Reported Behavioural Patterns of Electricity Use among Low-Income Households in Makhanda, South Africa

Uzziah Mutumbi *, Gladman Thondhlana and Sheunesu Ruwanza

Department of Environmental Science, Rhodes University, P. O. Box 94, Makhanda 6140, South Africa; g.thondhlana@ru.ac.za (G.T.); ruwanza@yahoo.com (S.R.)

* Correspondence: u.mutumbi@gmail.com

Abstract: Households consume up to 20% of overall electricity consumption globally; hence, they are important role players in efforts towards promoting sustainable consumption. Research on electricity use behaviour is important for informing intervention strategies; however, relative to developed countries, research on this subject is lacking in developing countries where electricity access is limited. In South Africa, electricity use behaviour among poor neighbourhoods remains little studied and understood. This study was carried out among low-income households in Makhanda, South Africa, characterised by high poverty and unemployment rates, low education levels, and limited access to basic services. Using a self-reporting approach, electricity use behaviour of low-income households was assessed against a list of common household electricity use actions. A survey of 297 households was conducted. The findings show mixed results, with households reporting both good electricity use behaviour (e.g., cooling down hot food before refrigeration and using washing machines on full load) and wasteful actions (e.g., leaving appliances on standby). Our results show that electricity use behaviour was influenced by socio-psychological values including universalism, benevolence, hedonism, and power. Some of the reported electricity behavioural patterns are consistent with those previously reported among high-income households. The theoretical and practical implications of these results are discussed.

Keywords: low-affluent households; electricity consumption; reported behaviour; interventions

1. Introduction

Globally, households consume a notable amount of electricity, with estimates suggesting that the residential sector accounts for up to 20% of overall electricity consumption [1]. Electricity is a basic social and economic need, but unsustainable use has several socio-economic and environmental repercussions [1,2]. The socio-economic and environmental costs of unsustainable electricity consumption are quite considerable, and can be seen in carbon dioxide emissions [3], grid instabilities [4], and energy poverty [5–7]. Government authorities and electricity managers from fossil-based economies, such as South Africa, are therefore faced with a challenge of finding alternative pathways for promoting sustainable electricity consumption to reduce carbon emissions and ensure stable electricity supply [8].

Similar to global trends, the South African residential sector consumes more than 20% of the total national electricity usage, thereby making it a major carbon emitter [9] and an important sector when considering efforts for promoting transition to sustainable electricity use. Consistent with major challenges facing the emergent BRICS economies (Brazil, Russia, India, China, and South Africa), the country also faces a seemingly double-sided challenge of simultaneously providing sufficient electricity and mitigating the negative effects of greenhouse emissions [3]. The country is among the top 20 greenhouse gas emitters globally [10]. A recent report by the South African electricity public utility company, Eskom, highlights that its power-generating plants produce high levels of carbon emissions and consume a lot of water [11], and this is also linked to Eskom’s aging infrastructure. At the local level, municipalities are in huge debts amounting to about ZAR...
28 billion (US$1.87 billion) and are at risk of being disconnected from the national grid by Eskom [9,11]. Despite the high rate (about 90%) of household access to electricity, the country remains energy insecure and a high proportion of households are energy poor [12]. The country is often burdened by recurrent power cuts, which disrupt service delivery and social lives [11,13]. A recent Eskom report shows that the company is in a financial crisis and urgently needs a government bailout of more than ZAR 50 billion (US$3 billion) in 2021 to maintain its operations—an amount that is unsustainable, given the struggling economy [11].

Considering the substantial amount of electricity consumed by the household sector, households are an important target for sustainable consumption debates and practice. Designing pathways towards sustainable electricity consumption at the household level can be achieved by an understanding of household electricity use behaviour [14,15]. A focus on reported behaviour for mapping sustainable electricity use pathways is important for several reasons. First, the benefits of sustainable electricity use accrue directly to the user because of reduced electricity bills [2]. Second, technical interventions such as retrofitting efficient equipment and construction of more infrastructure cannot address unsustainable consumption, and hence, are bound to be short-term solutions considering the predicted growth of most developing economies [16]. In South Africa, recurrent imbalances between electricity supply and demand, and the resultant power cuts, provide sufficient evidence that technical interventions may be useful but insufficient to address the country’s electricity instability [11]. Third and related to this, the expenses of retrofitting and building new infrastructure are quite substantial and beyond the reach of financially strapped governments and power utilities, as noted earlier, hence the need for investing in behavioural change interventions. Fourth, although regulations such as electricity efficiency labelling can result in the production of energy-efficient gadgets as seen in the USA, European Union, and Australia [17], many developing country households may not be able to afford these gadgets, or if they can, the propensity to buy more electronic appliances with increasing disposable income may result in consumption overtaking efficiency [18].

Therefore, behavioural change is arguably a cheaper and more sustainable way to achieve electricity conservation [19,20] and, in turn, address grid instability and energy poverty. Behaviour change has low implementation costs [19], can benefit users directly, is long-term, and can reduce municipal electricity bills, which means financial savings can be used on other service delivery issues [21]. However, there is still limited work on residential electricity consumption in South Africa apart from a few noteworthy exceptions [22,23]. Existing research on household electricity is useful but has limited scope with generic outcomes, which does not provide a complete picture of sustainable electricity consumption patterns. For example, examining electricity use behaviour among high-income households only [22] is not comprehensive given that most people in developing countries reside in low-income areas, thus the need for studies in these areas. Other works examine behaviour on specific gadgets only, such as the use of electric heaters [7] or home appliances with standby functions including satellite boxes and stereos [24]. The dispersed literature on household electricity use behaviour makes it difficult to understand and develop useful frameworks for encouraging sustainable electricity use. Consequently, not much investment has been directed towards the promotion of sustainable electricity use at the household level [25], despite South Africa’s intensive electricity use and huge environmental footprint. The diversity of income groups in South Africa (low, middle, and high) requires an understanding of electricity use behaviour from different socio-economic groupings using similar measures. Understanding the electricity use behaviour patterns of low-income households has both scholarly and practical value. First, it can be compared with similar work among high-income households, which could allow detection of behavioural trends and generalisation of inferences, bearing in mind that different sets of conclusions can be drawn, and corresponding policy recommendations crafted. Second, a focus on low-income groups can allow identification of problematic behavioural patterns,
which can be used to inform and support targeted interventions and policies for transition to sustainable electricity use behaviour. Third, from a moral standpoint, user-driven behaviour change interventions can contribute to a reduction in energy poverty, and financial savings from sustainable electricity consumption, which can improve household welfare. This is particularly important in South Africa, where energy poverty is widespread, with nearly half (47%) of the population considered to be energy poor (lack access to or cannot afford basic energy services) [9]. A previous study [26] found that low-income households in Soweto township in Johannesburg used more than 66% of their income on electricity purchase, which is quite substantial given that they earn low incomes. More often than not, poor households resort to unclean and unsafe alternative sources of energy such as kerosene and fuelwood [27,28]. Thus, crafting of effective options for ensuring energy security and household welfare improvement should consider the electricity use behavioural patterns of low-income households.

