart meters have not been introduced in South Africa as yet.

#### 6.2.3.1 Information and education

The groups' consensus on the need for information and education as an intervention was overwhelming. Through the information they had received in the focus group session, they believed that had they been informed about their impact on the environment and the consequences

of climate change, their behaviours could change. Moreover, besides information relating to environmental impact, simple information and education campaigns on electricity, its measurements, how to interpret the bill, as well as energy efficient devices are needed.

They were however quick to point out that too much information would have the opposite effect, and the information source needs to be trusted, accurate and consistent. Henryson et al (2000) found that customers were confused over the amount of information on energy efficiency and energy saving technologies. He also discovered that the information did not transmit the actual steps involved with energy saving measures, so despite receiving information, people were unable to implement the energy efficiency measures. Other research also observed that consumers preferred customised information rather than generic information which often did not relate to the individuals circumstances.

#### 6.2.3.2 Feedback

Participants were quick to point out that there electricity meters were only read once in three months and the average consumption billing, did not provide them with an accurate measure of their efficiency

initiatives. Further to this they believed that the format of the bill could be improved to provide trending and highlight high consumption months.

The visibility or display of the meters was also raised as a convenient and effective method of observing electricity consumption. The fact that meters are often located outside the property in an inaccessible enclosure meant that people would not readily consult the meters. A meter display that is easily legible, and can be fitted in a convenient location inside the house, would facilitate an awareness of consumption, and if the meter could display consumption in respect of money, this would be more effective. Katsev et al (1983) found that if an individual is given information indicating that he is saving money, he may develop a positive attitude toward continuing his behaviour, and actually become an energy conserver. The savings potential of direct feed back mechanisms like meters is recorded to be between 5-15%.
Katsev et al (1983) also states that feedback may not necessarily contribute to sustainable behaviour change, as once it is removed old habits return.

#### 6.2.3.3 Energy Labelling

Although not a common and legislative practice in South Africa as yet, people have noticed new appliances bearing energy ratings. Whilst they

acknowledge the energy saving potential of this appliance and see it as a benefit to them as a consumer, it is not a defining purchase criterion. When asked whether they would spend a 30% premium on a dishwasher that possessed a better energy efficiency rating, the responses were mostly no, as most considered it to be more of a marketing or sales fad. This contradicts Huh's (1998) research in Korea, where he found that people are willing to pay a premium for higher efficiency appliances.

The issue with energy labelling is that there has to be more information coupled with the label, as the average consumer is unable to relate the label information to actual savings. Shove (1997), confirms that it is a common misconception that lay people are well informed over the energy characteristics of appliances.

One of the focus groups suggested that appliance labelling in conjunction with legislation could be more effective.

#### 6.2.3.4 Incentives

Incentives offered in countries where the energy costs are high, had significant success in influencing conservation behaviour.

A common theme in all focus group discussions related to incentives as being the preferred intervention instrument however, the implementation of these incentives would need to be simple and tangible in order to encourage participation.

Those who have taken the opportunity to use the incentives provided by Eskom and other municipalities to purchase solar geysers have found it to be beneficial and have encouraged family and friends to take advantage of the incentive.

Eskom's demand side management programs also included the free distribution of energy saving light bulbs (CFL's), an intervention that quickly converted people to this new technology. Whilst many may argue that the financial benefits in their electricity usage was unnoticeable, the longevity of the bulb compared to the incandescent bulb was considered an incentive.

Incentives have to work in tandem with education and information as people who do not understand the mechanics of the incentive, will not readily respond to it. Pitts & Wittenbach (1981) found that tax credits promoting loft insulation, had little impact as many were unaware of the incentive.

Dwyer et al (1993) confirms that the design of the incentive is important and the implementation should be based over a long term, to enable broad participation and ultimately wide spread energy savings.

#### 6.2.3.4 Social influences

The comments around the impact of social influences to behaviour change in South Africa, is limited to doing the right thing in the context of the usual expectation of society. People get embarrassed, if a neighbour notices them throwing litter on the street or driving recklessly. There is the pressure to conform to social norms however, the norm in South Africa has not evolved to the same extent in other modern and developed countries. Driving a six cylinder car would solicit recognition of your status and accomplishment in South Africa, whereas in Holland or Denmark, this would be frowned upon by society.

Similarly, the social constructs relating to domestic electricity use in South Africa is also very lax, and not many would overly criticise you for not having changed your light bulbs to CFL's or running your pool pump during peak loads. Schools and community organisations in South Africa are becoming more active in engaging societies to participate in conservation programs but once again these were more targeted at the

cleaning of rivers and recycling of bottles, rather than to domestic energy conservation.

# CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

The research set out to understand the drivers of consumer behaviour towards electricity conservation in South African households. With this understanding, policy makers as well as businesses involved with energy efficient consumer products would be guided in their endeavours.

Using the insights gained through literary reviews, which included years of research into energy efficient consumer behaviour conducted in the US and Europe as well as parts of Asia, the environmental impact of electricity consumption, appeared to be a key motivator in driving electricity conservation behaviour amongst domestic consumers. The research delved into understanding the complex relationships between consumers' activities and the environment. The intended outcome was that consumers would have an appreciation for the urgency to address issues of climate change and resource sustainability by connecting their roles as electricity consumers to climate change, thereby changing their behaviour towards a conserve mentality.

