

**ASSESSING THE EFFECTS OF THE SOLAR WATER  
HEATERS PROGRAMME ON THE SOCIO-ECONOMIC  
DEVELOPMENT OF THE MBOMBELA LOCAL  
MUNICIPALITY RESIDENTS: MPUMALANGA PROVINCE –  
REPUBLIC OF SOUTH AFRICA**

by

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## DECLARATION

I declare that **ASSESSING THE EFFECTS OF THE SOLAR WATER HEATERS PROGRAMME ON THE SOCIO-ECONOMIC DEVELOPMENT OF THE MBOMBELA LOCAL MUNICIPALITY RESIDENTS: MPUMALANGA PROVINCE – REPUBLIC OF SOUTH AFRICA** (mini-dissertation) is hereby submitted to the University of Limpopo, for the degree of Master in Public Administration has not been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.



**Khoza VP (Mr)**

2016-09-15

**Date**

## **ACKNOWLEDGEMENTS**

Human wisdom tells us that many hands make light work. The following important people contributed to my life in different ways to ensure that this dissertation becomes a sound and well-structured document. I thank them for their continued support.

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It wouldn't be good if I left out three important officials Messrs, Themba Mona, Johannes Mulaudzi and Sgujana Lukhele who were like co-supervisors, assisting me in obtaining the relevant information for my dissertation. Most importantly I thank Pastor Lovemore Manaka for availing himself in editing my dissertation proposal and the final document.

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## **DEDICATION**

I dedicate this research study to my late grandmother Josephine Shabalala who encouraged me young age to work as a public servant and assist the needy people. This research study is dedicated to the poor community of Mbombela Local Municipality who cannot afford the high electricity cost which makes them resort to burning wood in order to have access to hot water for bathing, cooking and any other domestic purposes.

I also dedicate this study to my late mother Dorothy Khoza who raised me under very difficult socio-economic conditions earning very small salary. She worked very hard to give education that can make me be of help to others, so that with my academic knowledge I contribute in changing people's lives for better. She was always behind me through thick and thin ensuring that all what I need for my education is provided.

Lastly I dedicate this study to my colleague Themba Mona who was very inspirational. He was coaching and mentoring me when writing this dissertation.

## **ABSTRACT**

Mbombela Local Municipality became one of the cities in South Africa authorised to host the 2010 Federal International Football Association (FIFA) World Cup competition. As stipulated in terms of the Host City agreement, Mbombela Local Municipality was to implement specific projects which would contribute towards the reduction of carbon footprints emissions. The International FIFA Coordinators committed all Hosting Cities to comply with the Green Goal Concept which recommended the reduction of carbon emissions by providing green alternative energy sources while at the same time bearing in mind that more electricity would be required during the 32 days' match events (Mbombela Local Municipality Green Goal Concept: 2009).

An agreement for the provision of alternative energy sources was concluded by the municipality with Eskom as the main supplier of electricity in the area. A solar water heaters (SWH) pilot project, in this regard, was implemented in Kanyamazane Township. A local studio in this area was earmarked for the practicing and training of international teams that were participating in the world cup games. Eskom industry in collaboration with the Mbombela Local Municipality identified 1 200 households in the low income group in Kanyamazane Township for the implementation of the SWH project. The SWH project was funded and facilitated by Eskom. In this agreement, Eskom was to distribute electricity for the SWH project in the targeted area. The solar water heaters have been since installed in this area. Mbombela Local Municipality intends to escalate this type of project to other local townships in future such as Kabokweni, Hillsvie, Matsulu and Tekwane.

Through observation, it was realised that Mbombela Local Municipality was not ready to take over the project as prescribed in the Memorandum of Agreement (MOA). Resultantly, no formal report was prepared and presented before the Council on the outcome of the pilot project. It was then discovered that this lack of discrepancy could

serve as an area of study in order to establish what actually happened so that the future projects would learn from the envisaged findings.

It is against this background that the study sought to determine if the SWH project brought about an improvement in the lives of the recipients in the form of job creation, investment and savings in the Kanyamazane Township and to ascertain if the beneficiaries as stakeholders in the SWH project have had a significant role to play as far as the implementation of the project was concerned.

The study is based on the mixed approaches namely qualitative and quantitative approaches. The semi-structured interviews were administered to the three senior officials who were involved in the SWH project to determine the in-depth knowledge on the intention of the programme and the questionnaire survey was conducted where respondents' views and opinions were solicited to test if the SWH improved the socio-economic status of Kanyamazane Township beneficiaries.

The study confirmed the findings of the research in determining if SWH installation has improved the socio-economic status and if beneficiaries were involved in the decision making processes prior the installation of the SWH. The study proposed recommendations in terms of strategic approach on the programme in ensuring effective implementation of SWH project for future and policy development to guide the practitioners to have proper guidelines to rollout the SWH to other areas.

The findings of the study indeed indicated that SWH project has improved the socio-economic conditions of the targeted participants.



## TABLE OF CONTENTS

DECLARATION.....	i
ACKNOWLEDGEMENTS.....	iii
DEDICATION.....	v
ABSTRACT .....	vi
LIST OF TABLES.....	xii
LIST OF FIGURES .....	xiii
<b>CHAPTER 1: OVERVIEW OF THE STUDY .....</b>	<b>1</b>
1.1 INTRODUCTION .....	1
1.2 STATEMENT OF THE PROBLEM .....	4
1.3 AIM OF THE STUDY .....	6
1.4 RESEARCH OBJECTIVES .....	6
1.5 RESEARCH QUESTIONS .....	6
1.6 RATIONALE OF THE STUDY .....	6
1.7 SIGNIFICANCE OF THE STUDY .....	7
1.8 RESEARCH METHODOLOGY.....	8
1.9 RESEARCH DESIGN .....	9
1.9.1 Qualitative Approach.....	9
1.9.2 Quantitative Approach .....	9
1.10 RESEARCH AREA.....	10
1.11 POPULATION .....	11
1.13 DATA ANALYSIS .....	12
1.14 RESEARCH LIMITATION .....	13
1.15 ETHICAL CONSIDERATION .....	14
1.16 DEFINITION OF CONCEPTS .....	14
1.17 ARRANGEMENT OF CHAPTERS OF THE STUDY .....	16
1.18 CONCLUSION.....	17
<b>CHAPTER 2: LITERATURE REVIEW .....</b>	<b>18</b>
2.1 INTRODUCTION .....	18
2.2 THE CONCEPT OF SOLAR WATER HEATERS.....	18

2.2.1	Global Perspective.....	18
2.2.2	South African Perspective.....	24
2.3	CURRENT SOLAR WATER HEATERS POLICY INITIATIVES, SOUTH FRICAN LEGISLATIVE FRAMEWORK AND RELEVANCE TO SOLAR WATER HEATING TECHNOLOGY.....	38
2.3.1	National Government Policy initiatives.....	38
2.3.2	South African Legislative Framework that Impact on Solar Water Heaters.....	44
2.3.3	Local Government Policy Initiatives.....	47
2.4	CONCLUSION.....	53
<b>CHAPTER 3: RESEARCH METHODOLOGY.....</b>		<b>55</b>
3.1	INTRODUCTION.....	55
3.2	RESEARCH DESIGN.....	55
3.2.1	The Qualitative Approach.....	56
3.2.2	Quantitative Approaches.....	57
3.3	RESEARCH AREA.....	58
3.4	POPULATION.....	58
3.5	SAMPLING METHOD AND SAMPLE SIZE.....	58
3.5.1	Sampling Method.....	58
3.5.2	Sample Size.....	59
3.6	DATA COLLECTION METHODS.....	60
3.7	DATA ANALYSIS METHODS.....	61
3.7.1	Qualitative Analysis.....	62
3.7.2	Quantitative Analysis.....	63
3.8	ETHICAL CONSIDERATIONS.....	63
3.9	LIMITATIONS OF THE STUDY.....	65
3.10	CONCLUSION.....	66
<b>CHAPTER 4: DATA PRESENTATION AND ANALYSIS.....</b>		<b>67</b>
4.1	INTRODUCTION.....	67
4.2	DATA FROM INTERVIEWS.....	68
4.2.1	The actual intention by the municipality to install solar water heaters.....	69
4.2.2	Involvement of the local community in the programme.....	69
4.2.3	The criteria used to select the households for a programme.....	70
4.2.4	Involvement of local suppliers to install solar water heaters.....	70
4.2.5	Arrangements for solar water heating equipment maintenance.....	71
4.2.6	The management of the solar water heaters programme.....	71
4.3	PRESENTATION OF DATA FROM QUESTIONNAIRES.....	72

4.4	PRESENTATION AND ANALYSIS OF COLLECTED DATA THROUGH QUESTIONNAIRES .....	74
4.4.1	Occupation .....	74
4.4.2	Educational Level .....	76
4.4.3	Race Presentation .....	77
4.4.4	Age Categories.....	77
4.4.5	Respondents by Gender .....	78
4.4.6	Respondents by Marital Status .....	79
4.4.7	Gross income of the respondents per month.....	80
4.5	RESPONSES FROM OTHER QUESTIONS IN THE QUESTIONNAIRES .....	81
4.5.1	Kanyamazane community was consulted regarding the installation of solar water heaters .....	81
4.5.2	Do you benefit from the solar water heaters programme?.....	82
4.5.3	The project to install solar water heaters was imposed on the beneficiaries in Kanyamazane .....	83
4.5.4	Local people were employed during the implementation phase of the solar water heaters project .....	84
4.5.5	The solar water heaters project is a good solution to reduce poverty in the community of Kanyamazane .....	85
4.5.6	The use of solar water heaters has brought relief to people who cannot afford the cost of using convectional electricity .....	86
4.5.7	The solar water heaters are maintained by technically qualified people .....	87
4.6	CONCLUSION.....	89
<b>CHAPTER 5: CONCLUSION AND RECOMMENDATIONS OF THE STUDY .....</b>		<b>90</b>
5.1	INTRODUCTION .....	90
5.2	SUMMARY AND CONCLUSIONS OF THE STUDY .....	91
5.3	RECOMMENDATIONS.....	96
5.3.1	Recommendation one.....	96
5.3.2	Recommendation Two .....	97
5.3.3	Recommendation Three .....	98
5.3.4	Recommendation Four .....	99
5.3.5	Recommendation Five .....	100
5.3.6	Recommendation Six.....	<b>Error! Bookmark not defined.</b>
5.3.7	Recommendation Seven.....	102
5.3.8	Recommendation Eight.....	103
5.3.9	Recommendation Nine .....	103
5.4	FINAL REMARKS .....	104



<b>REFERENCES .....</b>	<b>106</b>
<b>ANNEXURE A .....</b>	<b>115</b>
<b>LETTER FOR AUTHORISATION TO CONDUCT A STUDY .....</b>	<b>115</b>
<b>ANNEXURE B .....</b>	<b>116</b>
<b>AUTHORISATION LETTER FROM THE EMPLOYER TO CONDUCT A STUDY .....</b>	<b>116</b>
<b>ANNEXURE D .....</b>	<b>122</b>
<b>THE QUESTIONNAIRE FOR THE STUDY (ENGLISH VERSION) .....</b>	<b>122</b>
<b>ANNEXURE E .....</b>	<b>127</b>
<b>THE QUESTIONNAIRE FOR THE STUDY (SISWATI VERSION) .....</b>	<b>127</b>

## LIST OF TABLES

**Table 1:** The illustration of the key Strategic outcomes – oriented goals as outlined in the National Energy Strategic Plan 2015 – 2020.

## LIST OF FIGURES

**Figure 1:** Illustration of Mbombela Local Municipality on the South African Map in relationship with the Mpumalanga Province and juxtaposed to all other provinces.

**Figure 2:** The image of a solar water heater on a low-income house in Kanyamazane Township.

**Figure 3:** The respondents by Occupation

**Figure 4:** Education levels of the Respondents

**Figure 5:** Ages of the respondents

**Figure 6:** Gender of Respondents

**Figure 7:** Marital Status of the Respondents

**Figure 8:** Income per month of the Respondents

**Figure 9:** The demonstration of the respondents who indicated the level of consultation regarding the installation of solar water heaters

**Figure 10:** The illustration of whether the respondents benefited from the solar water heaters programme

**Figure 11:** The chart indicating whether the SWH project was imposed on the residents

**Figure 12:** The chart portraying if the local people were employed during the implementation of the SWH project

**Figure 13:** The chart depicting if the solar water heaters project reduced poverty in the community of Kanyamazane

**Figure 14:** Reduction in the use of electricity

**Figure 15:** The chart indicating the response on the maintenance of solar water heaters

## LIST OF ABBREVIATIONS

<b>ASGISA</b>	Accelerated and Shared Growth Industries in South Africa
<b>CRER</b>	Renewable Energies and Energy Efficiency Centre
<b>COP</b>	Congress of Parties
<b>CTF</b>	Clean Technology
<b>DBSA</b>	Development Bank of South Africa
<b>DST</b>	Department of Science and Technology
<b>DTI</b>	Department of Trade and Industry
<b>EMM</b>	Ekurhuleni Metropolitan Municipality
<b>EE</b>	Energy Efficiency
<b>EEDM</b>	Energy Efficiency Demand Side Management
<b>EPWP</b>	Expanded Public Works Programme
<b>RE</b>	Renewable Energy
<b>FBE</b>	Free Basic Electricity
<b>FBAE</b>	Free Basic Alternative Energy
<b>FIFA</b>	Federation for International Football Association
<b>GW</b>	Giga Watts of electricity
<b>ICLEI</b>	International Council for Local Environment Initiatives for sustainability in local governments
<b>IDP</b>	Integrated Development Plan
<b>IP</b>	Investment Plan
<b>IPCC</b>	International Panel of Climate Change
<b>IPP</b>	Independent Power Producers
<b>KW</b>	Kilo Watts of electricity
<b>LED</b>	Local Economic Development
<b>LTMS</b>	SA's Long Term Mitigation Scenarios
<b>MLM</b>	Mbombela Local Municipality
<b>MOA</b>	Memorandum of Agreement
<b>MSOER</b>	Mbombela Local Municipality State of Energy Report 2013
<b>MPS</b>	Monthly Payment Scheme
<b>NERSA</b>	National Electricity Regulator of South Africa
<b>MW</b>	Mega Watts of electricity

<b>NGO</b>	Non-governmental Organisation
<b>NDP</b>	National Development Plan vision 2030 for SA
<b>NCCRP</b>	National Climate Change Response Policy
<b>SA</b>	South Africa
<b>SDC</b>	Swizz Agency for Development and Corporation
<b>SEA</b>	Sustainable Energy Africa
<b>SES</b>	Socio-economic status
<b>SONA</b>	State of the Nation Address 2015
<b>SOPA</b>	State Of the Province ( Mpumalanga) Address 2015
<b>SPSS</b>	Statistical Package for Social Science software
<b>SWH</b>	Solar Water Heaters
<b>UNCCC</b>	United Nations Convention on Climate Change
<b>UNCOP</b>	United Nations for Congress of Parties
<b>UNFCC</b>	United Nations Framework for Climate Change



# CHAPTER 1:

## OVERVIEW OF THE STUDY

### 1.1 INTRODUCTION

The installation of solar water heaters as an alternative source of energy is becoming a means to save energy and assists customers in all sectors of the economy in order to reduce electricity use and to lower energy costs. South Africa as a developing country with high levels of poverty, solar water heating programme may serve as a relief to poor communities in order to afford them the opportunity of saving their income from paying high electricity bills (McAllister, 2012:38).

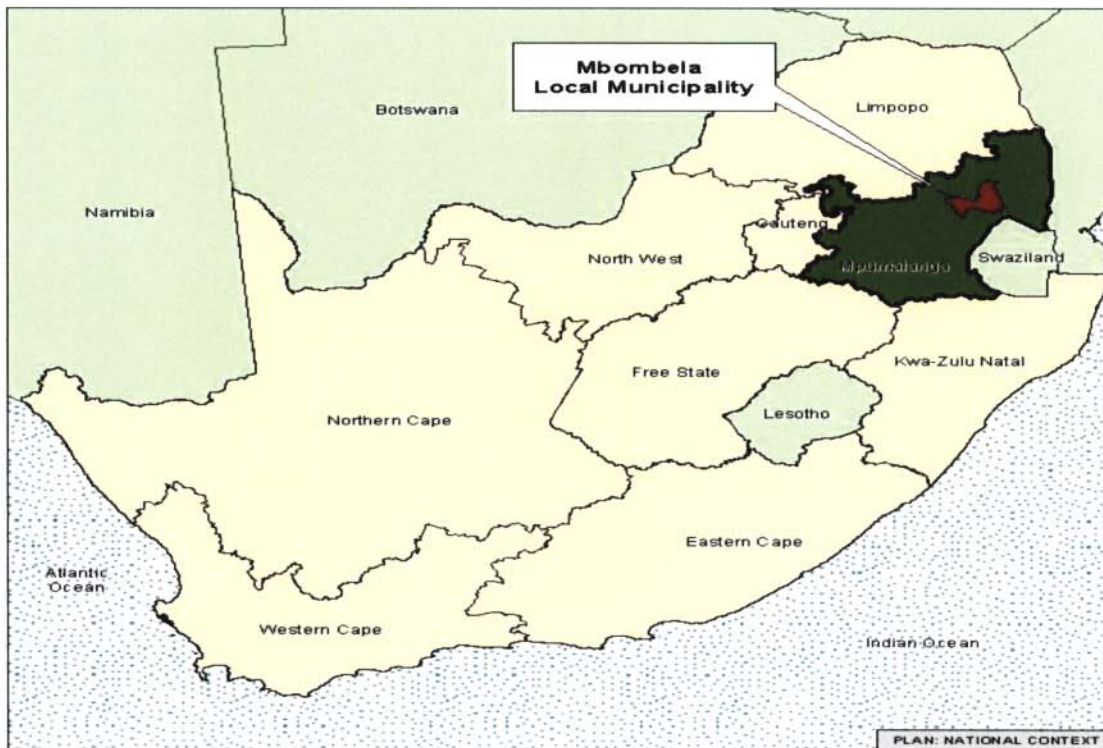
Taking our cue from the International Council for Environmental Initiatives (ICLEI) for sustainability in local government research studies, the use of solar water heaters as an alternative source of energy serves as a relief to low income groups. This was also highlighted in an earlier research conducted by Paul (2010:32) on the Municipality of Cape Town. The study revealed that the project of installing solar water heaters to residents with low income in Cape Town made a positive impact in the lives of the poor.

This study looked specifically into the effects of solar water heaters programme on the socio-economic development of the Mbombela Local Municipality residents in Mpumalanga Province. The targeted area was Kanyamazane Township's low income groups. However, the survey deliberately included the middle income groups since the area where the research was conducted has a mixture of low and middle cost houses.

Mbombela Local Municipality (MLM) is one of the municipalities in South Africa, located in the Ehlanzeni District Municipality of the Mpumalanga Province. The municipality was formed in 2000 by the merger of nearby transitional local council authorities of Hazyview, Nelspruit and White River. Mbombela Local Municipality is derived from a Swati language meaning "A lot of people living together in a small space". The municipality is situated in the North Eastern part of South Africa within the Lowveld sub-region of the Mpumalanga Province as depicted in Figure 1. The 2011

Census shows that, MLM has a population of 588 794, constituting 35% of the entire population of the Ehlanzeni District Municipality. This makes MLM to be the most populous municipality in Ehlanzeni District (Statistics South Africa, 2011). In addition, with regards to the municipality's population trends over the past 15 years, the municipality has been one of the fastest growing municipalities in the district (Mbombela Local Municipality - Integrated Development Plan, 2014:75).

**Figure 1: Illustration of Mbombela Local Municipality on the South African Map in relationship with the Mpumalanga Province and juxtaposed to all the other provinces**



Source: *Mbombela Local Municipality Spatial Development Framework, 2012*

The municipality is made up of 39 wards as per the new municipal demarcation, and 5 planning zones for the purposes of administration and management. The zones include Nelspruit A, Nelspruit B, Nelspruit C, Hazyview and Nsikazi. The municipal wards increased from 36 to 39 and part of Kruger National Park falls within the municipal area as part of ward 39. The research area in this regard, is Kanyamazane Township, situated 27 kilometres away from Mbombela Local Municipality on the eastern axis (MLM- IDP, 2014:76).



Mbombela Local Municipality is 320 km away from two metropolitan areas of Pretoria and Johannesburg towards the West. The municipality is 120 km eastward towards the international borders of Mozambique and Swaziland and 55km from the famous Kruger National Park. Urban areas in Mbombela Local Municipality include Nelspruit, White River and Hazyview. Its townships are Kabokweni, Kanyamazane, Matsulu and Tekwane (MLM- IDP, 2014:76).

The municipality is the capital city of the Mpumalanga Province and the head office of the provincial government (legislature). The location and its status of a capital city provide the municipality with a competitive advantage as a corridor for growth and development. The city has two airports, Kruger Mpumalanga International Airport to the north east, and the general aviation Nelspruit Airport to the south west. Kruger Mpumalanga is used for scheduled flights to Johannesburg and, less frequently, to Cape Town, Durban and other cities (MLM- IDP, 2014:76).