1.1. Understanding Behaviour

Wasteful electricity use practices in the household can be attributed to human behaviour [15,29]. Household daily electricity consumption practices have a direct impact on electricity demand [30]; hence, wasteful behaviours pose serious implications for both the household financial budget and the national grid [11,21]. Unsustainable electricity use practices can result in energy poverty [5,12] as a result of high electricity expenditures relative to income [12], as well as power cuts when electricity demand outstrips electricity supply, and can adversely impact the environment due to carbon emissions [11]. Hence, encouraging sustainable electricity use behaviour at household level can minimise these adverse impacts [14]. For example, switching off the lights in unoccupied rooms or turning off the geyser when not in use can result in substantial electricity savings [31]. Such electricity use actions need to be repeated until they become habits.

Habits are defined by [32] as actions (substrates of behaviour) that are repeated and internalised until they become involuntary and largely enacted without awareness or decisive thinking. Daily habitual electricity use practices such as leaving appliances on standby mode and leaving fans and lights on in unoccupied rooms can result in nescient power losses. According to [33], electricity users are generally reluctant to completely shut down certain appliances such as computers, satellite boxes, and stereo when they are not in use. This is partly due to forgetfulness, lack of awareness, laziness, unwillingness to compromise convenience, and the need for personal comfort [34]. However, leaving appliances on standby mode results in “vampire losses” because appliances consume electricity when they are not in use [35,36]. The literature suggests that standby electricity consumption can account for a significant proportion of household electricity consumption ranging from as low as 4% [37] to as high as 40% [36].

Several countries in the European Union have come up with several electricity efficiency policies [17]. However, with nearly half of the South African population considered poor and residing in low-income areas [38], most poor households might not be able to afford electricity-efficient gadgets. Moreover, while technical interventions such as improving the efficiency of electronic gadgets are useful, they do not address wasteful electricity use behaviours [39]. This therefore calls for research in low-income areas where several factors such as use of old inefficient appliances [26], low electricity price [9], lack of awareness on electricity saving tips and wasteful use practices [22], and illegally connected backyard dwellings [30] are at play and could shape electricity use behaviour.

1.2. Determinants of Behaviour

There are several factors that contribute to environmentally relevant behaviour (Figure 1), and by extension, these factors can determine the successes and longevity of behavioural intervention programmes [20]. Amongst these are socio-demographic factors, personal values that individuals hold, and situational factors [14].
1.2.2. Values

Values are desirable trans-situational goals that work as guidelines for people’s behaviour in social settings [43]. Personal values such as quality of life, comfort, and effort are major determinants of attitudes and behavioural choices among individuals and can assist in determining the probability of a person to act in the interest of the environment [44]. A comprehensive understanding of personal value factors can be understood from measuring the level of importance given to the 22 Quality of Life (QoL) factors suggested by [45]. These value factors can be further summarised and classified into ten domains, which are universalism, stimulation, hedonism, achievement, self-direction, security, power, benevolence, conformity, and traditionalism [45]. These factors can be further categorised into two main dimensions. The first dimension is openness to change versus conservatism, which differentiates values that stress independence (e.g., stimulation and self-direction) from values that emphasise conservatism (e.g., traditionalism and conformity) [43]. The second dimension differentiates self-transcendent values (e.g., altruistic values such as...
benevolence and universalism) from self-enhancement values (e.g., egoistic value factors such as power and self-enhancement value factors such as security) [43–45].

It is assumed that openness to change and altruism can lead to pro-environmental behaviour because people with such attributes tend to receive new ideas and environmentally friendly information more easily than those who have conservative dispositions and self-enhancement values [6]. Conservative people have a lower probability of engaging into pro-environmental behaviour because they like maintaining existing routines and are less likely to buy into new behaviours [43]. A study conducted by [22] found out that altruistic people are more likely to save electricity owing to their openness to new ways of doing things and their concern about protecting the environment than those who hold self-enhancement and conservatism values. However, in Mtutu and Thondhlana [33], it was found that most personal values were not associated with environment-friendly behaviour, and the few exceptions yielded very weak relationships.

Within this context, this study aims to examine the reported electricity use behaviour among low-income households in Makhanda, in the Eastern Cape province of South Africa. Given that some work has been conducted in high-income households within big cities of South Africa, we aimed to contribute knowledge regarding electricity use behaviour among low-income households in a small town. Such information can help to identify trends for informing behavioural interventions that can contribute towards electricity conservation. We acknowledge that a more direct approach, such as comparing household electricity use behaviour between different income groups (low, medium, and high) could have been more robust; however, our aim was to contribute knowledge from low-income households as part of a broader transdisciplinary project on promoting electricity conservation among low-income households. The following three research questions guided the research:

• What is the reported electricity use behaviour?
• What are the determinants of electricity use behaviour?
• What do the findings mean for inferences on pro-environmental behaviour, and practical implications for local-level transition to sustainable electricity use?

The study hypothesises that (i) socio-economic factors such as gender, age, income, and education are more likely to have a positive influence on electricity use behaviour, and (ii) people with self-transcendent values such as openness to change and altruism are more likely to save electricity than those with self-enhancement values. These hypotheses are consistent with previous studies examining electricity use behaviour [22]; however, in this study we aim to test them in low-income households where the socio-economic context is different. The paper is structured as follows: Section 2 focuses on the materials and methods, whilst results and discussions are presented in Section 3, and conclusions are presented in Section 4.

2. Materials and Methods

2.1. Study Area

The research was conducted among low-income households in Makhanda (33°18’33.0” S and 26°31’36.0” E), located in the Eastern Cape province of South Africa (Figure 1). The estimated population of Makhanda is about 70,000 [46]. Consistent with most towns in South Africa, Makhanda’s mostly poor population has increased since the country’s transition from apartheid to democratic rule in 1994. The increasing population size is attributed to an influx of people from surrounding communal black homelands into the town [47].

The Eastern Cape province is the poorest in South Africa, characterised by low levels of education and a high unemployment rate of about 33% [46]. It is estimated that only 15% of the total population has tertiary education, 5.5% are regarded as totally illiterate, while only about a quarter (24%) has National Senior Certificate (the highest qualification before tertiary level studies) [46]. Due to the high unemployment levels, a significant proportion (41%) of households receive government social grants, with recipients of social grants being higher for low-income than high-income households [46]. Like other South African
cities, Makhanda’s urban and geographical arrangement is characterised by apartheid spatial settings [47]. The Western side is made up of high-income households while the Eastern side accommodates low-income households. The Eastern side is generally characterised by low education levels, high unemployment levels, and small homesteads and houses. Houses consist of three types, namely, privately built blocks, state-built houses, and informal houses (locally known as shacks), made from an assortment of scrap metal, iron sheets, and wood and dagga. The low-income groups generally earn below ZAR 2500.00 (approximately $167) per month, which reflects a low social status, while the middle- and the high-income earn double and four times this amount, respectively [46]. Because of the above-mentioned low education levels, high unemployment, and a high population of low-income earners, Makhanda is ideal for examining the key questions posed in this study.

