ENCOURAGING THE HOUSEHOLD ENERGY EFFICIENCY OF HIGH-INCOME EARNERS

–

TOWARDS AN APPROACH FOR SOUTH AFRICA

by

VICTORIA HURTH

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University of KwaZulu-Natal

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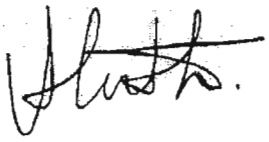
Abstract

High-income households are important for advancing energy efficiency in South Africa and yet little is known about how to encourage lower energy use behaviour in this group. This paper sets out the case for wide-scale research into how to encourage high-income earners to be more energy efficient behaviour in the home and presents the results of a prototype study. Behaviour change research offers no one framework for investigating behaviour in this group. However, the Theory of Planned Behaviour is a model, which has been successfully employed to understand and formulate behaviour interventions across a wide range of subject, including household energy use. In order to understand the potential of this model as a way of investigating how to encourage energy efficient household behaviour of high-income earners, a study investigating the model's practical and theoretical issues and benefits was undertaken. Component A sets the case for the important role high-income earners can play in achieving energy efficiency targets, summarises the history of relevant psychological research and establishes a methodology for the study. Component B summarises the case for the study and presents the research results and lessons learned in the style of a journal paper. The results suggest that the model has promise. Attitudes, Subjective Norms and Perceived Behavioural Controls accounted for 63.7% of the variance in intention of the sample to be energy efficient in the home. However, the study indicates that the model, although useful, is not sufficient for understanding actual behaviour and informing appropriate practical interventions. Consequently a number of suggestions are made as to how to design a future research approach.

Preface

The research described in this mini-dissertation was carried out at the Centre for Environment, Agriculture and Development, University of KwaZulu-Natal, Pietermaritzburg, under the supervision of Professor Robert Fincham.

This mini-dissertation represents the original work of the author and has not otherwise been submitted in any form for any degree or diploma at any university. Where use has been made of the work of others it is duly acknowledged in the text.



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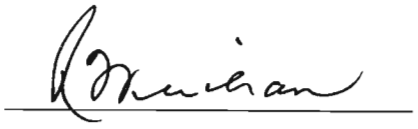

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CHAPTER 1

1 The Challenge of Encouraging Greater Energy Efficiency in Households

How high-income earners can be encouraged to be more energy efficient in their homes is a topic that is under-researched, yet it has an important role to play in achieving South African sustainable energy use. The following provides a summary of the need for this piece of research, the aim of the research and the objectives set to achieve the aim. It also sets out the structure of this dissertation.

1.1 Problem Statement

Despite efforts in the past 30 years to curb energy use based on fossil fuels, demand has grown considerably and is projected to continue. Global consumption is expected to rise by 59 percent between 2004 and 2030, with 85 percent of the growth coming from fossil fuels (EIA 2004a; IEA 2004a, 2004b). South Africa is no exception with a projected energy demand growth of 2.8 percent per annum between 2004 and 2014 (DME 2004a). This is particularly concerning as 80 percent of South Africa's energy comes from coal (DME 2004a), the most polluting fossil fuel (Gupta 2001). South African residential demand is expected to far outstrip overall demand, with a growth of 15 percent per annum expected over the next 10 years (Eskom 2004a).

To limit this growth the government realises it must adopt energy efficiency as a key strategy for sustainability. As part of its implementation plan it has pinpointed high-income households as a strategic priority, due to their high-energy consumption in comparison to low-income households (COCT 2003a; DME 2004a). Despite this, and other important reasons to focus on high-income households, almost nothing has been done to encourage energy efficiency in this group (DME 1998; COCT 2003a, Haskins 2005 *pers. comm.*) Instead low-income groups appear to have almost exclusively been the focus of household energy efficiency research and spending. High-income groups are perceived as unfathomable and difficult to persuade to be more energy efficient in the home (Borcher 2005 *pers. comm.*; Haskins 2005 *pers. comm*). Consequently a need exists for wide scale and concerted research into what influences the behaviour of South African high-income earners in respect to energy efficiency in the home? Such research would provide inform an appropriate strategic basis for government and other behaviour change interventions. To encourage wide-scale research, the importance of high-income earners to advancing household energy efficiency in South Africa must be clearly articulated and an appropriate

method of research suggested. No one approach has been established, but a well-used model for understanding how to influence behaviour change which may provide an appropriate structure for future research is Ajzen's Theory of Planned Behaviour (1985).

1.2 Aims

To establish the importance of high-income households in advancing energy efficiency in South Africa and exemplify the use of the Theory of Planned Behaviour as a potential approach to understanding the behavioural drivers and barriers of this group.

1.3 Objectives

1. To assimilate literature as a basis for establishing the framework of the study.
2. To explore the theoretical and practical suitability of the Theory of Planned Behaviour as a model for understanding behaviour of high-income earners in regards to household energy efficiency through a prototype study.
3. To obtain key lessons regarding use of the Theory of Planned Behaviour model to inform further research of the topic.

1.4 Structure of the Dissertation

Component A addresses objective 1 by setting out the case for the important role of high-income earners in achieving energy efficiency targets. It also summarises the history of relevant psychological research and establishes a methodology for the study. Component B summarises the case for the study and addresses objectives 2 and 3. It presents the research results and lessons learned in the style of a journal paper. Furthermore it presents a number of suggestions on how to design a future research approach.

CHAPTER 2

2 Energy, Households and High-Income Earners

The question of how to use energy sustainably is one of the most pertinent questions humans face and energy efficiency is considered by many to be at the heart of the answer. Households have an important role to play in achieving energy efficiency, but not all households use energy in the same way or can have the same influence on overall energy efficiency. High-income earners are one group of householders who's potential to influence energy efficiency is important and far-reaching. The following chapter summarises the issues surrounding why energy efficiency is of global importance, why households have a role to play and why high-income earners should be considered a priority when formulating energy efficiency policy and interventions.

2.1 The Energy Issue

The source of all energy is the sun. Energy underpins the existence of all living systems; it is also the basis of human economic development (Baumert, Bandhari & Kete 2002; EIA 2004b). Over the years, human systems have become increasingly successful at harnessing energy as a way to increase tangible material wealth, which is otherwise known as 'economics' (English Illustrated Dictionary 1990; Lal Basu 1999). Some thinking, such as Marxism's economic determinism, asserts that the human link with economics is so pronounced that everything from our social classes, value systems and norms to our religion and institutions, are defined by it (Craib 1984; Curtis 2002; Wikipedia 2005a; World Association of International Studies 2005). As a result, how and why energy is used is interrelated with the nature of human existence and therefore questioning the sources and patterns of human energy use necessarily involves considering the deep questions about human life and human wealth (Manning 2004).

The increasing human focus on material wealth is reflected in the escalating per capita demand for energy (Figure 1). This rise, combined with an increase in population (Figure 2) has resulted in soaring primary energy consumption. It is estimated that the world consumes 130 times the amount of energy than in pre-industrial times (Worldwatch Institute 2005). It consumes roughly double what it did in 1970 and is projected to increase demand by as much again by 2025 (Figure 3). Although population increases exacerbate the demand for energy, the primary driver of demand is evidently consumption levels per capita; between 1850 and 1970 the human population increased by more than 300 percent

but in the same period energy consumption went up 1200 percent, and between 1970 and 2002 the population rose 68 percent but fossil fuel use has increased by 73 percent (Worldwatch Institute 2004) See Figure 4 for emission increases. Although energy intensity (energy consumption per economic output) has improved in developed countries over the past 20 years, the link between energy and economic growth is very strong and globally energy intensity changed very little between 1980 and 2001 (EIA 2004a). The strong dependency of economic growth on energy use is set to continue, as demonstrated in the comparison of Figures 5 and 6. Here, the three possible trends of future GDP growth are mirrored in the three possible trends for energy consumption.

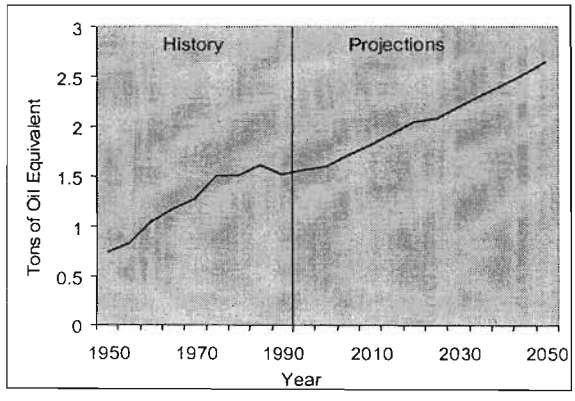

Figure 1: Global Energy Use Per Capita, 1950 - 1995, with Projections to 2050 (*after* Brown, Gardner & Halweil 1998)

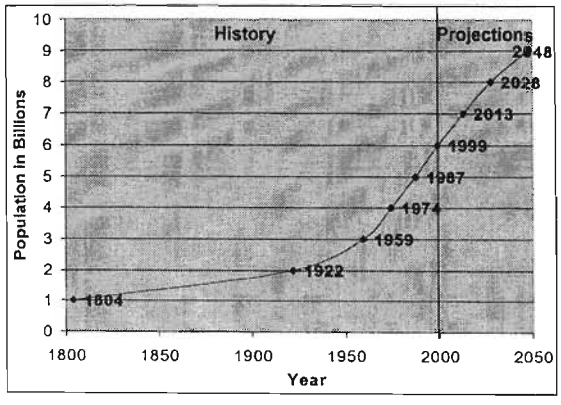

Figure 2: Total World Population 1880 – 1999, with Projections to 2050 (*after* U.S. Census Bureau 2002; UN 1995)

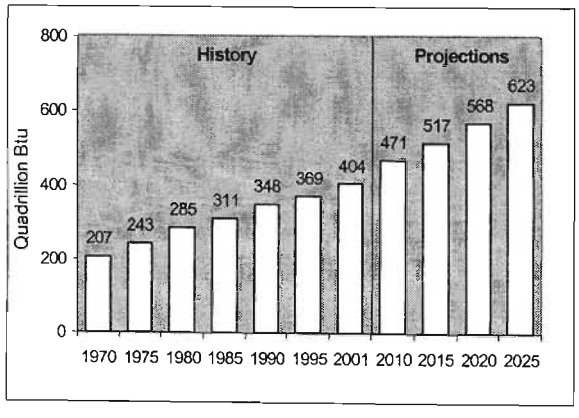

Figure 3: World Primary Energy Consumption (*adapted from* EIA 2004b)

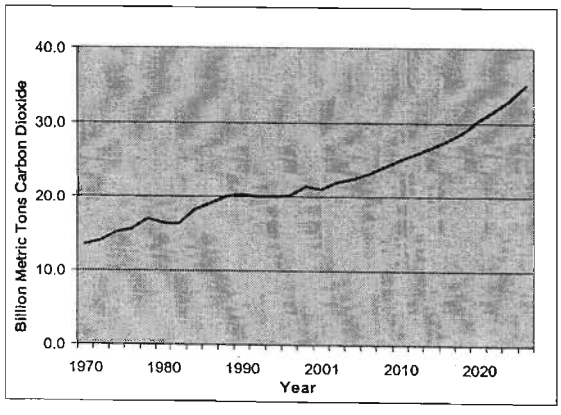

Figure 4: Total World Energy Related Carbon Dioxide Emissions 1970 - 2025 (*adapted from* EIA 2004b)

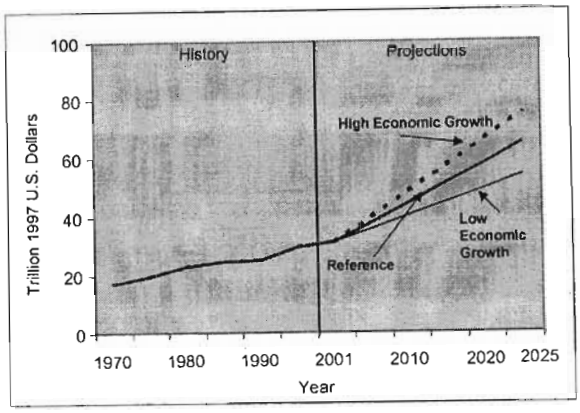

Figure 5: Three Economic Growth Cases (GDP) 1970 - 2025 (*adapted from* EIA 2004b)

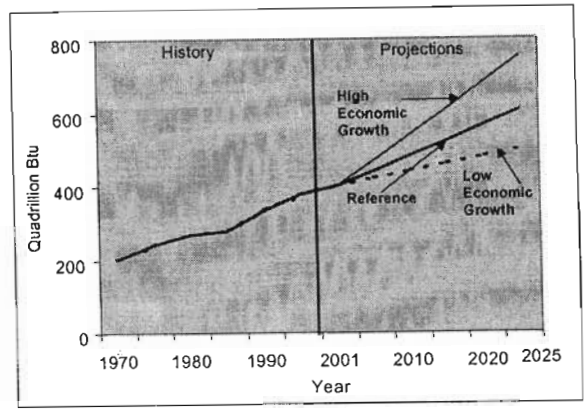

Figure 6: World Primary Energy Consumption in Three Economic Growth Cases (GDP) 1970 - 2025 (*adapted from* EIA 2004b)

In summary, the graphs above show that energy use is predicted to grow, both on an aggregate and per capita basis. The growth in future economic growth is predicted to be positively correlated to energy use and that carbon dioxide emissions are also set to grow steadily.

2.1.1 The Issue with Fossil Fuels

The central issue with human energy use is in relation to the past and continued reliance on fossil fuels as the main source of this energy. Presently, around 88 percent of all energy consumed is from fossil fuels (BP 2004) with nuclear, hydropower and renewables forming the other main sources (EIA 2004b). Fossil fuels are problematic because they have accessibility restrictions, they are distributed unequally around the globe and they produce harmful emissions when used.

Fossil fuels are in essence ancient stored solar energy in the form of oil, natural gas and coal. Therefore, if continued to be used at present rates, by definition they will run out at some point. However, before fossil fuels run out they will become unfeasible to acquire. At some point it will cost much more energy to extract fossil fuels than the embedded energy in them. This is a main basis of the 'Peak Oil' argument, which states that due to the depletion of most easy to reach sources, we are nearing the point where it will cost a

barrel of oil to extract a barrel of oil, therefore making the process of extraction pointless (Energy Bulletin 2005; Orr 2005). Advancing this possibility is the massive increase in global oil demand. If the average Chinese person consumed the same amount of oil as the average American, China would demand 11 million barrels of oil a day more than the whole world produced in 2001 (Worldwatch Institute 2004). 'Peak Oil' is a topic that is becoming increasingly discussed and accepted at a mainstream and governmental level, with the French government forecasting a possible peak in world oil production as early as 2013 (BBC 2005).

The second main issue with fossil fuels is that they occur unequally around the globe. Those who want to gain access to this randomly concentrated wealth must use money or force to do so (Manning 2004). Many conflicts have been blamed on the quest for energy resources, including the recent Iraq war and the dispute between China and Japan over the Siberian oil fields (Roberts 2004). As the issues with supply become more pronounced, it is argued that the chances of conflict over remaining resources will be heightened (Klare 2002).

The third, and the perhaps most fundamental issue of our past and continued reliance on fossil fuels, is the effect on life and the system that supports it - the natural environment. The pollutants released when fossil fuels are burned directly affect the well being of humans and other species (WHO 2005). It is estimated that between 2000 and 2020, 8 million people worldwide could die of respiratory diseases if fossil fuel use does not change (Working Group on Public Health and Fossil-fuel Combustion 1997).

Although the direct health issues with fossil fuels are substantial, the broader environmental costs of fossil fuels are perhaps more widely considered, with climate change being perhaps the most prominent. Climate change has been referred to as one of the most profound challenges humankind faces (Delay 2005; International Institute for Sustainable Development 2005).

When fossil fuels are burned, Carbon Dioxide is released and despite being one of the least potent greenhouse gases, Carbon Dioxide is a major contributor to climate change due to of the sheer volume released (Gupta 2001). As a result, dealing with the climate change problem generally means 'decarbonising' the world's energy sources (Nakicenovic 1996). In line with energy use growth, carbon dioxide emissions have roughly doubled

since 1970 (Figure 4) and around 75 percent of the increased carbon dioxide in the atmosphere is believed to be directly attributable to the burning of fossil fuels by humans (IPCC 2001). The potentially catastrophic effects of climate change on all life on earth (IPCC 2001) means that debates around the environmental effects of continued fossil fuel use are in many ways an ethical matter. Moral considerations such as equity and intergenerational-rights (Attfield & Belsey 1994) as well as non-anthropocentric arguments of animal and plant rights, embodied in philosophies such as Gaia Theory (Lovelock 1982), Deep Ecology and Bio/Eco-centricism (Attfield & Belsey 1994; Talbot 1998) are all represented in the energy use debate.

2.1.2 Energy Efficiency as 'the Cornerstone' of the Solution

There has been a growing global consciousness of the issues with fossil fuels and consequently, the need to alter human energy use patterns. ExxonMobil calls it a "very real problem" (2005:1) and the G8 leaders identified it as a main issue at their talks in Gleneagles describing it as "the challenge of transforming our energy systems to create a lower carbon economy" (G8 2005:1).