The municipality conducted a mini-household survey in 2013 which revealed that 42% of the households commented that the cost of electricity was too high for the consumers. This issue raised some serious concerns looking at the socio-economic conditions of the area, particularly lowest income households. This municipality has recently established a section in the office of the Municipal Manager designated as Energy, Sustainable Development and Expanded Public Works Programme (ESD & EPWP) which deals with energy matters. This section is also responsible for the climate change (mitigation and adaptation) measures and energy (efficiency and renewable) programmes coordination. Electricity is supplied by both Eskom and Mbombela Local Municipality (Mbombela Local Municipality State of Energy report, 2013:39).

Mbombela Local Municipality Local Economic Development Strategy (2014:13) demonstrates that the municipality has a high rate (36%) of unemployment when compared with the 2011 South African Statistics Report which indicates 25% unemployment rate. The city does not have mining industries even though it is growing at a very fast rate in terms of the housing, commercial and road infrastructure development. It is dominated by the agricultural activities which includes the plantation

of lemons, oranges, avocado, pear and mangoes, to name but a few. Vast areas of the municipality are rural with eight Tribal Councils within the municipal boundaries. The researcher became interested to ascertain if the solar water heating programme made a positive impact in the lives of those who benefitted by taking into account the socio-economic status of the area in general.

## **1.2 STATEMENT OF THE PROBLEM**

The continuous annual exorbitant increase of electricity bills in South Africa necessitates mass implementation of solar water heaters to low income groups. The provision of solar water heaters as an intervention affords access to hot water facilities without having to incur extreme energy costs. It is worth noting that without proper, purposeful and intentional awareness programmes to beneficiaries, solar water heating technology may lose its meaning. Subsequently, this lack of policy guidelines and legislative framework pertaining to the installation of solar water heaters to households exposes the municipality to experience difficulties in promoting the expansion of Solar Water Heaters (SWH) technology (Naicker, 2010:16).

The Mbombela Local Municipality is the capital city and a business and administrative hub of the Mpumalanga Province with a population of 588 794 and a projected population of 664 197 by the year 2020. Being predominantly rural (80% rural and 20% urban), it is predisposed to high poverty levels. The envisaged economic growth coupled with a growth in industrial activity indicates high demands of energy in the future. Judging from the socio-economic status and projected activities of the Municipality, there will be an increase in energy consumption which will consequently impact on affordability especially to families living below the poverty belt (Local Economic Development Strategy, 2014:14).

This impact on affordability is on both the municipal residents and also to the municipality itself. Mbombela Local Municipality provided solar water heaters to 1 200 households out of the 59 000 residents (Mbombela Local Municipality IDP: 2013:56). The municipality embarked on this pilot study with an intention to increase the scope of the projects in the future so as to benefit more people. To date, no further installations were commissioned. The monthly household incomes of 66% of the



population in the Greater Mbombela Local Municipality areas like Kanyamazane Township ranges between R400 and R1 600 per person (Mbombela Local Municipality IDP, 2013: 82). The rate at which people of Kanyamazane Township pay their electricity bills ranges from 29% to 32% (Financial Management Performance Report 2013:9). Other social dynamics included, these figures indicate that the residents of Kanyamazane Township were struggling to pay for their consumption of electricity.

The funding for the 1 200 installations came through the hosting of the 2010 Federal International Football Association (FIFA) World Cup. The Municipality obtained grants from the National Department of Energy to install solar water heaters in Kanyamazane in 2009, as a means to comply with Host City Agreement principles in terms of Green Economy (Host City Agreement, 2009:9). However, these geysers have not been maintained since their installation and this explains why they malfunction most of the times. Several complaints to this regard have been received by the municipality through public participation but the situation continues unabated and with severe financial implications to the recipients of these geysers.

The erratic availability of water supply in the area compounded the solar water heater's technology problems. Water is available during some nights or some days and in most cases, the supply is inadequate. The residents find it difficult to use solar water heaters effectively. The value of having such an alternative source of energy as a relief to reduce cost on the electricity consumption becomes a challenge (Integrated Development Plan 2014: 56). In the light of all these seemingly opposing factors, this study seeks to determine whether the solar water heaters programme in Kanyamazane Township still carried more weight vis-a-vis the status quo in positively influencing the socio-economic development of the Mbombela Local Municipality residents.

### **1.3 AIM OF THE STUDY**

The aim of the study is to determine the effects of the solar water heaters programme in enhancing the socio-economic status of the Kanyamazane Township residents.

### **1.4 RESEARCH OBJECTIVES**

The objectives of the proposed study are:

- To ascertain if the beneficiaries as stakeholders in the solar water heaters project have had a significant role to play as far as the implementation of the project was concerned; and
- To determine if the solar water heaters project brought about an improvement in the lives of the recipients in the form of job creation, investment and savings in the Kanyamazane Township.

### **1.5 RESEARCH QUESTIONS**

The proposed study is to seek to answer the following primary research questions:

- To what extent were the beneficiaries as stakeholders involved in decision making process in the installation of solar water heaters in Kanyamazane Township?
- What improvement has been brought about by the solar water heaters projects in the lives of the recipients in terms of the jobs, investment and savings in the Kanyamazane Township?

### **1.6 RATIONALE OF THE STUDY**

The study attempts to ascertain whether the solar heating programme in the researched area improved the socio-economic status of the beneficiaries. This topic was decided upon by the researcher based on the fact that Mbombela Local Municipality was in the process of planning to rollout solar water heater installation project to other townships in future. It was therefore necessary to conduct a survey in the pilot area to collect facts on whether the project met the anticipated objectives of



ensuring that the beneficiaries have less pressure on paying high electricity bills. The outcome of the study may assist the municipality to ensure that appropriate systems are put in place to at least guarantee the success of the next rollout plan.

The researcher embarked on the study as a means of collecting data and seeking to establish whether the beneficiaries from the 1 200 households installed with solar water heaters benefitted in terms of reducing their financial burden in paying electricity bills. It is envisaged that this study may assist the municipality in the future rollout of solar water heaters installation in ensuring that such type of a programme alleviates poverty and improves the lives of beneficiaries. This assertion is due to the fact that firstly, when this study was conducted there has been no evidence that a similar study was conducted in Kanyamazane Township. That having been stated, the preceding researches conducted by Paul (2013:2) and Nxumalo (2013:2) focussed mainly on the consumption level of electricity comparing the outcome of using the solar energy and convectional electricity. Secondly, that the Mbombela Local Municipality did not evaluate whether the programme was successful or not in meeting its objectives. In contrast, the aim of this study is to determine the effects of the solar water heaters programme in enhancing the socio-economic status of the Kanyamazane Township residents.

## **1.7 SIGNIFICANCE OF THE STUDY**

This study is important in that Mbombela Local Municipality with its intention to continue with the installation of solar water heaters programme, will through this study obtain information whether the installation of solar water heaters in Kanyamazane Township was a success or not. The study could assist other municipalities, government sectors and practitioners who may be interested on the solar water heaters installation programme by gathering information from this research and being able to plan the implementation of such a programme in an informed manner.

Again the study has potential value for practitioners in that the knowledge acquired through this study might necessitate the revision of policies and the modus operandi for service delivery with a positive result of improving the quality of life for the poor community.

Furthermore, the research findings may contribute to the Public Administration body of knowledge and serve as a basis for the new theories that will be developed by academics, especially those that focus on exploring the introduction and implementation of green energy technologies. The study may also serve as a basis for other researchers who would like to engage in similar studies in other provinces and the country because this study focused only on Mbombela Local Municipality in the Mpumalanga Province.

## **1.8 RESEARCH METHODOLOGY**

Research methodology refers to a scientific and methodological way of conducting a research in order to solve a certain a problem. It is a procedure a researcher engages in to describe, explain, predict phenomena, and describing study methods utilised to gain knowledge. The aim of research methodology is to provide a work plan of research (Rajasekar Philominathan and Chinnathambi, 2013:5). As espoused by Brynard & Hanekom (2011:36), research methodology encapsulates a body of methods of collecting data which will necessitate a reflection of planning signifies, structuring and execution of the research in order to comply with the demands of truth, objectivity and validity. As research is a process involving gathering scientific knowledge by means of various objective methods and procedures, as stated by Welman, Kruger & Mitchell (2010:2), it therefore is important to state the design of the research, methods of collecting and analysing data, and to specify the sample and how the sample was chosen. The research methodology became imperative for this study as it enabled the researcher to plan properly on how to collect and analyse data using appropriate methods.



## **1.9 RESEARCH DESIGN**

Research design refers to the plan according to which data is collected to investigate the study, hypothesis or question in an economical manner. The researcher embarked on the collection of data leading towards solving the research problem. The different research problems dictate the type of research design and methods which would result in the collection of different types of data with different interpretation of such data. A research design has two approaches namely a qualitative research approach and a quantitative research approach (Kgwefane, 2014: 60).

### **1.9.1 Qualitative Approach**

Kgwefane (2014:61) states that a qualitative research design is aimed at making an in-depth analysis of the manner in which the project is introduced where the responsible institution should be ready to manage the project and, at the same time, looking at the effects of the implementation of the project. Bearing this in mind, the gathering of information for this research was done through semi-structured interviews directed to the senior manager and the manager of Electrical Engineering Department and one senior official from the service provider (a company that installed the solar water heaters in Kanyamazane) to establish whether the beneficiaries were informed on the importance of the project. The researcher analysed the SWH project looking at how it was introduced and whether it was properly implemented and maintained.

The reason for selecting these officials for interview was due to the fact that they are experts in the field of electricity supply and responsible for the electricity installation programme in the entire municipality. The engagements with them through interviews may enable the researcher to have an in-depth knowledge of what might have happened prior to the implementation of the projects in terms of decision making processes.

### **1.9.2 Quantitative Approach**

Kgwefane (2014:60) describes quantitative research design as the approach that seeks to explain, predict, conform, validate and test a theory. Since the researcher

was collecting information on whether the targeted community was taken on board on the importance of the project and the benefits thereof, quantitative research was conducted. Quantitative research chooses methods that allow them to objectively measure variables. The intention of quantitative research is to establish, conform or validate relationships and to develop generalisations that contribute to theory.

The researcher through quantitative approach conducted an investigation to 50 Kanyamazane Township beneficiaries using the questionnaires to ascertain whether the project had an effect on the socio-economic status on the installation of solar water heaters. The questionnaires were designed and distributed to the researched population to collect data which was later interpreted, so as to determine the impact made by the solar water heaters on the lives of the beneficiaries in Kanyamazane Township. Since the researcher could not reach all beneficiaries due to time constraints, the questionnaires were a better solution to collect data which were further analysed and validated to produce new theories. The Likert Scale was used to analyse the data. The Likert Scale is used to measure respondents' attitude to a particular question or statement. The questionnaires are coded into a scale of five. It is a common ratings format for surveys (Allen & Seaman, 2013:1). The collected data will be subjected to the Statistical Package for Social Sciences (SPSS) software which is able to analyse both qualitative and quantitative data (Lukhele, 2009:3)

## **1.10 RESEARCH AREA**

Jobela (2011:18) describes the research area as the area of focus for the study which the researcher must concentrate on in order to conduct a good research with reliable results. The research focussed in one of the large townships in Mbombela Local Municipality known as Kanyamazane Township, situated in the eastern part of Mbombela Local Municipality. Kanyamazane consists predominantly of low income groups and the middle class mixed at low scale. Kanyamazane has three wards (18, 19 and 20 wards) with 15 000 households.

## **1.11 POPULATION**

According to Streeter (2011:46) a population means a segment of a large group within a society that share common characteristics. Brynard & Hanekom (2011:55) further state the importance of the population for the study which is referred to as the group or subjects possessing the same attributes in which the researcher is interested in order for the researcher to establish new knowledge. A sample of population is used to save time in the case of studying the large population and it be time consuming to collect data. The sampling of the population for the study also cuts costs.

The researcher focussed on the 1200 households from low income community who benefited from the solar water heaters project in Kanyamazane Township in Mbombela Local Municipality.

## **1.12 SAMPLING**

According to Brynard & Hanekom (2011:55) a sample should be a representative of the larger group with the same characteristics, and the researcher should ensure that the sample selected for the study is representative of the targeted entire community to ensure validity and reliability of the study.

As the study sought to determine if the socio-economic status of Kanyamazane residents who benefited from the solar water heaters has improved, and the extent to which Kanyamazane community benefited from the project, the researcher had to draw a sample from the households that benefited for the solar water heater project and the implementers of the project. The sample size for the study was 50 (fifty) households who benefited from the solar water heaters. In order for the researcher to collect the authentic data in the study the questionnaires were used for the data collection.



Welman, Kruger & Mitchel (2010: 56) state that researchers use a variety of sampling methods to collect data, and the most common are probability and non-probability sampling methods. The utilisation of probability sampling gives members of the population where a study is conducted an equal opportunity to be selected to participate in the study, whereas non-probability sampling is a selection of a sample based on, inter alia, convenience and does not need any representativeness. In the former participants may be selected using, among other methods, a simple random sampling technique and in the latter a purposive sampling technique.

For this study the researcher used both simple random sampling and purposive sampling to collect data from recipients of solar heaters and three officials that are experienced in the field of the electrical engineering and solar water heaters and who have an experience because of their involvement in the project respectively. The three selected officials are the Senior Manager: Electrical Engineering Department; Manager: Electrical Engineering Department (both employed by Mbombela Local Municipality); and the senior official from Eskom who is in charge of the solar water heaters project (Welman *et al*, 2010:69).

### **1.13 DATA ANALYSIS**

Brynard & Hanekom (2011: 60) describe data analysis as a process of analysing the data collected during research. Data analysis method serve as a means to choose a better statistical procedure which will enable the researcher to analyse the data. The researcher collect data and eliminate what is not relevant for the research project. Since this study on solar water heaters project was a combination of both qualitative and quantitative research approaches, the qualitative and quantitative data analysis methods were used to ensure that the actual research problem is properly dealt with until the conclusions are drawn based on the findings of the study.



## **Analysis of Qualitative Data**

Qualitative data analysis consists of words and observations that translate into meaning gathered from interviews and observation. Taylor-Powell and Renner (2003:1) state that in order to analyse qualitative data the researcher has to categorise data by coding or indexing, and has to identify themes and patterns in order to organise words that have similar theme and patterns into logical categories that give a summary and meaning to a text. This section is discussed further in chapter 3.

## **Analysis of Quantitative Data**

Taylor-Powell and Renner (2003:1) state that quantitative data analysis consists of statistical analysis which is more mathematical in nature since it involves figures. For this study the information gathered from questionnaires will be analysed through a statistical software called IBM - Statistical Package for the Social Sciences (IBM SPSS). This is a widely-utilised statistical package to interpret numerical data in order to provide an actual account of what took place in the unit of analysis, in this case the Mbombela Local Municipality.

### **1.14 RESEARCH LIMITATION**

This study strictly focused on the determination whether the project brought about an improvement in the lives of the recipients in the form of job-creation, investment and savings in the Kanyamazane Township and to ascertain if the beneficiaries as stakeholders in the project had a significant role to play as far as the implementation of the project was concerned.

The researcher did not investigate the cost of the installation of solar water heaters, but only focused on the socio-economic status of the Kanyamazane Township project beneficiaries by targeting only households that benefited on the project.

## 1.15 ETHICAL CONSIDERATION

According to Kgwefane, (2014:67) a researcher must look closely at the ethical implications of what is being researched on. In order to ensure that the researcher complies with the ethical consideration, he should provide consent to participants whether they agree or not agree to participate in the study.

The Ethical code of the University of Limpopo was observed during the research. Prescribed procedures were followed during the study to ensure compliance with the ethical code of the University such as, explaining the main aim of the study, making clear to the beneficiaries that participating in the study was voluntary and that the participants' privacy would be respected at all times and that everything the participants shared was going to be treated as confidential.

For confidential purposes the questionnaires did not have names of those were interviewed or participated in any other relevant manner. The researcher applied for authorisation to Mbombela Local Municipality to conduct this study regarding the effects of solar water heaters on the socio-economic status to those who benefited. The research results were provided for the municipality to use it for future references when the municipality embarks on a similar type of project with regards to the rollout of installations.

## 1.16 DEFINITION OF CONCEPTS

**Climate Change** – refers to the gradual increase in global temperature (warming) due to change in the composition of the earth's atmosphere. Humans have contributed to climate change, largely by burning fossil fuels, clearing land, and increased farming, which has exacerbated the greenhouse effect (Parry-Davis, 2013: 313).

**Greenhouse gases** – refers to the offensive gases such as carbon dioxide (CO<sub>2</sub>) which when emitted in the atmosphere in large quantities damage the ozone layer and the weather conditions become affected for example extreme heat conditions or very cold conditions( Renewable energy Strategy, 2013:25).

**Energy efficiency** - refers to the way of managing and restraining the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input or the same services for less energy input (Parry-Davis, 2013:313).

**International Council for Local Government Initiatives (ICLEI)** – refers to a non-governmental organisation and the international association that helps local governments meet their self-defined sustainability, climate and energy goals. The ICLEI's mission is to mobilise international cities to guild and serve a worldwide movement of local governments to achieve tangible improvement in global sustainability with a focus on environmental conditions through cumulative local actions, knowledge sharing and capacity building. (International Council for Local Government Initiatives (ICLEI) Africa Report 2013: 2).

**New growth path plan** – is a plan of South Africa introduced and adopted by national government to increase the emphasis towards developing and growing the green economy within the country thereby participating in the reduction of the greenhouse gas emissions while creating job opportunities for the poor communities (National Growth Path Plan, 2010:1).

**Renewable Energy:** is a programme in South Africa developed in response to the need of the country to participate meaningfully within the renewable energy sector internationally. Renewable energy aims to improve the country's environment, reduce the contribution to adverse climate change and alleviate energy poverty, whilst promoting green economy (North West Province Solar Water Heaters Strategy, 2012:12).

**Socio-economic status (SES)** is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position in relation to others, based on income, education, and occupation. Socio-economic is a field of study that examines social and economic factors to better understand how the combination of both influences something (Sustainable Energy Africa, 2014:3).



**Solar Water Heating Technology** – refers to the significant technology used to generate power to heat water in the geysers or any container through sun shine. Solar water heating depends on the availability of the sun (Johnson, 2012:32)

**Solar Water Heaters (SWH):** is one of the most effective ways of cutting a household's carbon footprint by reducing reliance on dirty fossil fuel usage. By offsetting the use of electricity, gas or heating oil, using solar water heaters can also provide financial savings by reducing energy costs (North West Province Solar Water Heaters Strategy, 2012:15).

**Sustainable City** – refers to a city marked by green economy, a local health and happy community, smart infrastructure and are bio-diverse low carbon resilient and resource efficient (Parry-Davis, 2013: 313).

## **1.17 ARRANGEMENT OF CHAPTERS OF THE STUDY**

The research consists of five chapters. Chapter one outlines the main areas of focus for conducting a research. It describes the problem statement and objectives of the study. It clarifies the primary research questions, the research methodology, ethical considerations and limitation of the study.

**Chapter two:** This chapter contains details of the literature review. It covers the information on solar water heaters technology from a global perspective. The chapter discusses in details the concept of energy and development within international and national context on socio-economic status. The chapter also includes the South African policy and regulatory framework that has bearing on the solar water heating programme in South Africa.

**Chapter three:** This chapter explains in detail the research design and methodology used in the study. The chapter describes the methods used to collect data such as the interviews and questionnaires that were conducted with the management and the community of Kanyamazane Township respectively. The questionnaires were utilised to collect data from the community of Kanyamazane Township. The chapter further

describes how data was collected secondary sources such as internet sources, books, journals, reports, policies and other relevant documents.

**Chapter four:** This chapter presents the analysis of the research findings. The information obtained in the literature review is compared to the results obtained from the questionnaire conducted with regard to solar water heaters project. The responses from the interviews and questionnaires are critically analysed to ensure their validity. The collected data is subjected to the Statistical Package for Social Sciences (SPSS) software which is able to analyse both qualitative and quantitative data.

**Chapter five:** This chapter contains the conclusion of the study and provides some recommendations. The areas for further research are also recommended. The limitations to the study are discussed and areas for further research are proposed.

## **1.18 CONCLUSION**

This chapter indicated the overview of the study by expressing the research problem, aim and objectives, and the research questions that would lead to possible answers that would assist in resolve the identified problem. The chapter further mentioned the research approach applied such as qualitative and quantitative. Furthermore, the methods to collect and analyse data were explained. It is quite important to also mention that the study had some limitations since only few residents in Kanyamazane benefited from the solar water heaters project. The critical terminologies or concepts for solar water heaters project used in the study were clearly defined so their meaning be understood when used in the report. Finally the chapter presented the overview of the chapter of the dissertation.

Chapter two of the study presents literature from different authors and scholars on the solar water heaters subject. The information will be from International and South African literature.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

Chapter one of the study provided an overview of the study and the problem statement. In this chapter a literature review focuses on the concept of solar water heaters in general terms and what other authors say about the subject in relation to the effect of solar water heaters programme on the socio-economic development of the communities of Mbombela Local Municipality. The discussion will include an exploration of solar water heaters from both an international and a localised South African perspective. Included in the discussion is the solar water heaters policy initiatives nationally and locally to detect what has been attempted by the statutory bodies on the grounds of dealing with matters of solar water heaters in a broader perspective.

#### **2.2 THE CONCEPT OF SOLAR WATER HEATERS**

This part of the chapter focuses on the research conducted globally and nationally in respect to solar water heaters programme and the importance of exploring such renewable energy programme especially for the poor communities as well as relevance to the study.