The research in many different contexts found varying behavioural responses attesting to the complexity of consumer behaviour and the multitude of factors that influence energy efficiency behaviour. Factors external and internal contribute to the perception of individuals to conservation and their

contribution to conservation efforts. Moreover, it was apparent that most people are primarily driven by self interests and the benefit to the environment and humanity is secondary. In most societies, other than those where the relationship with the environment is highly advanced, the issues of climate change are considered to be a phenomenon that does not require urgent attention. If attention is required, their feelings are that Industrial plants and governments should be the focal points for addressing their impact on climate change.

The research into behaviour of the South African domestic electricity consumer is consistent on most accounts compared to the research conducted internationally. In some instances which are largely due to external factors like South Africa's abundance of coal, cheap electricity prices, social priority to development, institutional lethargy, have contributed to the low levels of consciousness and connection of the South African society to the areas of conservation and environment. Therefore it would be imprudent to expect that the majority of South African's would reduce their electricity consumption to minimise environmental impact.

The study confirmed that our behaviours, particularly energy consuming behaviours are formed and influenced by several factors including our internal belief systems and external influences. Our behaviours can be

locked-in, but can also be changed in a short time as was evidenced through the electricity supply shortages experienced in South Africa.

Initiating behaviour change is challenging and in order to change people's behaviour, habits need to be broken and more positive behaviour needs to be introduced. To begin the process of behaviour change, education and information is an imperative. The message however needs to be simple, consistent and emanate from a credible source.

Education and information is the prelude to all other interventions that may be necessary, but it is important to understand which interventions shall be effective, and in which combinations they are to be deployed to make the impact significant.

In reality, the domestic electricity consumer has a significant role to play in ameliorating environmental degradation through electricity conservation behaviour and measures. The extent of this behaviour and measures need not mean a loss of utility, or comfort and does not require huge investment in energy efficient devices. All that is required is for domestic consumers to be conscious of their use of electricity and establish conservation as a way of life, to in turn make a positive contribution to climate change and non renewable natural resources.

## 7.1 Future research

The following areas could form the basis of future research:

Further experimental research is required to establish which behavioural change instruments can achieve the most sustainable savings:

- Display units – Design, location, format of display ( monetary, carbon, kWh).
- Better billing – Frequency of a bill, detail on the bill, and user information.
- Incentives – Design and communication and implementation.

A more exhaustive study on South African's environmental consciousness and correlation of their behaviour evolution through the degrees of consciousness

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# APPENDICES

## Appendix 1 – Discussion points for focus group session

1. What is your understanding of the greenhouse effect?

2. What is your understanding of the term "carbon footprint"

3. Describe some of the consequences of climate change. Are these consequences concerning enough to you and your family, for you to want to change your lifestyle?

4. What does the term non renewable energy sources mean to you?

5. How is domestic electricity use related to climate change?

6. How is electricity generated in South Africa?

7. How can domestic users reduce electricity consumption?

8. Do you currently practice these electricity conservation methods you have just described?

9. Is your conservation stance motivated by your concern for the environment or are there other motivators. Please elaborate?

10. Of the energy efficiency interventions (information and education, feedback, energy labelling on appliances, incentives, social influences), which do you believe would have the most impact on your behaviour towards energy efficiency?

**Discussion points for focus group session (contd.)**

11. Do you take purchasing decisions (e.g. appliances) as a family or is it left to one of the household members to make a choice.

12. What is the criteria for purchasing electrical appliances ( Washing Machines, Dish Washers )

13. Does the energy consumption play a role in your decision making?

14. Do you pay attention to the kW / kWh rating on the appliance

15. How many kWh are you consuming per month on average

16. Does this measure have any meaning e.g. one litre of liquid registers an association with a bottle of cold drink or milk, hence an immediate appreciation of what this measure means in physical reality

17. How many of you react to the Eskom load shedding notices warning of various stages of load on the electricity grid.

18. Those of you with children or other members of family / domestic helpers living with you, have you informed them of your energy saving initiatives and requested that they too use electricity sparingly?

19. Is comfort in the household the overriding factor, i.e. During cold or hot spells, do you react by turning on the air-conditioning or heaters, rather than dressing down or up?

20. Did you find that during the height of load shedding, everyone was extremely cautious about consumption, and as load shedding ameliorated the enthusiasm and effort waned?

## Appendix 2– Focus Group Participant Screening Questionnaire

| | | | | | |
|---|---|---|---|---|---|
| **Name** | | | | | |
| **Age** | | **Gender** | | | M/F |
| **LSM 8-10** | Y/N | **Education** | Matric | Grad | P/Grad |
| **Education – Field of study** | | | | | |
| **Occupation** | | | | | |

| | |
|---|---|
| **Single or family occupied residence** | S/F |
| **Number of occupants living in the residence?** | |
| **Have you installed or are you considering the installation of energy efficient devices (solar geyser, timers, ceiling insulation, timers)** | Y/N |
| **Do you use any alternative domestic energy sources other than electricity from Eskom or the municipality?** | Y/N |