Changing the source of energy from fossil fuels to renewables, at a national level, is an obvious approach to the problem. Although institutionalising renewables is not a straightforward process, as clearly outlined in Janet Sawin's 'Mainstreaming Technologies in the 21st Century' (2004), many countries have made large headway, such as Denmark who now supplies 20 percent of all its electricity demand through wind power (AWEA 2005). Other countries have adopted official targets for renewables, for example the European Union aims for 22 percent of its electricity to be supplied by renewables by 2010, Latin America and the Caribbean are aiming for 10 percent of total energy by 2010 and Thailand has published a goal of 21.2 percent of total energy to be supplied by renewables by 2011 (Sawin 2004).

Another main approach to reducing fossil fuel use is to fundamentally change the way we use energy in the first place. Energy efficiency can be defined as doing the same function or better, with less energy (EPA 2005). Reducing energy consumed is particularly important as policy makers have expressed concerns about the ability of renewable capacity to supply the extent of forecasted growth in energy demand (BBC 2004; Johnston 2005). That is one of the reasons that energy efficiency is viewed by some as 'the Cornerstone' of the solution to the energy issue (Flavin & Dunn 2001:1).

Energy efficiency represents both an environmentally impacting and at the same time, cost effective option. Energy efficiency is instrumental in de-coupling economic growth from increasing energy consumption, and therefore fossil fuel use as it represents a chance for the same output to be produced with less energy (Baumert, Bandhari & Kete 2002; EIA 2004b). Furthermore, the economic and environmental costs that occur because of wasted energy are significant. The Australian government predicts that implementing half of all energy efficiency programmes with a four year pay back could raise GDP by $975 million a year and reduce greenhouse emissions by 10 million tons (Commonwealth of Australia 2005). The UK could save 40 million tons of carbon emissions and £12 billion annually if it eliminated energy inefficiencies (10 Downing Street 2002).

Energy efficiency can be applied at all levels of society and can involve the use of more efficient technologies, such as a new generation diesel engine or a compact fluorescent light bulb, or through curtailing actions that waste energy, such as reusing waste in a production process rather than dumping it, or turning off lights in unused rooms. Energy efficiency has been embraced by governments and organisations all over the world as a major strategy to reduce dependence on fossil fuels. The European Commission has recently published its Green Paper on 'Energy Efficiency or Doing More With Less' (Commission of the European Communities 2005), the USA's Department of Energy has an Energy Efficiency and Renewable Energy Office and the UK government funds an organisation called the Carbon Trust which gives advice to businesses on how to reduce their carbon impact through energy reductions. Even traditional fuel companies are recognising the importance of energy efficiency with ExxonMobil, one of the largest multinational oil companies, stating that as a result of the fossil fuel issue "Conservation and the efficient use of energy are critically important" (2005:1).

Although, energy efficiency is seen as key to de-coupling the strong positive relation between economic growth and increased carbon dioxide emissions (Baumert, Bandhari & Kete 2002; EIA 2004b), and is considered a very useful and fair measure (Christian Aid 2000), a focus on energy efficiency without consideration of total emissions can be misleading and should be viewed cautiously. For example, the USA is keen to publicise their good energy efficiency record - between 1973 and 1999 energy efficiency increased by 41 percent (Flavin & Dunn 2001), however, the US net carbon dioxide emissions in fact rose by 20.2 percent in the same period (CDIAC 2005). Additionally, the '40% house'

study at Oxford University noted a trend in the UK whereby energy efficiency labels have encouraged people to replace old appliances with larger ones, such as American size fridges, therefore paradoxically resulting in a net increase in emissions (Killip 2005).

2.2 The Role of Households in Improving Energy Efficiency

Energy efficiency programmes are being applied by governments, Non-Governmental Organisations (NGOs) and other institutions, at many different levels. The household level is a key sector being targeted for energy efficiency improvements. The UK has committed to reduce carbon dioxide emissions from households by 60 percent by 2050 (Killip 2005). It is believed that in South Australia "an efficiency gain for residential energy efficiency improvement in the order of 25 percent would seem reasonable and achievable" (Lee & Denlay 2002:16). In Russia it is believed that household energy savings could account for 26-27 percent reduction in overall energy demand (Energy Ministry of Russia cited Asia Pacific Energy Research Centre 2002).

A major reason for targeting households is that they are large consumers of energy. On average households directly consume between 15 percent and 25 percent of primary energy (UN 1999). Households are seen as representing the greatest potential for savings through energy efficiency above any other sector in countries such as Australia and the UK (Commonwealth of Australia 2005, 10 Downing Street 2002).

Household energy consumption, as a proportion of the whole, is estimated to be much higher in developing countries (UN 1999) and in general, poorer people tend to spend a much larger proportion of their income on energy than richer households (DFID 2002). Although the proportion of household spending tends to fall as incomes rise, the net consumption of energy tends to rise (Steg 1999; EIA 2004b; EMM 2004). The link between household income and energy use is considered very strong (UNDP 1999) with the IPPC stating that "Energy consumption in residential buildings is strongly correlated with household income levels" (IPCC 2001:3.35:1). The proportion of carbon dioxide emissions from households will be influenced by the 'dirtiness' of the energy mix utilised by them and their suppliers. This will vary by country-to-country and even household-to-household depending on, for example, how much gas, paraffin or electricity is used and what fuels suppliers use to provide the electricity. In the UK for example the 30 percent share of energy that households consume, relates to a 27 percent share of the carbon dioxide emissions of the country (Killip 2005).

A second reason to target households is in relation to the merits of public participation. Large-scale change should arguably not be limited to national level action, for example government merely switching from fossil fuels to renewable energy centrally. In democratic societies, large-scale change without the buy-in and active support of 'the masses' can be both difficult and undesirable (Inglehart & Welzel 2005). If embraced and included however, the general population can provide huge stimulation and drive for change (Curtis 2002; Sanghera 2005a). Bottom-up change stimulated by social marketing through word-of-mouth and peer influence cannot be underestimated in its ability to shape ideas, aspirations, norms and ultimately the actions of society (McMaster University 2005). It has been argued that "only societies where environmental concern and awareness are much stronger than today can produce significantly reduced carbon emissions" by "providing the necessary framework and support of required policies" (Boardman, Darby, Killip, Hinnells, Jardine, Palmer & Sinden 2005:4). People should therefore be given the tools to understand and become part of the move to a more considered and long-term approach to energy use. The household is a level at which individuals can be effectively reached.

It has been stated that when dealing with matters of environmental change, a mix of approaches works best (Sawin 2004). Energy efficiency must be tackled at a household level as part of such a mix, not just because it will help reduce the overall energy demand of a country but will also help make headway in creating public and personal norms that embrace the idea that human energy consumption patterns must change and how, practically, this can be done.

2.3 The Role of High-income Earners in Improving Energy Efficiency

As already observed, changing energy use may involve changing peoples perceptions about the basis of our way of life, especially when it is applied at the intimate home level. It is also about ensuring those perceptual changes are translated into actual behaviour change. The complex and far-reaching nature of this task cannot be underestimated Human behaviour is extremely multifaceted and the links between attitudes and action are still unfathomable (Olsen 1981; Kollmus & Agyeman 2002; Linschiedt 2004). Therefore it is unlikely that one technology, information brochure, organisation, NGO, education campaign or book will move individuals to being more energy efficient in their homes. As modern marketing indicates, persuasive campaigns cannot be implemented without a

significant consideration of the heterogeneous needs of a population (Wedel & Kanakura 1999). A more strategic approach would instead involve segmenting people into groups based on an appropriate shared characteristic. Behaviour change programmes can then be tailored and targeted to the specific psychological drivers of those groups (Chartered Institute of Marketing 2005).

In relation to household energy efficiency, income is often used as a basis of analysis (Asia Pacific Energy Research Centre 2002; COCT 2003a; EIA 2004b). Income presents itself as a natural criterion for segmentation because income and energy use are highly positively correlated (see Section 2.2): the higher a households income the more energy they are likely to use (Dzioubinski & Chipman 1999; IPCC 2001; EIA 2004b). Additionally, behavioural barriers and opportunities are likely to be similar within income groups due to the influence of social norms within class groups (Elster 1989).

As incomes rise, both the relative decrease in energy costs to a household and the tendency towards larger homes, have an impact on energy use (EIA 2004b; Christian Aid 2000). However, increasingly the most prominent link between income and energy use is the households' ability to purchase electrical appliances (EIA 2004b; Worldwatch Institute 2004). The increasing penetration of appliances as household incomes rise is a trend that is predicted to continue (EIA 2004b). Worldwatch Institute has pointed out that, "Home appliances are the world's fastest-growing energy consumers after automobiles, accounting for 30 percent of industrial countries' electricity consumption and 12 percent of their greenhouse gas emissions" (2004:1). Consequently there appears to be a vicious energy cycle at a macro level; a country's energy consumption drives its wealth through economic growth, which drives its household energy consumption, which drives the country's wealth through economic demand for goods and services, and so on.

The correlation between income and energy use means that, in general, high-income earners are strategically important to reducing energy use. It could also be argued that it is only fair that high-income earners are the ones who reduce their energy consumption. Looking at the issue from a country level perspective illuminates the issue of justice and equity in regards to energy use.

Developed countries have cumulatively consumed far more energy than those developing countries and as a result have a far larger pollution debt. An estimated 80 percent of all

CO2 current build up in the atmosphere, which has resulted in the global warming phenomenon, originates from developed countries (World Resources Institute 2003). Therefore many argue strongly that it should not be the role of developing countries to help pay for such debts (Christian Aid 2000; Heinrich Boll Foundation 2002; World Resources Institute 2003). Additionally, high-income countries continue to pollute more than developing countries, which follows the global trend of higher income, higher energy consumption, higher carbon emissions (Figures 7 & 8). Although the aggregate gap is closing and developing countries are set to overtake as the largest polluters by 2020 (Figure 7), on a per capita basis Figures 8 shows that developed countries will continue to pollute massively more than developing countries for a long time to come. Furthermore, in poorer countries the energy that is used is more likely to be spent on essential goods and services rather than for non-essentials or cash accumulation (DFID 2002). This means that it would arguably be much more difficult to make energy reduction gains in developing country households. Compounding this issue is the fact that developing countries are almost twice as efficient in their energy use per unit of GDP already (Christian Aid 2000).

That does not mean that low-income countries and households should not be encouraged to be energy efficient as many health and economic gains are recognised to come from increased energy efficiency (Dzioubinski & Chipman 1999; Ward 2002), however it could be considered unjust if there was not a at least a similar emphasis placed on high-income countries and households, if not higher.

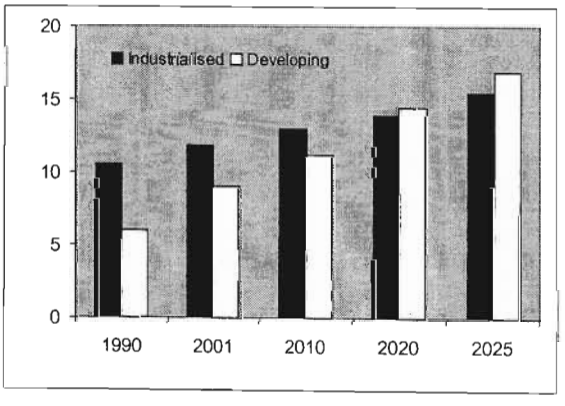

Figure 7: World Energy-Related Carbon Dioxide Emissions by Region 1990 - 2025 (*adapted from* EIA 2004b)

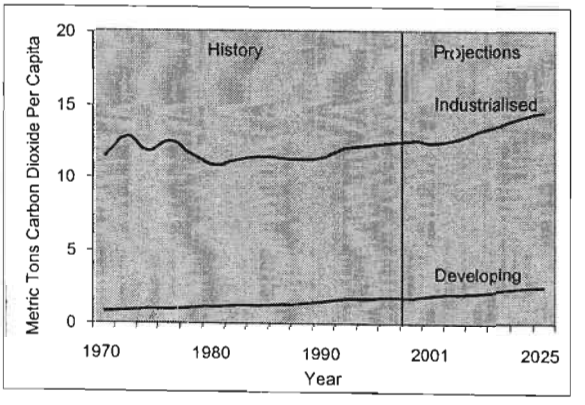

Figure 8: World Energy-Related Carbon Dioxide Emissions by region Per Capita 1970 - 2025 (*adapted from* EIA 2004b)

Equity and justice and the high amounts of energy consumed are important reasons for looking to high-income households to help solve carbon emission problems. However, there are further reasons why those with high-incomes are important to advancing household energy efficiency. Firstly, high-income earners provide normative examples to those aspiring wealthy lifestyles (Veblen 1899; Hirsch, Kett & Trefil 2002; Reinstaller & Sanditov 2003). Secondly, they have the income to be potential early adopters of energy efficient technologies, providing stimulus to emerging markets (Dzioubinski & Chipman 1999; Borcher 2004). Lastly, where the high-income reflects an influential occupation, they have the opportunity to effectively transfer ideas of energy efficiency to their place of work, thereby expanding energy efficiency (Haskins 2005 *pers.comm.*).

2.3.1 The Aspirational Influence of High-Income Earners

Social stratification is the hierarchical division of society into groups that have unequal levels of resources such as power, wealth and status (Wikipedia 2005b). The groups are often known as classes and "the members of each particular social class hold(s) similar amounts of scarce resources and share values, norms, and an identifiable lifestyle" (Glencoe 2005:1). In market economies there is a strong relationship between social classes and wealth (Hirsch, Kett & Trefil 2002). There is a tendency for people to aspire to move to higher social classes where better access to wealth, status and therefore resources exist (Veblen 1899; Reinstaller & Sanditov 2003). This is more likely to happen where social mobility is aided by society for example in countries where civil rights and anti-discrimination laws are strong (Hirsch, Kett & Trefil 2002). In other societies such as 'caste' systems in India, movement between classes is highly restricted and so, therefore, is the ability and motivation of people to try and change class (Glencoe 2005)

In order to be defined as a member of a class it follows that a person must demonstrate characteristics shared by members of that group. In many societies social groups are to some degree fluid and dynamic so these characteristics are not static (Wikipedia 2005b). An important indicator of a person's class membership is how well their behaviour conforms to the social norms of a class. Social norms can be defined "as a code of conduct about what is acceptable behaviour" (Oxford Brookes University 2005:1) and are defined and enforced by the group (Elster 1989). Those demonstrating behavioural norms of the higher-class groups are more likely to be accepted as a member of that group and lower classes tend to imitate higher-class behaviour in an effort to gain membership (Reinstaller & Sanditov 2003).

One important behavioural norm that reflects social group membership is that of consumption patterns. 'Conspicuous consumption' is a term made famous by Veblen in the 19th century which refers to the purchasing of goods in order to emulate the group one aspires to (Veblen 1899:75). Mary Douglas believes that "As communicators, goods are primarily 'markers' that indicate social relationships and classifications. Through the public meanings attached to goods and their public uses, consumption organises social order by making visible social divisions, categories, ranks and so on" (Douglas cited Sanghera 2005b:1). Reinstaller and Sanditov note that "members of different social groups observe the consumption patterns of other members in society. In the absence of more direct social contact consumption patterns reveal the social status of people. This is a process in which consumers compare, evaluate and imitate or reject the choices of relevant others" (2003:3). It is from the use of goods to indicate membership of or aspiration to a higher social class that the term 'status symbol' derives from (Sanghera 2005b)

Therefore in societies where the tendency is for people to aspire to the membership of more wealthy social groups, the behaviour and purchasing patterns of those who already belong to such a group are a vital influence on the behaviour and purchasing patterns of societies as a whole. In respect to product diffusion the phenomenon is known as the 'trickle down' effect (Reinstaller & Sanditov 2003). On the basis of the above factors, it would be very powerful for a country that wishes to expand energy efficiency if energy efficiency was considered a norm of higher income households.

2.3.2 High-Income Earners and Innovation Diffusion

Many sustainable energy technologies (energy efficiency technology and related renewable technologies) need help to become established especially as they often compete with powerful and sometimes subsidised traditional industries (Sawin 2004). Combined with the need to reduce carbon emissions quickly, this means that it is crucial for existing and new sustainable technologies to be given every possibility to be adopted 'en mass' as quickly as possible.

Another important concept for the adoption of innovations is that which states that a few key people must adopt a product before others will. The theory of diffusion, made famous by Everett Rogers suggests, amongst other things, that after 10-25 percent of the population adopts an innovation, the remaining adopters will follow fairly rapidly followed

by a longer period in which the last members finally adopt (Rogers 1995). Critical mass theory or the theory of the 'tipping point' are also concepts which refer to a key number of people needed to adopt a product before the others will quickly follow (Oliver, Marwell & Teixeira 1985; Gladwell 2002). Initial adopters not only act as a model for potential adopters but also provide experience for the producer and markets (Bornschier & Volken 2005).

Also important to product diffusion is economies of scale. Literally defined, economies of scale means the "as output increases, the average cost of each unit produced falls" often due to fixed costs being spread over more output units (The Economist 2005:1). Here attainment of a critical mass or the reaching of a 'tipping point' increases the possibility that a producer will have a big enough market for fixed costs to be spread over a larger end user group, these lower prices may in turn may advance the adoption of the product (Bratton, Bennett & Robson 2003). High-income earners are likely to have the disposable income to acquire what are sometimes expensive energy efficient technologies with long pay back periods (Dzioubinski & Chipman 1999; Borcher 2004).

