



## Case Study

# Alternative energy sources used by Nkulumane residents in Bulawayo, the case study of Nkulumane 12, Zimbabwe

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## Abstract

*The purpose of the study was to establish the coping strategies adopted by the residents of Nkulumane in light of the introduction of the pre-paid system of payment for electricity. For this study the author opted for the descriptive survey research. The subjects of the study were 120 household heads in 100 randomly selected houses of Nkulumane 12 from a population of 1000 houses. The major sources of energy used for cooking by the Nkulumane 12 residents are firewood, electricity, gas gel and paraffin, however with most residents using a variety of sources. The most widely used source of energy for cooking is electricity which is used by 92.5% of the residence in combination with other sources of energy. Most residents (31.7%) use electricity and paraffin for cooking followed by those who use electricity, firewood and paraffin (19.2%). There was a surprisingly low use of gas in all age groups with most residents claiming to use gas when there was no electricity. Only 9 out of the 120 households interviewed said they use solar for lighting and all of them were in the above US\$600 per month level of income. The major reason given for not using solar energy was that it was expensive. When asked about the costs of solar lighting units 90% of the residents said they had never bothered to find the cost of solar lighting units. From the interviews it was estimated that households spend on average US\$1.43 on candles. Based on the 2012 costs of solar lighting units it was estimated that residents would spend on average US\$0.12 per month based on a 25 year lifespan for solar panels and US\$0.58 based on a 5 year life span for solar panels. The results indicate that the residents of Nkulumane spend most of their money on electricity with 33.3% spending more than US\$20 a month whilst 34.2% spend between US\$11 and US\$20 and about 32.5% spending less than US\$10 on electricity per month.*

**Keywords:** Sources of energy, expenditure on energy.

## Introduction

There is an increasing desire by the international community to switch to alternative sources of energy thus moving away from the traditional sources of hydroelectricity and fossil fuels. The European Union is aiming to get at least 20% of their energy from alternative energy sources by 2020 with more than 30 countries around the world already getting above 20% of their energy from alternative energy sources<sup>1</sup>. The use of renewable energy worldwide began in the 1990s and increased greatly in the 2000s<sup>1</sup>. There has been a dramatic increase in the performance, scale and cost reduction in the production of energy from alternative sources which has resulted in most countries exceeding their targets by 2011<sup>2</sup>.

According to the World Bank projections, China was expected to produce 9GW of wind power and 0,5 GW solar power by 2020 only for China to exceed expectations by producing 62GW of wind power and 3GW of solar power in 2011. Global wind power energy was projected to be 34 gigawatts (GW) by 2010 by the International Energy Agency (IEA) in 2000, only for actual production to reach 200GW by 2010<sup>2</sup>.

At least 30 countries globally are already receiving more than 20% of their energy from renewable sources. About 120 other countries have different targets with the European Union having a 20% binding target for its members by 2020. However some countries have highly ambitious targets which include a 100% target for Denmark by 2030 and a 60% target for Germany. African countries like Algeria, Jordan, Madagascar, South Africa, Samoa, Senegal, Mauritius and Mali have set targets ranging from 10% to 50% by 2020 to 2030<sup>1</sup>. Other countries with targets of 10% to 50% are China, Indonesia, Jamaica, Vietnam, Ukraine and Thailand<sup>1</sup>.

The introduction of the pre-paid system of payment by the Zimbabwe Electricity Supply Authority (ZESA) has resulted in drastic changes in the utilization of electricity by most urban families. Most of these families had relied on running huge bills which they were not paying for a number of years. The advent of the pre-paid system has forced these residents to re-strategise in order to survive. The major courses of action taken by the residents was to look for other energy sources which include the use of firewood, gas stoves and paraffin stoves for cooking, candles and solar energy for lighting.