##### **2.2.1 Global Perspective**

There have been significant changes across the globe as pressure from environmental activists coerce organisations toward 'greener' energy sources, in order to reduce air pollution and fossil fuel depletion. This was further highlighted by the Kyoto protocol (which was adopted in 1997), and this agreement was undertaken by several developing and developed countries which "committed to reducing their greenhouse gas emissions by an average of 5, 2% of their 1990 levels" (Vernon, 2002). Since



electricity generators predominantly use fossil fuels in the production of electricity, these generating plants are deemed to be responsible for some of the greenhouse gases that are vented into the atmosphere. By using renewable energy to generate electricity, the air pollution from fossil fuel electricity generation is reduced significantly (Naicker, 2010:12).

It is internationally recognised that the energy saving of one unit is cheaper than producing the same unit of energy. Energy efficiency is the best approach and the most preferred way of addressing the climate change trends, high electricity cost and electricity supply constraints. The importance of energy efficiency is considered at global level, by the World Energy Council including related policies as a solution to reduce greenhouse gas emissions. Energy efficiency has therefore far reaching benefits in terms of savings and creation of green jobs (State of Energy in South African Cities Report, 2015:40).

Solar water heating technology is now a solution to substitute use of electricity. This was tested in the Chinese City called Zhejiang in 2009 where the research findings confirmed that the environmental and economic benefits from solar water heaters were outstanding in comparison to other energy sources. The social benefits were linked to the reduction of fossil fuel usage of households where it was revealed that the residents who benefited from the project lived a healthy life, the fuel cost is reduced and the indoor air quality in the houses has improved (Wlokas, 2011:28).

The Solar water heaters technology as a means to heat water has been found to be affordable and accessible by the communities of low-income category. This technology serves as a least expensive means of heating water for domestic purposes. Solar water heaters rely on the natural heat from the sun to produce radiation that will generate energy to heat water in the geysers. This is a water heating technology which is promoted to achieve two objectives. The first of these objectives in no particular order is to enable poor communities to have access to hot water without spending high cost on electricity. The second objective is the reduction of carbon footprints for the safety of the future generation (Visagie & Prasad, 2006:2).



The Solar water heating is a process of utilising the sun's heat energy to raise the temperature of water. The solar water heater (SWH) is installed on the roof of the house so that the flat plate solar collector can capture the sunlight. The flat plate solar collector operates on the basic principle that black surfaces are more efficient in absorbing heat energy and this collected heat energy on the absorber plate is then transferred to the water by the collecting tubes. The cover plate ensures that the heat energy from the sun remains within the solar collector. The resulting hot water rises due to density differences between hot and cold water, to the storage tank for utilisation. The fluid inlet is where the cold water enters to be heated and the fluid outlet is where the hot water is released for utilisation (Naicker 2010:13).

Paul (2013:16) states that the Solar water heaters introduction are aimed at providing affordable infrastructure services by ensuring that poor households have access to hot water at a very low and affordable cost while the greenhouse gas emissions are reduced. A challenge exists where technologies are not perceived to benefit low income households. The argument in this regard is that the introduction of renewable technology such as solar water heater is viewed as the nice-to-have by the middle class. This perception may be due to lack of awareness and the paucity of knowledge about benefits that technology comes with. The households only become interested on the product once they are aware of the benefits. Poor households may not have capital to install SWH or they may not have knowledge on the technology. Because of lack knowledge, these households may not understand the economic impact of SWH, for example, in the electricity consumption rebates. Such (rebates) are limited to certain individuals who may be able to afford this type of service.

Visagie and Prasad (2006:3) further mention that solar water heaters are easily fitted on roof buildings. The manufacturing industries contribute to poverty alleviation as jobs are created through installation, maintenance and general services. However individuals need to be properly trained in order for them to obtain a basic knowledge on the subject.

The Solar water heaters are characterised by a panel and insulated storage tank. The solar water heaters have two classifications, passive and active. The passive system

uses the thermosyphon principle to heat and circulate water but the active system has pumps to circulate through the system (Visagie and Prasad, 2006:06).

Naicker (2010:12) describes the various sources of renewable energy that may be harnessed from the earth. These include hydro, wave, solar and wind energy. Solar and hydro energy are favoured because they do not have an associated fuel cost, they are inexhaustible and there is virtually no resulting pollution. However, the distinct advantage that solar energy has over hydro energy is that it can be used almost anywhere where there is an abundance of sunlight, whereas hydro energy is limited to areas where there is water that is flowing continuously.

Globally, in the last fifty (50) years more coal and oil have been used to produce electricity and these fossil fuels may become extinct in the next 50 years if not conserved. The use of these fossil-based fuels contributes to the environmental damages through emission of greenhouse gases affecting the ozone layer in the atmosphere. The emissions of such fuels are changing the way energy from the sun enters and escape from the earth's atmosphere causing a greenhouse effect which brings rise to climate change challenges (Ward, 2008:5). Domestic water heating is considered as a huge consumer of electricity worldwide. Solar water heaters play a significant role in reducing electricity consumption. The use of solar energy is promoted as an affordable renewable energy for the low income households (Ward, 2008:12).

According to Nxumalo (2013:3), energy has become a central factor in people's daily lives because of high dependence on energy sources for everyday living internationally. Access to energy sources is still below the acceptable poverty level in developing countries, South Africa included. The use of solar water heating by communities from low income households will serve as a leverage to minimise costs (consumption cost) and therefore improve their socio-economic status. The solar water heaters have been promoted internationally as a proven innovative project that contributes towards increased access to hot water infrastructure in poor communities. It is common knowledge that poor communities are largely made up of low income groups.



The Millennium Development Goals (MDG) by United Nations prioritised poverty alleviation as one of its eight nodal points to ensure that every human being internationally has a basic income for survival. These (8) millennium goals were introduced in 2000 with an intention to have been accomplished by 2014. To date some strides have been noticed in terms of interventions (The Millennium Development Goals Report, 2014:3). The Sustainable Development Goals (SDG) which further takes the goals of MDG to another level includes the three important elements in addressing poverty which are inequality, job creation and climate change. In several international conventions (conferences) it has been realised that these elements are essential in addressing poverty internationally (Sustainable Development Goals Report, 2015:3).

The Millennium Development Goals Report (2014:4) demonstrates that a remarkable progress has been made to address poverty since 2000. From the researcher's point of view, it is partly true that there has been an improvement in terms of poverty alleviation however; these strides are hampered with the world population explosion. Population explosion obscures any form of impact especially if one looks at the economic growth situations. When addressing the issues that come with poverty, one needs to honestly deal with trends that threaten environmental sustainability. The industrial revolution is contributing heavily towards greenhouse gas (GHG) emissions into the atmosphere. These emissions if not reduced will deplete the Ozone layer thus increasing temperatures in weather conditions. Congress of Parties (COP) 17 in Durban, 2011 highlighted the importance of green economy which is a move to concretise all industries to develop strategies to minimise GHG emissions. The promotion of SWH actually seeks to address two critical inseparable aspects which are poverty and access to affordable energy sources.

The United Nations in terms of Millennium Development Goals 2010, implementation programme, conducted a Solar Water Heating Project in the poor community of India as a means to strengthen Global Solar Water Heating Market Transformation. The Indian government played a significant role in ensuring that the project becomes successful. The main objective was to promote investment in renewable energy technologies targeting the poor communities. The project sought to enable poor communities to have access to hot water without incurring any high electricity cost.



The Indian government is embarking on ambitious infrastructural developments which heighten demands in electricity. Contrary to these fast-paced infrastructural projects, their economy is developing steadily (Wong & Tandon, 2013:8).

The international studies conducted in China, Papua New Guinea and Laos focussed on the dissemination of solar water heaters technology which were promoted by World Bank. Access to solar water heaters by the poor communities in the above mentioned countries contributed to the ability to have hot water without incurring excessive high electricity bills. Access to SWH by poor communities is assumed to have provided relief in paying exorbitant high electricity bills and subsequently providing potential job opportunities to local people (Naicker, 2013:3).

The Renewable Energies and Energy Efficiency Centre (CRER) of the City of Betim in Brazil (2010) conducted a survey in four housing estates to determine the effects of the installation of the solar heaters. Betim is also internationally known for Salão do Encontro and Missão Ramacrisma, two entities recognized for their social work with the poor communities. Granted, there are lots of poor communities in Betim. The low income families within the municipality were targeted for the research. The main objective of the study was to compare the electricity consumption before and after installation of solar heaters. The solar heaters resulted in up to 20% savings of electricity consumption and up to 57% savings on the electricity bill for the average 3-4 members' family. The survey enabled a better understanding of energy consumption profile (Barbi & Cerqueira, 2010:2).

The survey conducted in the City of Betim made it possible to know the effects of the solar heaters at the housing units. The survey revealed that:

- The solar heaters reduced power consumption by up to 25% in the majority of cases maintaining an average consumption of 74kWh/month in 3-4 member households;
- In general terms the electricity bills were reduced by up to 57%;
- With these savings on the electricity bill, the use of solar heater enables a considerable increase in disposable household income;

- 94% of the surveyed stated that there is enough hot water provided by solar water heaters for the whole family throughout the day;
  - 98% approve of solar heaters
  - 96% would install a solar heater in another house
- (Barbi & Cerqueira, 2010:2).

Based on the results of the research, it may be concluded that introduction of SWH in this municipality of Betim became a relief financially to its targeted residents. They could save money for other domestic purposes. However this research will determine if the installation of SWH in Kanyamazane Township can confirm the outcome of the study of the City of Betim.

According to Naicker (2010:17) research conducted in India revealed that the Indian Government introduced financial incentives to end users with an intention to encourage use of domestic solar water heating systems (DSWHS). The domestic solar water heating system was designed in such a way that the package included financing in the form of loans for capital subsidies, with very low interest rates in order to make it affordable to low-income communities. Due to lack of knowledge on the advantages of having access to SWH, the levels of penetration were too low. It was therefore detected that dissemination of information to the citizens of India had been too limited. This signalled the importance of conducting awareness programmes to beneficiaries. The Greek government was successful in assisting its communities financially to install SWH. Between 1980 and 1990 there was a drastic growth of establishment of industries to manufacture the SWH locally. The financial assistance by the Greek government made it possible for poor communities in Greece to have access to SWH in their premises.

### **2.2.2 South African Perspective**

South Africa as the member of the United Nations Convention on Climate Change had to ensure that the use of fuels that have a high greenhouse gases emissions are reduced as decided in the Kyoto Protocol declaration of 1997. The South African economy has one of the values for energy intensity in the world. The fast developing



cities such as Johannesburg and Durban have energy systems which are characterised by highly inefficient coal powered electricity generation and coal-fed liquid fuel plants. This is a call for the provision of alternative green energy which will be affordable to the low income society (Wlokas, 2011:29).

Sustainable Energy Report (2014:19) states that independently and since 1990, the minerals and energy sectors have been central to the development of the South African economy. The mining industries require a high substantive amount of energy to survive. Coal was the only raw material which could be used to produce electricity and it was in abundance. During the Apartheid era, electricity production was done by Eskom Energy Supplier at a very cheap rate when compared internationally. Eskom was supplying electricity to all these mining industries cheaply. This move was in line with SA government job creation policies. The government did not analyse critically the outcome of the electricity cost against the production cost. Unfortunately the production cost was too high while the electricity was cheap. The worse situation was when Eskom entered into an agreement with government to reduce electricity by 20%. This decision had serious implications on the delivery of service in the long run. The New South African dispensation in 1996 embarked on an intensive electricity roll-out programme to previously un-electrified areas, taking into account the electricity low cost approved by government. The latest findings according South African national Statistics (2011), South Africa has successfully electrified 90% of its population. Subsequently, the lifting of international sanctions after the 1994 elections increased the opportunities for the international investors to enter the South African landscape thus increasing both the economy and the energy demand.

The 2014 report on Sustainable Resource Energy signalled the possible energy supply challenges, which was ignored after having experienced the economic meltdown which reduced the economic growth countrywide thus making the Eskom Energy Supplier focussing on maintaining the existing plants. Since 2008 Eskom struggled to meet the country's extreme energy demand. On the other hand the Kyoto protocol resolutions of 1997 promoted that human beings must be protected from any possible environmental pollution which may affect their health. This statement was included in section 24 of the Republic of South Africa Constitution, 1996 as one of the fundamental human basic rights for every person. This led to the importance of reducing the



greenhouse gas emissions into the atmosphere and ultimately to the introduction of green economy, promoting the use of cleaner energy. Solar energy contributes to the alternative source of energy (Sustainable Resource Energy, 2014:22).

Paul (2013:3) argues that South Africa has high solar radiation levels in the world. With such a natural advantage of plenty of sunshine, it is incumbent upon the nation to explore solar energy as the most sensible alternative to hydro-powered electricity. Regarding the findings of Statistics South Africa (2006) which shows that South Africa experiences more than 2 500 hours of sunshine per annum, one can press forward a thinking that the country has considerable opportunities to explore the use of solar water heating and other solar technologies. It goes without saying that the municipality will not encounter any challenges on the functioning of the solar water heaters when they are installed properly. The abundant availability of sunshine in South Africa enables the government to vigorously ensure that SWH becomes a solution to save electricity cost for other domestic needs.

In his research study Paul (2013:3) further explains that it may be eloquently mentioned that South Africa has a potential to explore the solar energy as an alternative source of electricity which will be accessed by the middle and lower income groups at a reasonable affordable rate. It cannot be denied the fact that South Africa is in a crisis situation in terms of supplying adequate convectional electricity to the country. South Africa is economically rated as a third world country due to high levels of poverty. Compounding the situation is the electricity cost that is unstable and increases annually without fail.

The crisis situation in South Africa was witnessed by the recurring load shedding schedules which heavily affected certain pockets of the country including the industries. Since January 2015, the whole of South Africa experienced electricity supply outages at different stages and intervals which would last sometimes two or three hours. The main aim of these outages was to prevent total blackouts and ensured that the current demands were properly managed while preventing possible breakdowns of power plants as a result of overloading (Eskom System Status Bulletin, 2015).

Since 1994, South Africa introduced many pro-poor energy policies such as 1989 White paper on energy, Free Basic Electricity (FBE), Free Basic Alternative Energy (FBAE) and national electrification and housing programmes. Despite these attempts South Africa is grappling with high energy poverty levels in the democracy which has been in existence for slightly over 20 years. South Africa continues to experience rapid urbanisation estimated at 64% of the country's population residing in urban areas of which 40% are residing in big cities. Urban population is postulated to reach 70% by 2030. According to the national census of 2011, the population growth in big cities is estimated to grow at 2%-3% per annum. The migration of communities from rural to urban environment puts pressure on the government to consider all categories socially and economically (Sustainable Energy Africa, 2013:7).

Solar water heating technology is generally a matured industry in South Africa. There is a significant body of knowledge in both industry and academia to support the modelling and development of the industry, as well as to support the current activities aimed at the industry's regulation. In 2003 an industry association, SolarSure, was established to represent the interest of all stakeholders in the delivery of services in the SWH industry. SolarSure has initiated task groups to deal with standards and testing facilities and procedures. The South African Government structures support the industry. The Central Energy Fund (CEF) is currently assisting SolarSure in executing these tasks (Visagie and Prasad, 2006:9).

Naicker (2010:3) says that Eskom Electricity Distributor (Eskom) is regarded as the major electricity industry which generates approximately 96% of the country's electricity. He points out that Eskom anticipated the possibility of population and infrastructural growth since 1980. During the period between 1980 and 1990 the infrastructural growth slowed down due to other factors like the economic crunch. Then, Eskom had enough power to supply all its areas. During the year 2000, the population explosion became eminent influencing a high rate of infrastructural development in most big cities. The challenges of electricity distribution capacity began to be felt in 2008. The government introduced the Independent Power Producers (IPP) approach to serve as leverage to lower the burden faced by the country. IPP focused on the solar energy as an alternative source of energy. This kind of intervention may serve as leverage in ensuring that renewable energy sources are



explored for the country's advantage to meet the supply demands. Subsequently the poor communities may be able to afford access to solar energy instead of ordinary electricity supply which in itself has been stretched beyond limits (Eskom System Status Bulletin no.309 of 2015).

Eskom planned to increase electricity cost by more than 10%. With this in mind, the cost of living becomes very high to poor communities every year. The installation of solar water heaters may be a solution to alleviate poverty and the savings may be used for other domestic purposes for survival. It is important to mention that energy plays a critical role in the development of the nation's economy; however energy sectors nationwide must ensure that the growing demand is satisfied while simultaneously providing security of supply and reducing greenhouse gas emissions. South Africans have allegedly developed a negative attitude towards Eskom for failing to meet its mandate to supply adequate energy. The commercial industries complain about poor service due to low intake because of load shedding challenges. This in return gives rise to job losses (Miller, 2015).

Electricity distribution against the demand is a cause for concern. The government is trying its level best to avert all problems pertaining to the supply of adequate electricity to South African citizens. Eskom on the other hand was pushing for a will review of its electricity tariffs to be increased by 12, 7% in 2015. The continuous increase on electricity puts pressure on the poor community in terms of access to affordable electricity. As if this was not enough, Eskom again approached the National Electricity Regulator in South Africa (NERSA) with the intention of negotiating to double the electricity tariff to 25, 3% from 2 July 2015. NERSA may be pushed to assist Eskom since the continuous outages have a bearing on the country's economic growth. This increase also affects the poor communities who may not be able to afford electricity due to extremely high electricity costs. The electricity outages began to reach a sensitive stage with the possible closure of certain industries which would undoubtedly result in increasing the unemployment rate thus shooting poverty levels high (Groenewald, 2015:7).

In 2007 The South African government developed a strategy called Accelerated and Shared Growth Initiatives of South Africa (ASGISA). Its main purpose was to address



poverty by creating an enabling environment for the entrepreneurs, among many other things, to participate in the solar water heaters manufacturing industry with an aim of reducing unemployment. The high level of unemployment in SA leads to an educated assumption that the level of poverty is consequentially increased. It was anticipated that ASGISA would enable other families to have food on the table. Visagie and Prasad (2006:2) state that in 2006 the South African government committed itself to halve poverty by increasing employment on solar energy programme. The South African government found itself having to double its efforts to ensure that SWH programme was rolled out at a speed that will enable millions of poor communities the ability to have access to affordable electricity and subsequently enhancing employment opportunities.

Musango (2011:4) says that the status of electricity generation from solar-based sources in South Africa is very low. The estimated supply is ranged at 24KW (kilowatts). There is still a need for further feasibility studies to focus on the development of plants for solar energy. However the private sector is encouraged by national government (Department of Energy) to provide solar water heaters in the households and to a large extent the small industries. Masekomeng, Simaleng and Saidi (2005:6) conducted a research in Giyani location targeting poor communities to ascertain the use of solar energy compared with convectional electricity. The results proved that at least 92% of the population used the convectional electricity for household activities and only 8% were using solar energy. The benefits of using solar energy may still be unknown to most people simply because of the low levels of awareness to the prospecting users. Since the research is focused on the effects of solar water heaters in poor communities, the results may serve as a yardstick to encourage the use of solar energy in order to save costs. Solar Water Heaters awareness programmes would be very critical in ensuring that the targeted communities are notified on the importance of SWH and the benefits thereof.

Musango (2011:4) in her research focussed on the importance of exploring the alternative energy sources such as solar energy. She concludes that energy is the important form of economic development. South Africa is a fast developing country in the Southern African region but is unable to meet electricity supply demand due to the high rate of infrastructural development in urban and rural areas putting pressure on

the service provider, Eskom (South African Electricity Distributor). Eskom frequently reviews the electricity rates in an attempt to address backlogs and to plan for future demands. The electricity supply increase has a huge bearing on the poor communities because the socio-economic life does not allow them to afford paying extremely high electricity bills while there is no food on the table. The urgent and robust interventions that provide alternative energy sources in the form of solar energy as a supplement may provide the anticipated relief to poor communities. The provision of solar water heaters is expected to make positive impact in the lives of beneficiaries. Eskom faces a situation of having to double the efforts to meet the electricity supply demand. This makes Eskom having to increase the electricity cost almost annually. The escalation of electricity bills creates a huge burden in the lives of the poor.

In one way or the other, perceived political instability in South Africa is promoting the emigration of wealthier people to overseas destinies, especially Europe and Australia which are assumed to be safe places where the wealth of these emigrants is protected. Between 2000 and 2014 at least 8000 of these South Africans emigrated. Some of these people have personal assets estimated to be worth more than R12, 44 million. On the contrary 500 wealthy people immigrate to South Africa, mainly from African countries. The main reason of this migration is political instability in their countries of origin. South Africa as a developing country is infested with high levels of poverty (Groenewald, 2015:6).

The current 25% unemployment rate (Statistics South Africa, 2011) will increase drastically if wealthy people leave the country. The adverse effect of this is the possible loss of jobs due to closure of certain industries. The economy in the country will be negatively affected promoting inflation as a side effect.

The supply of electricity increases annually and may reach a situation which will be hard for poor communities to afford paying the electricity bills. Introduction of solar water heaters in poor households will serve as a relief thus enabling them to pay low and reasonable electricity bills despite the hiking of such rates (Musango, 2011:7).