These theories suggest that in order for products to diffuse successfully the initial adopters, known as 'innovators' and 'early adopters' are key because they persuade others to adopt, provide companies and markets with experience and help reduce the price of the product for other end users. These initial adopters have been described as often intelligent and affluent whereas late adopters tend to be less intelligent, less wealthy and of lower social status (Rogers 1995). Additionally, the likelihood of a 'trickle-down' effect occurring in many societies means the chances of innovation adoption many be improved if higher-income groups adopt the innovation first (Reinstaller & Sanditov 2003). Consequently high-income earners are important to the diffusion of new sustainable technologies because of their financial means and their key role in a larger social process of technology adoption.

2.3.3 High-Income Earners' and Workplace Influence

A further potential benefit from increasing the energy efficiency intentions and actions of high-income earners in the home, is that there is the possibility these will be translated into the workplace. It is likely that high-income earners will be in relatively influential positions in their place of work compared to those with lower incomes. This opens up the possibility that a high-income person who embraces energy efficiency in the home may look for and

be in a position to implement energy efficiency in the workplace. The existence and importance of home to workplace influence is a hypothesis that needs further research and investigation (Haskins 2005 *pers.comm.*).

Energy efficiency is a central part of achieving sustainable household energy use. However, in order to achieve adequate efficiency quickly, governments and implementers must consider carefully who they are targeting and why. High-income earners have wide ranging potential to help improve a country's household energy efficiency and broader energy goals, and should therefore not be overlooked.

CHAPTER 3

3 The South African Context

For South Africa, implementing household energy efficiency is especially important and at the same time, particularly challenging. Again, households have an important role to play. More specifically, high-income households must be at the centre of any equitable efforts to reduce energy use, reduce the need for new power stations and expand energy efficiency.

3.1 South Africa's Energy Issue

South Africa is one of the world's top 20 polluters (Dunn 2002; DME 2004b), with high per capita carbon dioxide emissions (Figure 9). Furthermore, its carbon dioxide emissions have been increasing steadily (Figure 10), with a 16.3 percent rise between 1990 and 2001 (Marland, Boden & Andres 2001). There are a number of reasons for South Africa's pollution levels which stem from the country's heavy reliance on coal, "the most carbon intensive of all the fossil fuels" (EIA 2004b:1). South Africa has abundant natural supplies of coal (The Economist Intelligence Unit 2005). Consequently the country relies heavily on it with around 79 percent of South Africa's energy coming from coal (Figure 11), this combined with its high energy demand (Figures 12 & 13) make it the world's most coal intensive major energy consuming country (BP 2003).

The country's coal reserves have contributed to an abundance of cheap energy and enabled South Africa to be the fourth cheapest producer of electricity in the world (South African Business Guide 2002). For South Africa coal has been a driving force of its economy for both trade income and internal use; it provides 5.6 percent of global coal supplies, and consumes 3.6 percent of total global coal use (Marland, Boden & Andres 2001) with large demand coming from its energy intensive industries (DME 2004a). South African coal reliance is not predicted to change in the near future with use predicted to grow in proportion with overall energy demand (DOE 2004). Energy demand itself has been rising steadily over the past decades and is forecasted to continue this way (Figures 12 & 14).

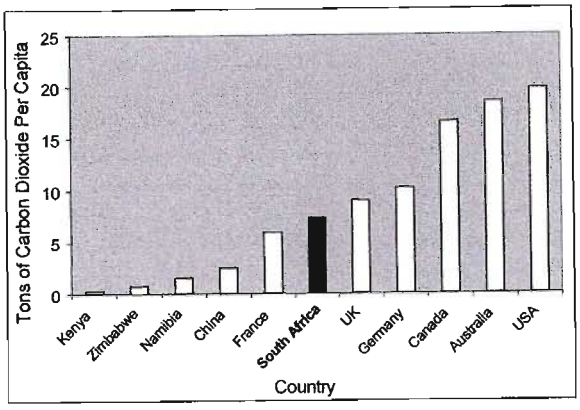

Figure 9: South African Per Capita Carbon Dioxide Emissions 2001 (*adapted from* DME 2004a)

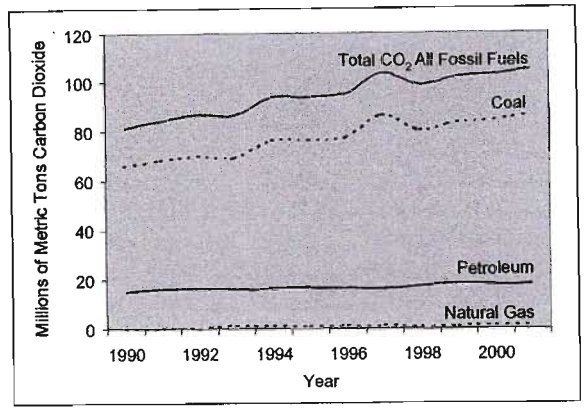

Figure 10: South African Carbon Dioxide Emissions 1990 – 2001 (DOE 2004)

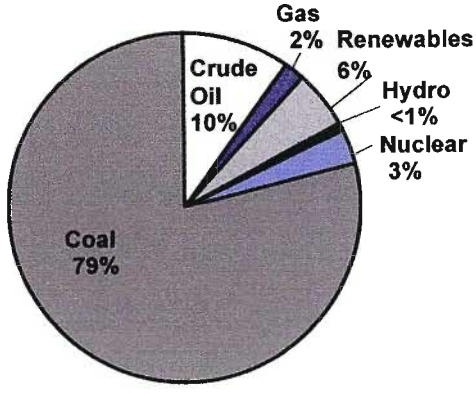

Figure 11: South African Primary Energy Supply 2000 (*adapted from* DME 2004a)

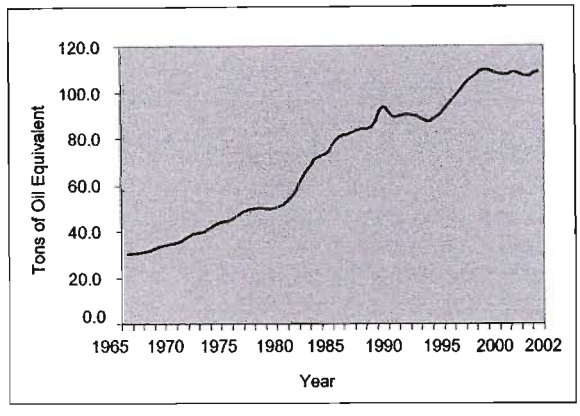

Figure 12: South African Primary Energy Consumption 1965-2002 (BP 2003)

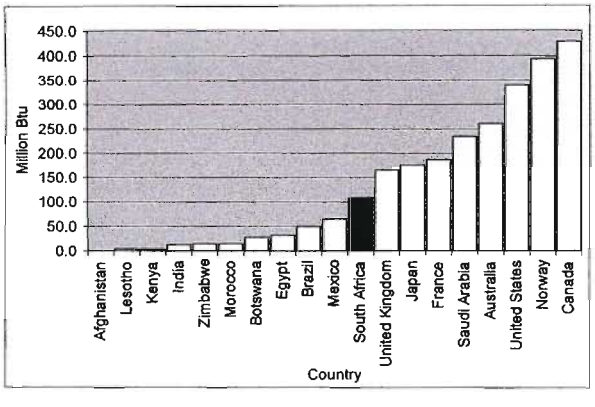

Figure 13: South African Per Capita Total Primary Energy Consumption 2003 (*adapted from* EIA 2005b)

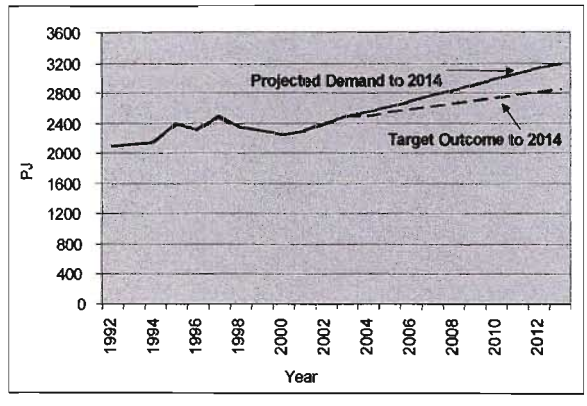

Figure 14: Projected South African Final Energy Demand to 2014 (*adapted from* DME 2004a)

The South African government recognises that it has an obligation to reduce its atmospheric pollution on both macro and micro levels (DME 2004a). Perhaps the strongest national commitment it has made to this is in Section 24 of the Constitution, which states that South Africans have the right:

- To an environment that is not harmful to their heath or well-being; and
- To have the environment protected, for the benefit of present and future generations, through legislative and other measures that -
  i. Prevent pollution and ecological degradation;
  ii. Promote conservation; and
  iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic social development (RSA 1996).

The Constitution is the supreme law of South Africa and imposes obligations on government to fulfil constitutional commitments (EMM 2004). The transition from these constitutional obligations to reduce carbon emissions, towards implementation, is reflected in the 1998 White Paper on Energy Policy, the 2003 White paper on Renewable Energy and the 2004 Draft Energy Efficiency Strategy, which all address the vital importance of energy efficiency (DME 1998; DME 2003; DME 2004a). The Draft Energy Efficiency strategy takes its mandate from the White Paper on Energy Policy (DME 1998) and is has been created to provide a practical short to long-term timetabled approach to improve energy efficiency. The overall goal of the Draft Energy Efficiency Strategy is to reduce energy demand by 12 percent of forecast by 2014 (DME 2004a) and although this still results in an overall increase in demand, it will not be an easy goal to reach (DME 2004a). In 1997 the country raised its commitments to reduce emissions to an international level by ratifying the United Nations Framework Convention on Climate Change. It subsequently acceded to the Kyoto protocol in 2002, although it is not legally required to meet targets until the next obligation period beginning in 2012 South Africa (Salgado 2005).

Although the government has made commitments to reducing carbon emissions it understands that it will not be easy. The Draft Energy Efficiency strategy states that "in many respects we start from a clean slate" when it comes to implementing energy efficiency (DME 2004a:2). The government blames the history of cheap energy in South Africa as providing few incentives to be energy efficient and resulted in many in the country taking fuel for granted (DME 2004a). The USA's energy information administration has also noted that in South Africa incentives to invest in energy efficiency standards have

been minimal, and that "energy efficiency standards in South Africa generally are lacking. While there has been recognition over the past few years of the benefits that would accrue from the introduction of energy efficiency standards, most have not been implemented" (EIA 2004c:1).

3.2 The Development Conflict

Energy consumption and wealth are highly linked (EIA 2004a), therefore South Africa's high emission levels and energy consumption (Figures 9 and 10) would seem to indicate that the country is prosperous with high standards of living. In fact, South Africa is in many respects a very poor country with only a minority having energy-rich lives. The country's unemployment rate was around 37 percent in 2001 and in 2000 an estimated 50 percent of people were living under the poverty line (CIA 2004). Additionally, in 2001 an estimated 33.9 percent of South Africans had no access to electricity (South African Business Guidebook 2002) and therefore relied on other forms of fuel such as biomass and paraffin for their energy needs (DEAT 1997). The contrasting statistics of energy wealth and poverty are symptomatic of the legacy of resource inequalities in the country, which were institutionalised and heightened during the four decades of apartheid rule (Stanford Journal of International Relations 2001). A recent study at the University of Kwa-Zulu Natal noted that the country continues to have massive socio-economic inequalities along racial lines, with 61 percent of blacks and 38 percent of coloureds living in poverty compared to 5 percent of Indians and 1 percent of whites in poverty (Makino 2003). The Central Intelligence Agency of America (CIA) estimates that the top 10 percent of households have 45.9 percent of total income and the lowest 10 percent have 1.1 percent (2004).

Naturally, the new democratically elected government, the African National Congress (ANC) has made poverty eradication its top priority (UN IRIN 2004a), a crucial mandate which was arguably at the heart of its election success (Bond 1998). Its main strategies to achieve this have been a combination of economic growth and resource redistribution, embodied in the Reconstruction and Development Programme (RDP) and the Growth, Employment and Redistribution strategy (GEAR) (DME 1998).

The government faces a compounded challenge to achieve two seemingly conflicting goals: not only is it obligated to reduce carbon emissions, but at the same time it is mandated to reducing poverty (DME 1998; DME 2004a). The basis of the apparent

conflict between the two is that an important way of relieving poverty is to increase energy use (UNDP 1999). Research has shown that when energy use per capita is raised there is a large decrease in infant mortality, illiteracy, and a rise in life expectancy (Fundación Bariloche 1976; World Energy Council 1993). The importance of energy as a development indicator was underlined when it was used as a key measure of poverty alleviation in the Millennium Development Goals (COCT 2003b). The South African government recognises this link stating that 'energy is the life-blood of development' (DME 1998) and that increasing energy use through maintaining cheap fuel prices and improving electricity access is a key poverty reduction strategy for the country (DME 1998; COCT 2003b). At the same time it has stated that as economic growth and development occur so will emissions (EMM 2004). It is in resolving the conflict between development and environmental impact that energy efficiency becomes a particularly useful tool. As discussed in Chapter 2, energy efficiency helps de-couple economics from carbon intensity and therefore allows for monetary development at the same time as carbon decreases (Baumert, Bandhari & Kete 2002; EIA 2004b). The Minister for Minerals and Energy in 2003 stated that "Energy Efficiency will help in increasing energy resources affordability, reduce energy costs and contribute to energy conservation, this practice can be implemented at minimal costs and its results are usually tremendous" (Mlambo-Ngcuka 2003:1).

3.3 The Role of Households in Improving South African Energy Efficiency

The South African Energy Efficiency Strategy sets out how energy efficiency is to be achieved. The strategy identifies the key role that households play in achieving emission reduction targets in South Africa (DME 2004a). As is the case in many countries, households contribute a large proportion to overall South African energy use, an estimated 17 percent overall (DME 2004a). South African households have an important role in reducing carbon emissions, and this role is set to expand as households are expected to increase their proportion of overall energy demand. Over the next 10 years total energy demand is predicted to rise by 2.8 percent pre annum (DME 2004a), however over the same period residential electricity demand is predicted to rise by a considerably higher figure of 15 percent per annum (Eskom 2004a). One reason for this growth is the government's electrification programme, which has been making around 300,000 new electricity connections a year to low-income households (EMM 2004), with 3.5 million connection having been made since 1993 (Phillip 2001). The second reason is that higher income households, who are almost entirely dependant on electricity (DME 1998; COCT

2003a), continue to expand as a result of economic growth and have an important impact on energy demand growth (DME 2004a). With over 90 percent South Africa's electricity produced from coal (DOE 2004), it is clear that controlling household energy use is vital to controlling carbon dioxide emissions.

The South African government has set out its implementation plans to reduce household energy use within its Draft Energy Efficiency Strategy. Here it states it aims to cut household energy use by 10 percent of forecast by 2014 (DME 2004a). The strategy recognises that changing household behaviour is key to achieving the target. It states that: "many energy saving decisions lie at the individual household level" (DME 2004a:14). Additionally it points out that the promotion of pubic awareness is one of the most neglected areas of South African energy efficiency programmes. The strategy therefore points to an "ongoing awareness drive will be necessary" to achieve the goal (DME 2004a:14).

In Cape Town the local level government has taken matters into its own hands and produced its own draft energy strategy and local targets for household energy efficiency. The City of Cape Town for example aims to reduce Carbon Dioxide emissions from households by 10 percent by 2010 and for 90 percent of homes to be using Compact Fluorescent Lightbulbs (CFLs) by that time (COCT 2003a).

The growing impact of households on total energy demand provides a further incentive for South Africa to improve its energy efficiency – that incentive is the growing issue of supplying the country's peak electricity demand. Eskom, a government parastatal, provides 96 percent of the country's electricity, and two thirds of African electricity (DOE 2004) with 92 percent of this produced from coal (South African Business Guidebook 2002). Although overall electricity capacity of its stations is adequate, the ability to provide for peak time use isn't (DME 2004b). During 2003, peak time demand occasionally reached up to 84 percent of installed capacity (DME 2004c). Households have a profound impact on peak time demand (Eskom 2004a). Eskom understand that with the forecasted rise in household energy demand they will have to consider building a costly new power station merely to supply household needs for a few hours a day, for a few months a year (Eskom 2004a). Consequently Eskom, and thus the government, have an added incentive to reducing household energy demand, as a way to defer this investment (Eskom 2004a). Since 1994 Eskom has formally engaged in a Demand Side Management (DSM)

programme to try and reduce energy demand especially at peak times, as reflected in the National Integrated Resource Plan legislation (COCT 2003b). Although DSM is primarily aimed at shifting load out of peak times, it is using the national and international interest in improving overall energy efficiency to support its goals (Eskom 2004b).

3.4 The Role of High-Income Earners in South African Energy Efficiency

In South Africa income is also a natural way to segment household users of energy use. Cape Town and Ekurhuleni Municipalities have produced a State of Energy reports, and both use income levels as a way to express findings (COCT 2003b, EMM 2004). The Ekurhuleni report notes "energy usage characteristics tend to correlate with income levels" (EMM 2004:44).

There appears to be no absolute or guideline definitions of what constitutes different income groups in South Africa. Groups are usually referred to as simply low and high-income with mid-income also occasionally referred to. It has been expressed that for the purpose of analysis, the high-income group should not be too narrow with a cut off point of R100,000 per household per year considered a reasonable way to define 'high-income households' in South Africa (Haskins 2005 *pers. comm.*) National statistics suggest that this is almost four times the national average of R24,792 per annum with 88 percent of households indicated to be earning less than R60,000 a year (Statistics South Africa 2002, 2004). In the City of Cape Town 3 percent of households report to have an income of over R92,000 a year, although this may not represent the full proportion as a further 13 percent did not specify their wage (COCT 2003b).