There are quite a number of primary sources of energy which include nuclear energy, fossil fuels and renewable sources. The fossil fuels include oil, coal and gas, with the renewable sources including wind, solar and hydropower. All these primary sources of energy are normally converted to electricity for domestic and industrial use.

**Statement of the Problem:** The introduction of the pre-paid system of payment by the Zimbabwe Electricity Supply Authority (ZESA) has resulted in drastic changes in the utilization of electricity by most urban families. Most of these families had relied on running huge bills which they were not paying for a number of years. The advent of the cash power system has forced these residents to re-strategise in order to survive. ZESA also practiced load shedding during the time of the study which at times was not scheduled. The major courses of action taken by the residents was to look for other energy sources which include firewood, gas stoves and paraffin stoves for cooking, candles and solar energy for lighting. However some of these alternative sources of energy might be beyond the rich of many residents.

**Aim of the study:** The purpose of the study is to find out the coping strategies adopted by the residents of Nkulumane in light of the introduction of the pre-paid system of payment for electricity.

**Assumptions of the Study:** It is assumed that the residents of Nkulumane will respond positively to the study and provide all the necessary information required to complete the study. It is also assumed that other stakeholders will cooperate in giving out information relevant for the study. It is also assumed that some residents use alternative sources of energy.

**Significance (or Importance) of the Study:** The study will look at the different types of energy sources used by the residents and their costs and will thus assist residents make an informed choice when deciding which energy source to use. The study will also assist ZESA to streamline their provision of electricity.

**Scope (Delimitation) of the Study:** The study will cover the Nkulumane 12 residents which comprises house numbers 12 000 to 12 999 inclusive. The study will look at the different types of energy sources used by the residents.

**Limitations of the Study:** This will be case study and as such findings from the study may not necessarily apply to all situations in the country. However with case studies there is a possibility of making biased and selective reports<sup>3</sup>. This criticism can however be said of any research design. Some academics have argued that a case study is not scientific<sup>4</sup>. The case study methodology investigates specific cases in detail and brings out issues in their natural setting disguising them in formalized experimental design<sup>3</sup>.

The other argument against case study research is that findings from such studies are difficult to generalise to other settings, an

argument which can be countered by saying that the findings can be generalized to similar settings<sup>5,6</sup>. Nkulumane high density suburb is similar to the other high density suburbs of Zimbabwe therefore the findings can be generalised to those settings. The respondents were informed of their right not to respond to questions and the study was therefore based on voluntary cooperation which meant that lack of cooperation could weaken the study. The researcher created good rapport with respondents and provided user friendly questionnaires, which were easy to understand and were unambiguous.

**Ethical and Legal Considerations:** All the participants were informed fully about the purpose of the research and the possible outcomes of participating in the study. They were also informed of their right to withdraw from the study if they felt in any way uncomfortable or threatened. The participants were also assured that all the information supplied would be confidential and anonymity would be observed throughout the study. They were also assured that the results of the study would be made available to all of them and that they would be protected from any harm that might arise from participating in the study.

**Organisation of the study:** The introduction addressed the context of the problem by looking at the background of the study, then going on to outline the statement of the problem. This was followed by the purpose of the study, the assumptions of the study, the significance/importance of the study, the scope/delimitation of the study and the limitations of the study. The chapter ended with a discussion of the ethical and legal considerations.

The research methodology discusses the research design/plan, the population and sample of the study, the instruments used, and lastly the data presentation and analysis procedures. The section on results and discussion presents the findings of the study and gives a discussion and analysis of these findings. The study ends with a conclusion on the sources of energy used by the Nkulumane residents.

## Methodology

This section will look at the research design, subjects or participants, research instruments, data collection procedures, data presentation and analysis procedures. The chapter mainly focuses on the research design employed to analyze the alternative energy sources used by Nkulumane residents. The chapter begins by explaining the understanding of research design/plan. This is followed by a description of the subjects and research instruments used in carrying out the study.

**Research Design/plan:** For this study the author opted for the descriptive survey research which is appropriate for studying specific situations.