The householders have to collect a lot of information before deciding to purchase the Solar Water Heater Equipment or request for installation, reason being the fact that



the mainstreaming of the renewable technologies is very limited. The householders are not aware of any benefits that are associated with the renewable technologies. They are blank to the advantages of having such a product. This therefore means that the level of marketing and awareness campaign on the programme is very low or not existent. Solar water heaters come in different sizes, meaning that they can be used for heating water and other domestic purposes. It can be assumed that awareness programmes on the product and any rebates associated with solar water heaters remains a challenge. The SWH programme runs slowly since the poor communities have no tangible knowledge on the advantages of access to solar water heating technology (Paul, 2013:16).

Solar water heaters have a potential to create job opportunities and subsequently alleviating poverty. The Kuyasa Project to low-income households has yielded positive results indicating the high level of public participation in local communities with regard to the installation of the SWH equipment. Solar water heaters installation has increased jobs and the energy consumption has been reduced by saving 50 - 60% on electricity cost. Above all this there is potential for the low income households to have access to hot water and be able to bath and wash with warm water thus contributing to reduced emissions of fossil fuels. The South African Government looked at the SWH as the potential significant job creator. This can be achieved by involving local communities during the manufacturing, installation and maintenance. During the launching of the SWH programme, Minister of Energy, Ms Peters announced in her budget speech in October 2009 (Department of Energy Report, 2009:5) that the SWH programme would create 100 000 jobs in South Africa. The manufacturing of solar water heating equipment locally would contribute to job creation opportunities thus improving the low income groups' socio-economic status (Wlokas and Ellis, 2012:3-4).



**Figure 2. The image of a solar water heater on a low-income house in Kanyamazane Township**



***The source: MLM Local newspaper- 2015***

Prasad and Visagie (2006:11) state that the Department of Science and Technology (DST) and the Department of Trade and Industry (DTI) are known to be in support of all renewable energy programmes. These programmes are said to be creating an enabling environment for the people from poor communities to learn skills of manufacturing the solar water heaters and to participate in the installation project in order to alleviate poverty. The community must be seen getting involved in the marketing of the product. This suggests that SWH equipment must be manufactured locally and local people must be exposed to relevant training programmes for them to become technicians. The householders would be able to acquire maintenance services at their door steps.

The Mbombela Local Municipality Integrated Development Plan (2014:120) outlines the total population 588 997 for the Mbombela Local Municipality with a very high percentage in the 25 to 40 age group. This is the economically active category of the population. With the unemployment rate standing at 36%, it shows that the introduction of youth in the economy of the municipality is a bone of contention and requires serious attention in order to increase the local economy and guarantee the possible luring of

investors from other areas to open business opportunities in support of job creation. The Local Economic Development Strategy (2014:16) promotes the involvement of youth in economic transformational processes by getting involved as entrepreneurs and tenderpreneurs as well. Section 14 of the Ministerial Determination – Code of Good Practice for employment and conditions of work for Expanded Public Works Programme, government notice Number 34032 of 18 February 2011 (2011:9) introduces a programme wherein the learned youth are encouraged to undergo a training programme and be technicians in the manufacturing, installation and maintenance of the solar water heaters. The EPWP employees obtain accredited certificates which serve as proof of competency in required skills. They become employable on the basis of the new technical skills acquired.

Visagie and Prasad (2006:8) say that provision of hot water using solar water heaters technologies has the benefit of providing quality local government infrastructure services while attracting savings from electricity cost. The provision of SWH is the least expensive means of heating water for domestic use because solar energy is available.

As long as the sun keeps shining cheaper and cleaner sources of electricity can be afforded by the poor community. Mpumalanga Province is an area which experiences sunny weather throughout all its four seasons. Visagie & Prasad (2006:8) argue that the provision of solar water heating technology to households could potentially reduce the overall national energy demand by at least 4,5% or 9000 GWh/annum. The high level of solar radiation enables SWH technology to be the least-cost means of meeting the national target for increased use of renewable energy. The study will seek to ascertain if these arguments are true and the information may add value to the new theories discovered.

The research conducted by Sustainable Energy Africa (2014:11) reveals that in terms of water heating for bathing purposes 80% of households rely on a single energy source, with 66% using an electrical appliance to heat water. In electrified households, common appliances used for this end use are the electric geyser (31%), electric kettle (23%) or an electric stove (7%). In contrast, although the majority of non-electrified



households (79%) use a single energy source for this purpose, the sources used are predominantly firewood (46% households) with 27% using paraffin exclusively.

A combination of firewood and paraffin is used by 16% of households. In terms of water heating for other purposes, the survey indicates that 95% of South African households on average depend on a single energy source, with the remaining share of households using multiple energy sources for this use. In electrified households, 83% use an electrical appliance to heat water. In non-electrified households, firewood is predominantly used (52% of households) followed by a further 38% of households that use solely paraffin for this purpose. Based on this argument it can be assumed that the level of heating water for domestic purposes is very high. Therefore high consumption of electricity stems from heating water. The use of SWH as green energy source reduces greenhouse gas emissions and allows poor communities access to an affordable hot water heating commodity (Tackling Energy Poverty Report, 2014:13).

Mbombela Local Municipality in South Africa, has a 36% unemployment rate, which is high, according to the Local Economic Development Strategy (2014:15). In 2009, the Municipality took an initiative to introduce the solar water heaters to contribute to green energy and probably to improve the socio-economic status of its residents pending investigations in terms of this research. Looking at the need to provide alternative sources of energy, the researcher has become interested in conducting a study to determine whether the solar water heaters programme in Kanyamazane Township had a positive effect on the socio-economic development of the Mbombela Local Municipality residents. The pilot project of solar water heaters installation was a call for the municipality to introduce alternative renewable energy in ensuring that greenhouse gases emissions are reduced thus complying with FIFA requirements (Mbombela Local Municipality Green Goal Concept, 2010:12).

The municipality might not have been ready to take over the project for the rollout to other areas. Since the project was completed in 2009 there has never been any other assessment done from the side of the municipality or Eskom to check whether or not the beneficiaries benefited socially and economically. Neither was there any study conducted to determine the SWH technological conditions.



Mbombela Local Municipality plans to explore the envisaged roll-out so as to extend the SWH project to other areas in order to comply with the resolutions contained in the Mbombela Local Municipality State of Energy Report (2013:34). This has to be done in such a manner that the Supply Chain Management Policy prescripts of the municipality are upheld for legislative compliance purposes. These policies are meant to be equitable in their promotion of the appointment of local entrepreneurs to reduce poverty. It is therefore imperative that the municipality will carry out this new project after having made an assessment of the impact of the SWH projects in the lives of the beneficiaries including the kind of challenges encountered at the initial stages. The study will seek to address this identified gap and provide new theories that will assist the municipality to improve in the future implementation of solar water heaters for the low income communities (Mbombela Local Municipality Supply Chain Management Policy, 2012:56).

The Mbombela Local Municipality Local Economic Development Strategy (2014) which reports the 36% unemployment rate, demonstrates the high energy demand under the circumstances. This study will be conducted in the Kanyamazane precinct which is the biggest of the five local townships in the municipality. Kanyamazane has a variegated socio-economic profile even though it is made up of the predominantly low income groups (Mbombela Local Municipality Local Economic Development Strategy, 2014:14).

Nxumalo (2013:2) says that solar water heaters are identified as a cost effective strategy for allowing low income communities to have access to hot water. In such situations where the socio-economic status is such that the community may not afford to pay for high bills of electricity, SWH provision may be a solution. Mbombela Local Municipality has been able to deliver solar water heaters to low income households only in Kanyamazane Township. This serves as the pilot project, since the area was targeted during the preparation for the 2010 FIFA world cup competition and no further solar water heaters installation has taken place ever since. Nxumalo argues that the use of solar water heaters technology provides an alternative access to hot water without the use of fossil-based electricity. This approach may assist the low income households in Kanyamazane to have a better life while they pay less electricity bills

due to access to solar energy. It is hoped that local people might have been appointed during the SWH project implementation process.

Energy has become a high demand in people's everyday life because of high dependency on energy sources for all their daily living. Many people in developing countries still do not have access to energy due to population explosion in big cities such as Durban and Johannesburg. The infrastructure development usually comes long after the people would have settled in undeveloped areas which are normally referred to as informal settlements. Energy plays a major role in poverty reduction. The provision of SWH in these areas may serve as the relief to poor communities by having access to hot water without incurring excessive electricity costs (Nxumalo, 2013:3).

According to the Mbombela Local Municipality State of Energy Report (2013:26) the personal monthly income profile in Mbombela Local Municipality reveals that 43% of the population has no regular income while those with some form of income ranging between R1 and R 800 stands at 28, 7%. It may be theoretically assumed that the socio-economic status in the area indicates the prevalence of high levels of poverty. Cross-referencing these findings with the Mbombela Local Municipality Local Development Strategy (2014:14), it can be noted that 63% of youth in this municipality are unemployed. The provision of solar water heaters in the poverty stricken areas may serve to better the lives of poor communities. In the case of the area under study, it is envisaged that the rollout of the solar water heaters to other areas will provide an opportunity for the identified low income households to have access to hot water while enjoying savings from paying cheaper electricity bills.

Progressive governments and municipalities in the world are undertaking substantial programmes to introduce renewable energy generation technologies. The reasons include the need to diversify energy supplies and protect the environment from activities related to the generation, distribution and transportation of energy, as well as to address inequities in energy service provision. With respect to South Africa, renewable energy is being taken very seriously by the government. The national target for energy from renewable sources is 10,000 GWh/yr in 2013. The introduction of renewable energy sources is still not done according to expectations since the



electricity supply does not meet the demand (Mbombela Local Municipality State of Energy Report, 2013:36).

Paul (2013:23) researched on consumer assessment of household attitudes awareness, drivers and likelihood of installing solar water heaters under a monthly payment scheme in Cape Town. This study focussed on determining the attitudes of the beneficiaries towards the payment for the installation of solar water heaters. Lundh (2009:21) researched about domestic heating with solar thermal. This study focussed on the use of solar energy as the alternative source of energy for domestic thermal purposes such as cooking. Both researchers did not indicate whether the beneficiaries realised the impact this approach had in their socio-economic status. Unfortunately their studies were not targeting poor communities in terms of socio-economic status. Since a gap was identified in terms of the previous research, a new theory is needed to be discovered and formulated to determine if the solar water heaters project brought any improvement in the lives of the recipients and if so, in what form.

The researcher focused on Kanyamazane Township residents who benefited from the installation of solar water heaters project. There was a need to ascertain whether the installation served as the anticipated relief to high bills of electricity and whether the installation resulted to the reduction of greenhouse gasses in the atmosphere to protect the environment. This is aimed at determining the effects of the solar water heaters programme in enhancing the socio-economic status of the Kanyamazane Township residents. The results of this study may provide new information in terms of ensuring that the new beneficiaries become relieved from a burden of high electricity bills so that they will be able to use those savings for other domestic purposes (Jobela, 2012:12).

Sustainable Energy Africa on Sustainable Energy Report (2010:21) indicates the importance of involving the community before the rollout of the SWH project so that they become aware of the importance of the project and possibly have an interest in it. The report clarifies the exchange of skills provision of the training to local community for capacity building. It emphasises the need to empower local people to get involved in the manufacture, installation and general maintenance. The community awareness campaign enables the local community to understand the rollout projects and the



maintenance programme underway. The research in Kanyamazane Township will determine if the beneficiaries were involved in the decision making process which is very critical.

## **2.3 CURRENT SOLAR WATER HEATERS POLICY INITIATIVES, SOUTH AFRICAN LEGISLATIVE FRAMEWORK AND RELEVANCE TO SOLAR WATER HEATING TECHNOLOGY.**

This section of the study will present the position of the country in terms of the policy initiatives on solar water heaters programmes and legislative framework and relevance to solar water heating technology. The presentation of the information will be from National perspective to local government level.

### **2.3.1 National Government Policy initiatives**

The National Development Plan (NDP), vision 2030 (2011:164) puts emphasis on the importance of exploring alternative energy sources in the country since the current supply is not equal to the demand and to ensure that coal-generated electricity is reduced to control the increase of greenhouse gas emissions into the air which contribute negatively to global warming conditions thus affecting weather patterns (climate change conditions). It reports the need to implement Climate Change Response Policy objectives by adapting to climate change challenges and develop mitigating strategies in ensuring that the impact in weather patterns does not destroy the environment for future generation. The provision of the two new electricity power stations (Kusile and Medupi) in South Africa is not actually the move towards cleaner energy (green energy) but a means to provide the much needed relief to the current electricity supply demand faced by Eskom in ensuring adequate supply to all who deserves such a service. The NDP is clear about the provision of solar power energy as an alternative source of energy. The provision of solar water heaters to poor communities is a great stride by the government but it is imperative to ensure that such action makes the desired impact in the lives of those who are benefiting. Subsequently

the maintenance of the equipment is crucial in realising the importance of this intervention.

National Climate Change Response Policy reports that internationally from 1988 during the formation of International Panel of Climate Change (IPCC) which then led to the establishment of the United Nations Framework Convention on Climate Change (UNFCCC). The main objective was to stabilise the concentrations of greenhouse gases in the atmosphere. The 1992 United Nations Conference on Environment and Development involved all developed countries in ensuring that this mission is accomplished. Numerous engagements in the form of conferences have taken place including the United Nations Congress of Parties (COP) 17 which was held in South Africa, Durban in 2011. Since then, very little has been done to improve on the provision of alternative energy for heating purposes. On paper, this attempt of installing the solar water heaters is taking a correct direction as eloquently emphasised in the National Development Plan – Vision 2030 (National Climate Change Response Policy, 2011:12).

The National Climate Change Response Policy (NCCRP) (2011:31) states that Department of Mineral Energy and the Industrial Sector, among others, should drive renewable energy and energy efficiency programmes. The adoption of both energy efficiency and renewable energy in South Africa should contribute to low base cost of primary energy. It must be attractive from an investment point of view. The renewable energy sources are currently being investigated including solar powers to serve as an alternative source of energy. The provision of solar energy is expected to allow low income groups to have access to an affordable service for sustainability.

The National White Paper on Renewable Energy 2004 is to set out Government's principles, goals and objectives for renewable energy. It furthermore commits Government to a number of actions to ensure that renewable energy becomes a significant part of its energy portfolio over the next ten years. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years, a sustainable, non-subsidised alternative to fossil fuels. To embark upon a deliberate path towards this goal, the Government's medium-term (10-year) target is 10,000 GWh renewable energy contribution to final energy



consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1,667 MW) of the projected electricity demand for 2013 (41,539 MW). The abundance availability of sun in the country will make the planners prioritise use of solar energy (EThekweni Renewable Strategy, 2008:36).

The Accelerated and Shared Growth Initiatives of South Africa's main purpose is to address poverty by reducing unemployment. In 2006 the government committed itself to reduce poverty by increasing employment via its solar energy programme. Solar water heaters technologies are aimed at providing affordable infrastructure services by ensuring that poor households are having access to hot water at very low cost while the greenhouse gas emissions are reduced drastically (Visagie and Prasad, 2006:2).

Paul (2013:16 states that renewable technologies are not perceived as being of benefit to low income households. The argument is that the introduction of renewable technology such as solar water heater is viewed as nice-to-have due to the lack of vigorous awareness programmes. The beneficiaries become interested on the product when they are aware of the advantages which are associated with rebates programmes. Everybody is concerned about the price hikes on electricity and wishes for a relief in some way. Conversely the access to solar water heaters seems to be possible for the middle to high income groups than to the low-income ones.

The provision of solar water heaters may be viewed as a means to leverage the electricity cost burden to low income households but the middle and high income groups wish to have access to solar water heaters to experience similar benefits. The Ekurhuleni Metropolitan Municipality (EMM) has recently signed an agreement with the Central Energy Fund (CEF), allowing the latter to run a solar water heater (SWH) rollout programme in the Metro aimed at mid- to high-income residents. The agreement allows CEF to approach creditworthy customers on the EMM database and offer them a choice of attractive financial solutions for a range of SWHs. EMM is also partnering with Sustainable Energy Africa (SEA) in an effort to develop and implement a low-income SWH solution. SEA is also assisting the Metro in investigating the possibility of an energy efficient water heating bylaw, which ensures all new houses



built in the Metro have to install a SWH or a heat pump instead of an electric geyser (EMM current energy project, 2005).

Eskom is currently encountering the problem of being unable to meet electricity supply demand countrywide. The National Solar Water Heating programme (2009) gave effect to the development of the Solar Water Heating Rebate Programme with an aim of promoting the use of sustainable resources to realise the energy savings targets set by the South African Government's Department of Energy. Eskom is encouraging consumers to use solar water heating technology for energy savings and reduction of emissions of fossil fuels to the air. NERSA is allocating financial incentives to customers who install solar water heaters. The rebates are paid for a period of five years since they contribute in the effort to reduce electricity supply. The solar water heating rebate programme provides a list of approved and South African Bureau of Standards (SABS) accredited SWH suppliers. Homeowners are eligible to apply for a rebate after they have successfully installed solar water heaters (Congress of Parties 17 Eskom Fact Sheet, 2012).

The South African Government's political desk, as reported in the National Renewable Energy Report (2013:24) puts the renewable energy matters on the top of their agenda, in order for the administrators to deliver on the mandate. Since it has been observed that the electricity supply is unable to meet its demand and simultaneously the introduction of renewable energy serves to reduce emissions of fossil fuels into the atmosphere which may adversely affect human health, the Climate Change principles encourage that public and private bodies must move to green energy for the sake of the human health.

The Minister of Energy, Ms T. Joemat-Peterson made an announcement of the preferred bidders from the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) Bid Window 4 where government is taking a stance to involve both local and foreign investors to ensure that renewable solar energy adds 1084M/W to the grid on top of the 5243M/W already procured since 2011. Government strives to involve the private sector to come on board and contribute to the means of reducing the electricity supply burden and make it affordable while it makes impact in the carbon footprint for the country. The advantage of promoting solar

energy may enable the poor communities to afford the low cost use of electricity (Maimane, 2015:11).

The Minister of Energy in South Africa, Minister Joemat-Pettersson further reported about the flagship projects of Sishen Photovoltaic Plant in Kalahari where the Spanish Company installed solar panels in the open land of 10km. The plant supplies 74M/W of renewable electricity capacity into South African power grid. The output is actually 95M/W but the output is 74M/W. This project takes an advantage of abundant availability of the sun throughout the season (Paul, 2013). The interesting approach in this initiative is the involvement of the local community which obtains employment (at least 19 people) and have 10% shareholding rights. The plants' development company has committed 2,1% of its annual revenue estimated at R8 million, to community-development programme measures (Maimane, 2015:11).

The South African Local Government Association (SALGA) has through funding from Swiss Agency for Development and Cooperation (SDC) developed a Local Government Energy Efficiency and Renewable Energy (LG EE &RE) Strategy 2010-2013. The strategy was developed for the South African Municipalities as a programme directed to contribute to the reduction of GHG emissions in South Africa through energy efficiency intervention at policy, monitoring, research, training and implementation levels (LGEE and RE Strategy, 2010).

In ensuring its alignment with National Climate Change Response Policy 2011, section 10.2.6 recognises the role which must be played by all municipalities in meeting the climate change challenges, including energy service delivery matters. In addition, the draft National Energy Efficiency Action Plan of the Department of Energy encourages sectors and other government spheres to develop their own plans towards national efficiency targets in ensuring that energy efficiency and renewable energy programmes are rolled out amicably (Modise, 2014:15).

The National Department of Energy presented a National Solar Water Heaters Programme roll-out strategy in parliament on 14<sup>th</sup> November 2014. This strategy serves to advocate the intervention to improve energy efficiency primarily through delivery of energy savings. The main objective of the strategy is to reduce electricity



demand by transferring the water heating load from the grid to the renewable energy source. The strategy targets everybody from high to low income households. It is cushioning the poor communities from rising electricity tariffs and facilitating the creation of job opportunities through increased local manufacturing and industrialisation (Modise, 2014:15).

The Solar Water Heaters Strategy describes the environmental levy that was announced by the Minister of Finance, Pravin Gordhan on the 14<sup>th</sup> February 2012, which is 1c per kilowatt hour and it serves as a new mechanism to replace current funding mechanism for energy efficiency initiatives such as solar water geysers programme. It allows Eskom to enter into a long agreement with the manufacturers and suppliers of SWH to make the programme accessible while being promoted nationally. National government has discouraged the imported units of SWH and discontinued the low-pressure SWH rebate programme, which is being replaced by New Contracting Model. This model is promoting local manufacturing and development of Small Medium Micro Enterprise (SMME's) largely as installers within the SWH value chain. National Treasury through annual budget makes provision for the success of this initiative (National Budget Speech, 2012).

The State of the Nation Address (SONA) tabled by the State President, Mr Jacob Gedleyihlekisa Zuma on the 12<sup>th</sup> February 2015, outlined the need to explore the renewable energy programme. He added that the National Development Plan (NDP), a South African 2030 vision is emphasising the new move towards investigating the renewable energy to supplement the electricity supply which is currently under huge demand. This confirms the importance of providing the alternative sources of energy such as solar energy. The country is actually in deep trouble, the continuous load shedding challenges portray that the grid is overloaded and the demand increases daily. The provision of solar water heaters is not a luxury but a drive to provide alternative energy sources to ensure that those in low income brackets can afford to pay for electricity bills at reasonable cost (SONA, 2015).