2.2. Sampling and Data Collection

This study is part of the broader two-year Leading Integrated Research for Agenda 2030 in Africa (LIRA 2030) funded project. Ethics approval for this project was granted by the Rhodes University Ethics Committee (Review Reference No. 2019-0720-750). LIRA 2030 is a 5-year research programme that aims to support the production of “high-quality, inter- and transdisciplinary, solutions-oriented research on global sustainability by early career scientists in Africa”. The sampling strategy was informed by the need to recruit participants willing to be part of a two-year research project. The households were selected via convenience sampling using social clusters. In convenience sampling, the research selects participants who are conveniently located and those who are willing to cooperate [48]. Hence, this approach was employed in this study as it upholds volitional choice, that is, voluntary participation of participants. Although findings are not generalisable [48], the intention of this study was not to make generalisations but to acquire insights that can be transferable in our understanding of a complex and subjective research question of electricity consumption behavioural patterns. Data collection took place between October and November 2019, as part of the baseline data in the broader above-mentioned LIRA 2030 project.

The research targeted household heads and, in their absence, the eldest adult member of the family with a fair understanding of how electricity is used in their respective household. In total, 297 households selected from Tantyi, Joza, Pumlanzi, Vukani, and Fingo suburbs participated in the study. A structured questionnaire designed to obtain socio-demographic information, personal values, and daily self-reported electricity consumption actions was used for data collection. The questionnaire was pretested for errors, clarity, and consistency among 35 households. The study recruited local volunteers (electricity champions) to help in the data collection process. These volunteers were pre-trained at Rhodes University before data collection, to ensure a general understanding of the nature of the research, and how to interpret responses and record them properly. There were no expected variations in responses between data collectors as all questions were closed-ended, and the respondents chose from a given set of answers.

Measures

- Socio-demographic variables

  The questionnaire captured socio-demographic information of the respondents and their household structures including age, gender, household size, education level, social grants status, employment, household size, number of rooms in the house, whether they are recipients of government free electricity, and ownership of appliances.

- Electricity use behaviour

  Electricity use behaviour was measured from a set of 20 electricity use actions (Appendix A) related to the use of household appliances including entertainment gadgets (e.g., computers, desktops, and televisions) and kitchen appliances (e.g., refrigerators,
stoves, and microwaves). These electricity use actions were drawn from previous studies in South Africa [22,23] and represent common areas of electricity use in many households. The questions asked how often the respondents engaged in given actions. For example, “How often do you use matching pot sizes and hot plates on a stove?” Electricity use behaviour was then scored on a five-point Likert scale (1 = never; 2 = rarely; 3 = sometimes; 4 = usually; 5 = always). Responses were computed from the 20 electricity use actions, with average scores close to 1 and 5 representing poor and good electricity behaviour, respectively.

- **Values**

  Participants were asked to self-report the degree of importance they attached to a list of personal value orientations (22 QoL factors) on a five-point Likert scale (1 = unimportant; 2 = less important; 3 = important; 4 = very important; 5 = critical), following [45]. The QoL factors were further classified into nine value domains, which are universalism, self-direction, benevolence, security, hedonism, stimulation, power, achievement, and traditionalism. These were further divided into four high-order values, namely, self-transcendence, openness to change, self-enhancement, and conservation, following [22]. Finally, individual scores were combined under each domain with average scores close to 1 and 5 representing a low and high disposition to the particular value orientation.

2.3. **Data Analyses**

  Data were analysed through STATISTICA (Version 13). Socio-demographic data were summarised in tables using descriptive statistics. Mean scores for each electricity use action were calculated to indicate electricity consumption behaviour. Frequency of electricity use behaviour was indicated through modal responses. Action scores for appliances owned by less than 10% of the sample were excluded in the analysis as this information cannot provide useful insights into potential interventions applicable to the whole community. Given that data were coded, non-parametric tests were used for analytical statistics. Differences in mean behaviour scores between males and females were tested through a Mann–Whitney test. A Spearman’s correlation analysis was performed to find out the direction and strength of relationships between electricity use behaviour, and socio-demographic and personal value factors. A regression analysis was used to find out the determinants of electricity saving.

3. **Results and Discussions**

3.1. **Socio-Demographic Profile of the Participants and Their Households**

  Of all the participants, there were more males (65%) than females (35%) (Table 1), and the mean age for all participants was 47 ± 17 years. The average household size for the research sample was 4.3 ± 2, with adults (18 to +65 years) constituting 67% of the targeted population. Participants were characterised by low levels of education, with about 20% having no education at all, 14% with primary education only, 47% with secondary education, and only 19% having attained either a diploma or a degree.

  Less than half (47%) of the participants were formally employed, and out of these just above half (56%) received a monthly income of less than ZAR 3500 (US$233), about 43% ranged between ZAR 3500 and ZAR 10,000 (US$233–US$667), and only 1% had income between ZAR 10,000 (US$667) and ZAR 30,000 (US$2000). About 79% of all the participant households received government social grants, which suggests limited employment opportunities and high poverty levels. About 75% lived in their own formal building structures, 21% in government Reconstruction and Development Programme houses (RDPs), and about 4% in informal building structures. Roughly 64% of the households had separate household units within their homesteads, and out of these, only 35% had separate electricity meters for different units. A sizeable proportion (40%) of the households received monthly Free Basic Electricity (50 kWh) from the government, which is given to poor households. Apart from electricity, households used multiple sources of energy with more than half (51%) using gas, 41% (paraffin), 7% (firewood), and 1% (solar).
Table 1. Socio-demographic characteristics of participants and households.

| Variable                                      | Values                  |
|-----------------------------------------------|-------------------------|
| Gender (%) of household head                  |                         |
| Female                                        | 35%                     |
| Male                                          | 65%                     |
| % household heads                             | 53%                     |
| Mean age of respondent (years)                | 47 (±17)                |
| Mean household size                           | 4.3 (±2)                |
| Below 5 yrs                                   | 9%                      |
| 6–17 yrs                                      | 24%                     |
| 18–35 yrs                                     | 29%                     |
| 35–65 yrs                                     | 29%                     |
| +65 yrs                                       | 9%                      |
| Education of household head (%)               |                         |
| No education                                  | 20%                     |
| Primary                                       | 14%                     |
| Secondary                                     | 47%                     |
| Tertiary                                      | 19%                     |
| % of household heads employed                 | 46%                     |
| Number of members employed/household          | 0.97                    |
| % of households receiving social grants       | 79%                     |
| Income bracket (ZAR)                          |                         |
| <3500                                         | 56%                     |
| 3500–10,000                                   | 43%                     |
| 10,001–30,000                                 | 1%                      |
| >30,000                                       | -                       |
| % of households receiving free basis electricity | 40.5%                  |
| Alternative electricity                       |                         |
| Gas                                           | 51%                     |
| Paraffin                                      | 41%                     |
| Firewood                                      | 7%                      |
| Solar                                         | 1%                      |
| Household description                         |                         |
| Own built formal                              | 75%                     |
| Reconstruction and Development Programme houses | 21%                   |
| Informal/Shack                                | 4%                      |
| % of homesteads with separate housing units at the homestead | 64%          |
| % households with separate meters for different units | 35%            |

The results show that a sizable proportion of the population under study receive social grants, consistent with poor urban communities in South Africa. Social grants are given to people who live below the country’s poverty line [46]. Social grants are an initiative under the Social Security in South Africa, which was established in 1994 with the goal of alleviating poverty and improving social lives of marginalised communities [46]. The substantial number of households that receives Free Basic Electricity (FBE) shows that a considerable number of the participants are poor. Free Basic Electricity is an initiative that was launched by the South African Government in 2003, with the main goal of supporting poor households in meeting their basic electricity needs [27]. The number of participants in RDPs, and those who use paraffin as an alternative form of energy also shows that a sizeable proportion of the community is poor and cannot afford cleaner forms of energy. These results are consistent with findings elsewhere [27], which showed that paraffin is one of the widely used alternatives to electricity in poor communities.
3.2. Ownership of Appliances and Lighting

More than 75% of the participant households possessed common electric kitchen appliances such as kettles, refrigerators, stoves, and microwaves, and entertainment and communication gadgets such as TVs, satellite boxes, stereos, and cell phones (Table 2). Slightly more than half of the households had computers and washing machines while less than half had electric geysers, water heating elements, fans, electric heaters, electric blankets, vacuum cleaners, tumble dryers, air conditioners, and dishwashers. About 80% used LED lighting, 3% used incandescent lighting and/or florescent, and 10% used more than one form of lighting. The remaining 4% did not know the type of lighting they used.