For South Africa, income is particularly relevant as the observed links between its household energy use and income levels are striking. It is estimated that the highest 20 percent households by income consume over 50 percent of all residential energy demand and mid-income electrified houses produce on average more than three times the carbon dioxide emissions of equivalent low-income households (Borcher 2004). In the City of Cape Town it has been approximated that poor un-electrified households produce 146 kilograms of carbon dioxide per month and poor electrified households 193 kilograms, compared to 751 kilograms for wealthier households (Figure 15). Additionally in the City of Cape Town it is estimated that poor households spend between 10 percent and 15 percent of their incomes on energy, compared to 3 percent to 5 percent for wealthier households (COCT 2003b). In Ekurhuleni it was observed that for energy use "a transition from third

to first world consumption patterns occurs at around the R38,000 per annum household income level" (EMM 2004:14). In Ekurhuleni 70 percent of households in the area fall under this income level and at least 78 percent are indicated to be falling under this nationally (EMM 2004; Statistics South Africa 2004). This suggests that a small proportion of households consume significantly higher levels of energy than the majority who appear to be living at 'third world' energy levels. Indeed President Mbeki has repeatedly referred to South Africa having two economies in one country, one rich and skilled and one marginalized and poor (UN IRIN 2004b).

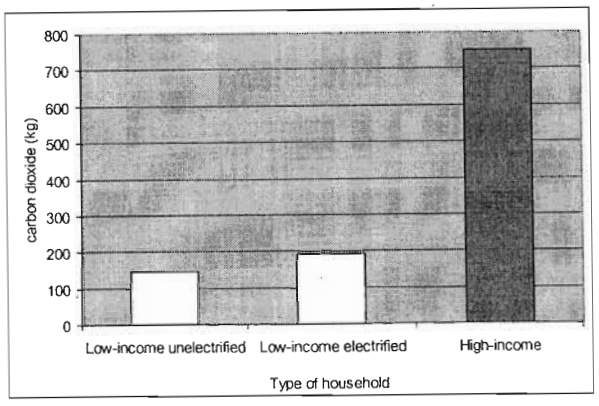

Figure 15: City of Cape Town Carbon Dioxide Emissions Per Month (*source data* COCT 2003b)

There is evidently a marked difference between income and associated energy use patterns of low and high-income groups in South Africa. Consequently, in order to effectively implement energy efficiency measures, a 'one size fits' all approach should be considered inappropriate.

Section 2.3 sets out the reasons why high-income households are important for energy efficiency. These are all applicable to South Africa, but there are two further reasons specific to the country. Firstly, high-income households are almost exclusively dependant on electricity (DME 1998, 2004a) and are therefore large contributors to peak demand (Eskom 2004a). Consequently a change in their behaviour is most likely to help delay the need to build new power stations. Secondly, high-income households in South Africa "set the trends to which other sectors of society aspire as part of the process of 'modernisation'" (Borcher 2004:2). Therefore the implications of social norms are particularly relevant in a South African context if social aspirations and class movement are becoming an important aspect of South African society.

The importance of high-income households for advancing energy efficiency and the lack of progress in addressing them has not gone unnoticed by the government. The White paper on Energy Policy states "there is...great potential to stimulate energy demand management and other strategies in middle and high-income households" but that "energy policy has...not adequately addressed energy conservation by high-income electricity-dependent households" (DME 1998:4). The Department of Mineral's and Energy's Draft Energy Efficiency Strategy reflects this by stating that the approach to household energy efficiency programme "will initially address higher income (i.e. higher usage) homes" (DME 2004a:31). Cape Town Metropolitan Council's Draft Energy Strategy says that in the mid to high-income groups there is a "saving of about 40% in energy use and CO2 emissions feasible, yet currently little being done" (COCT 2003a:6). To redress this lack of action it plans to "facilitate and promote residential energy efficiency initiatives in the mid to high-income sector" (COCT 2003a:7). However when talking to a key contributor of the strategy, it appears the initiative may be slow in implementation due to the lack of knowledge about how to approach high-income households (Haskins 2005 *pers. comm.*). In the South African NGOs, business and research sectors there is also recognition of the vital importance of high-income households to advancing energy efficiency (Anderson 2005 *pers. comm.*; Borcher 2005 *pers. comm.*; Petrie 2005 *pers. comm.*).

An engineering consultant in Cape Town also noted in his paper about household energy efficiency that "the most significant reductions in energy consumption can be effected by middle and upper income homes" and that they are estimated to consume six times that of lower income homes (Harris 2005:52). He goes on to say that despite the increase in low income housing, energy consumption in higher income homes will increase to a total of 55GWh per annum by 2014, compared to a total of 9 GWh across low-income housing stock. As a result it is estimated that in order to achieve the governments target of 10 percent reduction of forecast in residential energy consumption, higher-income homes will have to reduce their consumption by as much as 60 percent of current levels (Harris 2005).

Despite the recognition of the need to address high-income earners, energy efficiency efforts to date appear to have almost entirely been aimed at the low-income group. When researching energy efficiency in South Africa it is not uncommon to come across studies such as: 'Energy efficient lighting in low-income households; barriers and opportunities' (Clark & Bredenkamp 1998), 'Social determinants of energy use in low-income

metropolitan households in the Western Cape (Phase I)' (Mehlwana & Qase 1996) as well as 'Cost-benefit analysis of energy-efficiency in low-cost housing' (Winkler, Spalding-Fecher, Tyani & Matibe 2000) and 'Framework for improving energy-efficiency in low-income households: the case of low-income households' (Phillip 2001). No similar studies for high-income earners could be found after an extensive search, and only a couple of research papers which have already been mentioned, even refer to the need to address higher-income groups. When searching the South African Energy Research Centre library, the library attendant believed that there were no documents on high-income earners in the building and expressed surprise that they were of strategic importance to government (*pers. obs.* 2005). At the Domestic Use of Energy Conference in Cape Town during March 2005, at least seven papers concentrated directly on the issues of energy efficiency in low-income households yet only two considered even the theoretical importance of high-income households (DUE 2005).

Improving energy efficiency in low-income households is vital for many reasons. For example, incomes would be enhanced as energy costs are reduced and disposable income is proportionately increased (DME 2004b). Additionally, it would the increase health, safety and time of low-income households as reliance on dirtier, unsafe and inaccessible forms of fuel is reduced (Ward 2002). Furthermore, with the massive RDP drive to provide houses for the poor, there is a unique opportunity to make sure these houses are built and used in an efficient manner (Beyers 2000). However, the singular approach to actively tackling household energy efficiency in South Africa could be considered an inadequate strategy. By not fully engaging high-income households, or researching how to, opportunities for emission reductions, workplace energy efficiency, peak electricity demand reduction, equity and positive aspiration building will have been missed.

Furthermore by focusing on low-income households alone, energy efficiency gains within the group in the future may be undermined if energy efficiency becomes associated with poverty. It is widely considered that the main motivators for low-income earners to be energy efficient are because firstly, a large proportion of a low-income household budget will spend on energy, therefore for a family that spends 10-20 percent of its income on energy in the home, opportunities to reduce this amount are attractive even if it involves more effort (COCT 2003a, Haskins 2005 *pers. comm.*). Secondly the fuels they rely on such as coal, paraffin and biomass, are 'dirty' and a cause of many respiratory problems

(Ward 2002). Thirdly these fuels are often unsafe, with whole locations frequently being destroyed due to paraffin stoves and fourthly long distances often have to be travelled to acquire the fuel (DME 1998; COCT 2003a; Ward 2002).

These latent motivations are understandably utilised when trying to increase energy efficiency of low-income households, as it is an effective way to achieve energy efficiency results (Ward 2002; Borcher 2005 *pers. comm.*). Furthermore, national and global funding aimed at low-income households has resulted in many subsidised technologies in low-income areas particularly through schemes such as the Clean Development Mechanism (CDM). CDM is a subsidy from developed countries for energy technologies in developing countries that contributes to sustainable development, while reducing impacts on the global environment (Thorne, Rosenberg & Mqadi 2005). However, without similar interventions in high-income households there is a perceived risk that energy efficiency will become visually and socially associated with a status of poverty (Borcher 2005 *pers. comm.*; Petrie 2005 *pers. comm.*). Additionally, if development measures succeed and low-income households have the means and access to unlimited electricity then motivations for being energy efficient to improve health, convenience and finances may be diminished. Research has shown that as incomes rise household energy savings are less of a concern as it is easier to meet energy costs (Asia Pacific Energy Research Centre 2002). Therefore in the absence of a norm for energy efficiency within the higher income group, an increase in wealth could continue to be associated with the luxury of not having to worry so much about how much energy is used. Energy efficiency could be seen as the burden of being poor, rather than a social imperative or status of wealth. This fear was echoed in a paper presented as part of the Domestic Use of Energy Conference 2005 held in Cape Town. The paper by Holm referred to a study that had been done in Mmabatho in 1991 and which showed that "people aspire to live in homes similar to the higher income level groups." (2005:163). It went on to criticise the government for concentrating on the poorest of the poor for implementing energy reduction strategies rather than the higher-income groups who can afford to and have the long-term vision to make it viable. Holm suggested that high-income market is important for creating awareness and desire by all who follow suit (Holm 2005).

The importance of breaking down perceived norms of higher income households is demonstrated with one project manager's experiences in a RDP house-building project in Pietermartizburg. Each family who is getting a home has a certain, small, budget for

building their house. New cheaper, more durable and environmentally friendly materials than brick now exist, which if chosen would be as effective as brick and leave more money to spare for decoration (Vorster 2004 *pers. comm.*). However when that was offered, Mr Vorster of Dezzo Housing Project Management Solutions said the new residents unanimously turned down the suggestion. The householders said that brick was what the more affluent houses were made from and they wanted nothing else (Vorster 2004 *pers. comm.*). It is one example of how the social norms of higher income households had influenced the actions of low-income groups. If higher income households are also seen to be adopting energy efficient measures then the effects of energy efficient programmes in low-income homes would appear to have a better chance of enduring or even being built on as lifestyles improve.

As well as confirming the strategic importance of high-income households, some useful insights have been gained from key people working with energy efficiency implementation in South Africa as to why little has been done to target high-income households to date. The first major reason cited was political imperatives. The predominant government mandate is to redress the institutionalised inequalities of the past through eradication of poverty and redistribution of wealth (DME 1998; DME 2004a). Therefore any programmes which are seen to be spending money on those with high-incomes, who are also predominately white, could be politically difficult, even if it was for the greater good of the poor (Anderson 2005 *pers. comm*; Borcher 2005 *pers. comm.*; Haskins 2005 *pers. comm.*).

The second major reason cited was that high-income earners are perceived as a very difficult group to motivate behaviour change in (Borcher 2005 *pers. comm.*; Haskins 2005 *pers. comm*; Prasad 2005 *pers. comm.*). One government official stated that there is reluctance to act without proper information about how to, and because there is almost no tangible information about how best to promote energy efficiency to high-income earners, inaction has resulted (Haskins 2005 *pers. comm.*).

It is apparent that high-income households must be actively encouraged to adopt more energy efficient behaviours however it is also apparent that little is understood about their behavioural drivers. Advancing this knowledge as a matter of urgency is vital if behaviour change programmes are to be strategically informed and therefore be effective and cost efficient. Chapter 4 will discuss what can be deduced from the psychological discipline

about how to encourage energy efficient behaviour in households. Although no research could be found which looks directly at energy efficiency in high-income homes, by considering studies about household energy efficiency in developed countries, an understanding of behaviour change in households with wealthier energy consumption patterns can be gained. The chapter will look at the most relevant psychological research, theories and models. These will be used to arrive at an appropriate methodology based on Ajzen's Theory of Planned Behaviour. This model will be used to carry out a small piece of primary research that will demonstrate the use of the model.

CHAPTER 4

4 How to Influence the Energy Use Behaviour of Individuals

The field of household energy efficient behaviour is a complicated area to research. Firstly the subject does not sit easily in one discipline but is relevant to many diverse fields such as marketing, psychology, sociology, philosophy, engineering, economics and architecture (Linschiedt 2004; Attfield & Belsey 1994; Pykro & Noren 1998; University of Hawaii School of Architecture 2005, Guy & Shrove 2000). Secondly, the subject concerns understanding the nature of pro-environmental behaviour, an issue that "is such a complex one that it cannot be visualised through one single framework or diagram" (Kollmus & Agyeman 2002:1). Consequently, this mini-dissertation could have easily considered a myriad of different approaches and angles, which would have weakened its usability as a practicable piece of research and is beyond the scope of a mini-dissertation.

During an extended and wide literature review no study was found which looked specifically at the topic in hand - how to alter the behaviour of *high-income earners* in regards to household energy efficiency. However, there were many studies that looked at how to promote energy efficiency and other pro-environmental behaviours in households in high-income countries, as well as useful models and theories of behaviour change. The majority of relevant literature was based within the discipline of psychology, which presents itself as the field that has most thoroughly explored the topic. For this reason the following review of research, theory and the subsequent methodology for the primary research have focused primarily on this discipline, although the interdisciplinary nature of the topic means works of other disciplines are included where psychological methods are utilised (Pykro & Noren 1998; Linschiedt 2004). When reading the following review it is important to note that the psychological approach is necessarily concerned with individuals. Therefore although it is the household level that is being considered and usually referred to, it is the behaviour of the individuals within them who are the primary focus of analysis.

4.1 Early Psychological Research

The bulk of the existing psychological research on household energy efficiency was complied in the USA in the 1970's. The 1973 oil crisis had sparked great concern about energy supply and high prices, which spurred an unprecedented interest in energy use reduction (Hirst 1990; Pyrko & Noren 1998). The crisis put energy efficiency high on the

government agenda and as a result large amounts of funding was available, with California reportedly spending over 200 million dollars a year on energy efficiency (Archer, Aronson and Pettigrew cited Costanzo, Archer, Aronson & Pettigrew 1986). Additionally many studies were the result of funding by Demand Side Management programmes of American utilities (Pykro & Noren 1998). These resources may explain why a concerted research effort by psychologists to understand how to improve energy use in households at this time is evident (Winett, Kagel, Battalio, & Winkler 1978; Winett, Hatcher, Fort, Leckliter, Love, Riley & Fishback 1982; Olsen 1981). However, as the energy crisis diminished investments in energy efficiency waned (Phillip 2001), which may explain the apparent decrease in relevant literature after this time. Since then pro-environmental household behaviour research appears to have progressed worldwide, but in a more fragmented way. In many cases later studies do not appear to have superseded the groundbreaking insights of the 1970's and early 1980's and therefore those early studies are often still vital and relevant today.

A main objective of much of the early research was to understand the relative effects of information, monetary incentives and feedback as ways to guide and reinforce energy efficient behaviour in the home (Kohlenberg, Phillips & Proctor 1976; Hayes & Cone 1977; Winett *et al.* 1978). Due to the influence of the oil crisis on the energy research these studies only infrequently made reference to a broader environmental grounds for energy efficiency, for example Olsen (1981), and sometimes included exploring innovative approaches to saving energy such as the effects of patriotic appeals (Hayes & Cone 1977).

The chief outcome of these studies was the virtual consensus that monetary incentives were the most effective way of producing household conservation behaviour change (Hayes & Cone 1977, Kohlenberg, Phillips & Proctor 1976; Winett *et al.* 1978). In comparison, feedback was found to be slightly effective, and information was found to be relatively ineffective at directly influencing behaviour (Hayes and Cone 1977; Winnett, Kagel, Battalio and Winkler 1978).

The early studies often took a rational-economic view of individuals (Kollmus & Agyeman 2002; Linschiedt 2004). As such people were considered reasonable decision-making beings, who, with perfect information, consume market goods in a manner that maximises their utility. Consequently, only prices and income guide behaviour (Linschiedt 2004).

Furthermore, with the guidance of the invisible hand of the market, the individual quest for maximised utility will ultimately serve the collective good (Smith, 1776). The results of the studies seemed to confirm this view, indicating that money was the main motivator for behaviour change and that feedback was a useful information tool to help consumers understand the financial implications of their behaviour. These results are likely to have encouraged the opinion that the most important action government could take was to set the right prices in order to achieve sustainable consumption (Linscheidt 2004).

However fiscal measures have been highly criticised as a single solution for sustainable household energy consumption. Subsequent studies, although taking cognisance of the benefits of direct monetary incentives, noted that in many cases the incentives were too expensive to administer especially in relation to the resulting benefits in energy saving (Hayes & Cone 1981). Additionally, some research suggested that similar monetary incentives applied in different contexts produced widely varying results. For example Stern, Berry & Hirst (1985) noted that household energy conservation programmes which were identical in terms of the financial incentives used, often resulted in very different results depending on the context therefore indicating other non-monetary factors seemed to be accounting for the variance in behaviour. One programme cited in their paper was rolled out across eleven electricity companies and had a success rate of between 8 percent and 90 percent.

As well has the high financial cost of price incentives and deterrents, there is also a political cost to price interventions which made it unpopular as a tool for government to use (Costanzo *et al.* 1986; Linschiedt 2004). Additionally, the individual pursuit of gain, in many cases, has proven to conflict with the common good (Hardin 1968; Samuelson 1990): a phenomenon known as 'the tragedy of the commons' (Hardin 1968). These factors made monetary incentives unfeasible in many circumstances (Costanzo *et al.* 1986; Linschiedt 2004).