The State of the Mpumalanga Province Address (SOPA) tabled by the Premier, Mr DD Mabuza during the parliament address on the 27<sup>th</sup> February 2015 emphasised the importance of energy security which is required soon to attract large scale investments



into the province. He mentioned the need to explore alternative energy sources. It was reported that the transition to green economy is framed around the three central sustainability concepts of climate resilience, resource-efficiency and job creation (SOPA, 2015:13).

South Africa relies on its coal mines for 80% of its energy supply and that needs to change. South Africa needs to look at new ways to generate clean energy for sustainable economic and social development and to reduce its dependency on coal. Bold and achievable targets to generate clean energy must be investigated and implemented. In 2009 South Africa received a major boost in its ambition to meet clean energy goals. The \$500 million for South Africa's Clean Technology Fund (CTF) Investment Plan (IP) paves the way for the country to move closer to its vision of generating four percent of its electricity from renewable energy by 2013, improving energy efficiency by 12 percent by 2015, and providing 1 million households with solar water heating over the next five years (Parry-Davis, 2013: 312).

South Africa's Long Term Mitigation Scenarios (LTMS) have allowed for the development of a national climate policy based on what is required by science to limit temperature increase to two degrees Celsius above pre-industrial levels. In response to the LTMS, the Government has adopted mitigation strategies that focus on accelerated energy efficiency across all sectors, ambitious low carbon technology research and development, new clean energy sources and behavioural change, as well as regulatory mechanisms and economic instruments (Parry-Davis, 2013: 312).

### **2.3.2 South African Legislative Framework that Impact on Solar Water Heaters**

#### **a) The Constitution of the Republic Of South Africa, 1996**

Section 24 of the Republic of South Africa Constitution, 1996 states that everybody has a right to a safe and healthy environment and free of any hazard which may harm his well-being and destroy the environment. The National Environmental Management Act, 1998) emphasises the need to protect the environment and ensure that the future

generation is able to exist in the same environment. The different environmental laws are strict on matters of environmental protection and must be adhered to.

**b) White Paper on Energy Policy of the Republic of South Africa of 1999**

The White Paper on Energy Policy of the Republic of South Africa (1999:14) explain the government intentions to introduce renewable energy programmes for the remote areas. The national government believes that renewable energy can provide the least cost energy service to the low income communities. This was first commitment by the national government to explore the renewable energy sources in the form of the solar energy which later was escalated to solar water heaters programmes.

**c) White Paper on Renewable Energy of the Republic of South Africa of 2003**

The White Paper on Renewable energy of the Republic of South Africa (2003:20) elaborate on the abundance availability of solar energy in South Africa. This was confirmed by the research by Council for Science Information and Research (CSIR) in 2001 where it was mentioned that South Africa experiences the solar energy throughout all four seasons. The research findings recommended for the country to consider solar water heating technology for domestic purposes.

**d) Electricity Generation Act as amended Act no 4 of 2006**

This legislation seeks to promote the use of diverse energy sources. It encourages that those who wish to use or to manufacture other sources of energy must be done according to the procedures permitted by Eskom as the custodian of electricity (Electricity Generation, 2006: 03).

**e) Electricity Regulations on New Generation Capacity of 2009**

Electricity Regulations on New Generation Capacity, 2009: This national strategy serves as a guide to any independent power producer (IPP) to ensure that the renewable energy technologies are competent enough to be connected to the grid without affecting the actual electricity circulation in the system. It regulates the entry and buying of such electricity which is normally captured in the power purchasing agreement (Department of Energy, 2009:13).



**f) New Growth Path 2010**

The New Growth Path, 2010 plan sets targets for creating job opportunities for five million people by the year 2020. According to this plan, the government expects the private sector to also contribute on matters of renewable energy technologies. It encourages local companies to participate in the manufacturing, installation and maintenance of SWH (New Growth Path, 2010:2).

**g) The National Energy Act, no.34 of 2008**

The National Energy Act, no.34 of 2008 (2008:10) provides for the promotion of the diverse energy resources that are available quantities and affordable prices in South African Economy to support economic growth and poverty alleviation, while taking into account environmental considerations in ensuring that the public is exposed to an environment which does not have high concentration of the carbon dioxide in the atmosphere. The National Energy Act, 2008 also provides for the increased generation and consumption of renewable energy and the establishment of an institution to be responsible for the promotion of efficient energy generation and consumption of energy and energy research. The provision of solar water heater to low income houses would bring change in the lives of the communities in the form of the access to affordable energy sources and the job opportunities.

**h) The National Energy Efficiency Strategy of 2009**

The National Energy Efficiency Strategy (2009:47) indicates the widespread installation of solar water heating industrial, commercial buildings and houses has the potential to defer the need to build more fossils-fuel generated power plants for electricity generation/production. This was a way to discourage the increase of the construction of the coal generated electricity generation power plants by the government but explore the renewable energy programmes. The government continuously encourage Eskom to market the installation of the solar water heaters especially in the houses.

**i) National Energy Strategic Plan 2015 - 2020**

The Department of Energy is currently committed in terms of the National Energy Strategic Plan 2015 – 2020, (2015:2) to continue with the plans to regulate and transform the energy sector for the provision of secure sustainable and affordable



energy. The solar water heaters technology is one of the priorities in the plan. The emphasis of escalating the solar water heating programme in South Africa is outlined in the strategic outcomes – orientated goals as illustrated in the table below:

**Table 1: The illustration of the key Strategic outcomes – oriented goals as outlined in the National Energy Strategic Plan 2015 – 2020.**

Strategic outcomes	Goal statements
Universal access and transformation	To ensure that there is diverse energy mix for universal access within a transformed energy sector
Environmental Assets	To ensure that environmental assets and natural resources are protected and continually enhanced by cleaner energy technologies
Climate Change	To implement politics that adapt to and mitigate the effects of Climate Change.

Source: National Energy Strategic Plan 2015

### 2.3.3 Local Government Policy Initiatives

Section 25 of the Local Government: Municipal Systems Act 32 of 2000 requires that each municipality develop and adopt an Integrated Development Plan (IDP). The IDP is a five-year strategic document directing all Municipal activities. It aims to achieve the Municipal vision by responding to social, environmental and economic needs of citizenry. The IDP is reviewed annually in consultation with communities and stakeholders. Mbombela Local Municipality has produced IDPs for the period 2003-2007 and most recently 2011-2016. The IDP includes the matters of environmental management. Local communities are called upon to present their needs during the process when IDP's are developed. Currently the municipality has embarked on a process to develop a Climate Change Response Policy for Mbombela Local Municipality. This policy will address matters of renewable energy and energy

efficiency. The municipality intends to cascade the installation of solar water heaters to other areas while taking into account the need to resort to cleaner energy.

Since democracy, 21 years back, there has been a substantial shift in energy policy in South Africa as influenced by the National Climate Change Response Policy 2011. In it, local governments are invited to develop their policies and strategies to address matters of climate change focusing on sustainability and putting more emphasis on energy efficiency and renewable energy. The Metropolitan Cities such as Cape Town, Durban, Johannesburg and Tshwane have moved forward in terms of compliance with NCCRP prescripts. Secondary municipalities such as Mbombela Local Municipality, Polokwane and Rustenburg are re-organising themselves to upscale matters of sustainable energy. The installation of solar water heaters in low income groups is found to be a contributory factor in providing relief on their socio-economic status (SEA, 2015:36).

The introduction of solar water heater to low income areas will probably result in increased water usage due to more 'free' hot water being available for the household. These negative impacts need to be weighed up against the positive economic (energy savings, local employment), environmental (carbon dioxide reduction) and social benefits (saved time, health benefits) of free hot water in a household. All key low income solar water heaters initiatives to date have been fully subsidised, with the closest approximation to a payback coming from the Kuyasa project in Cape Town, where staff employed by the project were also solar water heaters beneficiaries, and had R30 per month deducted from their salaries to pay for their solar water heaters (SWH) (Western Cape SWH Implementation Strategy, 2013: 10).

Mbombela Local Municipality Water Services Master Plan (2004:30) describes the level of demand in terms of water supply within Mbombela Local Municipality areas of jurisdiction. It puts more emphasis on the need for bulk supply since the available sources of raw water supply do not meet the demand. The township under study currently experience seldom supply of water. This is caused by population explosion in the study area while the infrastructure development is unable to meet the demand. The argument is that solar water heaters may be effective or may not be effective as expected due to inadequate supply of water to the households.



The Mbombela Local Municipality State of Energy Strategy (2014:59) indicates the rate at which the municipality grows as against the energy availability for the entire area. It further indicates the need for electricity demand management plans as the research indicated the electricity illegal connections in other townships. Exploring of the other alternative sources of energy such as solar energy is found to be possible since Mbombela Local Municipality is in the lowveld escarpment of the country. The positioning of the municipality close to Swaziland and Mozambique international borders makes it economically viable on condition that it caters for economic growth, taking into account the future infrastructural development as against the electricity demand. The Local Economic Development Strategy 2014, suggests the integration of all programmes to ensure that service delivery matters which contribute towards economic spinoffs are properly coordinated such as water reticulation and electricity distribution, road and transport, social amenities and other examples of infrastructural demands.

The Member of the Executive Council, Ms R Mtshweni issued a warning to the community of Mataffin in Mbombela Local Municipality Mpumalanga Province, South Africa against illegal electricity connections. The spread of illegal electricity connection which affects the economy of the local municipality (Mbombela Local Municipality) is an accomplice of the high rate of unemployment and poorer socio-economic status which tempts some people to resort to criminality for survival (Sithole, 2015:3).

The Provincial Government of the Western Cape has been pro-active in gazetting the first provincial white paper on Sustainable Energy for the Western Cape in 2010. This includes amongst other items targets for residential energy efficiency (10% reduction by 2014) and an overall energy efficiency of 15% by 2020. Solar water heating will play a key role in achieving this target. To support this a legislation is being drafted which aims to get local government within the province to develop their own sustainable energy and climate change action plans. These plans will need to include approaches to facilitate the implementation of Solar Water Heaters (SWH) within their specific municipality (Western Cape SWH Implementation Strategy, 2013:13).



Typical actions which need to take place will be:

- Enforcement of national legislation requiring SWHs or heat pumps in new buildings;
- Facilitating rollout of SWHs in all households in line with Eskom, private industry, national and municipal initiatives;
- Ensuring all local government buildings are retrofitted with SWHs.

(Western Cape SWH Implementation Strategy, 2013:13).

The North West Province developed a Solar Water Heater Strategy (2012:28) which adds more knowledge on the importance of taking an advantage of the solar energy in South Africa. The strategy describe the solar energy in three categories namely: Photovoltaic (PV), Concentrated Solar Power (CSP) and Solar Water Heating (SWH). South Africa receives approximately 7,500MJm<sup>2</sup> of the average solar radiation in the whole world. South Africa is fortunate of receiving sunshine throughout all four seasons. Most provinces in the country average more than 2,500hours of the sunshine per year. For solar water heaters to be effective, there should be adequate solar energy and water supply plus the solar water heating equipment installed by the competent company or individual.

The Municipal Finance Management Act, No. 56 of 2003, provides that municipalities must ensure that during procurement of goods and services, the Supply Chain Management Policy must be designed in such a way as to allow competitive bidding processes to unfold and must create job opportunities by appointing local people where the project is based. Section 152 (d) of the Constitution of the Republic of South Africa, 1996 encourages the involvement of local communities in matters of service delivery. It is assumed that the community of Kanyamazane was supposed to have been approached before the solar water heaters were installed in 2009. The installation of solar water heaters in Kanyamazane Township is supposed to have benefited the local people in terms of job creation. The Mbombela Local Municipality SCM prescripts support this initiative.

Visser (2009:1) argues that energy experts agree on solar water heaters installation could significantly reduce the demand in electricity. The increase in solar water heaters project roll-out plan could eliminate the need for the additional power stations to alleviate Loadshedding challenges. This could be achieved through providing financial support to municipalities to encourage and promote SWH installation and actually regulate the industry for control purposes. He alludes that as the municipalities prescribe the solar water heaters installations in new dwellings, the building regulations should be amended and ultimately the solar water heaters by-laws be developed in future.

The City of Cape Town is far ahead in South Africa in terms of promoting solar water heaters. In its policy, Cape Town realised the need to look at the future and the sustainability of projects. The monthly payment scheme (MPS) was introduced. MPS is complementary to the existing Eskom rebate scheme and is currently proving effective in other solar markets. This MPS was introduced in 2013. It caters for all economic groups from low to high income and is affordable (Paul, 2013:26). City of Cape Town drafted and promulgated Solar Water Heaters By-laws. The main purpose of the by-law is to serve as mitigation initiatives advising those who intend to install SWH in their households so that they do it according to specific requirements. Grimwood, (2012:12) says that City of Cape of Town had to wait for too long to promulgate the by-laws due to political leadership changes. This municipality developed a Solar Heaters Strategy with targets. The assumption was that at least 10% of households must have been installed with the SWH by 2010.

A strategic analysis for the Provincial Government of Western Cape (2010:9) discuss the rules for the energy efficiency and Demand Side Management (EEDM) which enables the National Department of Energy together with the Development Bank of South Africa (DBSA) and Renewable Energy Agency to take the management of NERSA allocated funds instead of Eskom. The strategic analysis suggests that Eskom's incentive attracts the mid to upper income households for the installation of SWH. The Department of Energy incentivises those low income households and Eskom is focusing at providing rebates for the middle to upper households, which is more supported than that of the low income households. The reason for this may be lack of awareness (SEA, 2010:9).



The low income households depend on Free Basic Services (FBS) in terms of electricity supply, it may be difficult for this group to afford solar water heaters unless they are financially supported in the form of subsidy. Government's intervention is critical because the installation of solar water heaters to low income households relieves them from the burden of high electricity cost. Eskom is taking control in ensuring that SWH are accredited and SABS-approved in terms of design, performance and installation of both low and high pressure solar water heaters (SAE, 2013).

Several studies have reviewed the history of energy options. Paul (2013:27) argues that energy interventions and policies over the last 30 years could have yielded the most cost effective benefit compared to the other options. The success of energy options will depend on the coordinated effort of the government, private sector, non-governmental organisations (NGO's), and community groups (Paul, 2013:36). In the opinion of the researcher, it can be mentioned that exploring the alternative energy options will yield better results as long as it is supported by stringent policies for its effectiveness with clear guidelines on the roles and responsibilities in ensuring the success of the solar water heaters programme.

During the period 5<sup>th</sup> January to 28<sup>th</sup> February 2015, Mpumalanga Province and the whole Country of South Africa experienced load-shedding measures. During this time, Eskom had to execute unplanned and planned outages. The System Status Bulletin No 309 from Eskom reported that on the 5<sup>th</sup> January 2015 the Mega Watts available for the supply to consumers were at the brink of exceeding what the power sources could hold. The unplanned outages had to be applied to avoid an explosion that could have resulted in a national blackout (Eskom System Status Bulletin no.309 of 2015).



## 2.4 CONCLUSION

This chapter concentrated on the views of the other authors about the solar water heaters subject. The literature as reviewed through the study elaborated on the need for solar water heaters and the benefits thereof. The literature focused on international and national environment indicating the importance of the solar water heaters programme in their contribution to the reduction of greenhouse gas emissions which have a serious effect on the climate change conditions. During the review it transpired that the solar water heaters programme is a solution to provide affordable access to hot water in poor communities since it requires only the abundance of sun shine in order for the water to be heated in the geysers.

The study conducted by different authors internationally and nationally acknowledges that the equipment procurement might be expensive but the effects of the programme on the lives of the poor communities on socio-economic status is of high importance and will bear fruits.

The authors outline the importance of the solar water heaters installations and the implications thereof. The international countries are far ahead when compared with South Africa since they are able to encourage the communities to install the solar water heaters without any cost. The installation of the solar water heaters funded by government in India encouraged the majority to participate and ultimately the solar water heaters installation project became a success.

In South Africa the rollout of the solar water heaters is minimal however the policies developed between 2003 and 2015 enable the public and private sectors to ensure that the solar water heaters programme as supported by government must be enhanced. The legislative framework in place is continuously encouraging the South Africans to explore renewable energy putting more emphasis on the solar water heaters.

Provincial and local governments such as Western Cape and North West Provinces have been active to develop the solar water heaters strategies which assist the local municipalities to learn from the policy prescripts and exchanging the research information gathered around the solar water heaters projects. The City of Cape Town has managed to develop the solar water heaters policies as well as the Solar Water Heaters Municipal By-law.

Chapter three discusses the research design and methodology used in the study.

## CHAPTER 3

### RESEARCH METHODOLOGY

#### 3.1 INTRODUCTION

The previous chapter dwelt with the literature review on solar water heaters internationally and nationally. It included the national policy initiatives as well as the legislative framework to determine the level of commitment by the national government on solar water heating technology. The researcher managed to research on the ideas and views of other authors about the solar water heaters project.

As this study is exploratory in nature, it was imperative to have a research methodology chapter that gives details on how data was gathered. As stated by Welman *et al*, (2010:2), research methodology is the explanation of the logic behind research methods and techniques, a scientific method used to attain knowledge of human behaviour in a variety of context, and a process that involves obtaining knowledge by means of various objective means and techniques to confirm a hypothesis.

The chapter provides information on the methodology that was utilised to obtain data and its justification thereof. It covers the research design and the population of the study. The chapter will also mention the sampling methods used in choosing a sample size. Furthermore, data collection methods and the analysis of data will be expounded on. Finally the chapter will point out ethical issues that were considered for the study and the limitations.

#### 3.2 RESEARCH DESIGN

According to Kgwefane (2014:59) research design refers to the plan according to which data is collected to investigate the study, hypothesis or question in an economical manner. The researcher is expected to collect data leading towards



solving the research problem. Different research problems dictate the types of approaches to be engaged in the collection of different types of data. De vos *et al* (2009:133) states that there are two types of approaches in a research design, namely the qualitative approach and the quantitative approach. On one hand qualitative research is by means of conducting interviews, observation or focus groups, and is used to describe, explain, explore, interpret and build theory. On the other hand the quantitative approach is utilised to investigate the extent of the problem by collecting data in the form of numbers and percentages through questionnaires that will be interpreted to prove the hypotheses.

### **3.2.1 The Qualitative Approach**

A qualitative research is described as an approach to get the information on the phenomenon. It is a design or a set of techniques and interpretation techniques which seek to describe, translate or come into terms with the meaning of naturally occurring phenomena in the social world. Therefore qualitative approach is a descriptive form of research. The interviewee is given opportunity to talk freely about the situation. The researcher must have clear idea about the aspects he wants to explore. This is why the researcher ensured that the research questions were in line with the research objectives (Welman *et al*, 2010:188). According to Kgwehane (2014:61) a qualitative approach is aimed at making an in-depth analysis of the manner in which the project is introduced where the responsible institution should be ready to manage the project. In this case the qualitative approach is aimed at making an in-depth analysis of the manner in which the solar water heaters project was introduced where the responsible institution (Mbombela Local Municipality) should be ready to manage it and, at the same time, looking at the effects of the implementation of the Kanyamazane solar water heaters project. In this study the researcher used a qualitative research approach to determine whether the community of Kanyamazane Township was involved in the decision making process as far as the project implementation is concerned, and to establish if the beneficiaries received a clear explanation on the socio-economic importance of the programme. The three respondents (two officials from the municipality and one from Eskom) were interviewed using a semi-structured interview schedule.

### **3.2.2 Quantitative Approaches**

A Quantitative approach seeks to explain, predict, conform, validate, and test a theory. The approach also seeks to establish, conform or validate relationships, to develop generalisation (Kgwefane, 2014:60). The data collected was presented in numbers as the sample may have been too big to be interpreted without using quantitative approach. Since the researcher was going to collect information on whether the targeted community was taken on board on the socio-economic importance of the project and the benefits thereof, the quantitative approach was utilised in which the researcher distributed questionnaires to residents of Kanyamazane that benefitted from the solar heater project with the purpose of arriving at validated conclusions.

In this study, the researcher used both qualitative and quantitative research approaches which are known as the mixed methods. Maree (2008:260) states that the use of mixed methods in research builds on both qualitative and quantitative approaches. This type of study requires the use of a survey to establish the attitudes of participants towards a topic of the study and the in-depth interview to learn about the individual's perspective on the topic or the decision made in terms of the topic. In utilising a mixed methods approach, the researcher constructs knowledge about real world issues based on pragmatism. Furthermore Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, (2013:3) describe mixed methods in research as a useful strategy which provides the valuable information which can yield a case for qualitative studies whereas quantitative methods used are generally established and based on probability theory.

The study focused on qualitative and quantitative approaches to allow flexibility in interpreting the results without any challenges and also to get a balanced view on the effects of solar water heaters from both officials and recipients of solar water heaters.



### **3.3. RESEARCH AREA**

The research focused on the community of Kanyamazane who benefited from the solar water heaters installation. Kanyamazane is one of the famous township in Mbombela Local Municipality which has more low income houses than the high level middle class houses. Kanyamazane Township has 59 000 residents with 15 000 households. Kanyamazane Township comprises of three wards (18, 19 & 20). The study was directed to only 1200 households benefited from the solar water heaters installation project. (MLM-IDP 2011:83).

### **3.4. POPULATION**

A population is the study of object and consists of individuals, groups, organisations, human products and events or the conditions to which they are exposed. It is the full set of cases from which a sample is withdrawn (Welman *et al.* 2010:52). The researcher focused on the 1200 households from the low income community who benefited from the solar water heaters project in Kanyamazane Township in the City of Mbombela Local Municipality.