Table 2. Ownership of appliances by households.

| Appliance                          | % Households |
|------------------------------------|--------------|
| Kitchen appliances                 |              |
| Electric kettle/jug                | 99           |
| Refrigerator                       | 95           |
| Electric stove                     | 88           |
| Microwave                          | 79           |
| Dishwasher                         | 2            |
| Washing machine                    | 63           |
| Entertainment and communication    |              |
| TV                                 | 96           |
| Satellite boxes                    | 96           |
| Stereo                             | 96           |
| Cell phone                         | 96           |
| Computer (desktop/laptop)          | 52           |
| Other appliances                   |              |
| Electric cylindrical water heater  | 33           |
| Element water heater               | 32           |
| Fan                                | 26           |
| Electric heater                    | 19           |
| Electric blanket                   | 10           |
| Vacuum cleaner                     | 7            |
| Tumble dryer                       | 6            |
| Air conditioner                    | 4            |

3.3. Reported Electricity Use Behaviour

Participants were asked to indicate their frequency of engagement in several electricity use actions, and the results are presented in Appendix A. Good electricity use behaviour reported, as illustrated by mean scores of at least 4 and respondents reporting usually or always practicing an action, include cooling down hot food before packing it in a refrigerator, covering liquids when storing in the refrigerator, making use of daylight instead of lights during the day, and turning off lights in empty rooms. Out of all the actions that were usually or always practiced, at least half of the respondents reported so, which is illustrative of environmentally friendly behaviour. A modal response of “always” was reported for actions such as turning off digital microwaves completely, matching pot sizes and hot plates on stoves, unplugging phone chargers, and turning off cylindrical water heaters (geysers), but by less than half of the respondents showing both good and wasteful electricity use practices. Low scores (<3.5) were recorded for actions such as adjusting refrigerator power settings according to weather, switching off the refrigerator when it is empty, defrosting refrigerators without automatic settings, and turning off appliances completely instead of leaving them on standby, with most respondents reporting ‘Never’ or ‘Sometimes’ doing these actions. About 43% of participants ‘Sometimes’ defrost the refrigerator without an automatic setting, about 53% ‘Sometimes’ overload their refrigerators, 71% ‘Never’ adjust refrigerator settings according to weather conditions, 48% ‘Never’ switch off their refrigerators when they are empty, 83% ‘Never’ use task lighting for activities that
need minimum lighting, and 33% ‘Never’ turn off appliances but rather leave them on standby. Consistent with Williams et al. [22], the results from this study show that there are elements of positive behaviour among low-income households. For example, people always cooled down hot food before storing it in the refrigerator and always turned off lights in empty rooms. This shows that even poor people have instances where they act in the interests of the environment, results which are contrary to conventional knowledge [49]. A possible explanation is that these electricity use actions are easy for them to do, or they are more informed about the benefits of practising them than the knowledge they might have on standby electricity losses.

The findings also highlight evidence of poor environmental behaviour related to standby electricity loss. This is consistent with previous studies in low-income households [23], in high-income households [22], and in a university setting [50], where wasteful electricity use practices were common including not switching off appliances completely when they are not needed.

Comparison of the reported electricity use behaviour with high-income households [22] shows both similarities and considerable differences. Both low-income and high-income households reported good behavioural patterns including keeping windows and doors closed when heater is on, cooling down hot food before storing in refrigerator, making use of daylight instead of lights during the day, and turning lights off in empty rooms. However, notable differences were noted, with low-income households, albeit less than half, reporting good electricity use behaviour such as unplugging phone/iPad chargers after use, turning off geysers when not in use, and defrosting refrigerators compared to high-income households [22]. However, our study findings show poor electricity use behaviour among low-income households including never turning off home appliances completely when not in use. This suggests that wasteful electricity use practices are prevalent among both low- and high-income households.

3.4. Relationship between Pro-Environmental Behaviour (PEB) and Socio-Demographic Factors

A Spearman correlation coefficient was performed to ascertain the relationship between reported PEB and socio-demographic factors. The results showed that only households with separate units yielded a statistically significant but weak positive relationship with PEB (Table 3). Though not significant, there were expected positive relationships between PEB and gender, age, and education and negative relationships between PEB and number of children below 5 years, household size, free electricity, and access to social grants.

| Variable                                      | Valid N | Spearman R (rho) | t-(N-2) | p-Value |
|----------------------------------------------|---------|------------------|---------|---------|
| Gender Dummy (Female = 1; Male = 0)          | 214     | 0.008            | 0.111   | 0.911   |
| Age                                          | 216     | 0.092            | 1.345   | 0.180   |
| Number of children below 5 years             | 218     | -0.067           | -0.989  | 0.324   |
| Education                                    | 176     | 0.140            | 1.868   | 0.063   |
| Household size                               | 218     | -0.064           | -0.947  | 0.344   |
| Access to social grant                       | 218     | -0.059           | -0.861  | 0.390   |
| Access to free electricity                   | 217     | -0.011           | -0.168  | 0.867   |
| Number of rooms                              | 218     | 0.070            | 1.037   | 0.301   |
| Separate housing units                       | 218     | 0.164            | 2.443   | 0.015 * |
| Separate electricity meter                   | 140     | -0.118           | -1.391  | 0.167   |

*denotes significant difference.

It is expected that households with separate units can report sustainable electricity use behaviour, possibly because they may feel that they have control and are accountable for the amount of electricity they use at any given time as compared to households with shared units. It was also expected that recipients of Free Basic Electricity were going to
report poor electricity use behaviour because they do not pay for it [27], and hence they are bound to be wasteful as they are less accountable for the amount of electricity they use. The above observations concur with a study by [23], which notes unsustainable electricity use practices among recipients of free electricity.

3.5. Relationship between PEB and Values

The results based on Spearman’s correlation coefficient between PEB and values showed that five of the higher-order values (universalism, benevolence, self-direction, hedonism, and power) yielded positive and significant relationships with PEB (Table 4). However, the relationships between these value factors are generally very weak, with rho values ranging between 0.14 and 0.27. Though not significant, higher-order value factors such as stimulation, achievement, security, and spirituality showed a positive relationship with PEB but the latter was inconsistent with the expected relationship.