As early as 1985, researchers were highlighting the point that "the behavioural basis of consumer response to (monetary) incentives is unknown" (Stern, Berry & Hirst 1985:133). There is now research, driven primarily by sociologists, that suggests discarding the linear view of perfect rationality of individuals altogether as ineffective (Kollmus & Agyeman 2002; Blake 1999; Linscheidt 2004). Other fields have also embraced this new approach. The economist Linscheidt (2004), in his essay 'Consumer Behaviour and Sustainable

Change' explains the theory of 'bounded rationality' in regards to households. The theory states that instead of goods being consumed directly for utility, they are instead merely a production input along with many other factors such as time and skills. Households take these production inputs and process them in order to maximise utility. The theory takes account of the complexity and imperfectness of the input and processing decisions, which are often undertaken subconsciously by individuals. It also suggests that households are continuously learning and innovating with ways to maximise utility. Moreover it asserts that after basic survival needs, utilities such as joy and comfort are actually subjective, flexible and open to change. In this context price changes would be only partially and indirectly effective in altering household energy use. Further evidence from the UK suggests that higher income consumers for whom energy costs are a small percentage of overall outgoings, have an inelastic demand response to energy prices changes. In addition, lower income households would be heavily penalised for such changes (DEFRA 2003).

Due in part to the issues with monetary incentives to promote household conservation, some sought to re-explore the effects of information and feedback more deeply (Kantola, Syme and Campbell 1984; Hayes & Cone 1981). Kantola, Syme and Campbell tried to determine if it was information per se that was ineffective, or instead the form of information and method of its application. They explored the effects of Festinger's theory of cognitive dissonance (1957). The theory states that where a person is made aware of a discrepancy their beliefs and their actions, the person will seek to resolve the conflict by altering either their beliefs or their behaviour to achieve harmony (Festinger 1957). Where a belief is deeply held, it is more likely the behaviour will be changed. The results of this study were positive and this pointed to the potential importance of evoking existing moral obligations to induce behaviour change.

4.2 Attitude Research and the 'Value-Action' Gap

A second main area reflected on in early studies was that of attitudes towards energy use. A comprehensive overview of the numerous early studies on attitudes towards energy efficiency are presented by Olsen in his paper Consumers' Attitudes Towards Energy Conservation (1981). An attitude can be defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Ajzen 1985:6). The premise had been that information influences a person's knowledge, which influences their attitude, which in turn influences their behaviour. This linear

approach was made famous by Fishbein's attitude research of 1963 (Fishbein 1963). The premise has been used in the environmental education field as an 'early and widely accepted model for environmental action' (Hungerford and Volk 1990:9) as shown in Figure 16. A more recent and slightly different version of the model is referred to as AIDA (Awareness-Information-Decision-Action) and is frequently used in policy-making (Barr & Gilg 2005).

Figure 16: Traditional Attitude Model (Hungerford and Volk 1990)

One of the main outcomes of the early attitude research was the virtual consensus that in general, and also in regards to households energy efficiency, information and any resulting general positive attitudes towards an object, do not result directly in positive behaviour change towards that object (Hayes & Cone 1977; Ajzen & Fishbein 1977; Kohlenberg, Phillips & Proctor 1976; Olsen 1981; Kantola, Syme & Campbell 1982). However, Olsen points out that although general attitudes indeed appear ineffective at directly altering behaviour, they may provide an important context for other factors of intent. Additionally he notes that specific rather than general attitudes are influential to the behavioural intent to be energy efficient (1981). The issue of generality versus specificity highlights the importance of how attitudes are interpreted and used within research methodology. For example in a questionnaire, asking; 'do you think households should help the environment?' is methodologically very different from asking 'do you think households should turn off their lights when not in use?'.

Refuting the assumption that a positive attitude leads to positive action was fundamental to the question of how to encourage pro-environmental behaviour change. It is now often referred to as the 'value-action' gap and is still contemplated in current research (Kollmus & Agyeman 2002; Barr 2003). The paper 'Mind the Gap' provides a detailed analysis of the persisting issue (Kollmus & Agyeman 2002). It states that although the value-action gap is an issue on which numerous studies have been based, no definitive answer as to why this gap occurs, or how to overcome it appears to have been found. Additionally they point out that the issue is so complex that perhaps "developing a model that tries to incorporate all factors might neither be useful or feasible" although they and others have

attempted to do so (Figure 2) (Kollmus & Agyeman 2002:239). The vitally important value-action gap therefore presents opportunities for new models of behavioural prediction to be developed. However, despite a wealth of evidence supporting the existence of a value action gap over many decades, the traditional attitude model has been, and continues to be, the basis of many unsuccessful government and organisational campaigns to promote pro-environmental behaviour (Costanzo *et al.* 1986; Kollmus & Agyeman 2002; Barr 2003).

4.3 The Theories of Reasoned Action and Planned Behaviour

A key model which sought to predict behaviour and which attempted to account for some of the issues with the traditional attitude model, was the subsequent behavioural intention work of Fishbein and Ajzen. In 1980 Ajzen and Fishbein published their Theory of Reasoned Action (TRA) (Ajzen & Fishbein 1980) The TRA was based on the view that someone's behavioural intention was closely linked to their actual actions. Although not identical to actual behaviour, intention is considered a good proxy (Kurland 1995; Olsen 1981). Consequently, if you could determine what drove the behavioural intent of a person for a given subject, you could establish what was likely to drive their actions. These drivers could then be the subject of interventions to encourage behaviour change. The model tried to refine Fishbein's earlier attitude research by considering 'specific' attitudes to the behaviour, which were considered more powerful indicators than general ones (Ellis & Gaskell 1978). The TRA stated that subjective norms in combination with attitudes explained most of the variance of behaviour, and therefore was a good determinant of action (Ajzen & Fishbein 1980). In this model attitudes were defined as 'one's anticipated consequences from (an) action combined with one's evaluations of those consequences' and subjective norms were defined as 'one's understanding of what salient other people expect one to do (in regards to a particular action) and one's willingness to accept those expectations' (Olsen 1981:119).

Later Ajzen further altered the model by adding 'Perceived Behavioural Control' (PBC) to the TRA, thereby creating a new model called the Theory of Planned Behaviour (TPB) (Figure 17). PBC was added because Ajzen believed that behaviour is not totally voluntary, as was the premise of the TRA, and is in fact influenced by external controls (Ajzen 1985). The TPB maintains that a combination of attitudes, subjective norms and PBC accounts for most of the variations in a persons behavioural intent.

The definition of PBC is widely debated (Fishbein and Stasson 1990; Kurland 1995). Ajzen states that PBC "refers to peoples' perceptions of the ease or difficulty of performing the behavior of interest" (Ajzen cited Kurland 1995:299). Ajzen additionally confirmed that rather than to do with time or effort associated with performing the task, which would arguable fall under his definition of attitudes, the definition is more closely related to Bandura's self-efficacy (Ajzen cited Kurland 1995) in other words, 'I can do it if I want to' (Kurland 1995:299). However Ajzen himself states that PBC can vary across different actions or situations (Ajzen 1991). The TPB model has been tested on a number of occasions to determine the effectiveness of including PBC's, with varying results (Fishbein & Stasson 1990; Kurland 1995; Barr & Gilg 2005).

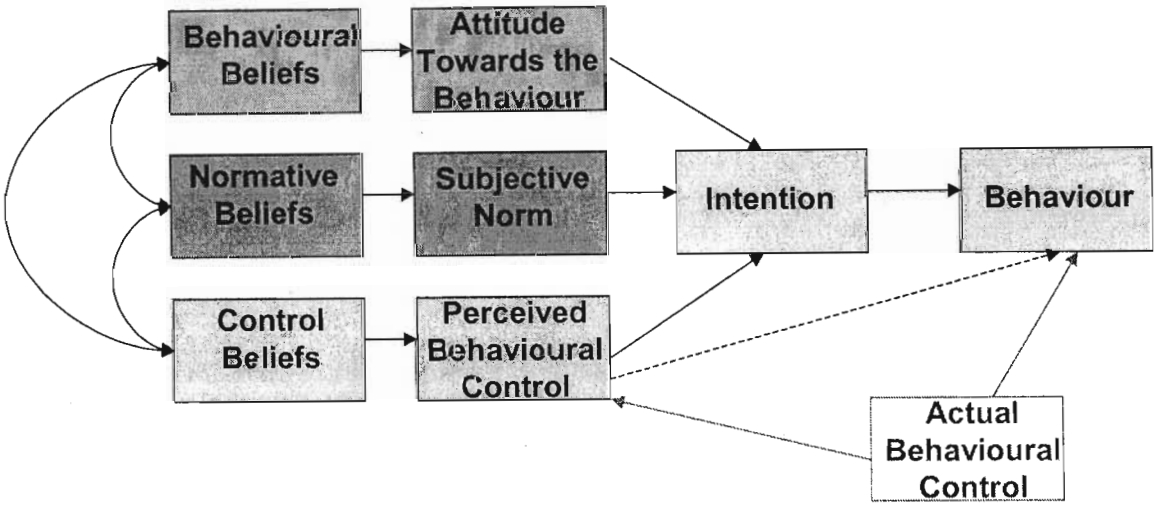

Figure 17: The Theory of Planned Behaviour (Ajzen 2005)

In general, the more positively a person views a specific behaviour (attitude), the more social pressure they feel to carry out the behaviour (subjective norm) and the more in control of the behaviour they feel (perceived behavioural control), the more likely they are to intend to carry out that behaviour (Ajzen 2002). By understanding which of these factors (and the drivers for them) are most important in predicting intention, appropriate interventions can be formulated. These will endeavour to increase the chance that someone will intend to perform the behaviour, and thus the chance of the person behaving in a certain way.

The TPB has been widely utilised by researchers to understand behaviour and to give insights into appropriate behaviour change interventions. Between 1985 and January 2004 the TPB was the theoretical base for 610 studies published in the PsycINFO

database (Francis, Eccles, Johnston, Walker, Grimshaw, Foy, Kaner, Smith & Bonetti 2004). The model has been used across a wide range of subjects from coupon use (Bagozzi, Baumgarten & Yi 1992) to ethical intentions of insurance brokers (Kurland 1995). Although the health care field appears the one of biggest user of the TPB (Francis *et al.* 2004), many studies over the decades have used the TRA or TPB to try and understand how to promote conservation behaviour (Barr 2003; Olsen 1981; Kantola, Syme & Campbell 1982; Kollmus & Agyeman 2002).

Although the TPB model is considered by many to be very useful way of understanding conservation behaviour (Kantola, Syme and Campbell 1982; Phillips, Holley, Bates and Freestone 2002), the model has weaknesses. It depends on a well-crafted questionnaire that encompasses the relevant underlying factors specific to the behaviour in question. If not performed correctly Ajzen warns "it can produce measures with relatively low reliabilities and lead to an underestimate of the relations among the theory's constructs and of its predictive validity" (Ajzen 2002:4).

Additionally, many see it as giving only part of the complex answer to what drives behaviour and as a result have made modifications to the model when necessary (Barr & Gilg 2005, Kurland 1995). Ajzen himself states that in certain circumstances modifications are desirable to more accurately fit the context being studied, although he says modifications should be made with caution (Ajzen 2005). One element considered to be missing from the TPB in certain circumstances is that of Personal Moral Obligation (Kantola, Syme and Campbell 1982, Kurland 1995). As defined by Kurland, PMO is "that which is sanctioned by one's conscience as what is one's perceived duty with respect to a specified other " (1995:309). A measure of moral obligation has since been successfully used in conjunction with the TPB creating a so-called 'modified TPB' (Kurland 1995). In regards to household energy efficiency, it has been found that these moral obligations, which are often in respect to wider society, are more influential when applied to energy efficient practices rather than capital investments in technologies (Black, Stern and Elworth 1985).

Furthermore, the presence of additional factors that influence either intention or behaviour cannot be discounted. Studies have found that further factors mediate the relationship between intentions and actions. Kantola, Syme and Campbell (1982) found age to be important influence on the intention to conserve water. The impact of habits is an area

that requires greater research consideration in relation to household energy efficiency and is not represented directly in the TPB (Kollmus & Agyeman 2002). In addition, Barr's study of households recycling shed light on the value-action gap by assessing if the influences on intention were different to those on action (Barr 2004). He used a modified Theory of Reasoned Action, which included investigating actual barriers to behaviour (Figure 18). The study indicated that the availability of a kerbside recycling bin correlated strongly with the level of recycling in a household, whereas it did not appear to influence the intention to do so. The availability of a recycling bin is an example of an 'actual behavioural control', which, although recognised visually in the TPB model (Figure 17) are not analysed directly but are instead considered to be approximated by perceived behavioural controls (Ajzen 2002).

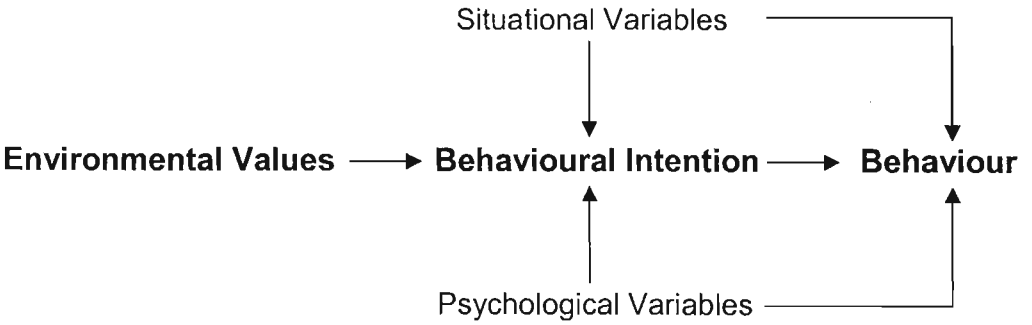

Figure 18: Conceptual Framework of Environmental Behaviour (*adapted from* Barr & Gilg 2005)

The existence of the 'value-action gap', also weakens the model. The TPB was purportedly designed to take account of the value-action gap by measuring specific rather than general attitudes, and by considering normative pressures and perceived control factors (Ellis & Gaskell 1978). However, it could be argued that because attitudes are such an important part of the TPB's representation of intention, the presumption that those intentions lead to actions, is weakened by the value-action gap.

These factors demonstrate that the Theory of Planned Behaviour is not a one size fits all solution to understanding behaviour. But despite the TPB's weaknesses, it arguably persists as one of the most useful ways of investigating behaviour with a mind on subsequent, practical, interventions (Kurland 1995; Phillips *et al.* 2002; Barr & Gilg 2005). In the absence of a definitive model and because of its wide use the TPB presents itself as a useful framework for starting to understand the energy efficiency behaviour of high-income earners. As was highlighted in the Corby Waste Not study (Phillips *et.al.* 2002),

the lack of coordinated effort researching sustainable behaviour change is a hindrance and using a model such as the Theory of Planned Behaviour in a concerted way across the field would be of great benefit.

CHAPTER 5

5 Methodology and Context

In order to understand the potential for the Theory of Planned Behaviour (TPB) as a framework for future study into improving the household energy efficiency of high-income earners, a prototype study is necessary. The aim of this study is to demonstrate and inform the potential use of the model for future research.

The study will apply the TPB to a small group of high-income earners in Pietermaritzburg, South Africa. Pietermaritzburg's status of administrative and legislative capital of Zwa-Zulu Natal, the most populated province in South Africa (Wikipedia 2005c), along with its compact yet growing business community (Zondi 2004) means it provides a suitable location to begin researching high-income earners in South Africa.

As a result of consultation, a cut off point of R100,000 household income per annum will be used (Haskins 2005 *pers. comm.*). Only respondents with a household income above this point will be considered.

Given the growing cultural complexities of the high-income group, with black membership increasing rapidly (Klein 2006), it would be valuable to analyse behavioural drivers on socio-economic basis. However, it is felt that this is not within the scope of this study but should be a vital part of any future research.

5.1 Sampling

A non-probability sampling scheme will be used as high-income earners represent a small percentage of the South African population and it is important they are identified directly to ensure enough responses are collected. In the City of Cape Town around 3 percent of households have a confirmed income of over R92,000 a year in 2003 (COCT 2003b). Consequently, potential respondents will be contacted at their place of work, which will aid collection of responses from those relevant to the study and ensure that respondents are monetarily influential household members. The sampling items will be identified in a purposive manner based on knowledge of the Pietermaritzburg commercial areas. The locations visited will include two local shopping malls and two main streets in the CBD. Each building in each area will be visited in person and questionnaires given where a willing participant is present. It is felt that this sampling process should provide at least 40

usable questionnaires. Although a larger sample would offer more robust results, given the restricted timescales and the nature of this pilot such a sample should be adequate.

Questionnaires will be collected by hand to aid response levels. A brief outline of the project will be given to all potential respondents and more detailed information on the nature of the project and how to fill in the questionnaire will be included at the beginning of the questionnaire. Any questions the respondents may have will be answered, but interaction with the researcher will be minimised to avoid respondents wishing to respond in a way they may see as favourable to the researcher.

5.2 Questionnaire

The TPB is prescriptive in how it should be administered and detailed guidelines are available from Ajzen (Ajzen 2005) as well as a detailed handbook recommended by Ajzen (Francis *et al.* 2004). A questionnaire will be specifically compiled to administer the TPB in relation to energy efficient household behaviour taking into consideration these guidelines (see Appendix 1 for the questionnaire which was compiled).