### **3.5 SAMPLING METHOD AND SAMPLE SIZE**

For an exploratory study like this one it was imperative for the researcher to identify methods to be utilised in choosing respondents and to specify the sample size that will give adequate information in order to validate the study.

#### **3.5.1 Sampling Method**

De vos *et al.* (2002: 197) argue that sampling is the most important concept in the total research process, and therefore a sampling plan that clearly states how sampling is going to be done becomes vital. As the study sought to determine if the socio-economic status of Kanyamazane residents who benefitted from the solar water



heaters has improved, and the extent to which Kanyamazane community benefited from the project, it was necessary to have a sample drawn from the households that benefitted for the solar heater project and the implementers of the project.

Welman *et al* (2010: 57) mention two types of sampling methods namely probability sampling and non-probability sampling. The probability sampling includes choosing samples in a random manner and all the members of the population have an equal opportunity to be participants in the study. The researcher randomly selected residents who benefitted from the solar heater project in the Kanyamazane Township. On one hand the non-probability sampling is a method or a sampling technique that does not involve random sampling and does not give all individuals in the target population an equal opportunity to be selected. The technique includes methods such as snowballing and purposive sampling. In this study the purposive sampling technique was used to select officials for the qualitative interviews since these officials were involved in the implementation of the solar heater project, and therefore were considered to have the necessary experience and knowledge that assisted in this research.

### **3.5.2 Sample Size**

Mouton (2013:186) explains the sample size and selection procedure by indicating that the sample size should be taken into consideration for a study. The sample size in quantitative sampling process may be a random or stratified sample to cover areas earmarked for the study. Furthermore Bless *et al*, (2005:106) stipulate that the sample size should be representative of the population to be studied which may not be less than five percent of the entire area. This study targeted Kanyamazane Township with 1200 households which have solar water heaters, where only 50 houses were randomly selected.

### **3.6 DATA COLLECTION METHODS**

Welman *et al* (2010: 134) define data collection methods as the measurement theories and various ways to use instruments to collect relevant information for the study. According to Naicker (2010:67) qualitative data collection methods include the observations, interviews, objects, written documents, audio-visual material, electronics document and any other source of information that assists in answering research questions. As stated by Brink (1996:148), when planning the process of data collection, the researcher was guided by five important factors which are what, how, who, where and when. Data may be collected from two sources which are primary and secondary sources. The primary data is the original data collected by the researcher through interviews and questionnaires.

#### **a) Primary Data**

The primary data were administered through interviews and questionnaires to collect data in this study. For the purpose of this study, the instrument used to gather qualitative data was a semi-structured interview schedule. A semi-structured interview is an open type of interview that was used by the interviewer to obtain the required information or opinion about the phenomenon. The interviews were directed to three officials who are professionals and have knowledge of the solar water heaters project. The first one is the Senior Manager responsible for the electrical department and the manager reporting to the senior manager within the same department. They were selected because of their technical background on the project. The third one is the Senior Manager from Eskom who was appointed as the service provider in the installation of the SWH.

To gather data from the large number of Kanyamazane residents who were the beneficiaries of the solar heater project the researcher utilised questionnaires. These questionnaires were personally administered by the researcher (De vos *et al*, 2002:165). The researcher was also assisted by two officials from the section dealing with Energy and Sustainable Development Programmes in Mbombela Local Municipality who were thoroughly trained by the researcher on how to handle each question in the questionnaire. The survey questionnaires were developed to obtain



the information from the respondents in terms of biographical details in the form of income levels, typical behaviour, opinions or beliefs and attitudes. The questionnaire was designed in a simplified but comprehensive way to enable illiterate respondents to answer questions without any challenges. The researcher with two assisting officials physically visited all residents and were able to explain the questions during the engagement (Welman *et al*, 2010:153).

#### **b) Secondary Data**

The secondary data is the information usually collected by the individuals, agencies and institutions other than the researcher himself and such data may come from papers, books, internet, thesis and any other dissertations. The secondary data was obtained through reading material from authors in the field of solar water heaters such as, among others, books, journals, dissertations, newspapers and media, including the relevant legislation and related policies (Welman *et al*. 2010:149).

### **3.7 DATA ANALYSIS METHODS**

Data analysis methods are the means to choose an appropriate statistical procedure to analyse data that the researcher will eventually obtain. This is the platform to develop steps to analyse and interpret the data obtained in the previous data collection processes (Welman *et al*, (2010: 210). Data analysis means technical use of statistics to investigate variables as well as their effects, relationships and patterns of involvement within the world of research and it included qualitative and quantitative data analysis.

Qualitative data analysis basically involves producing concepts in order to identify themes and quantitative data analysis deals with the counting of numbers. However specific concepts or variable in qualitative texts cannot be studied in a quantitative way because these variables may have different meanings when relationships between the concepts are taken into account (Welman *et al*, 2010: 221).

Following Kgwefane's (2014:63) influence the researcher used the descriptive data analysis method where the in-depth semi-structured individual interviews were used



to analyse and interpret results. The questions were designed in such a manner that they demonstrated whether the local community became involved in the decision making process on the solar water heaters project. Five themes were identified for the analyses of the data. These fundamental themes are:

- The actual intention by the municipality to install SWH;
- The criteria used to select the households for a programme;
- The level of community involvement in the programme;
- The involvement of local suppliers to install SWH and
- The plan to be adhered to for SWH equipment maintenance.

The targeted people for interview were directly approached with open ended questions which were asked by the researcher. The qualitative and quantitative data analysis methods used in the study will be discussed in detail as hereunder.

### **3.7.1 Qualitative Analysis**

Naicker (2010:70) says that data collected needs to be analysed so that the information gathered can be reduced to a small set of underlying themes. Qualitative data requires creativity, discipline and a systematic approach from the researcher. In analysing qualitative data the researcher had to compare information gathered to determine and recognise relationships. The researcher sorted a large body of collected information according to emerging themes, characteristics and codes through inductive reasoning to identify similarities and differences.

Taking my cue from Taylor–Powel and Renner (2003:1), the following techniques were used in the identification of critical themes for analysing qualitative data:

- Identifying repeated words by respondents in interview schedule and ensuring that they have similar meanings for proper interpretation;
- Comparing answers given by respondents in interview schedules in ensuring that the information gathered is not ambiguous;
- Analysing the expression by respondents when answering the questions during interviews to determine the extent of the problem the study intends to address;
- Researcher familiarising himself with the content of the interview schedule in order to detect the different viewpoints expressed by respondents;

The above mentioned techniques enabled the researcher to scale down the enormous amount of information into smaller understanding in order to make interpretation easy. The information gathered from research was documented, analysed and conclusions drawn on whether the objectives of the solar water heaters projects in Kanyamazane Township were met.

### **3.7.2 Quantitative Analysis**

Quantitative analysis employs techniques in which the collected data are converted into a numerical form and subjected to statistical analysis. The process of converting data to numerical format must be in a machine-readable form so that the data can be read and manipulated electronically. The Statistical Package for Social Sciences (SPSS) software was used to analyse the quantitative data of the study since this software is flexible for both qualitative and quantitative analysis in nature (Wagenaar and Babbie, 2005:242).

## **3.8 ETHICAL CONSIDERATIONS**

Leedy and Ormond (2005:107) emphasise the importance of observing ethics during the research. The use of human subjects in research is quite common and whenever the human beings are the focus of investigation, the researcher must look closely at ethical implications of what the researcher is proposing to do. Most ethical issues in research fall within the categories of protection from harm, informed consent, right to privacy, and honesty with professional colleagues.

De vos *et al* (2002:62) confirm that when the human beings are the objects of the study in the social sciences, it brings unique ethical problems. Anyone involved in research needs to be aware of the general agreements about what is proper and improper in the research. The level of right to privacy should be upheld. The researchers deliberate the importance of explaining adequately all information on the actual goal of investigation, the procedures that will be followed during the investigation including the

possible advantages and disadvantages in terms of dangers to which the respondents may be exposed. Key concepts to this are consent, voluntary participation, confidentiality and plagiarism. The researcher will take time to explain each of them here below.

### **Consent**

The researcher is very much aware of the ethical implications of what is being researched hence he sought consent from the respondents to either agree or disagree to participate in the study. In other words, participating in this research was voluntary and not coerced.

### **Voluntary Participation**

The important ethical procedures such as application for the study and authority to conduct it were followed during the study to ensure compliance with the ethical code of the University of Limpopo. These include explaining the main aim of the study, making clear to the beneficiaries that participating in the study is voluntary that the participants' privacy will be respected at all times and that everything the participants share were treated as confidential in such that no names would be used in the research report (Kgwefane, 2014:67).

### **Confidentiality**

For confidential purposes the questionnaires did not have names of those interviewed or participated. The researcher applied for authorisation to Mbombela Local Municipality to conduct this study regarding the effects of solar water heaters on the socio-economic status to those who benefited. The authorisation was granted. Ultimately the research results will be provided for the municipality to use it for future references when the municipality embarks on a similar type of project with regards to the rollout of SWH installations.



## **Plagiarism**

In addition, the importance of ethical behaviours in research includes matters such as plagiarism and honesty in reporting of results, arise in all research. A code of ethics is over emphasised which demands certain accepted professional behavioural conditions such as adhering to certain rules and conduct prescribed by the institution for professionalism. The code of ethics as prescribed by the University of Limpopo were adhered to in that throughout the study where use is made of the work of other authors, it is duly recognised and acknowledged Welman *et al* (2010:181).

### **3.9 LIMITATIONS OF THE STUDY**

The research focused only on the effects of solar water heaters programme on the socio-economic development of the Kanyamazane Township residents. The research sought to determine if the SWH brought about an improvement in the lives of the recipients in the form of job creation, investment and savings and to ascertain if the beneficiaries as stakeholders in the SWH project have had a significant role to play as far as the implementation of the project was concerned. The study was limited only to a randomly selected sample of the 1200 beneficiaries who benefited in the Kanyamazane SWH project.

During the study the researcher encountered a challenge of seldom water availability in the reticulation system of Kanyamazane Township which impacted on the results of the research. Secondly the damaged or dysfunctional SWH which were not maintained during mechanical breakdowns also impacted on the data collection and analysis. This therefore provided the researcher with limited answers.

### **3.10 CONCLUSION**

It is imperative that the researcher employs different data collection methods to have valid and reliable data. Since data collection has a bearing on the outcomes and analysis of the findings, appropriate data collection methods are critical to arrive at an informed decision in terms of the study. In conducting this study the mixed methods were used such as qualitative and quantitative approaches to establish the attitudes of participants towards the topic and the in-depth interview to learn about the individual's perspective on the topic or the decision made in terms of the topic. The benefit of mixed methods was to get a feel for the key issues on a subject before embarking on further development in the study. In addition, the selection of the experienced and knowledgeable officials for qualitative data collection enabled the researcher to find relationships between the officials' responses and that of the residents during quantitative research.

Furthermore, the chapter explained the population of the study and the sample size. The stratified random sampling method was chosen to be the best method to sample Kanyamazane Township residents for the solar water heaters project. Structured questionnaires and observations were used to gather the information from the participating households. The researcher observed the principles of ethics and ensured that an authorisation for a study had to be granted by the institution where the study was done. Respondents who participated in this study were doing it voluntarily and their names were not going to be divulged in the interest of confidentiality.

Finally the chapter provided the limitations of the study where the researcher focussed specifically on the effects of the solar water heaters programme on the socio-economic development of the Mbombela Local Municipality residents in Mpumalanga province targeting Kanyamazane Township. The researcher took note of the seldom availability of reticulated water in Kanyamazane Township which had a bearing in data collection and analysis.

Chapter four presents the research findings, the analysis and interpretation of the collected data of this study.

## CHAPTER 4

### DATA PRESENTATION AND ANALYSIS

#### 4.1 INTRODUCTION

The aim of this chapter is to present and analyse data of the research conducted. The theory obtained in the literature review is compared to the results obtained from the qualitative interviews and questionnaires conducted with regard to the SWH project. The study included both qualitative and quantitative data analyses.

According to Lukhele (2009:43) Data interpretation means the application of statistical procedures to analyse specific facts from a study to confirm a hypothesis. An interpretation of data usually contains a chart or a graph. It contains a set of data which will need to be analysed to reach to certain conclusions. During the interpretation of data the numbers used should be known what they stand for based on the type of the questions asked. As the researcher embarked on the data presentation and analysis, such data was interpreted to confirm the hypothesis.

The qualitative interviews were directed to three senior officials who were involved in the solar water heaters project. These officials were two officials from the Mbombela Local Municipality and one from Eskom who was responsible for the implementation of the SWH project in Kanyamazane Township. Responses from these officials were critically analysed to ensure the validity.

The survey questionnaire was divided into five fundamental themes which sought to ensure that the respondents provide reasonable information to reach to the conclusion on the main aim of the project which seeks to determine whether the community of Kanyamazane benefited from the SWH project on socio-economic status. These themes were based on the research questions as illustrated in chapter one. The survey questionnaires were distributed to a sample of fifty (50) residents who received the solar water heaters in Kanyamazane Township. Most questions were structured in a five-item Likert scale. The data gathered were converted into pie charts. A Pie Chart



can be described as the circular graph which shows the relative contribution that different categories contribute to an overall total. A wedge of the circle represents each category of data in different sizes. The Pie charts are important because:

- They display data that are classified into either nominal or ordinal. Nominal data are categorised according to descriptive or qualitative information and the ordinal data are similar but the different category can also be ranked for example: Strongly agree, agree, uncertain, disagree and strongly disagree;
  - They are generally used to show percentages or proportional data and the percentage represented by each category is provided next to a corresponding slice of pie;
  - They provide good visual representation of the data using different colours;
- (Student Learning Development, 2009:1-3).

## **4.2 DATA FROM INTERVIEWS**

The researcher collected data from the three officials through interviews. The interviews were done in July 2015. All three officials selected for interview were reached according to the proposed plan. Two of them were from the Mbombela Local Municipality, a Manager and the Senior Manager in Electrical Engineering and one from the Service Providers appointed by the Eskom to install the solar water heaters in Kanyamazane Township. The interview schedule is attached as **Annexure C** in the report. The questions focused on the following main aspects:

- The actual intention by the Municipality to install SWH;
- Involvement of the local community in the programme;
- The criteria used to select the households for a programme;
- Involvement of local suppliers to install SWH ;
- Arrangements for SWH equipment maintenance.

The researcher conducted interviews to three senior officials who were involved in the decision making process to determine the in-depth of the study. The officials were interviewed at different times to collect data for analysis. The results of the interview are discussed in details as here below.

#### **4.2.1 The actual intention by the municipality to install solar water heaters**

The Manager and Senior Manager in the electrical engineering department responded that the solar water heaters project was implemented to prepare for the FIFA International World Cup 2010 hosted by South Africa. This project was used to serve as the green project which formed part of the requirements of the Green Goal Concept (2009) for the soccer world cup. FIFA dictated the importance of having green projects which seek to reduce carbon emissions as one of the compliance signposts.

These officials further alluded that the SWH project was implemented to serve as the leverage to minimise load shedding challenges during the world cup proceedings. The senior manager appointed by Eskom confirmed the same information and further added that the SWH project served to address electricity consumption demand.

#### **4.2.2 Involvement of the local community in the programme**

All three respondents mentioned that the community was involved in the programme on an ongoing basis. Community meetings were held after hours and during weekends to explain about the programme, the intention of the programme and the roll out plan which was to reduce electricity demand and reduce greenhouse gas emissions in the atmosphere as a means to go green during world cup for the sake of the health of the beneficiaries and the future generation and to minimise climate change impacts.

### **4.2.3 The criteria used to select the households for a programme**

The two municipal officials could not provide the information on the actual criteria used to select the beneficiaries. However the service provider disclosed that the project targeted the people who were designated as indigents, who are old and mostly on pension and the geographical positioning of the house was also used to ensure that there is enough solar radiation to heat water in the geysers. The qualifying delegates had to submit application letters for assessment and approval thereof. Eskom managed the selection of the qualifying households for the installation of solar water heaters.

### **4.2.4 Involvement of local suppliers to install solar water heaters**

The manager and the senior manager in the Electrical Engineering Department in Mbombela Local Municipality responded that Eskom used their listed local suppliers in the procurement, manufacturing, delivery and installation of solar water heaters equipment. At least the approach was that the Service Provider was tasked to appoint local companies as sub-contractors and ensure that they are trained on the project as the part of skills transfer. The Senior Manager in electrical engineering further confirmed that local suppliers were involved to install SWH in Kanyamazane Township. The local supply chain management policies (2010) prescribes the importance of appointing local people whenever there is a project to alleviate poverty while creating job opportunities.

In confirming the same information from both the Manager and the Senior Manager from Mbombela Local Municipality, the Senior Manager appointed by Eskom to champion the SWH project added that the local politically elected councillors were involved to assist in ensuring that the local people have an opportunity to participate in the project. Fifteen (15) sub-contractors were appointed for the manufacture, delivery and installation of the SWH equipment.



#### **4.2.5 Arrangements for solar water heating equipment maintenance**

The manager and senior manager from Mbombela Local Municipality had no knowledge of the arrangements for the maintenance of the damaged or malfunctioning solar water heating equipment. The service provider disclosed that there were local people who underwent an intensive training programme to learn to maintain the damaged solar water heating equipment. The municipality was in terms of the signed memorandum of agreement (MOA) between Mbombela Local Municipality and Eskom supposed to have formalised the arrangements by either hiring the trained people or ensuring that these trained people were provided with working tools to respond to the mechanical breakdowns reported by solar water heaters beneficiaries and be contacted when need arises.

Unfortunately it was revealed by the Service Provider from Eskom that this arrangement never happened which therefore means that the prescripts of the memorandum of agreement were not upheld. This non-adherence to the MOA had a bearing on the effective utilisation of the solar water heaters. Most beneficiaries were concerned about lack of a maintenance plan to all damaged solar water heaters equipment.

#### **4.2.6 The management of the solar water heaters programme**

The study area receives electricity from Eskom even though the area forms part of Mbombela Local Municipality Local Municipality's demarcation and could actually be connected to the electricity distribution system that falls under the municipality. The service has been like this since the apartheid regime (pre-1994). Mbombela Local Municipality provides all services in the area except electricity.

The introduction of the programme was as a result of the 2010 FIFA requirements. The municipality as the Host City for 2010 FIFA Soccer world cup competition signed a Memorandum of Agreement (MOA) with Eskom. The agreement outlined that Eskom would install the solar water heaters to 1200 households and Mbombela Local Municipality was supposed to take over the project for maintenance purposes.

Unfortunately the maintenance programme for the solar water heaters project was not followed meaning that the MOA arrangement was not fulfilled as alluded by the Eskom Service Provider.

#### **4.3 PRESENTATION OF DATA FROM QUESTIONNAIRES**

A total of fifty (50) questionnaires were prepared and used to collect data from 50 households visited in Kanyamazane Township. Each questionnaire had 26 open ended questions and all of 50 questionnaires distributed were collected successfully. This represents a 100% response. The statistical data was collected with the assistance of two officials from the Energy and Sustainable Development section in Mbombela Local Municipality.

The presentation of raw data from questionnaires to numerical format was done by using the IBM Statistical Package for Social Sciences (IBM-SPSS) software.

A copy of the questionnaire on the effects of the solar water heaters programme on the socio economic development of the Mbombela Local Municipality Local Municipality residents, Mpumalanga Province is attached as **Annexure D and E** in the report. The five fundamental themes of the questionnaire are explained in detail below:

**Section A:** The purpose of this section was to obtain the information in relation to occupation, educational level, race, age, sex, marital status, number of dependents and if employed, monthly income level. It was important to ascertain if participants were in any kind of employment and the level or types of employment as this would assist in determining:

- a) If the majority of the recipients were classified as the disadvantaged community;
- b) Whether the project was able to create employment opportunities and make a difference in the participants' socio-economic status in the Kanyamazane Township; and
- c) If the participants could afford the maintenance of the solar water heater system.



It was also vital to determine participants' educational level as this has a direct bearing on their employment opportunities that will in turn assist as far as participation in the green economy issues and debates are concerned and further expand their knowledge in such issues and debates. Again the age and sex had to be looked into because the researcher would be able to know if the recipients of SWH are of an employable age. The sex category of participants was necessary in this study as it would assist the researcher to determine the number of both sexes (male and female) participating in the project and to hear their views on how the project contributed to each category economically. It also must be noted that this study was not gender-specific.

**Section B:** This section sought to gather information in relation to awareness on the solar water heaters to determine if the beneficiaries were consulted on the programme before the SWH installation. This information will assist to determine if the residents participated in the decision-making process on the programme and whether the beneficiaries were informed regarding the benefits of the programme and its implications.

**Section C:** This section solicited the information on the knowledge of the solar water heaters programme. The aim was to establish if the beneficiaries were informed of the need to participate in the programme and its contribution in the lives of the residents. This section assisted in ascertaining if the participants were informed on the safe keeping of the solar water heating system for its effectiveness and determine if the beneficiaries understood the functioning of the SWH and solar radiation contribution to warm water in the geysers for sustainable development.

**Section D:** This section sought to gather information on socio-economic benefits of the project. This was to determine if the programme yielded positive results to the beneficiaries in the form of having access to hot water regularly without having to use electricity, saving them from paying high electricity bills and the possibility of job opportunities created to local residents during the project implementation process. The local people are supposed to have benefited through employment during the SWH equipment implementation.