Table 4. Spearman’s correlation coefficient between PEB and high-order value factors.

| High-Order Value | Valid N | Spearman R (rho) | t-(N-2) | p-Values |
|------------------|---------|------------------|---------|----------|
| Universalism     | 217     | 0.192            | 2.864   | 0.005 *  |
| Benevolence      | 217     | 0.167            | 2.487   | 0.014 *  |
| Stimulation      | 217     | 0.056            | 0.822   | 0.412    |
| Self-direction   | 217     | 0.162            | 2.403   | 0.017 *  |
| Hedonism         | 217     | 0.146            | 2.156   | 0.032 *  |
| Achievement      | 217     | 0.119            | 1.761   | 0.080    |
| Power            | 217     | 0.271            | 4.134   | 0.000 *  |
| Security         | 217     | 0.067            | 0.982   | 0.326    |
| Spirituality     | 216     | 0.008            | 0.119   | 0.906    |

* denotes significant difference.

From the list of aggregated high-order values, self-transcendence values (universalism and benevolence) showed a positive and significant relationship with pro-environmental behaviour, which suggests that people who have a disposition towards environmental quality, nature, and aesthetic beauty and who care for others were more likely to be pro-environmental. Positive linkages between the love for nature, environmental quality, social relations, empathetic attributes (a cluster of values that form universalism) and pro-environmental behaviour have been reported elsewhere [51,52], including among high-income households in South Africa [22]. For instance, in a study examining individual involvement in solving social dilemmas, it was discovered in Gärling [51] that most British individuals with an orientation to self-transcendence values corresponded positively to pro-social behaviour. In a study exploring relationships between value orientation and environmental concern, it was found in Hansla [52] that most Swedish residents with dispositions to environmental concern and good social relations exhibited environmentally friendly behaviour. According to the Schwartz’s Theory of Basic Values, biospheric values (universalism) are characterised by concern for larger society and usually result in environmentally friendly behaviour [43].

Counter-intuitively, self-direction, hedonism, and power values showed significant positive relationships with pro-environmental behaviour. A positive association between power and pro-environmental behaviour is consistent with findings by [22] among high-income households in South Africa. Usually these value factors are associated with elements of self-centeredness, and according to the literature, people holding this set of values are less likely to behave pro-environmentally [42]. Similarly, people who have an orientation to power often exhibit poor environmental behaviour as they might have the money to do things that are pleasing to them [42,44,53]. However, the meaning of values could be different in different settings. For instance, the interpretation of power from our study might not relate to material possession or personal comfort but to the ability of individuals to change situations [54]. These sentiments are supported by the authors of [43] who argue that most of these values are context-specific. Moreover, it should be
noted that most people rarely reflect about what is important to them, since these value orientations are based on reported behaviour. Hence, people might not have clear answers about their actual value orientations.

3.6. Predictors of PEB

The generalised linear regression analysis results show that only two factors, inclination to power and education, predicted PEB (Table 5). Negative correlation coefficients were recorded for socio-demographic factors such as number of rooms, household size, separate meters, and employment status, and on high-order value factors such as universalism, benevolence, stimulation, self-direction, achievement, and security.

Table 5. Determinants of electricity use behaviour.

| Variables                          | Coef. Estimate | Std. Error | Wald Stat. | p    |
|------------------------------------|----------------|------------|------------|------|
| Intercept                          | 1.021          | 0.129      | 62.451     | 0.000 * |
| Gender (1 = female; 0 = male)      | 0.006          | 0.045      | 0.016      | 0.900 |
| No. of rooms                       | -0.002         | 0.005      | 0.201      | 0.654 |
| Age of household members           | 0.001          | 0.001      | 3.332      | 0.068 |
| Household size                     | -0.010         | 0.006      | 2.475      | 0.116 |
| Number of people below 5           | 0.024          | 0.018      | 1.677      | 0.195 |
| Number of people above 65          | 0.018          | 0.019      | 0.875      | 0.350 |
| Educational status                 | 0.035          | 0.015      | 5.826      | 0.016 * |
| Employment status (1= employed; not employed) | -0.050         | 0.031      | 2.495      | 0.114 |
| Grants (1 recipient; 0 non-recipient) | 0.014          | 0.016      | 0.767      | 0.381 |
| Free electricity (1 = recipient; 0 = non-recipient) | 0.019          | 0.012      | 2.616      | 0.106 |
| Separate meter                     | -0.028         | 0.022      | 1.747      | 0.186 |
| Universalism                       | -0.001         | 0.023      | 0.002      | 0.968 |
| Benevolence                        | -0.012         | 0.022      | 0.307      | 0.579 |
| Stimulation                        | -0.004         | 0.013      | 0.076      | 0.783 |
| Self-direction                      | -0.009         | 0.027      | 0.113      | 0.737 |
| Hedonism                           | 0.032          | 0.023      | 1.938      | 0.164 |
| Power                              | 0.057          | 0.021      | 6.948      | 0.008 * |
| Achievement                        | -0.020         | 0.023      | 0.748      | 0.387 |
| Security                           | -0.021         | 0.024      | 0.749      | 0.387 |
| Spirituality                       | 0.011          | 0.012      | 0.935      | 0.334 |

* denotes significant relationship.

The regression model provides some insights that are important for the understanding of electricity use behaviour. For instance, the results are consistent with previous studies which showed that education had a significantly positive relationship with electricity saving behaviour [20,43]. Most studies suggest that people who are educated are generally more aware about the environmental impacts of their behaviour and hence are likely to engage into environmentally friendly behaviour [20]. According to [43], having education represents a certain level of understanding, which translates into an understanding of complex issues that guide our behaviour. This implies that more focus needs to be directed towards raising education and awareness among groups that have low levels of education. For instance, a study by [14] in Singapore found that educating households about electricity saving strategies had the capacity to reduce electricity consumption by two percent. If similar initiatives are employed in the South African context, this might contribute huge electricity savings, given that low-income households constitute most of the South African population.

The results also showed counter-intuitive results concerning the influence of power on environmental behaviour. However, in a developing country context, the issue of power might be understood differently. For example, in poor communities, powerful people (e.g., politicians, religious and community leaders) are those who have a high social status and often want to lead by example and contribute to the welfare of the society [55]. Hence, this might explain the positive effect of power on PEB.
Consistent with previous studies [20, 45], household size had a negative relationship with electricity saving behaviour. This is perhaps explained by the fact that the bigger the household, the more difficult it can be to assign electricity saving duties, and hence such households are bound to be wasteful [20]. Surprisingly, about 70% of the value domains had a weak negative relationship with electricity saving behaviour, which supports the argument by [42] that there is no universal application of value factors on behaviour.

4. Policy Implications

Wasteful household electricity use behaviour results in unnecessary losses with negative implications for electricity demand. Sustainable electricity use practices might lead to grid stability, and minimising the pressure on the grid enables service providers to provide sufficient electricity for everyone. Moreover, reducing electricity wastages at the household level can minimise financial resources directed towards electricity purchases, thereby alleviating energy poverty among low-income households. Although the environmental benefits of sustainable electricity use may appear insignificant at the household level, saving electricity is important given the collective impacts of wasteful electricity use practices on the country’s carbon emission factor. Hence, leveraging responsiveness by policy makers, practitioners, and service providers in promoting behavioural change can yield socio-economic and environmental benefits.