The descriptive survey method is also appropriate for those data that are derived from case studies through the use of actual observations or data derived from questionnaires or other

techniques. The strengths of a descriptive survey method are that it is useful in describing the characteristics of large populations and one can use a large number of questions to derive data on any given issue which can improve flexibility in the analysis of the data<sup>8</sup>. The descriptive survey method allows for the use of a variety of data gathering instruments such as questionnaires and interviews<sup>6</sup>. These instruments make it possible to acquire data, organize and present it systematically so that valid and accurate conclusions can be drawn.

One of the disadvantages of the descriptive survey method is that it may be not be easy to control some outside factors which might affect the findings of a study which differs with other designs like in an experimental design where the researcher has some measure of control of certain variables<sup>9,10</sup>. The descriptive survey method is susceptibility to distortion and bias<sup>11</sup>. The possibility of bias in this study will be minimized by emphasis on anonymity and confidentiality in the handling of research data. The study will use descriptive survey design looking at the case of a given area.

**Population for the study:** The population of the were the residents of Nkulumane 12, houses number 12 000 to 12 999.

**Sample of the study:** The subjects of the study were 120 household heads in 100 randomly selected houses of Nkulumane 12.

**Research Instruments:** Face to face interviews will be done and one of the advantages of this instrument is that a relationship is developed between researcher and respondent. It is also possible to be flexible with the respondent. The interviewer can rephrase questions which are not clear, clear any misunderstandings and make a follow-up on new ideas that arise during the interview. Questions and answers can be clarified by both the interviewer and interviewee. One of the key features of face to face interviews is that the interviewees do not need to be literate to participate as the researcher can explain the questions.

One of the advantages of interviews is that the interviewer can get more information by observing non-verbal actions, which is not possible with other research instruments<sup>12</sup>. The advantages of face to face interviews are<sup>13</sup>: i. They are flexible and adaptable way of data collection, ii. They offer the possibility of rephrasing the questions to suit existing conditions. iii. One can observe non verbal responses during the interview which are in their own right, important in bringing out possible changes in the meaning of some aspects under probe.

The disadvantages include: i. Error in phrasing of questions for different respondents, ii. Error in interpretation especially for coded answers. iii. Errors in recording data.

The disadvantage of face to face interviewing is that it takes time to arrange, in addition the process of collecting data is time consuming and travelling can be costly where participants are located away from the researcher, which is common<sup>12</sup>.

**Data Presentation and Analysis Procedures:** Data obtained from the study will be presented in tables and graphs in order to give an overview of findings to identify trends and to establish relationships between parts of the findings. Tables in general conserve space as they present data in such a way that it is summarized in individual cells<sup>14</sup>. Relationship among data in a table may be visualized and this process facilitates the process of data comparison. Comprehension of tabulated data is enhanced as it is easier to understand and remember such data. Graphs will also be used to offer good visual presentation of the results.

**Results and discussion**

This section will present the findings of the study and gives a discussion and analysis of these findings.

**Major sources of energy for cooking:** The major energy sources for cooking are listed in Table-1.

**Table-1:** Major Energy Sources for Cooking.

Source of energy	No. of H/holds	%
Electricity and Paraffin	38	31.7
Electricity and Gel	10	8.3
Firewood and Paraffin	9	7.5
Electricity, Firewood and Gas	21	17.5
Electricity and Firewood	19	15.8
Electricity, Firewood and Paraffin	23	19.2
Total	120	100

The major sources of energy as shown in Table-1 are firewood, electricity, gas gel and paraffin, however with most residents using a variety of sources. The most widely used source of energy for cooking is electricity which is used by 92.5 % of the residence in combination with other sources of energy. Most residents (31.7%) use electricity and paraffin for cooking followed by those who use electricity, firewood and paraffin (19.2%). The least number is those who use firewood and paraffin. It was noted that none of the residents use solar for cooking as there are presently no stoves in the market which use solar energy. The data actually shows that electricity and firewood are the most widely used sources of energy with 35% (electricity and firewood plus Electricity, firewood and paraffin) of the residents using them.