**Section E.** This section intended to gather information on whether the installed SWH were maintained for effective functioning. The purpose was to check if there were any contractual arrangements with service providers. The section was going to assist the researcher to establish if the solar water heating equipment was installed at the will of the beneficiaries and if the beneficiaries were informed to make their own arrangements for the maintenance of the equipment.

The questions administered to respondents had closed and open ended questions to allow participants to feel free in responding to questions. The questions were structured to enable the illiterate respondents to respond without any hassles by also providing the questionnaires in the SiSwati language. The respondents had enough time to interact with the clients during the survey since the researcher with his two working colleagues was physically involved. Each engagement per household took 30 minutes to complete the information required for the study. The questionnaires were written in two languages, SiSwati and English. The survey was completed within five weeks. Data collected from the questionnaires was categorised into five sections and will be discussed as follows. In respect of the questionnaire, the initial section had the information required based on biographical details of respondents that would help the researcher to obtain useful information in understanding the respondents' background on matters among others, relating to occupation, education, race, age, marital status, sex and gross income.

#### **4.4 PRESENTATION AND ANALYSIS OF COLLECTED DATA THROUGH QUESTIONNAIRES**

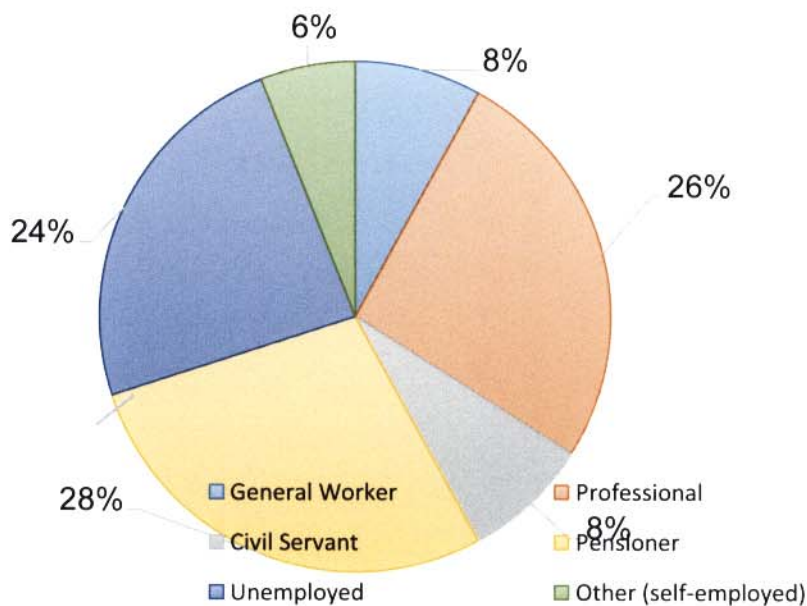
##### **4.4.1 Occupation**

The research was conducted to fifty households to determine the level of occupation. The respondents for General Workers was 8%, Professionals 26%, and Civil Servants 8%. The pensioners were more by 28% confirming that most heads in the houses visited were pensioners. The unemployed respondents were 24% and 6 % for the other (self-employed). The chart in Figure 4, demonstrates the level of employment in

the houses visited. The results depict the high level (52%) of unemployment and ultimately demonstrate high levels of poverty. The community may not be able to pay for high electricity bills which therefore mean that the introduction of the solar water heaters programme in this community as envisaged proved to be an economic relief for residents.

Mbombela Local Municipality Economic Development Strategy (2014) indicates that the unemployment rate in Mbombela Local Municipality stands at 36% and is expected to increase by 0, 28% per annum. The relationship between the two unemployment rates demonstrate the high level of unemployment in the Mbombela Local Municipality. It therefore confirms the high levels of poverty in the study area (Mbombela Local Municipality Economic Development Strategy, 2014:12).

**Figure 3: The respondents by Occupation**

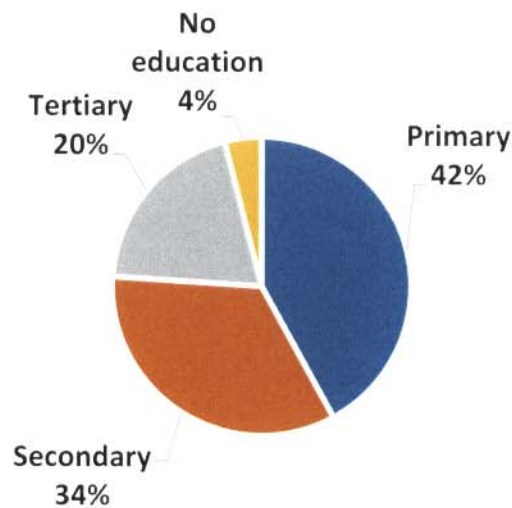


#### 4.4.2 Educational Level

Figure 5 indicates that out of 50 households only 4% of respondents do not have any formal education, 42% have primary education, and 34% have secondary education. The remaining 20% of those respondents have tertiary education. The level of education is very low in terms of the results obtained and this shows that most residents in the study area had primary education. This demonstration of low level of education in the study area has an influence on the unemployment rate which exacerbates the level of poverty. In this case few people are employable and those that are employed find themselves in relatively low paying positions. The previous census indicated that the whole municipality has 11, 9% of the people who had never been to school (Statistics South Africa – Municipality Profiles, 2011).

The demographics of the municipality are such that the area is 20% urban and 80% rural with nine (9) Traditional Authorities. The migration of community members from rural to township increases the statistics of people who have little or no education at all (IDP 2015-16:57).

**Figure 4: Educational levels of the Respondents**





### 4.4.3 Race Presentation

Kanyamazane Township has only one type of race group. The questionnaires were all indicating Africans, Asians, Coloured and Whites. All questionnaires depicted that only Africans were approached. The research area had only Africans. It therefore means that all 50 questionnaires were coming from Africans.

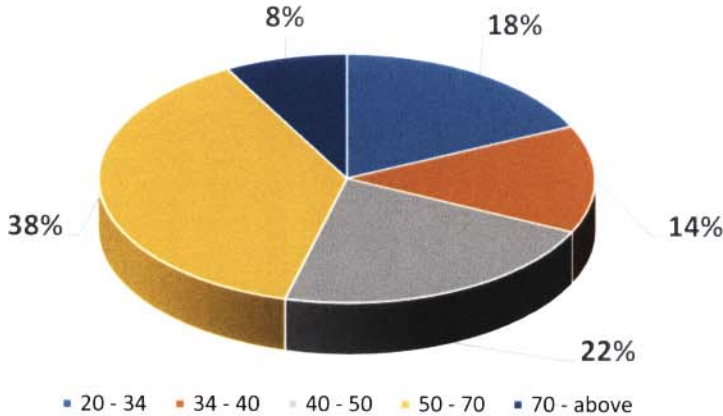
### 4.4.4 Age Categories.

Out of the 50 respondents 18% were from the youth group, 14% from the young adults (33-45), 22% from the adult group, 38% from middle-aged group (50-65 years) and 8% from the aged team 70 years and above as portrayed in Figure 6. The results are dominated by the indigent group which according to the Municipal Indigent Policy (2014) means the range of population that has reached pensionable age and do not have employment. The indigent policy also includes people with disability. The indigent policy prescript suggests that the indigents are entitled to a certain amount towards their municipal rates and taxes obligations and they are subsidised through equitable share from the National Treasury. The actual age to qualify as indigent ranges from 60 and above for the pensioners and for the other category it depends on the authentic assessment report from social workers.

Most participating households (46%) visited were headed by the people between 50 years and above 70 years including the indigent. This statement confirms that the targeted people for the solar water heaters project were those who are older and at least, pensioned.

Khoza, Vusumuzi Patrick.  
Assessing the effects of the  
solar water heaters  
programme on the  
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**Figure 5: Ages of the Respondents.**

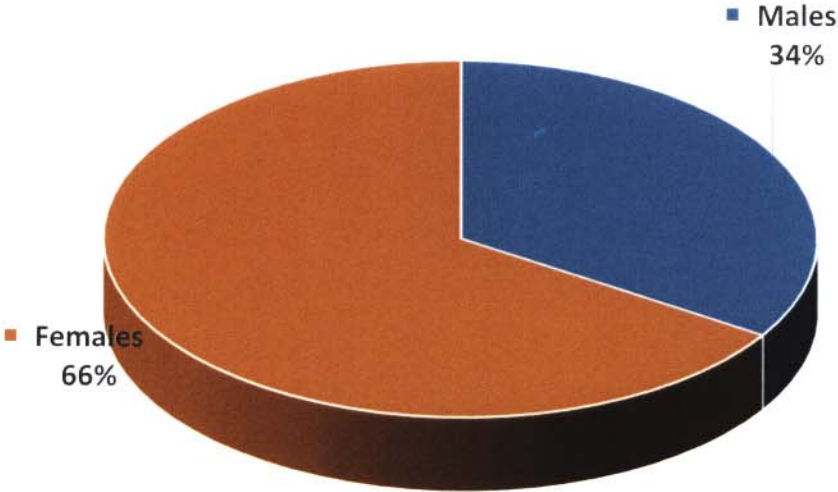


**4.4.5 Respondents by Gender**

The total of 50 houses visited had high volume of females 66% than males 34%. These figures are almost consistent with the demographics of the area. This is an indication of the high level of single parent families headed by females. The survey was targeting the selected area without any biasness. The Municipality IDP (2014:79) indicates that there are more females than males in Mbombela Local Municipality. The results indicate the high number of women-headed families. This, translated means that most families have no male figures due to various reasons like death, divorce, desertion or even for some unknown reasons. This points to the phenomenon of female numerical domination in the area but was not the scope of this research.

**Figure 6: Gender of Respondents**

**Figure 7: The illustration of respondents by Gender**

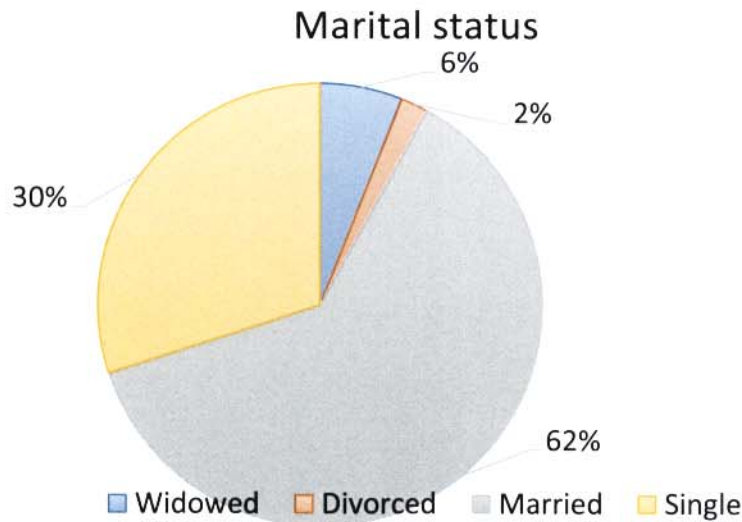


**4.4.6 Respondents by Marital Status**

The results of the research revealed that 62% were married and 30% single headed families. The single-headed families were all females except one family headed by a single man. The widowed were 6% and 2% were from divorced females. The 62% of the married females were among the pensioners who form part of the targets for the solar water heaters project. It was observed that most participating (70%) households are headed by older participants between the ages 50 and 80. These families have been in this locality since the apartheid regime (pre-1994). It indicates that the pilot project focused on the local citizens who have reached pensioning category (60 years of age and above).



**Figure 7: Marital Status of the Respondents**

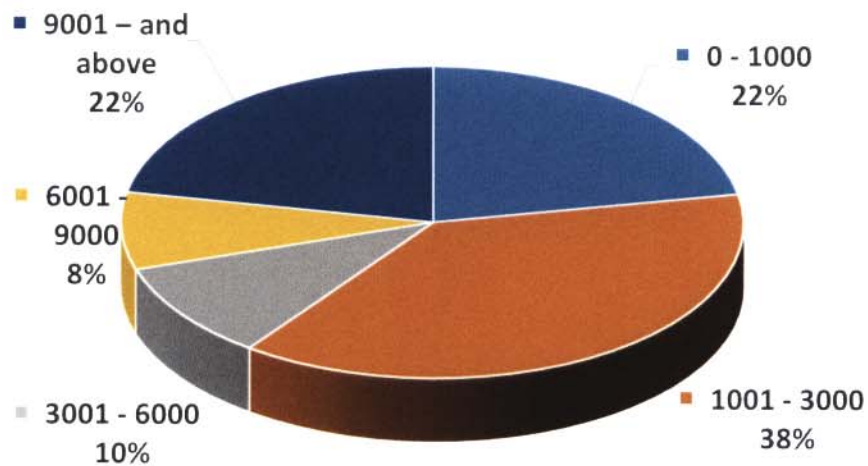


#### **4.4.7 Gross income of the respondents per month**

Out of the 50 respondents 22% earn between R0-1000 and those who earn between R1001-R3000 is 38% of which most of them were pensioners. Those who earn between R300-R6000 were 10% and those who earn R6001-R9000 were 8%. It is only 22% who earn from R9001 and above. The combination of those earning between 0-R1000 and R1001-R3000 amounts to 60% portraying high levels of poverty. The level of poverty in the Kanyamazane is too high based on the results obtained since the majority of residents are pensioners. Few of those who are unemployed have back rooms that are used for renting-out purposes or for local informal trading. The total of 60% (22% + 38%) were the relevant category for the solar water heaters project, since the project targeted the poor families and those who are already at pensioning stage.

The Mbombela Local Municipality Local Economic Development Strategy Review (2014:40) states that the majority of those employed in Mbombela Local Municipality are from Government Services. The strategy seeks to take an advantage of the corridor between Maputo and Pretoria through N4 by encouraging entrepreneurship and SMME's to provide opportunity to the small businesses to increase economy thus growing the local socio-economic status. Most families depend on social grants or informal trading (street trading). This intervention, however, is a long term plan.

**Figure 8: Income per month of the Respondents**

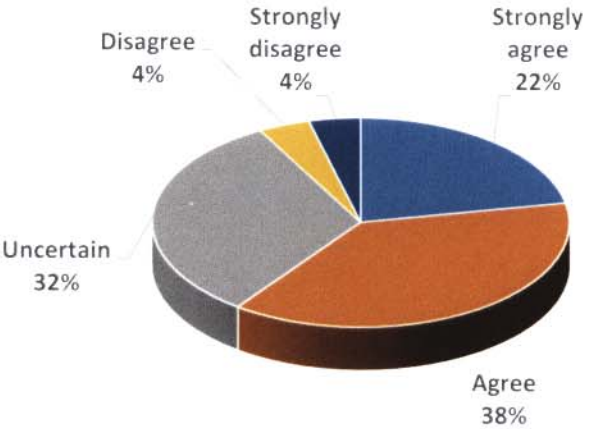


#### **4.5 RESPONSES FROM OTHER QUESTIONS IN THE QUESTIONNAIRES**

##### **4.5.1 Kanyamazane community was consulted regarding the installation of solar water heaters**

Out of 50 respondents 22% strongly agreed and 38% agreed that Kanyamazane community members were consulted regarding the installation of the solar water heaters. Those who were not sure were at 32% due to the reasons being that those respondents are tenants or they recently bought houses from owners. Some disagreed 4% and strongly disagreed 4%. The correlation between the results of “strongly agree” and “agree” reveals that the community of Kanyamazane Township was reasonably and sufficiently consulted.

**Figure 9. The demonstration of the respondents who indicated the level of consultation regarding the installation of solar water heaters**



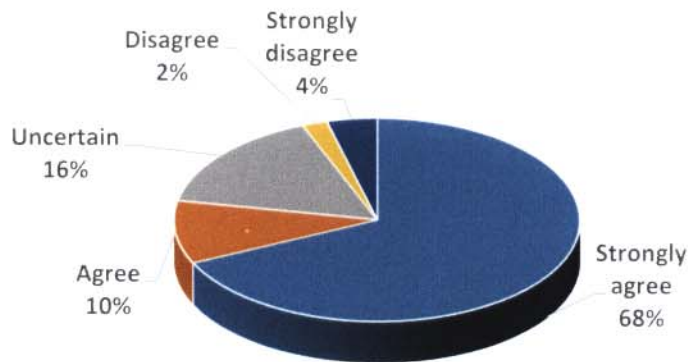
**4.5.2 Do you benefit from the solar water heaters programme?**

Sixty-eight percent (68%) of the respondents mentioned that they strongly agree and 10% agreed when they were asked if they benefited from the programme. The other 16% of residents were not sure including the 2% of those who disagreed while 4% strongly disagreed.

Generally, the observation depicts that the majority (78%) of the residents are benefiting from the programme. The respondents are paying less electricity bills from the time they had the SWH. They have access to hot water facilities without having to use electricity to boil water for bathing and cooking purposes. The solar water heating equipment is affordable to all that have it because they are not paying for it. It was provided free of charge.



**Figure 10. The illustration of whether the respondents benefited from the solar water heaters programme**

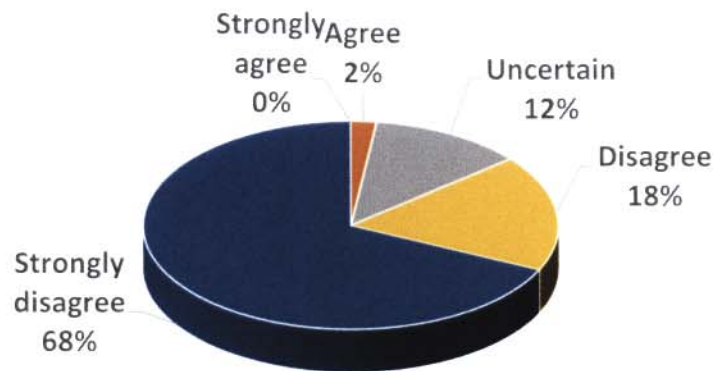


#### **4.5.3 The project to install solar water heaters was imposed on the beneficiaries in Kanyamazane**

The study sought to determine if the project was imposed on the respondents. In response, 68% strongly disagreed and 18% disagreed that the project was imposed on the beneficiaries. Only 12% of the residents who were uncertain and 2% who agreed that the SWH project was imposed. This shows that there was proper consultation prior to SWH project implementation. The majority disputed the possibility of the project being imposed on the respondents.

The residents were informed on the project through public participation process. This came up when the management was interviewed initially. It was mentioned that those interested submitted the applications for the solar water heaters installations. On approval of the project the solar water heating equipment installation team visited all qualifying houses for a preparation to install the solar water heating equipment.

**Figure 11: The chart indicating whether the SWH project was imposed on the residents**



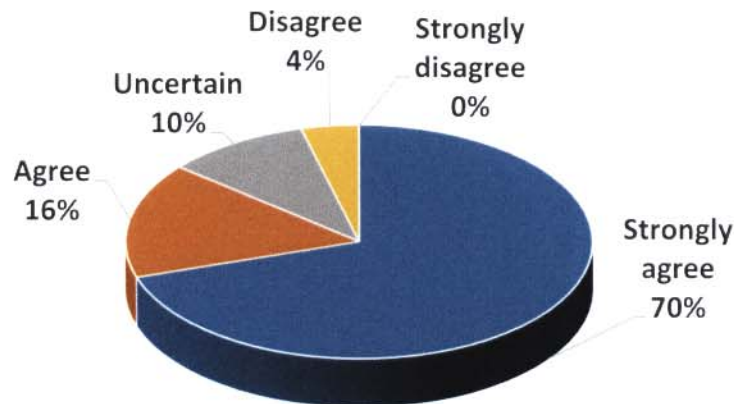
#### **4.5.4 Local people were employed during the implementation phase of the solar water heaters project**

70% of the respondents strongly agree and 16% agree that local people were employed during the implementation phase of the solar water heaters project in the community of Kanyamazane Township. Only 10% were not sure. Only 4% of those asked, disagree that local people were employed during the implementation phase of the solar water heaters project. This means that 86% confirms that local people were employed and therefore there might have been some economic gain from the project by the Kanyamazane community. There was a betterment of the socio-economic status in the area but the research did not go further to determine the link between the SWH project spinoffs with the fact that most participants had extended their houses from the ordinary four roomed houses and making them bigger was not.

The local companies based in Mbombela Local Municipality and coming from Kanyamazane Township were sub-contracted to install SWH equipment where all employees were subjected to an on the job training programme in order for them to have technical knowledge on the installation and repair of the solar water heaters. The project took only 18 months and it was completed early in 2010 before the FIFA World Cup competition (June 2010). After the completion of the SWH project, some (30%)

were employed elsewhere and others (70%) were jobless again. This conversely increased the level of unemployment due to unsustainability in this project.