Personal Moral Obligation (as discussed in section 4.3) will be included to test its influence on intention and potential for future research.

The TPB will be administered though a questionnaire which includes both direct and indirect measures as recommended by Ajzen (2002). Ajzen is very clear that both methods test the same construct and so are expected to be correlated, but that the one does not determine the other (Ajzen 2002).

The direct measures will test the importance of the Attitudes, Subjective Norms, Perceived Behavioural Controls and Personal Moral Obligation components in influencing a person's intention to be more energy efficient in the home. The direct measures will also be used to test the model. Although Ajzen suggests that either direct or indirect measures can be used to test the model but as intentions are assessed directly it is more consistent to use direct measures (Ajzen 2005).

The indirect measures aim to probe more specifically why certain attitudes, subjective norms and perceptions of behavioural control exist. Therefore they potentially provide

very useful information for formulating effective behavioural interventions. The definitions of these indirect measurements are central to the TPB and are as follows:

- Attitudes (ATT) are defined as 'one's anticipated consequences from (an) action combined with one's evaluations of those consequences' (Olsen 1981:119). It is represented by the equation: $A \propto \sum b_i e_i$ where A is Attitude (ATT), *b* is the individual's behavioural belief an outcome will occur and *e* is the evaluation of that consequence.
- Subjective Norms (SN) are defined as 'one's understanding of what salient other people expect one to do (in regards to a particular action) and one's willingness to accept those expectations' (Olsen 1981:119). It is represented by the equation: $SN \propto \sum n_i m_i$ where *n* is the individual's normative belief in whether the person/group in question expects them to perform the behaviour in question and *m* is the motivation to comply with that expectation.
- The definition of PBC is widely debated (Fishbein & Stasson 1990; Kurland 1995) as discussed in section 4.3. However, for the purpose of this study, PBC is seen as a measure of one's belief in being able to perform a given behaviour which is line with Ajzen's guidelines (Kurland 1995). PBC is represented by the equation: $PBC \propto \sum c_i p_i$ where *c* is the individual's control belief that a certain factor would affect the ability to perform the behaviour in question and *p* is the perceived power the individual has over the factor.

Personal Moral Obligation will not be tested indirectly as there is a lack of guidance available on an appropriate equation for an indirect measurement of PMO and direct measures should be sufficient to assess whether the component should be pursued in further research.

Each item for ATT, SN and PBC are tested using two scored questions, one for the behavioural belief and one for the evaluation of that belief. Multiplying the score from both parts gives the score for that specific item and adding together all the item scores gives the overall ATT, SN and PBC scores for an individual. For a group sample, calculating the average of all the averages for ATT, SN and PBC, gives a measure of the strength and direction of each factor for the sample group (Francis *et al.* 2004).

The items testing Attitudes, Subjective Norms and Perceived Behavioural Controls will be compiled using information gathered from consulting with a variety of experts in the field of energy efficiency in South Africa, as well as information gained from literature. The major assumptions which have been gathered about high-income earners in respect to energy efficiency, and which will be incorporated into the questionnaire are:

- It is too much bother for high-income earners to investigate energy efficiency (North 2004 *pers. comm.*)
- There is a low level of awareness on environmental issues, how to be energy efficient, what costs and savings are involved and where to buy energy efficient products (North 2004 *pers. comm.*; Prasad 2004 *pers. comm.*)
- There is no environmental ethic in the high-income group only socio economic motivations (Haskins 2004 *pers. comm.*)
- Money savings are not a motivation for high-income earners (Anderson 2004 *pers. comm.;* Borchers 2005 *pers. comm.*; Haskins 2005 *pers. comm.*)
- Energy efficient technology is too difficult to get hold of and it has a reputation for poor reliability (Petrie 2005 *pers. comm.*; Prasad 2005 *pers. comm.*)

Questions will be posed using unipolar Likert scales using seven points, as recommended by Ajzen (2005). Although a bipolar scale utilising the semantic differential theory is optimal, investigating and compiling adjectives was not within the scope of this study but could be employed in the future (Ajzen 2005).

For example;

Most people who are important to me think I should be more energy efficient

completely true: 1 2 3 4 5 6 7 : completely false

Positive and negative scales and question topics will be inter-dispersed within the final questionnaire, as recommended, to avoid standardised responses (Ajzen 2002).

The dependant variable, intention, will be measured though a question asking respondents directly of their intention to be energy efficient in the home. An energy audit measuring self-reported current behaviour will be created by adapting a previously administered audit for the 21 Households pilot project in Cape Town which included assessing energy use in households (Amathemba Environmental Management Consulting 2003).

5.3 Statistical Method

The results of the questionnaire will be quantitatively examined through descriptive methods and through the statistical application SPSS (Statistical Package for the Social Sciences) which is a recognised package for analysing raw data. Descriptive statistics are an important way to get information from the TPB data and will be used to analyse responses at a component and item level (Francis *et. al.* 2004). A reliability analysis will be performed on the data and simple correlations, regressions and multiple regressions will be used to both test the model and analyse what items contribute the most explanation to variability of intention.

Key lessons from implementing the model will be noted throughout the research and summarised along with overall conclusions about the theoretical and practical advantages and disadvantages of the model.

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8 Personal Communications

Anderson, Megan
Sustainable Energy Africa
The Green Building,
9B Bell Crescent Close,
Westlake Business Park,
Tokai,
7945
South Africa

Borchers, Mark
Sustainable Energy Africa
The Green Building,
9B Bell Crescent Close,
Westlake Business Park,
Tokai,
7945
South Africa

Haskins, Craig
Environmental Management Department
City of Cape Town
Private Bag X4
Parow
7499
South Africa

North, Tamara
University of Cape Town
Rondebosch

7701
South Africa

Petrie, Belynda
One World Sustainable Investments
Unit 14, 8th Floor,
4 Loop Street
Cape Town
8000
South Africa

Prasad, Gisela
Energy Research Centre
Faculty of Engineering and the Built Environment
University of Cape Town
Rondebosch
7701
South Africa

Vorster, Anton
Dezzo Housing Project Management Solutions
No. 8 Posselt Road,
New Germany,
3620
South Africa

9 Appendix 1 - Questionnaire

Is your household income over R100,000 p/a? Yes No

Introduction

This questionnaire forms part of an academic study designed to understand the views of high-income earners towards household energy efficiency. Household energy efficiency is all about reducing the amount of energy used in your home from electricity, coal, wood or other energy sources. This can either involve practices such as turning off lights and appliances when not in use, turning down your geyser temperature and only heating rooms in use or it can involve installing energy efficient technologies such as solar water heaters, draft proofing, energy efficient appliances geyser insulation, low flow shower heads (which reduce hot water use) or energy efficient light bulbs.

This questionnaire seeks to understand your personal opinions on household energy efficiency. Please answer **all** of the questions. **There are no right or wrong answers so please answer as honestly as possible from your personal point of view.**

Please circle your answers to the following questions along the lines of the following example:

Example

If you think the weather today is quite bad then circle 2 if you think it is extremely good circle 7.

The weather today is;

Bad :	1	2	3	4	5	6	7	:Good
	extremely	quite	slightly	neither	slightly	quite	extremely	

Please note the descriptions of the scales change so please read the questions carefully. Please do not circle more than one number. Please answer ALL questions.

Thank you for participating

If I adopt more energy efficient practices and technologies in my home I will;

1a) Save money on my energy bill

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

1b) Saving money on my energy bill is:

extremely important: 1 2 3 4 5 6 7 :extremely unimportant

2a) Have to spend a lot of money

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

2b) Spending a lot of money on energy efficiency is:

acceptable : 1 2 3 4 5 6 7 : unacceptable

3a) Have a less comfortable house

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

3b) Having a comfortable house is:

extremely important: 1 2 3 4 5 6 7 :extremely unimportant

4a) Have to take much more time and effort finding out how to be energy efficient in my home

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

4b) Have to take much more time and effort in my daily routine

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

4c) Spending more time and effort is:

unacceptable : 1 2 3 4 5 6 7 : acceptable

5a) Provide a good example to others

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

5b) Providing a good example to others is:

extremely important: 1 2 3 4 5 6 7 :extremely unimportant

6a) Have an impact on the overall energy situation

extremely likely : 1 2 3 4 5 6 7 : extremely unlikely

6b) Having an impact in the overall energy situation is:

extremely important: 1 2 3 4 5 6 7 :extremely unimportant

7a) If I installed energy efficient technologies, the chances they would be reliable are:

extremely good : 1 2 3 4 5 6 7 : extremely bad

7b) Reliable energy efficient technology is:

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

8a) If I installed energy efficient technologies, the chances they would save me money is:

very good : 1 2 3 4 5 6 7 : very bad

8b) Saving money on my energy bill is:

extremely important: 1 2 3 4 5 6 7 :extremely unimportant

9) I intend to develop more energy efficient habits in my home this year

strongly agree: 1 2 3 4 5 6 7 : strongly disagree

10) I intend to install energy efficient technologies in my home this year

strongly agree: 1 2 3 4 5 6 7 : strongly disagree

11) I intend to find out more about energy efficiency in the home this year

completely true: 1 2 3 4 5 6 7 : completely false

12) Being energy efficient in the home is:

extremely important: 1 2 3 4 5 6 7 :extremely unimportant

13) Global warming and air pollution will affect me negatively in the next couple of years

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

14) I have experienced negative effects of global warming or air pollution in the past

very frequently : 1 2 3 4 5 6 7 : very rarely

15) I would invest in energy efficient technologies if the pay back period though savings on my electricity bill was:

6 months:

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

1 year:

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

3 years:

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

5 years:

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

10 years or over:

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

16) Most people who are important to me think I should be more energy efficient

completely true: 1 2 3 4 5 6 7 : completely false

17) I know many other people who are trying to be more energy efficient

completely true: 1 2 3 4 5 6 7 : completely false

18) I would feel embarrassed if people thought I wasn't trying to save energy in my home

completely true: 1 2 3 4 5 6 7 : completely false

19) If I saw my neighbour was being energy efficient, such as having solar panels fitted, I would be more likely to do the same

extremely unlikely : 1 2 3 4 5 6 7 : extremely likely

20) If I wanted to be energy efficient I could

definitely false : 1 2 3 4 5 6 7 : definitely true

21) The following factors would make it much easier to be energy efficient:

a) Knowing where to find information on how to be energy efficient in my home

completely agree: 1 2 3 4 5 6 7 : completely disagree

b) Knowing where to buy energy efficient technologies

completely agree: 1 2 3 4 5 6 7 : completely disagree

c) Knowing which energy efficient technologies are best for me

completely agree: 1 2 3 4 5 6 7 : completely disagree

d) Knowing how to deal with any technical issue that arise from energy efficient technologies

completely agree: 1 2 3 4 5 6 7 : completely disagree

e) Not having to change any of my current habits

completely agree: 1 2 3 4 5 6 7 : completely disagree

f) My family not having to change any of their current habits

completely agree: 1 2 3 4 5 6 7 : completely disagree

g) Knowing that any energy efficient technology I bought would be properly installed

completely agree: 1 2 3 4 5 6 7 : completely disagree

h) Knowing any energy efficient technology I bought would be reliable

completely agree: 1 2 3 4 5 6 7 : completely disagree

22) The following individuals/groups/mediums believe that I should be more energy efficient:

a) Family

not at all : 1 2 3 4 5 6 7 : definitely

b) Friends

not at all : 1 2 3 4 5 6 7 : definitely

c) Neighbours

not at all : 1 2 3 4 5 6 7 : definitely

d) Colleagues

not at all : 1 2 3 4 5 6 7 : definitely

e) Social groups

not at all : 1 2 3 4 5 6 7 : definitely

f) Government

not at all : 1 2 3 4 5 6 7 : definitely

g) Adverts

not at all : 1 2 3 4 5 6 7 : definitely

h) Newspapers

not at all : 1 2 3 4 5 6 7 : definitely

23) Finding information on how to be energy efficient is:

extremely difficult : 1 2 3 4 5 6 7 : extremely easy

24) Changing my energy use habits in the home would be very difficult

completely agree: 1 2 3 4 5 6 7 :completely disagree

25) It would be very difficult for me to get the rest of my family to change their energy use habits in the home

completely agree: 1 2 3 4 5 6 7 :completely disagree

26) Knowing where to buy energy efficient technologies is:

extremely difficult: 1 2 3 4 5 6 7 : extremely easy

27) Knowing which energy efficient technologies are best for me is:

extremely difficult: 1 2 3 4 5 6 7 : extremely easy

28) Dealing with any technical issue that arises from energy efficient technologies would be:

extremely difficult: 1 2 3 4 5 6 7 : extremely easy

29) Getting energy efficient technologies properly installed is:

extremely difficult: 1 2 3 4 5 6 7 : extremely easy

30) Finding reliable energy efficient technology is:

extremely difficult: 1 2 3 4 5 6 7 : extremely easy

31) In general, I care what the following individuals/groups/mediums think I should do:

a) Family

not at all : 1 2 3 4 5 6 7 : definitely

b) Friends

not at all : 1 2 3 4 5 6 7 : definitely

c) Neighbours

not at all : 1 2 3 4 5 6 7 : definitely

d) Colleagues

not at all : 1 2 3 4 5 6 7 : definitely

e) Social groups

not at all : 1 2 3 4 5 6 7 : definitely

f) Government

not at all : 1 2 3 4 5 6 7 : definitely

g) Adverts

not at all : 1 2 3 4 5 6 7 : definitely

h) Newspapers

not at all : 1 2 3 4 5 6 7 : definitely

32) For moral reasons it is important for individuals to conserve energy in their homes

completely agree: 1 2 3 4 5 6 7 :completely disagree

33) I feel a moral obligation to conserve energy in my home

completely agree: 1 2 3 4 5 6 7 :completely disagree

34) The following individuals/groups have been very important in shaping my views towards energy efficiency in the home:

a) Family

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

b) Friends

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

c) Schooling

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

d) Neighbours

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

e) Colleagues

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

f) Government

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

g) Adverts

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

h) Newspapers

extremely unimportant: 1 2 3 4 5 6 7 :extremely important

35) If I was more energy efficient I would feel better about the environmental impact of my lifestyle

completely true: 1 2 3 4 5 6 7 : completely false

36) How many energy efficient practices do you do consciously on a daily basis?

.....

Please list them

37) How many different sorts of energy efficient technologies have you installed in your home? .....

Please list them

38) Have you conducted any monitoring of energy consumption within your house?

Yes No Don't Know

39) Do you know how much you spend on electricity every month?

Yes No

If yes how much Summer R..... Winter R.....

40) Please rank in order the which activities costs you the most on your electricity bill;

1)Water heating 2)Space heating 3) Lighting 4)Cooking

41) Does your house have designated responsibilities for conserving energy use?

Yes No Don't Know

42) Do you have a prepaid meter or monthly billed meter?

Pre paid Monthly Don't Know

43a) If you have security lights are they on a timer, sensor or manual?

N/a Manual Sensor Timer Don't Know

43b) Are they altered according to the seasons and light?

Yes No Don't know N/A

44) Do you have insulation in your roof?

Yes No Don't know

If yes what kind .....

45) Do you have underfloor heating?

Yes No Don't know

46) Do you use fans or air-conditioning in the summer?

Yes No Don't know

47) Are any of your appliances labelled energy efficient?

Yes No Don't know

If yes how many?

48a) Do you know what temperature your geyser is set at?

Yes No Don't know

48b) Is it insulated?

Yes No Don't know

48c) Does it have a timer?

Yes No Don't know

49a) Do you use a tumble dryer?

Yes No Don't know

50b) If yes, when do you use it

Only when it rains All the time Never

50) Do you leave appliances such as TV and computer on stand by?

Often Sometimes Occasionally Never

51) Have you draft proofed your house?

Yes No Don't know

END OF QUESTIONNAIRE

THANK YOU FOR YOUR PARTICIPATION

COMPONENT B

Component B contains the results, discussion of results and recommendations in the style of a paper for a journal article. The paper has been written with the Journal of Energy in Southern Africa in mind.

Author's Guidelines

The author's guidelines of the Journal of Energy in Southern Africa stipulate that:

- All contributions should be submitted in English.
- Text should be single-spaced, with a wide left-hand margin.
- Tables and figures should be numbered consecutively in Arabic numerals and given captions; they should all be referred to in the text.
- Standard international (SI) units must be used throughout.
- An abstract of the article should be provided, not exceeding 500 words, resuming the contents and conclusions of the article. A maximum of six keywords should be included, reflecting the entries the author(s) would like to see in the annual Subject Index published in the last issue for the year. The keywords may consist of more than one word each, but the entire concept should not be more than 30 characters long, including spaces.
- References should be made according to the Harvard (author, date) system.

Encouraging the Household Energy Efficiency of High-Income Households – Towards an Approach for South Africa.

Abstract

High-income households are important for advancing energy efficiency in South Africa and yet little is known about how to encourage lower energy use behaviour in this group. This paper sets out the case for wide-scale research into how to encourage high-income earners to be more energy efficient behaviour in the home. The paper also summarises a prototype study that explores the potential of the Theory of Planned Behaviour as a framework for such research. The results suggest that the model has promise. Attitudes, Subjective Norms and Perceived Behavioural Controls accounted for 63.7 percent of the variance in intention of the sample to be energy efficient in the home. However, the study indicates that the model, although useful, is not sufficient for understanding actual behaviour and informing appropriate practical interventions. Consequently a number of suggestions are made as to how to design a future research approach including more emphasis on actual behaviour change and the use of supplementary qualitative investigation.