The positive behaviour reported in this study can be used as a basis for developing electricity saving strategies encompassing other wasteful practices. Concerning wasteful behaviour, there is a need for policy interventions to address standby power losses on household appliances. TVs, satellite boxes, and stereos use electricity when they are on standby mode, which translates into unnecessary electricity wastages [37]. The losses could be quite substantial considering that most households own such entertainment gadgets in South Africa. In response, stringent measures aimed at promoting the manufacturing and purchasing of energy-efficient gadgets (e.g., smart TVs) might provide a pathway to reducing standby losses, as seen in the EU [35]. However, technical interventions alone might be insufficient to address wasteful electricity use practices, particularly in contexts where households might not be able to afford to replace or purchase ‘wasteful appliances’. Therefore, technical interventions should be combined with behaviour change interventions such as awareness raising campaigns, highlighting the socio-economic and environmental benefits of good electricity use behaviour.

For instance, raising awareness about the load profile of household appliances might result in behaviour change and reduction in standby electricity losses. A load profile estimation conducted by [55] found out that the average hourly consumption for a basic television is 60 watts, and considering that a TV is used for about 3 h per day, this translates to about 180 watts per day. Following Eskom standards [27], a basic television consumes 20% of the actual consumption when it is on standby mode. Thus, in principle, a television set completely switched off for 21 h can save up to 252 watts per day or approximately 7.6 kWh per month. In our context, the average electricity consumption per household is approximately 162 kWh per month; thus, switching off TVs completely when not in use can save roughly 5% of electricity monthly. Another illustration relates to the use of refrigerators. According to [53], the average wattage for a refrigerator is about 130 watts. This means switching off an empty refrigerator can result in electricity use of up to 3 kWh per day, or 2 kWh if the refrigerator is used for the recommended 8 h per day. In the context of this study, these potential electricity savings can translate into reduced electricity bills for households already struggling to meet daily electricity needs, and money saved can be used for other basic needs. Further, electricity savings can translate into reduced electricity demand and carbon emissions.

In designing electricity saving interventions, efforts that build on the values people consider important might yield electricity savings. In other words, if electricity saving strategies can clearly show linkages with elements of universalism, such as nature loving, environmental quality, and empathy, they can trigger responsiveness by the users of
electricity. Findings on the determinants of behaviour suggest policy makers and service providers need to be cognizant of both the value orientations and socio-demographic determinants of behaviour in formulating rational and meaningful interventions. This implies that interventions should be context-specific and should not be implemented independent of the end-users as the initial beneficiaries of the initiatives. Beyond benefiting the end-users, reductions in electricity can also be beneficial for local municipalities and service providers as they are mandated with providing basic services. In South Africa, municipalities that use electricity beyond their allocated monthly quota are penalised financially or risk being disconnected from the grid by the power utility, Eskom [11]. Thus, implementing behavioural interventions can result in reduced electricity demand by households. On the other hand, considering Eskom’s bad financial situation [11], reductions in electricity use would mean a reduced need for increasing electricity generation and related maintenance costs. This implies that electricity reductions at household level are beneficial to several stakeholders. Hence, there is a need for collaborative initiatives aimed at formulating the problem (electricity wastages) and interventions for addressing the problem, as has been suggested elsewhere [56]. For example, the provision of electricity saving tips to households in the form of stickers and pamphlets has been shown to yield substantial electricity savings, though there is evidence of households reverting to wasteful electricity use practices post interventions [57,58].

5. Conclusions

This study has come up with several key issues that are salient to our understanding of electricity use behavioural patterns, including factors that should be considered in creating relevant and rational interventions for behaviour change. The findings show that among low-income households, there is evidence of both electricity saving and wasteful practices. Key areas of concern relate to the potential prevalence of standby electricity losses and the use of kitchen appliances such as the refrigerator. When these findings are considered relative to other studies, it appears that wasteful electricity practices are prevalent among both low-income and high-income households. Thus, there is potential for investment in behavioural interventions for promoting electricity use behaviour. Such interventions should be informed by and reflect the values that people consider important and align with local people’s interests, priorities, and needs to yield positive behaviour changes. From a policy perspective, local municipalities should invest in education and awareness programmes aimed at sensitising local households about the importance of electricity conservation, including reducing household electricity expenditure and minimising pressure on the national grid and disruptions to electricity supply. Drawing on lessons from similar programmes elsewhere may provide useful frameworks for initialising user-driven electricity saving programmes.

Author Contributions: Conceptualisation, G.T. and S.R.; methodology, U.M., G.T., and S.R.; software, U.M.; validation, U.M., G.T., and S.R.; formal analysis, U.M.; investigation, U.M.; resources, G.T. and S.R.; data curation, G.T.; writing—original draft preparation, U.M.; writing—review and editing, U.M.; supervision, G.T. and S.R.; project administration, G.T.; funding acquisition, G.T. and S.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Leading Integrated Research for Agenda 2030 in Africa (LIRA2030) program, Grant No. LIRA2030-GR02/20. LIRA2030 is a five-year program aimed at supporting collaborative research projects led by early-career researchers across Africa. The program is being implemented by the International Science Council (ISC), in partnership with the Network of African Science Academies (NASAC), with support from the Swedish International Development Cooperation Agency (SIDA). The views herein do not necessarily represent those of NASAC or ISC or SIDA. Additional funding was provided by Rhodes University.

Institutional Review Board Statement: Ethics approval for this project was granted by the Rhodes University Ethics Committee (Review Reference No. 2019-0720-730).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.
Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments: We thank the residents of Makhanda for taking part in the research.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Self-reported electricity use practices.

| Electricity-Saving Action                                                                 | Number of Respondents | Mean PEB Score | Modal Response | Percentages (%) |
|------------------------------------------------------------------------------------------|-----------------------|----------------|----------------|-----------------|
| Keeping windows and doors closed when fan is on                                          | 56                    | 3.5            | Sometimes      | 36              |
| Keeping windows and doors closed when heater is on                                       | 45                    | 3.9            | Always         | 64              |
| Turning off microwave completely instead of leaving it on stand-by                         | 151                   | 3.2            | Always         | 43              |
| Matching pot sizes and hot plates on stove                                                | 179                   | 3.9            | Always         | 49              |
| Defrosting refrigerator without automatic settings                                         | 135                   | 2.6            | Sometimes      | 43              |
| Overloading the refrigerator                                                             | 198                   | 2.6            | Sometimes      | 53              |
| Cooling down hot food before storing in refrigerator                                     | 204                   | 4.3            | Always         | 67              |
| Covering liquids stored in the refrigerator                                               | 204                   | 4.5            | Always         | 69              |
| Taking all ingredients from the refrigerator at once when preparing food                 | 204                   | 3.2            | Sometimes      | 40              |
| Adjusting power setting according to weather condition                                   | 200                   | 1.6            | Never          | 71              |
| Switching off the refrigerator when it is empty                                          | 193                   | 2.2            | Never          | 48              |
| Boiling just enough coffee/tea water as you need                                         | 204                   | 3.8            | Always         | 44              |
| Making use of daylight instead of lights during the day                                   | 207                   | 4.3            | Always         | 72              |
| Turning lights off when nobody is in the room                                             | 207                   | 3.8            | Always         | 52              |
| Using task lighting for activities requiring small amount of focus light (e.g., reading lamps) | 196                   | 1.4            | Never          | 83              |
| Turning off home appliances (TV, stereos, iPads, and satellite boxes) instead of leaving on stand-by | 193                   | 2.8            | Never          | 33              |
| Allowing computer to be on hibernation mode after 10–15 min                               | 43                    | 3.1            | Sometimes      | 47              |
| Switching off computer completely when not in use for more than 30 min                   | 44                    | 3.7            | Always         | 39              |
| Unplugging phone/iPad chargers after use                                                  | 152                   | 3.6            | Always         | 43              |
| Turning off geyser when not needed (e.g., overnight)                                      | 61                    | 3.3            | Always         | 46              |