The residents were then arranged in terms of their different age groups and their sources of energy for cooking and the information from the interviews is shown in Table-2.

The results show that in the under 20 years category 50% of the residents use electricity, firewood and gas with 25% using electricity and paraffin and the remaining 25% using electricity,

firewood and paraffin. In the over 50 age group 48% of the residents use electricity and paraffin. There was a surprisingly low use of gas in all age groups with most residents claiming to use gas when there was no electricity. In the under 20 age group 50% of the residents were using a combination of electricity, firewood and gas.

**Major sources of energy for lighting:** Only 9 out of the 120 households interviewed said they use solar for lighting and all of them were in the above US\$600 per month level of income. The major reason given for not using solar energy was that it was expensive. When asked about the costs of solar lighting units

90% of the residents said they had never bothered to find the cost of solar lighting units. From the interviews it was estimated that households spend on average US\$1.43 on candles. Based on the 2012 costs of solar lighting units the residents were estimated to spend on average US\$0.12 per month based on a 25 year lifespan for solar panels and US\$0.58 based on a 5 year life span for solar panels.

**The cost of the different energy sources used by Nkulumane residents:** The residents were interviewed on the money spent on different energy sources per month and the results are shown in Table-4.

**Table-2:** The different age groups and their sources of energy for cooking.

Sources of Energy	>20yrs	21 – 30yrs	31 – 40yrs	41 – 50yrs	>50yrs	Total	%
Electricity and Paraffin	3	8	5	9	13	38	31.7
Electricity and Gel	0	7	2	1	0	10	8.3
Firewood and Paraffin	0	0	4	2	3	9	7.5
Electricity, Firewood and Gas	6	7	2	2	4	21	17.5
Electricity and Firewood	0	0	13	0	6	19	15.8
Electricity, Firewood and Paraffin	3	6	10	3	1	23	19.2
Total	12	28	36	17	27	120	100

**Table-3:** Level of income and the energy source used for lighting.

Energy Source	Less than US\$200 per month	US\$201 – US\$300 per month	US\$301 – US\$600 per month	More than US\$600 per month	Total
Electricity and candles	4	55	29	11	99
Electricity and solar	0	0	0	9	9
Electricity and cellphone	2	3	6	1	12
Total	6	58	35	21	120

**Table-4:** Money spent on the different energy sources for cooking per month.

Energy sources	Less than US\$10	US\$11 to US\$20	More than US\$20	Total
ZESA	39(32.5%)	41(34.2%)	40(33.3%)	120
Firewood	90(75%)	19(15.8%)	11(9.2%)	120
Paraffin	120(100%)	0	0	120
Gel	120(100%)	0	0	120
Gas	107(89.2%)	13(10.8%)	0	120

The results indicate that the residents of Nkulumane spend most of their money on electricity with 33.3% spending more than US\$20 a month whilst 34.2% spend between US\$11 and US\$20 and about 32.5% spending less than US\$10 on electricity per month. This is followed by firewood where 9.2% of the residents spend more than US\$20, 15.8% between US\$11 and US\$20 and 75% spending less than US\$10 per month on firewood. The least money is spent on Gas, paraffin and gel with all the residents spending less than US\$10 per month on paraffin and gel. For gas however 10.8% of the residents spend US\$11 to US\$20 per month and 89.2% spend less than US\$10 per month. The reason given for so much expenditure on electricity is that it is the preferred source of energy with most residents only using other sources when electricity is not available.

## Conclusion

The most widely used source of energy for cooking by Nkulumane residents is electricity followed by firewood, with other sources being used sparingly. Electricity is also the most widely used source of energy for lighting with other sources like candles, solar energy and cellphones being used when electricity is not available.

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