Keywords: Energy efficiency, High-Income

Background

The Energy Problem and the Role of Household Energy Efficiency

Energy underpins the existence of all living systems; it is also the basis of human economic development (EIA 2004; Baumert, Bandhari & Kete 2002). The quest for economic development has caused the demand for energy to steadily soar, with energy consumption rising by 1200 percent between 1850 and 1970 (Worldwatch Institute 2004) and more than doubling since then (EIA 2004). Fossil fuels have been the basis of this demand and currently provide 88 percent of all energy (BP 2004). The strong link between economic growth and fossil fuel use has resulted in carbon dioxide emissions also roughly doubling since 1970 (EIA 2004). The negative impacts of fossil fuel use on the health and security of the planet and its inhabitants are beginning to be felt, and more clearly understood (BBC 2005; G8 2005; IPCC 2001). However, the global demand growth for energy is projected to continue and the basis of this expansion is expected to be from fossil fuels, unless key changes are made to energy use (IEA 2004a, 2004b).

Energy efficiency is seen as one of the most important ways of de-coupling economic growth from carbon emissions. Energy efficiency can be defined as doing the same function or better, with less energy (EPA 2005). That requires rethinking the way energy is used so that energy waste is reduced. Energy efficiency involves the utilisation of energy efficient technologies and changing energy use patterns.

Households are considered key to achieving global energy efficiency targets (G8 2005). Most notably, they directly consume a large proportion of between 15 percent and 25 percent of primary energy (UN 1999). Furthermore, it could be argued that households *should* be involved in national energy efficiency drives. Public participation in change is an important element of democracy: without the acceptance and involvement of the general public, fundamental change could be both difficult and undemocratic (Curtis 2002; Dewey 2004).

Household Energy Efficiency in South Africa and the Role of High-Income Earners

In South Africa, households are recognised as vital to achieving energy efficiency targets (DME 1998, 2004a; Eskom 2004). South Africa is one of the world's highest consumers of energy and producers of carbon emissions (Dunn 2002; BP 2003; DME 2004b) and South African households consume 17 percent of the country's total energy demand (DME 2004a). In its Draft Energy Efficiency Strategy, the government sets out its aims to cut household energy use by 10 percent of forecast by 2014 (DME 2004a).

High-income earners are a particularly important target group for advancing household energy efficiency. Firstly, they are high energy consumers with higher income households estimated to consume six times that of lower-income homes (Harris 2005). Secondly on the basis of higher consumption, it would only be just that high-income earners reduce their use in order to reduce emissions. Thirdly, those with higher incomes provide normative examples to those aspiring wealthy lifestyles; if energy efficiency is targeted too exclusively to the fuel-poor, energy efficiency could become associated with poverty rather than being socially desirable (Veblen 1899; Hirsch, Kett & Trefil 2002; Reinstaller & Sanditov 2003). Fourthly, theories such as critical mass and tipping point indicate that high-income earners have the income to be potential early adopters of energy efficient technologies, providing stimulus to emerging markets (Oliver, Marwell & Teixeira 1985; Gladwell 2002; Bratton, Bennett & Robson 2003). Lastly, where the high-income reflects an influential occupation, they have the opportunity to effectively transfer ideas of energy efficiency to their place of work, thereby expanding energy efficiency (Haskins 2005 *pers. comm.*).

The importance of high-income earners to achieving energy efficiency has been recognised by the South African government and other organisations. The White Paper on Energy Policy states that "there is...great potential to stimulate energy demand management and other strategies in middle and high-income households" but that "energy policy has...not adequately addressed energy conservation by high-income electricity-dependent households" (DME 1998:4). The Department of Mineral's and Energy's Draft Energy Efficiency Strategy reflects this by stating that the approach to household energy efficiency programme "will initially address higher income (i.e. higher usage) homes" (DME 2004a:31). Cape Town Metropolitan Council's Draft Energy Strategy says that in the mid to high-income groups there is a "saving of about 40 percent in energy use and CO2 emissions feasible, yet currently little being done" (COCT 2003:6). To redress this lack of action it plans to "facilitate and promote residential energy efficiency initiatives in the mid to high-income sector" (COCT 2003:7).

Despite the recognition of the need to address high-income earners, energy efficiency efforts to date appear to have almost entirely been aimed at the low-income group. When researching energy efficiency in South Africa it is not uncommon to come across studies such as: 'Energy efficient lighting in low-income households; barriers and opportunities' (Clark & Bredenkamp 1998), 'Social determinants of energy use in low-income metropolitan households in the Western Cape (Phase I)' (Mehlwana & Qase 1996) as well as 'Cost-benefit analysis of energy-efficiency in low-cost housing' (Winkler, Spalding-Fecher, Tyani & Matibe 2000) and 'Framework for improving energy-efficiency in low-income households: the case of low-income households' (Phillip 2001). No similar studies for high-income earners could be found after an extensive search, and only a couple of research papers (which have already been mentioned) even refer to the need to address higher-income groups. When searching the South African Energy Research Centre library, the library attendant believed that there were no documents on high-income earners in the

building and expressed surprise that they were of strategic importance to government (*pers. obs.* 2005). At the Domestic Use of Energy Conference in Cape Town during March 2005, at least seven papers concentrated directly on the issues of energy efficiency in low-income households yet only two considered even the theoretical importance of high-income households (DUE 2005).

Improving energy efficiency in low-income households is vital for many reasons. However a single-minded approach to energy efficiency could be considered risky and unsuitable.

Not only is the current approach to *who* should be targeted narrow, but it could be argued that the approach of *how* to target households to be more energy efficient is also not as effective as it could be. The government's Energy Efficiency Strategy recognises that changing household behaviour is key to achieving the goal and points out that "many energy saving decisions lie at the individual household level" (DME 2004a:14). It goes on to state that consequently an "ongoing awareness drive will be necessary" to achieve its energy efficiency goals (DME 2004a:14). However, research suggests that this may not be an effective way to alter behaviour. The disconnect between general attitudes and actual behaviour is well documented. There is a virtual consensus that those who demonstrate general positive attitudes towards an object are no more likely to alter their behaviour towards that object (Kohlenberg, Phillips & Proctor 1976; Ajzen & Fishbein 1977; Hayes & Cone 1977; Olsen 1981; Kantola, Syme & Campbell 1982). Consequently it is suggested that awareness-raising should not be relied on to bring about behaviour change (Olsen 1981; Kollmus & Agyeman 2002; Barr & Gilg 2005). The complexity and wide ranging implications of bringing about the required change in behaviour cannot be underestimated (Kollmus & Agyeman 2002). Marketing theory suggests that targeting similar groups of individuals in distinct ways, based on information specific to them, would be appropriate (Wedel & Kamakura 1999).

When formulating appropriate interventions, suitable theories of behaviour change should be utilised. Furthermore, the drivers and barriers to increasing energy efficiency of high-income earners should be researched in a concerted and focused way and on a large scale. One popular model that may provide a structure for this research is Ajzen's Theory of Planned Behaviour. The following research aims to explore the potential use of this model when developing a South African understanding of what drives the household energy efficiency of high-income earners.

The Theory of Planned Behaviour

Icek Ajzen's Theory of Planned Behaviour (TPB) (Figure 1) is a widely used quantitative psychological model of behaviour change. The TPB has its roots in Fishbein and Ajzen's Theory of Reasoned Action (TRA), which states that Attitudes (ATT) and subjective norms (SN) explain most of the variables of behavioural intention. Behavioural intention is considered a good, although not identical, proxy for actual behaviour (Olsen 1981, Ajzen & Fishbein 1980). Ajzen later added Perceived Behavioural Control (PBC) to the TRA to form the TPB. Ajzen believed that PBC would account for the important role played by non-volitional situational barriers to action and as such would give the model more explanatory power (Ajzen 1988).

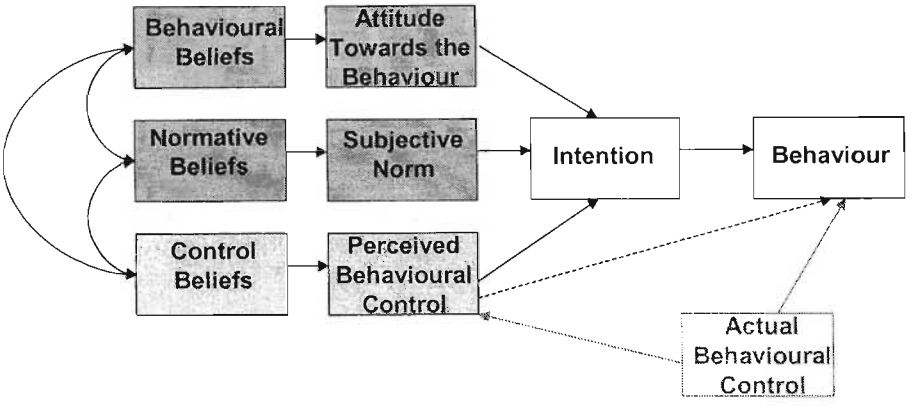

Figure 1: The Theory of Planned Behaviour (Ajzen 2005)

In general, the more positively a person views a specific behaviour (Attitude), the more social pressure they feel to carry out the behaviour (Subjective Norm) and the more in control of the behaviour they feel (Perceived Behavioural Control), the more likely they are to intend to carry out that behaviour (Ajzen 2002). By understanding which of these factors (and the drivers for them) are most important in predicting intention, appropriate interventions can be formulated which aim to increase the chance that someone will intend to perform a behaviour, and thus the chance of the person behaving in a certain way.

Ajzen states that in certain circumstances modifications to the TPB are desirable to more accurately fit the model to the context being studied (Ajzen 2005). One modification that has been successfully made is the inclusion of a measure of a person's moral obligation to the behaviour in question (Kantola, Syme and Campbell 1982, Kurland 1995).

The TPB has been widely utilised by researchers to understand behaviour and to give insights into appropriate behaviour change interventions. Between 1985 and January 2004 the TPB was the theoretical base for 610 studies published in the PsycINFO database (Francis, Eccles, Johnston, Walker, Grimshaw, Foy, Kaner, Smith & Bonetti 2004). Many studies over the decades have used the TRA or TPB to try and understand how to promote conservation behaviour (Barr 2003; Olsen 1981; Kantola, Syme & Campbell 1982; Kollmus & Agyeman 2002).

Methodology and Context

The Theory of Planned Behaviour (TPB) was used in a prototype study testing its potential for use in future research into improving the household energy efficiency of high-income earners. The study took place in the CBD of Pietermaritzburg, South Africa. Pietermaritzburg's status of administrative and legislative capital of Zwa-Zulu Natal, the most populated province in South Africa (Wikipedia 2005), along with its compact yet growing business community (Zondi 2004), means it provides a suitable location to begin researching high-income earners in South Africa.

For the purpose of this study, and as a result of consultation, 'high-income' was considered to be any household with an income of R100,000 per annum or over (Haskins 2005 *pers. comm.*).

Personal Moral Obligation was tested alongside the conventional components of Attitudes, Subjective Norms and Perceived Behavioural Controls to assess whether it has any use in future research.

Given the growing cultural complexities of the high-income group, with black membership increasing rapidly (Klein 2006), it would be valuable to analyse behavioural drivers on socio-economic basis. However, it is felt that this is not within the scope of this study but should be a vital part of any future research.

Direct and Indirect Measures

The TPB was administered though a questionnaire which included both direct and indirect measures. The direct measures tested the importance of the Attitudes, Subjective Norms, Perceived Behavioural Controls and Personal Moral Obligation components in influencing a person's intention to be more energy efficient in the home. The direct measures were also used to test the model as recommended by Ajzen (Ajzen 2005). The indirect measures tested the same construct as the direct measures, but did so by testing responses to items that were believed to influence the components. Therefore the indirect measures are important as they give insights into *why* certain components may influence behaviour.

The indirect measures are specifically defined as follows:

- Attitudes (ATT) are defined as 'one's anticipated consequences from (an) action combined with one's evaluations of those consequences' (Olsen 1981:119). It is represented by the equation: $A \propto \sum b_i e_i$ where A is Attitude (ATT), *b* is the individual's behavioural belief an outcome will occur and *e* is the evaluation of that consequence.
- Subjective Norms (SN) are defined as 'one's understanding of what salient other people expect one to do (in regards to a particular action) and one's willingness to accept those expectations' (Olsen 1981:119). It is represented by the equation: $SN \propto \sum n_i m_i$ where *n* is the individual's normative belief in whether the person/group in question expects them to perform the behaviour in question and *m* is the motivation to comply with that expectation.
- The definition of PBC is widely debated (Fishbein and Stasson 1990; Kurland 1995). However, for the purpose of this study, PBC is seen as a measure of one's belief in being able to perform a given behaviour which is line with Ajzen's guidelines (Kurland 1995). PBC is represented by the equation: $PBC \propto \sum c_i p_i$ where *c* is the individual's control belief that a certain factor would affect the ability to perform the behaviour in question and *p* is the perceived power the individual has over the factor.

Attitudes, Subjective Norms and Perceived Behavioural Controls were tested using both direct and indirect measures. Personal Moral Obligation was not tested indirectly as there is a lack of guidance available on an appropriate equation for an indirect measurement of PMO. Additionally, because the aim of including PMO was to gain an initial understanding of it potential impact it was felt direct measurement would be sufficient at this point.

Questionnaire

The items tested in the questionnaire were compiled through interviews with a variety of experts in the field of energy efficiency in South Africa as well as information gained from literature. The information was translated into a series of item level questions (Table 1). The items were tested by two questions, one representing the behavioural belief and one the evaluation of that belief. 25 items were identified resulting in 50 indirect measure questions.

The direct and indirect measures were tested in the questionnaire using seven point unipolar likert scales as recommended by Ajzen (2002) and following appropriate

guidelines (Ajzen 2002, Francis *et al.* 2004). For example, positive and negative scales and question topics were inter-dispersed within the final questionnaire to avoid standardised responses (Ajzen 2002).

For example;
Most people who are important to me think I should be more energy efficient
completely true: 1 2 3 4 5 6 7 : completely false

The dependant variable, intention, was measured though a question asking respondents directly of their intention to be energy efficient in the home. Actual behaviour was measured though a self-reporting questionnaire at the end of the main questionnaire. This was based on a questionnaire used in the 21 Households project in Cape Town which measured energy use of a number of households (Amathemba Environmental Management Consultancy 2003).

Table 1: Item Summary

Attitude items tested (in relation to household energy efficiency)	**SN items tested (in relation to household energy efficiency)**	**PBC items (in relation to household energy efficiency)**
Saving money Spending money Comfort of house Time and effort finding out how Time and effort in daily routine Providing a good example Impact on the overall energy situation Reliability of technologies Savings from technologies	Family Friends Neighbours Collegues Social Groups Government Adverts Newspapers	Finding information Changing habits Changing family members' habits Knowing where to buy EE technologies Knowing appropriate EE technologies Dealing with technical issues Getting EE technologies properly installed Finding reliable technnologies
Example two questions testing an item	**Example two questions testing an item**	**Example two questions testing an item**
If I adopt more energy efficient practices and technologies in my home I will;	**The following individuals/groups think I should be more energy efficient:**	**The following factor would make it much easier to be energy efficient;**
Have a less comfortable house:	Family,	Knowing where to find information on how to be energy efficient in my home:
extremely unlikely : 1 2 3 4 5 6 7 : extremely likely	not at all : 1 2 3 4 5 6 7 : definitely	completely agree: 1 2 3 4 5 6 7 :completely disagree
Having a comfortable house is:	**In general, I care what the following individuals/groups think I should do:**	**Finding information on how to be energy efficient is:**
extremely important: 1 2 3 4 5 6 7 :extremely unimportant	Family, not at all : 1 2 3 4 5 6 7 : definitely	extremely difficult : 1 2 3 4 5 6 7 : extremely easy

Data Collection

A non-probability sampling scheme was used as high-income earners represent a small percentage of the South African population and it was important they were identified directly to ensure enough responses were collected. Potential respondents were contacted at their place of work, which also aided collection of responses from relevant parties and ensured that respondents were monetarily influential household members. The sampling items were identified in a purposive manner based on knowledge of the Pietermaritzburg commercial areas. The locations visited included two local shopping malls and two main streets in the CBD. Each building in each area was visited in person and questionnaires were given where a willing participant was present.

Of the 60 questionnaires that were accepted, 32 were retrieved and 27 of these were useable. Of the five unusable questionnaires two were incomplete and the respondent could not be revisited and three had household incomes under the cut-off point of R100,000 per annum. The 28 non-retrieved questionnaires were not completed by the respondents in enough time. Given the restricted time scale and funds for the study, along with need for sometimes up to five repeat visits to ensure a response from the 27 usable questionnaires, supplementary canvassing was not possible. As the aim of the study was to explore the possible use of the theory of planned behaviour as a framework for future

study, it was decided that the sample was sufficient for analysis to be performed on this basis and key lessons for the future researchers complied.

Statistical Method

Descriptive and inferential statistics were used to gain insights from the sample. Although 27 is a small sample number for parametric tests, it conforms to the guidelines for parametric tests set out by George Washington University whereby the "dependent variable is an interval or ratio measure, the population distribution is approximately normal or the sample size exceeds 25, and there is homogeneity of variance" (2001:1) with the significance of Levene statistics above 0.05 for all components and graphs showing the data to be approximately normal. However, as the data is only just within the limits it is suggested that the results only be seen as a potential indication of the use of the model and as a reference for further, more expansive research.