References

1. Ivanova, D.; Stadler, K.; Steen-Olsen, K.; Wood, R.; Vita, G.; Tukker, A.; Hertwich, E.G. Environmental Impact Assessment of Household Consumption. *J. Ind. Ecol.* **2016**, *20*, 526–536. [CrossRef]
2. International Energy Agency. *IEA Sustainable Recovery—Analysis*; IEA: Paris, France, 2020; pp. 1–23.
3. Azevedo, V.G.; Sartori, S.; Campos, L.M.S. CO₂ Emissions: A Quantitative Analysis among the BRICS Nations. *Renew. Sustain. Energy Rev.* **2018**, *81*, 107–115. [CrossRef]
4. Ahlborg, H.; Boräng, F.; Jagers, S.C.; Söderholm, P. Provision of Electricity to African Households: The Importance of Democracy and Institutional Quality. *Energy Policy* **2015**, *87*, 125–135. [CrossRef]
5. González-Eguino, M. Energy Poverty: An Overview. *Renew. Sustain. Energy Rev.* **2015**, *47*, 377–385. [CrossRef]
6. Frederiks, E.R.; Sterner, K.; Hobman, E.V. The Socio-Demographic and Psychological Predictors of Residential Energy Consumption: A Comprehensive Review. *Energies* **2015**, *8*, 573–609. [CrossRef]
7. Nel, P.J.C.; Booyzen, M.J.; van der Merwe, B. Energy Perceptions in South Africa: An Analysis of Behaviour and Understanding of Electric Water Heaters. *Energy Sustain. Dev.* **2016**, *32*, 62–70. [CrossRef]
8. United Nations Environmental Program. *Emissions Gap Report 2019*; UNEP: Nairobi, Kenya, 2019; pp. 1–63.
9. Department of Energy. *Department of Energy Annual Report 2018/2019*; South African Government: Pretoria, South, Africa, 2019; pp. 1–16.
10. Timperley, J.; McSweeney, R. The Carbon Brief Profile: South Africa. 2018. Available online: https://www.carbonbrief.org/the-carbon-brief-profile-south-africa (accessed on 31 March 2021).
11. Eskom. Eskom Integrated Results. 2020. Available online: https://www.eskom.co.za/IR2020/Pages/default.aspx (accessed on 31 March 2021).
12. Mbewe, S. Investigating Household Energy Poverty in South Africa by Using Unidimensional and Multidimensional Measures. Master’s Thesis, University of Cape Town, Engineering and the Built Environment, Department of Mechanical Engineering, Cape Town, South Africa, 2018. Available online: http://hdl.handle.net/11427/29336 (accessed on 17 June 2021).

13. Esterhuizen, N. Impact of Load Shedding on Consumers—Brief. 2019. Available online: https://www.bbrief.co.za/2019/02/22/impact-of-load-shedding-on-consumers/ (accessed on 31 March 2021).

14. Kua, H.W.; Wong, S.E. Lessons for Integrated Household Energy Conservation Policies from an Intervention Study in Singapore. *Energy Policy* 2012, 47, 49–56. [CrossRef]

15. Steg, L.; Perlaviciute, G.; van der Werff, E. Understanding the Human Dimensions of a Sustainable Energy Transition. *Front. Psychol.* 2015, 6. [CrossRef]

16. Vlad, L.B.; Hurduzeu, G.; Josan, A.; Vlăsceanu, G. The Rise of BRIC, the 21st Century Geopolitics and the Future of the Consumer Society. *Rom. Rev. Polit. Geogr.* 2011, 13, 48–62.

17. European Union. Energy Label and Ecodesign. 2020. Available online: https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign_en (accessed on 31 March 2021).

18. Midden, C.J.H.; Kaiser, F.G.; McCalley, L.T. Technology’s Four Roles in Understanding Individuals’ Conservation of Natural Resources. *J. Soc. Issues* 2007, 63, 155–174. [CrossRef]

19. Abrahamse, W.; Steg, L.; Vlek, C.; Rothengatter, T. A Review of Intervention Studies Aimed at Household Energy Conservation. *J. Environ. Psychol.* 2005, 25, 273–291. [CrossRef]

20. Abrahamse, W.; Steg, L. How Do Socio-Demographic and Psychological Factors Relate to Households’ Direct and Indirect Energy Use and Savings? *J. Econ. Psychol.* 2009, 30, 711–720. [CrossRef]

21. Cambell, P.; Della Valle, N. Tackling Energy Poverty Through Behavioral Change: A Pilot Study on Social Comparison Interventions in Social Housing Districts; Social Science Research Network: Rochester, NY, USA, 2020.

22. Williams, S.P.; Thondhlana, G.; Kua, H.W. Electricity Use Behaviour in a High-Income Neighbourhood in Johannesburg, South Africa. *Sustainability* 2020, 12, 4571. [CrossRef]

23. Thondhlana, G.; Kua, H.W. Promoting Household Energy Conservation in Low-Income Households through Tailored Interventions in Grahamstown, South Africa. *J. Clean. Prod.* 2016, 131, 327–340. [CrossRef]

24. Shuma-Iwisi, M.V.; Gibbon, G.J. Domestic Appliances End-Use Efficiencies: The Case of Eleven Suburbs in Greater Johannesburg. In *WIT Transaction on Ecology and Environment*; WIT Press: Ashurst Lodge, UK, 2009.

25. Marais, S.; Kusakana, K.; Koko, S.P. Energy Monitoring for Potential Cost Saving in a Typical South African Household. In Proceedings of the 2019 Open Innovations (OI), Cape Town, South Africa, 2–4 October 2019; pp. 122–126.

26. Kabule, N.; Yessoufou, K.; Nwul, N.; Mbohwa, C. Temporal Analysis of Electricity Consumption for Prepaid Metered Low- and High-Income Households in Soweto, South Africa. *Afr. J. Sci. Technol. Innov. Dev.* 2019, 11, 375–382. [CrossRef]

27. Musango, J.K. Household Electricity Access and Consumption Behaviour in an Urban Environment: The Case of Gauteng in South Africa. *Energy Sustain. Dev.* 2014, 23, 305–316. [CrossRef]

28. Isreal-Akinbo, S.; Fraser, J.S.G. The Energy Transition Patterns of Low-Income Households in South Africa: An Evaluation of Energy Programme and Policy. *J. Energy South. Afr.* 2018, 29. [CrossRef]

29. Steg, L. Promoting Household Energy Conservation. *Energy Policy* 2008, 36, 4449–4453. [CrossRef]

30. Laicane, I.; Blumberga, D.; Blumberga, A.; Rosa, M. Reducing Household Electricity Consumption through Demand Side Management: The Role of Home Appliance Scheduling and Peak Load Reduction. *Energy Procedia* 2015, 72, 222–229. [CrossRef]

31. Meyers, R.J.; Williams, E.D.; Matthews, H.S. Scoping the Potential of Monitoring and Control Technologies to Reduce Energy Use in Homes. *Energy Build.* 2010, 42, 563–569. [CrossRef]

32. Nilson, P.; Robak, K.; Broström, A.; Ellström, P.-E. Creatures of Habit: Accounting for the Role of Habit in Implementation Research on Clinical Behaviour Change. *Implement. Sci.* 2012, 7, 53. [CrossRef]

33. Mtutu, P.; Thondhlana, G. Encouraging Pro-Environmental Behaviour: Energy Use and Recycling at Rhodes University, South Africa. *Habitat Int.* 2016, 53, 142–150. [CrossRef]

34. Thondhlana, G.; Hlatshwayo, T.N. Pro-Environmental Behaviour in Student Residences at Rhodes University, South Africa. *Sustainability* 2018, 10, 2746. [CrossRef]

35. Gerber, D.L.; Meier, A.; Liou, R.; Hosbach, R. Emerging Zero-Standby Solutions for Miscellaneous Electric Loads and the Internet of Things. *Electronics* 2019, 8, 570. [CrossRef]

36. Olatunji, O.O.; Akinlabi, S.A.; Madushele, N.; Adedeji, P.A.; Ishola, F.; Ayo, O.O. Wastage amidst Shortage: Strategies for the Mitigation of Standby Electricity in Residential Sector in Nigeria. *J. Phys. Conf. Ser.* 2019, 1378, 042062. [CrossRef]

37. Sahin, M.C.; Aydinalp Koksal, M. Standby Electricity Consumption and Saving Potentials of Turkish Households. *Appl. Energy* 2014, 114, 531–538. [CrossRef]

38. Stats South Africa. *Poverty Trends in South Africa: An Examination of Absolute Poverty between 2006 & 2015*; Statistics South Africa; Government of South Africa: Pretoria, South Africa, 2017; pp. 1–109.

39. Langerwe, J.; Guran, P.L.; Wen, J. Reducing Energy Consumption in Low Income Public Housing: Interviewing Residents about Energy Behaviors. *Appl. Energy* 2013, 102, 1358–1370. [CrossRef]

40. Barr, S. Factors Influencing Environmental Attitudes and Behaviors: A UK. Case Study of Household Waste Management. *Environ. Behav.* 2007, 39, 435–473. [CrossRef]
41. Trotta, G. Factors Affecting Energy-Saving Behaviours and Energy Efficiency Investments in British Households. *Energy Policy* 2018, 114, 529–539. [CrossRef]
42. Lindén, A.-L.; Carlsson-Kanyama, A.; Eriksson, B. Efficient and Inefficient Aspects of Residential Energy Behaviour: What Are the Policy Instruments for Change? *Energy Policy* 2006, 34, 1918–1927. [CrossRef]
43. Schwartz, S.H. Are There Universal Aspects in the Structure and Contents of Human Values? *J. Soc. Issues* 1994, 50, 19–45. [CrossRef]
44. De Groot, J.I.M.; Steg, L. Value Orientations and Environmental Beliefs in Five Countries: Validity of an Instrument to Measure Egoistic, Altruistic and Biospheric Value Orientations. *J. Cross Cult. Psychol.* 2007, 38, 318–332. [CrossRef]
45. Poortinga, W.; Steg, L.; Vlek, C. Values, Environmental Concern, and Environmental Behavior: A Study into Household Energy Use. 2004. Available online: https://journals.sagepub.com/doi/abs/10.1177/013916503251466 (accessed on 30 March 2021).
46. Stats South Africa. *Census: Statistical Release (Revised) P0301.4*; Statistics South Africa; Government of South Africa: Pretoria, South Africa, 2011; pp. 1–77.
47. Freund, B. *The African City: A History*; Cambridge University Press: New York, NY, USA, 2007; ISBN 978-0-521-52792-7.
48. Emerson, R.W. Convenience Sampling, Random Sampling, and Snowball Sampling: How Does Sampling Affect the Validity of Research? Available online: https://journals.sagepub.com/doi/10.1177/0145482X1510900215 (accessed on 31 March 2021).
49. Liere, K.D.V.; Dunlap, R.E. The Social Bases of Environmental Concern: A Review of Hypotheses, Explanations and Empirical Evidence. *Public Opin. Q.* 1980, 44, 181–197. [CrossRef]
50. Bulunga, A.A.L.; Thondhlana, G. Action for Increasing Energy-Saving Behaviour in Student Residences at Rhodes University, South Africa. *Int. J. Sustain. High. Educ.* 2018, 19, 773–789. [CrossRef]
51. Gärling, T. Value Priorities, Social Value Orientations and Cooperation in Social Dilemmas. *Br. J. Soc. Psychol.* 1999, 38, 397–408. [CrossRef]
52. Hansla, A.; Gamble, A.; Juliusson, A.; Gärling, T. The Relationships between Awareness of Consequences, Environmental Concern, and Value Orientations. *J. Environ. Psychol.* 2008, 28, 1–9. [CrossRef]
53. Hasanuzzaman, M.; Saidur, R.; Masjuki, H.H. Investigation of Energy Consumption and Energy Savings of Refrigerator-Freezer during Open and Closed Door Condition. *J. Appl. Sci.* 2008, 8, 1822–1831. [CrossRef]
54. Laverty, A. Africa Power Explained: An Analysis of Africa’s Dismissal as a World Power. 2011. Available online: https://www.scribd.com/document/157078101/Africa-Power-Explained-An-Analysis-of-Africas-Dismissal-as-a-World-Power (accessed on 31 March 2021).
55. Chatterjee, A.; Brent, A.; Rayudu, R.; Verma, P. Microgrids for Rural Schools: An Energy-Education Accord to Curb Societal Challenges for Sustainable Rural Developments. *Int. J. Renew. Energy Dev.* 2019, 8, 231–241. [CrossRef]
56. Ambole, A.; Musango, J.K.; Buyana, K.; Ogot, M.; Anditi, C.; Mwau, B.; Kovacic, Z.; Smit, S.; Lwasa, S.;Nsangi, G.; et al. Mediating Household Energy Transitions through Co-Design in Urban Kenya, Uganda and South Africa. *Energy Res. Soc. Sci.* 2019, 55, 208–217. [CrossRef]
57. He, H.Z.; Kua, H.W. Lessons for Integrated Household Energy Conservation Policy from Singapore’s Southwest Eco-living Program. *Energy Policy* 2013, 55, 105–116. [CrossRef]
58. Nahiduzzaman, K.M.; Aldosary, A.S.; Abdallah, A.S.; Asif, M.; Kua, H.W.; Alqadhib, A.M. Households Energy Conservation in Saudi Arabia: Lessons Learnt from Change-agents Driven Interventions Program. *J. Clean. Prod.* 2018, 185, 998–1014. [CrossRef]