The results were examined using a combination of processes outlined in Statistical Techniques in Geographical Analysis (Shaw & Wheeler 2000) and the approach set out in the researchers handbook (Francis *et al.* 2004) recommended by Ajzen (Azjen 2005) whereby the results are converted into scores, bivariate correlations performed to test the data and the results analysed through multiple regression.

The direct measures were used to verify the data and the model. Ajzen suggests that either direct or indirect measures can be used to test the model but as intentions are assessed directly it is more consistent to use direct measures (Ajzen 2005). Indirect measurements, which were much more numerous and detailed, were analysed at a component and item level to gain insights into the reasons behind behavioural intentions.

The data was reworked before use. The self-reported behaviour questionnaire was converted into scores and an overall behaviour score calculated for each respondent. Where positive and negative scales had been reversed in the questionnaire to avoid standardised responses, the resulting scores had to be transposed so that scores were consistent.

Results

Data Consistency

Direct measure within-group correlation: An initial zero level bivariate correlation was performed on the direct measures to check for significant correlations between Attitudes (ATT), Subjective Norms (SN), Perceived Behavioural Controls (PBC) and Personal Moral Obligation (PMO) (Table 2). PMO and SN were significantly correlated (Pearson 0.507, sig. 0.01). The correlation analysis also showed that PMO was not correlated to intention and that SN was, therefore it was decided that PMO should be excluded from further analysis and the TPB model tested in its original form.

ATT and PBC were also correlated (Pearson –0.414, sig. 0.05). The negative correlation indicates that, as may be expected, those from the sample who felt more confident about being energy efficient in the home are more likely to have a positive attitude towards it.

Table 2: Direct measure component correlations

		Attitude	Subjective Norms	Perceived Behavioural Control	Personal Moral Obligation
Attitude	Pearson Correlation Coefficient	1	0.242	**-0.414**	0.245
	Significance	-	0.224	0.032	0.218
Subjective Norm	Pearson Correlation Coefficient	0.242	1	-0.075	**0.507**
	Significance	0.224	-	0.709	0.007
Perceived Behavioural Control	Pearson Correlation Coefficient	**-0.414**	-0.075	1	-0.159
	Significance	0.032	0.709	-	0.428
Personal Moral Obligation	Pearson Correlation Coefficient	0.245	**0.507**	-0.159	1
	Significance	0.218	0.007	0.428	-

Internal consistency: A reliability analysis tested the internal consistency of all direct and indirect responses within ATT, SN and PBC. Table 3 shows the high internal consistency for SN and PBC. ATT was slightly below the recommended Cronbach Alpha of 0.70 (Kurland 1995) but above the 0.60 recommended by Francis et al. (2004).

Table 3: Internal consistency between direct and indirect measures

	Cronbach's Alpha
Attitude	0.6491
Subjective Norms	0.9327
Percieved Behavioural Controls	0.7226

Simple bivariate correlations and linear regressions were performed between the indirect and direct measures to ensure the indirect measure was assessing the same construct as the direct measure. A lack of correlation could indicate problems with how the questions were understood (Francis *et al.* 2004). The results were positive for ATT and SN (Table 4). The lack of correlation for PBC points to a misunderstanding of the direct level questioning of this component, which deals with self-efficacy.

Table 4: Correlations between direct and indirect measures

	Pearson Correlation Coefficient	Significance	R^2
Attitude	0.694	0.000	0.482
Subjective Norm	0.635	0.000	0.403
Perceived Behavioural Controls	-0.144	0.475	n/a

Descriptive Statistics

For ease of interpretation the data below are reported as an average score representing the equations in the methodology and as average scale scores reflecting the unipolar scales. Thereby 7 is the highest score, 1 is the lowest and 4 represents indifference. For ATT, the higher the score, the more positive the attitude and for SN the higher the score,

the higher the social pressure to be energy efficient in the home. For PBC the level of negative control was measured as in the handbook by Francis et al. (2004), therefore the higher the score, the higher the perceived lack of control.

Component level: The indirect aggregate scores in Table 5 show the sample has a fairly strong negative control perception of being energy efficient in the home, a fairly strong positive attitude towards the behaviour but a slightly weak perception of social pressure towards household energy efficiency. The direct scores for intention showed that across the group, the intent to be more energy efficient in the home was moderately high In contrast the actual behaviour score was fairly low with an average of 30 points being scored out of a possible 75, representing 39.5 percent of possible points being achieved.

Table 5: Component level results

	Average Score	Average Scale Score
Attitude	25.1	5.0
Subjective Norms	15.5	3.8
Perceived Behavioural Control	26.5	5.1
Intention	n/a	4.8

Item level: Table 6 shows the frequencies of scale scores for each component. Within the PBC component the highest two items (weakest control items), related to energy efficient technologies; knowing which is best (5.6) and its reliability (5.6). For SN the lowest SN was seen to come from neighbours (3.5) and newspapers (3.5). For ATT the highest item average score was regarding reliability of energy efficient technology; therefore respondents thought reliability was both important and that the chances that it would be reliable was quite high. The next highest scoring items showed a positive attitude to the potential monetary savings from energy efficient technologies (5.6) and to the potential impacts of adopting energy efficient practices and technologies on the overall energy situation (5.6).

Table 6: Frequencies of item level scale score averages by component

	0.0 - 0.9	1.0 - 1.9	2.0 - 2.9	3.0 - 3.9	4.0 - 4.9	5.0 - 5.9	6.0 - 7.0
Attitude	0	0	0	0	4	5	0
Subjective Norms	0	0	0	5	2	1	0
Percieved Behavioural Control	0	0	0	0	2	6	0

Inferential Statistics

Behaviour

Self reported behaviour was not significantly correlated with any direct or indirect measure, including intention (Table 7).

Table 7: Behaviour correlation results

		Attitude	Subjective Norms	Perceived Behavioural Control	Intention
Behaviour	Pearson Correlation Coefficient	0.122	-0.150	-0.184	-0.102
	Significance	0.544	0.455	0.358	0.612

Intention

Direct measures: The direct measurement data were analysed to understand which components were preliminarily highlighted as most useful in explaining intention. Analysis showed that ATT correlated strongly with intention and accounted for 57 percent of the variation in intention (Pearson 0.754, R^2 0.569, sig. 0.01). SN also correlated, to a lesser degree, with intention (Pearson 0.436, R^2 0.190 sig. 0.05). At this level, PBC did not have a significant relationship with intention.

Model test: Together, the direct measures accounted for 63.7 percent of variance in intention (sig. 0.01) indicating potential for the model.

Indirect measures: To deduce which of the specific indirect belief measures were most important in explaining intention, a multiple stepwise regression was used as it is a useful way of synthesising large amounts of variables into those that are likely to most effectively explain the variance of the dependent variable at the highest level of significance (Shaw & Wheeler 2000). The model highlighted three items; whether technologies would bring monetary savings (ATT), knowing which technologies were most appropriate (PBC), and whether energy use habits would have to be changed (PBC). In other words, those with stronger intentions to be energy efficient in the home had a more positive attitude to the potential monetary savings from energy efficient technologies, felt a lack of control over being able to choose the right technologies and felt confident about changing their habits in the home. These three items together explained 54.2 percent of the variance in intention. The standardised beta values and significances can be seen in Table 9

Table 8: Stepwise multiple regression – results of best model

Component	Item	Standarised Beta	Significance
Attitudes	Monetary savings from energy efficient technologies	.384	.015
Perceived Behavioural Control	Knowing which energy efficient technologies are most suitable	.377	.017
Perceived Behavioural Control	Changing energy use habits in the home	-.321	.038

Discussion and Limitations

The results indicate that the Theory of Planned Behaviour has potential for investigating the household energy efficiency behaviour of South African high-income earners in the future. The model test indicated that direct measures accounted for 63.7 percent of variance in intention. At an aggregate level the Theory of Reasoned Action would have, however, proved just as useful because Perceived Behavioural Control added nothing significant to the ability of the model to account for intention variability. This concurs with findings of many researchers such as Boyd and Wandersman (1991) and Randall and Gibson (1991). Furthermore Subjective Norms accounted for only some variability. Therefore Attitudes were revealed to be the most important predictor of intention for the sample, with it alone accounting for 56.9 percent of variances in intention using direct measures. Although the results are promising, due to the small sample these figures can

only be seen as a potential indication of the use of the model and a basis on which further research can draw from.

Attitudes were shown to be the most important predictor of intentions and within the component, how strongly someone viewed the likelihood of saving money from being energy efficient, was the most influential. This contradicts the assumption in the field that those with high-incomes are not motivated by the opportunity to save money though energy savings (Anderson 2004 *pers. comm.;* Borchers 2005 *pers. comm.*; Haskins 2005 *pers. comm.*).

When analysing indirect measures the indications were slightly different. Although Perceived Behavioural Controls (PBC) were not correlated to intention at a component level, analysis at an item level revealed that two of the most significant items were within the PBC component. The fact that direct PBC measures were not correlated to the indirect PBC measures may help explain the difference in significance at the two levels. It is possible that the direct PBC question 'If I wanted to be more energy efficient in my home then I could be', although adhering to guidelines, may have been too vague and not understood by respondents to reflect the same construct as indirect PBC questions. Issues of consistency within the PBC questions is one experienced in many other studies and has been in part attributed to the lack of a definitive classification for PBC in the first place (Randall & Gibson 1991; Kurland 1995)

The results showed that Personal Moral Obligation (PMO) was strongly correlated to Subjective Norms (SN) and as with SN itself, the scores reflected a relative indifference of the respondents to moral obligation. It is possible that questions relating to moral issues are perceived as similar to those dealing with the influence of 'others'. As defined by Kurland, PMO is "that which is sanctioned by one's conscience as what is one's perceived duty with respect to a specified other"(1995:309). In that respect both SN and PMO are both concerned with whether intentions are being influenced by an 'other' force, be it family, newspapers or on the other hand guilt, duty or the perception of others. The links between SN and PMO in regards to household energy efficiency requires further research as at present no conclusions can be drawn about the importance of PMO to the intentions of high-income earners to be more energy efficient in the home. If PMO and SN are found to be linked, SN questions could perhaps encompass questions regarding moral influences on intentions.

The results also showed there was no statistical link between behaviour and either intention, ATT, SN or PBC, at either a direct or indirect level. This reflects criticisms of the model as highlighted by Kurland (1995) and Barr and Gilg (2005) that it is ineffective at contributing enough to the understanding of actual behaviour. It also supports the existence of a value-action gap; that a stronger intention does not necessarily reflect proportionate action (Kollmus & Agyeman 2002; Barr & Gilg 2005). The conversion of intention to behaviour is so vital to making tangible improvement in energy efficiency in high-income households that any future study must attempt to overcome these issues (see section below for model lessons).

Although the drivers of intention are the basis of the model, useful information can also gained from the response scores alone (Francis et al. 2004). The averaged scores indicated that within the sample there was a strong intention and positive attitude towards household energy efficiency, but weak perceived social pressure to be more energy efficient.

A useful insight from both inferential and descriptive analysis, is that technologies seem to play an important role in intention. Of the three strongest explanatory items of intention, two were concerned with technologies. Being positive about saving money through energy efficient technologies was an important attitudinal factor. Furthermore, those who believed that knowing which technologies were most suitable was important, yet difficult, had stronger intention levels. Response scores also showed that the sample group viewed technology as an important issue and had a low level of confidence regarding them.

The issue of habits was also shown to be important, both regarding the respondents and their wider families. It is therefore an area that would benefit from further investigation, possibly considered in a manner separate from the confines of the PBC component.

Model Lessons and Recommendations

Through administering the TPB in this study, key recommendations for future research have been gathered.

Model modification: The model in its pure form, although a useful framework, is not entirely appropriate for directly understanding how to *change behaviour* as its emphasis is on intention. Finding urgent ways to invoke actual changes in the household energy use behaviour of high-income earners must be the goal of any research in this area. Therefore a model such as the TPB that has clear weaknesses predicting actual behaviour, is not on its own sufficient. This study echoed findings of many others, that there is a disconnect between intention and behaviour. It is vitally important to understand what mediates that gap. If actual barriers to behaviour, such as affordable technology or knowledge are extensive in regards to energy efficiency behaviour, then they must be identified and understood. The sample group in this study certainly demonstrated that it is not the intent to be energy efficient that is lacking but rather the actual action. Consequently, an approach more similarly resembling Barr & Gilg's (2005) work would be more appropriate (Figure 2). They have modified the TPB so that it examines where influences on intention and behaviour are the same and where they are different. Such an approach should also consider more closely aspects such as the influence of existing habits, which were highlighted in this study as potentially important.

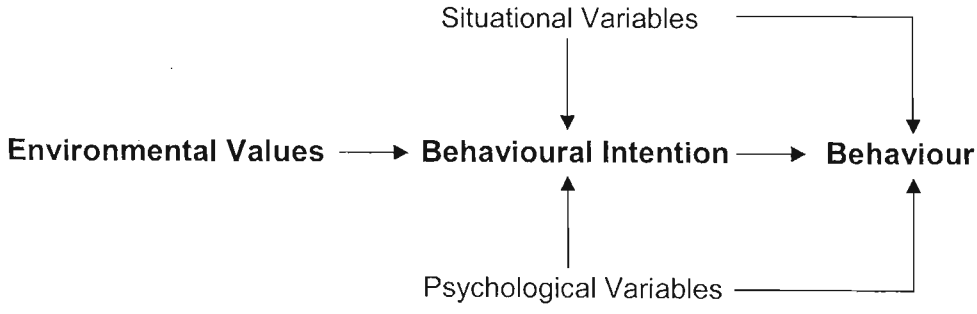

Figure 2: Conceptual Framework of Environmental Behaviour (*adapted from* Barr & Gilg 2005)

Removing direct measures: The study highlighted that although direct measures are useful in indicating which components may influence intention, without understanding the more specific drivers of intention at the indirect level, the former has very little practical

application and important insights could be overlooked. On that basis it could be contended that because Ajzen states direct and indirect measures evaluate the same construct, direct measures could be excluded when applying the model (2002). Instead indirect measures could be concentrated on, thereby making the model both quicker to administer and less confusing to interpret. This is an approach that has been taken in other studies (Kantola, Syme & Campbell 1982; Kurland 1995).

Increasing response rates and scale: This study only aimed to provide insights for future research rather than results that can be relied on for programme or policy formation. Future research should therefore be performed on a much larger scale with large sample across a variety of locations in South Africa and taking account of the complexities and influences of the growing cultural differences within the high-income group (Klein 2006). The low response rate and difficulties encountered trying to retrieve usable responses may have been a result of the length of the questionnaire. Future questionnaires should possibly be condensed by including less items and could be administered though a pre-arranged interview to aid response rates.

Supplementary qualitative research: It is the opinion of the author that given the complexity of behavioural analysis, a purely quantitative approach to the subject is not appropriate. Much greater depth would be gained from an holistic study that combined a quantitative analysis along the lines of the TPB, along with a qualitative aspect, perhaps in the form of in-depth focus group discussions. These focus groups could also provide the basis of identifying the items to be tested as recommended by Ajzen (2002). The addition of a qualitative aspect may allow for a slightly condensed quantitative questionnaire, which could possibly be mailed/e-mailed to a larger number of people.

Combine renewable energy with energy efficiency: Finally, given the nature of the energy issue it is unhelpful to consider renewable energy and energy efficiency separately. Others have also called for an amalgamation of the terms when considering how practically carbon can be reduced and 'sustainable energy' has been put forward as an alternative (CPMR 2005).

Conclusions

South Africa has a difficult challenge ahead if it is to fundamentally alter its energy use patterns and reduce associated emissions. High-income earners are strategically important to reducing household emissions for a variety of reasons. Yet despite their recognised importance, almost nothing appears to have been done to understand how to encourage behaviour change in this group. If South Africa is to reach its energy efficiency goals then high-income earners must become part of a more strategic plan of who is being targeted. Furthermore, the method by which these groups are being targeted must also be the subject of strategic planning if resources are to be used effectively.

The government's Energy Policy and the Energy Efficiency Strategy stated that in respect to changing public opinion, awareness raising will continue to be the main approach adopted. Past research indicates that this would be a mistake. Any increase in awareness is very unlikely to lead to a change in behaviour, which certainly is the final aim of any energy efficiency intervention.

What should replace awareness raising, in respect to high-income groups, is unclear. The issue of behaviour change is very complex and it seems that even very recent research provides more questions than answers. South Africa is not alone in having no body of

research into energy efficiency in high-income households. Even if research becomes available in other countries, for the results to be wholly relevant, a South African specific study must be undertaken.

This study aimed to set out the case for large-scale focused research into what drives the behaviour of high-income households in respect to energy efficiency. It also aimed to investigate the Theory of Planned Behaviour as a possible model to be used. The results indicate that the model has potential as the basis of a quantitative framework. However it is recommended that it is modified to include an analysis of the factors influencing actual behaviour and not just intention, along the lines of Barr & Gilg's work (2005). If used alone, even with some modification, the model appears to lack the ability to give enough insights into the complexities of actual behaviour. Therefore it is recommended that qualitative investigation is also used, perhaps in the form of focus groups. Wide-scale research that combines the use of a modified TPB with qualitative investigation should result in vital information that can help shape strategic and effective energy efficiency programmes.

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Personal Communications

Haskins, Craig
Environmental Management Department
City of Cape Town
Private Bag X4

Parow
7499
South Africa