**Figure 12: The chart portraying if the local people were employed during the implementation of the SWH project**



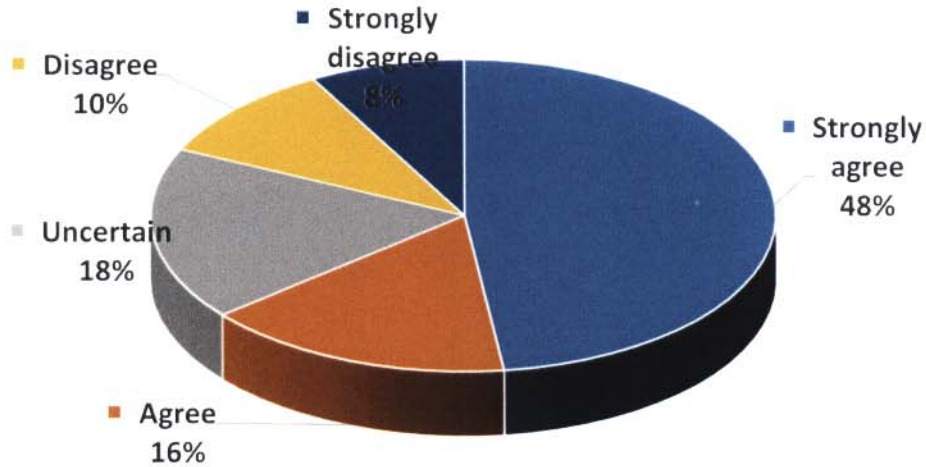
#### **4.5.5 The solar water heaters project is a good solution to reduce poverty in the community of Kanyamazane**

The 48% of the respondents strongly agreed and 16% agreed that SWH project is a good solution to reduce poverty in the community of Kanyamazane. Of the respondents, 18% were not too sure about it whereas 10% disagreed and 8% totally disagreed with the statement. The community of Kanyamazane Township is dominated by poor families that have difficulty in affording to pay high electricity bills on a monthly basis. The provision of solar water heaters serves as a leverage of keeping the electricity bills lower and affordable.

The respondents were happy about the programme but they were concerned with the frequent unavailability of water supply during the day which renders the solar water heaters ineffective.



**Figure 13: The chart depicting if solar water heaters project reduced poverty in the community of Kanyamazane**

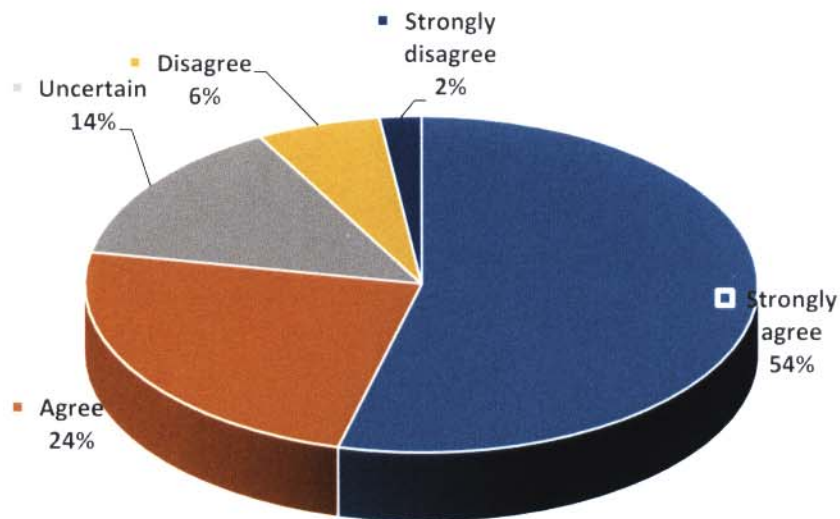


#### **4.5.6 The use of solar water heaters has brought relief to people who cannot afford the cost of using convectional electricity**

Fifty-four percent (54%) of the respondents strongly agreed and 24% agreed that the use of SWH has brought relief to people who cannot afford the cost of using convectional electricity. There were 14% who were not sure and there were those who disagreed while 6% and 2% strongly disagreed respectively.

The total of 78% (54%+24%) of respondents agreed that the SWH brought relief to people who could not afford the cost of using convectional electricity and their electricity bills went down from R800,00 per month to at least R120 per month. The use of SWH has brought relief to people who cannot afford the cost of using convectional electricity. From the savings on electricity the respondents were able to afford other basic needs rather than to spend their little finance on electricity bills. The analytical report depicts that the beneficiaries indeed benefited economically.

**Figure 14: Reduction in the use of electricity**



#### **4.5.7 The solar water heaters are maintained by technically qualified people**

The majority of the respondents (90%) represent those who strongly disagree with the notion that the SWH are not maintained and 6% disagree. Only 4% were not sure. While the respondents were appreciative of the programme of solar water heaters, they were mostly complaining about lack of assistance on the repair of the damaged solar water heating equipment. All residents mentioned that there was no technical team to maintain the SWH equipment. This has a negative effect on the socio-economic gains of the programme. The respondents complained that the incompetent sub-contractors were appointed for the project due to frustrations and loss of hope.

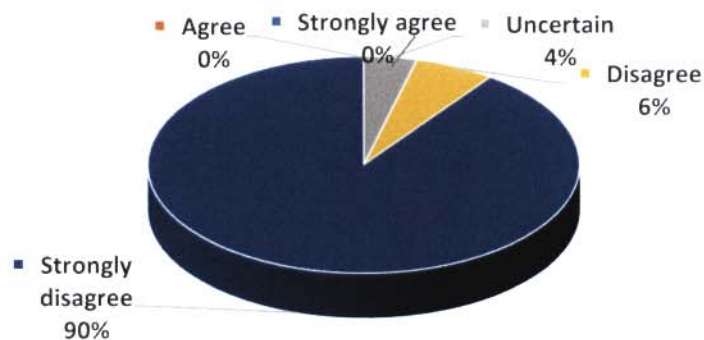
During the households visits the following critical problems were observed:

- Broken solar panels on the roof of the beneficiaries;
- Geysers without water due to blocked pipes in the system and

- Damaged ceilings and roofs due to continuous water leakages from the geysers.

The introduction of the solar water heaters served as an alternative renewable energy source in principle. If those who participated in the SWH project do not feel the benefits, the actual objective of the programme would not have been fulfilled and the project is deemed a failure. The lack of this technical maintenance team makes it difficult for the other beneficiaries to keep the system functional. This may defeat the purpose of solar water heaters.

**Figure 15. The chart indicating the response on the maintenance of the solar water heaters**





## 4.6 CONCLUSION

The interviews conducted provided an in-depth specialised study as the interviews were directed to the few three knowledgeable and experienced officials who are experts in their own right. The main objective to conduct these interviews was to ascertain if the beneficiaries as stakeholders in the SWH project have had a significant role to play as far as the implementation of the project was concerned. During the interviews it was revealed that the pensioners and poor families were targeted for the SWH project. The project was successful as it targeted the poor families.

The data from survey questionnaires revealed that the respondents supported the programme because there were no cost implications while they have access to hot water at most crucial times to them as far as installation is concerned. Participants had concerns regarding:

- The lack of a SWH maintenance programme;
- Unattended broken solar panels on the roof of the participants' houses;
- Leaking geysers which were destroying the beauty of their houses;
- Damaged ceilings and roofs resulting from unattended leakages.

Generally the respondents appreciated the project despite challenges such as the ones noted above.

Chapter five provides a summary of the findings and the conclusions drawn from the findings. Furthermore the chapter presents recommendations on the findings by indicating areas which may require further research.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS OF THE STUDY

#### 5.1 INTRODUCTION

The researcher embarked on the study to determine if the solar water heaters project brought about an improvement in the lives of the recipients in the form of job creation, investment and savings in Kanyamazane Township. The study had to ascertain if the beneficiaries as stakeholders in the SWH project have had a significant role to play as far as the implementation of the project was concerned. The study targeted the previously disadvantaged Kanyamazane community that is unable to afford high electricity bills because of their place on the social upward ladder. The SWH project provided some relief to the poverty-stricken recipients as it provided some form of employment.

Chapter one focussed on the planning for the programme which was expected to bring a solution to the low-income households to have access to hot water without incurring extra costs.

Chapter two elaborated on the theoretical information regarding the SWH. The research was conducted to learn what other authors and experts say about the study on the effects of the solar water heaters programme on the socio-economic development of the Mbombela Local Municipality residents, Mpumalanga Province. The research looked at the global, national and local experiences including the policies and other legislative mandates.

Chapter three outlined the research methodology that was used in the dissertation which included research design elaborating at both qualitative and quantitative approaches emphasising on the importance of using both approaches. The study further explained the population of the study and data collection methods.

Chapter four presented the data collected through interviews and questionnaires, including the interpretation and analysis thereof. Interviews conducted provided the in-depth perspective of the study as the interviews were directed to the three and well experienced officials in SWH concept.

## **5.2 SUMMARY AND CONCLUSIONS OF THE STUDY**

The installation of solar water heaters to only 1200 households was a flagship project for the success of the 2010 FIFA world cup tournament. Subsequently, the project served as the pilot for the future rollout of solar water heaters project to other local townships. The researcher found it appropriate to conduct the study on the effects of the solar water heaters programme on the socio-economic development of the Mbombela Local Municipality residents to determine if the community benefited on the SWH project.

Chapter 4 of this study dealt with presentation of collected data that were analysed and interpreted to confirm the hypotheses. The presented data was from qualitative interviews to determine the in-depth of the study as well as research questionnaires to obtain the information from the individuals who benefited from the SWH project. The interviews were conducted to three experienced senior officials who managed to provide relevant information as far as the SWH project is concerned. These were two officials from Mbombela Local Municipality and one from Eskom. The interviews included among other things the intention by the municipality to implement the project, involvement of the local community in terms of project implementation and getting job opportunities in the process and finding out if there were arrangements made with regards to solar water heaters equipment maintenance.

The survey questionnaires had open-ended type of questions that were directed to fifty beneficiary households. The questions were based on the five fundamental themes which included:

- Biography of the respondents to establish their ages, occupation level of education, to name but a few;



- Information in relation to the awareness on the SWH project by the beneficiaries whether they were consulted in advance about the project and participation thereof;
- Information in relation to having knowledge of the SWH project in terms understanding the need by the community to participate in the SWH project and benefits and the reduction of carbon footprint.
- Information on socio-economic benefits of the project to determine if the beneficiaries had access to hot water without incurring extra costs as well reduction of electricity bills as a result of SWH project implementation.
- Information on whether the installed SWH were maintained on a regular basis in case of mechanical breakdowns.

In summary, the findings of the study depicted that:

- a) All fifty households sampled were reached successfully. The study revealed that there is high level of unemployment and most people participated in the project were aged between 50 and 80. Most respondents have little or no level of education and that being mainly primary school level. Generally, these people may not be able to look for the jobs which will pay them high salaries as the majority of the people who participated in the SWH project were pensioners.
- b) Only Africans participated in the SWH project. This township under study has only black population since it was established during the Apartheid regime. Other races were allocated their own townships such as Indians and Coloureds.
- c) The major findings demonstrated that the criteria for the selection of the beneficiaries were pensioners and other poor communities with single parents or child headed families. The study shows that poor families were targeted for the SWH project because they cannot afford high electricity bills.
- d) The implementation of the SWH project showed that there was no project steering committee or project management team that would deliberate on the

project in details and assign certain responsibilities to ensure that there is integration of the activities between Eskom, Mbombela Local Municipality and residents of Kanyamazane Township. Resultantly, there was a lack of effective communication and coordination between these three parties mentioned above. Moreover the agreement which was signed between the Municipality and Eskom was not properly managed. The Mbombela Local Municipality had no structure in place that could continuously liaise with the service provider during the SWH installation process.

- e) The SWH project under discussion was never discussed at an administrative level regarding the hand-over of the actual project to the municipality in order for the municipality to be able to prepare itself to respond to community complaints with respect to maintenance. This project mismanagement ultimately led to inability to address public complaints. The project was introduced to respondents in different uncoordinated approaches. Some were only approached in their houses and others attended the community meetings organised by local municipality. Although most respondents indicated that they had been consulted, the message conveyed to participants was inconsistent. Some had been asked to participate in the SWH project because it was a free undertaking and others were told that this was a plan to reduce high electricity consumption which might result to uncontrolled supply of electricity during 2010 FIFA world cup tournament.
- f) The project was welcomed by the participants without any hassles since it was funded by Eskom and there was no cost to be incurred by the beneficiaries. The service provider and local councillors visited houses during the night without involvement of the Municipal officials because the local councillors decided to champion the management of the SWH project.
- g) Despite the frequent unavailability of water in Kanyamazane Township, most respondents were happy that access to hot water without incurring electricity cost contributed positively to their socio-economic status. All participants disclosed that the electricity consumption indeed was reduced drastically. Most



participants witnessed the drastic reduction of electricity cost which provided some savings for them to re-direct those funds to other social needs.

- h) The solar water heaters project under study had no maintenance programme in place. There were concerns in other areas visited during the investigation where the participants indicated the support of the SWH project but worried about unattended technical problems. Some recipients raised the concern about the blocked pipes preventing water from reaching the geysers on the roof others mentioning that they decided to disconnect the SWH equipment since it was damaging the houses due to continuous water leakages. Some of the solar water heaters were broken and not used at all. The lack of maintenance of the SWH equipment might have had a negative effect on the outcome of the study. The SWH project was implemented free to all beneficiaries. The participants took initiatives to make individual arrangements for the repairs of the broken solar water heaters equipment and make their own arrangements for SWH maintenance. Most of them could not seek for assistance in terms of repairs or maintenance due to lack of finances.
- i) There were no arrangements made by the municipality to fund the project in the process for its sustainability. On the contrary, countries like China (2009) provided funds to sustain the solar water heaters project to ensure that in case of breakdowns the maintenance team is called for repairs at cost to the government of China. South Africa as the second largest economy in Africa could learn from this approach.
- j) There was no system of managing complaints that had been put in place. Complaints were lodged with the local satellite municipal offices without any assistance. The complainants were not receiving feedback and above that no assistance could be provided as the municipality did not have customer care service specifically provided for this project.
- k) Since the project was in Kanyamazane Township, most local people were employed in the project. Unfortunately the project implementation period was 18 months. After the SWH project most people were left jobless. The on-the-



job training programme was conducted to all employed local people, but there was no intensive accredited training which could enable them to confidently look for jobs elsewhere or become cooperatives or SMME's. Being a rural municipality, Mbombela Local Municipality would benefit economically if the local people are trained to a level of becoming entrepreneurs who can later contribute financially to grow the revenue base of the municipality.

- l) The SWH project was implemented in one local township out of six. Since this project was significant to the poor communities to provide relief from paying high electricity bills, it made impact in terms of changing the lives of the poor in the entire municipal boundaries taking into account that other townships were not included. It would be good if most local townships were targeted initially. However it was noted that the intention of Mbombela Local Municipality was to extend SWH project to the other townships in the future.
  
- m) The Mbombela Local Municipality has had no policy guidelines in terms of the SWH installation rollout plan, management and control of the SWH. The lack of the policy guidelines which stipulates the actual involvement of participants in the project created numerous challenges such as lack of systems to report breakages and having answers on the objectives of the project. There was no regulations governing the management of the project in ensuring that in future only accredited companies may be allowed to install such SWH equipment.

The introduction of renewable energy in the form of SWH in poor communities is not new globally but may still be unknown by certain people in South Africa. Lack of awareness programme to politicians, administration and communities was a big issue that required serious attention as the main aim of this type of intervention is to address climate change challenges by striving towards reducing the greenhouse gas emissions while taking care of the poor communities who cannot afford high electricity bills.

South Africa, as a developing country has realised the importance of reducing greenhouse gas emissions by introducing green energy as a well as green jobs to respond to climate change dynamics. Solar water heating technology provides a

solution to address climate change challenges whereas on the other hand benefiting poorer communities through their participation in the SWH project.

### **5.3 RECOMMENDATIONS**

Based on these findings the following are recommendations emanating from the data collected and literature review:

#### **5.3.1 Recommendation one**

##### **Solar water heaters programme needs to be properly managed for its effectiveness**

The contractual arrangements between Mbombela Local Municipality and Eskom in terms of the SWH project in Kanyamazane Township had management challenges which made this project compromised its proper implementation. The memorandum of agreement signed between the two parties never worked in favour of the project because the contractual obligations were not met to their full extent. As the project was implemented to comply with 2010 FIFA world Cup hosting requirements, the municipality had some limitations in dealing with programme requirements. Kanyamazane Township is situated where the 2010 FIFA world cup training venues benefited. As pointed out earlier, this area is under the authority of Eskom to distribute electricity. The municipality must in future utilise its own Energy, Sustainable Development Section to facilitate and coordinate all energy related programmes going forward. The advantage of using the Energy and Sustainable Development Section to coordinate the management of the SWH project is that it is responsible to report in the e-carbon registry. This information can be accessed internationally and in real time thus enabling quicker tracking and responses in an attempt to reduce carbon footprint and thereby ensuring that the emission of greenhouse gasses is reduced.

The supply chain management processes need to be facilitated by the energy office and the Electrical Engineering may bring the expertise when the service provider is



appointed. The contract management between the municipality and the service provider must be championed by the energy unit.

### **5.3.2 Recommendation Two**

#### **A need for extensive community consultation on solar water heaters programme**

The introduction and provision of the SWH programme in Kanyamazane Township was done haphazardly to all beneficiaries. Solar water heaters programme is unique and requires a dynamic community engagement so that beneficiaries have a knowledge on the actual importance of the installation of the SWH and the direct benefits thereof. Since government has a challenge to have programmes which address energy provision and subsequently contribute in the reduction of the greenhouse gas emissions, the awareness programme should focus on climate change impacts. The scenarios shared with the community should make them feel the importance of becoming involved in the programme. For example, the increase of greenhouse gas emissions has exacerbated the global warming and extreme weather conditions are being experienced as a result of heatwaves striking the whole country. This has a bearing on the health of the humans, flora and fauna. For a complete buy-in and for the success of the project, communities should not feel as if they are being pushed or short changed. Communities should be able to be led to a position where they can make informed decisions after acquiring a holistic understanding of the situation and recognising the importance of such integrated interventions. The economic advantages due to savings in reduced electricity costs and the benefits of saving the planet from inhospitable climate change will eventually gain ground.

Understanding solar water heating technology requires extensive intervention. Public participation programmes require that the project must be explicitly outlined to the community before the actual project implementation process. This will enable those who can afford to take initiatives to install the solar water heating equipment without having to wait for government. The Sustainable Resource Energy Report (2014:22) emphasises the importance of introducing the renewable energy publicly by ensuring that the level of greenhouse gas emissions is reduced for the sake of the health of



those people exposed to it bearing in mind that GHG emissions have cumulative effect. As the whole world is concerned about the effects of climate change, the community must be well informed of new technologies and interventions which seek to reduce pollution to the environment. They should also be informed of the socio-economic benefits brought about by such interventions and technologies. The public must be educated about this type of technology and its implications for future expansion.

### **5.3.3 Recommendation Three**

#### **All local townships need to benefit from solar water heaters programme**

The SWH project has been found to be supported by most of the respondents in the study. It is therefore imperative to extend this service to other areas of the municipality. The entire municipal area is dominated by low income groups. These people may appreciate having access to hot water facilities without incurring extra electricity costs. It is therefore recommended that this programme be extended to all local townships to benefit all poor communities. These townships are:

- Tekwane Townships
- Kabokweni Township
- Matsulu Township
- Phumlani Village
- Shabalala Village.

The advantage extending the programme is the reduction of greenhouse gases emissions and the lowering of electricity consumption demand in the grid thus minimising the chances of load shedding. A situational analysis of targeted areas must be done so that the implementation plan must seek to address the problems identified initially in terms of the study. The elite should be advised to participate in the programme since it seeks to address the challenges of load shedding as well.

Naicker (2010) shows that the studies conducted in China in 2009 revealed that the Chinese Government distributed its solar water heaters project to all poor communities

thereby improving the socio-economic lives of the its citizens. The programme became successful simply because all beneficiaries could have access to hot water without incurring further costly electricity bills. The expansion of the SWH programme to all Mbombela Local Municipality Townships will enable poor communities to save on costs and to obtain jobs in the process.

#### **5.3.4 Recommendation Four**

**There is a need to fund the rollout of SWH project for future expansion.**

The capital outlay of solar water heating equipment is costly depending on the type of the technology decided upon for the programme. However the resounding saving is felt in the long run. It is recommended that National Department of Environmental Affairs in collaboration with Department of Energy jointly assist municipalities with adequate grants for solar water heaters projects implementation. These grants must be properly managed to ensure the effective implementation of the programme and the positive implications thereof.

The provision of the SWH to poor communities require subsidy or any other form of financial assistance. Without such intervention it may not be affordable. Funding institutions should be explored for intervention. The government can promote this type of technology to the public and private sectors since both parties benefit in the programme differently. It cannot be denied that local people need to benefit from the project to alleviate poverty and improve their socio-economic status.

Local governments should develop a levy or some form of contribution system which will enable the poor communities to access solar water heaters equipment and maintenance in future. Such levy must be affordable especially to the targeted poor communities.

### **5.3.5 Recommendation Five**

#### **Harness the employment potential in the solar water heaters programme.**

It transpired in the study that Kanyamazane Township residents had an opportunity to participate in the SWH project as far as employment is concerned. This is so unfortunate that the project was not sustainable since it lasted for the period of 18 months and it stopped. The research that was conducted in 2003 demonstrates that the operations and maintenance jobs of solar water heaters are out of the scope of all other Eskom projects. It is therefore recommended that the big companies target local people to get involved in the installation of the SWH equipment. The employment could be threefold viz; manufacturing, installing and maintaining the equipment (South African Renewable Energy Policy roadmaps, 2010:5).

The Municipal Supply Chain Management Policy (2014) encourages the appointment of local people when any service delivery project such as the SWH project is implemented. This therefore means that the municipality must enforce this principle of the appointment of local people in all projects and it must be monitored systematically.

### **5.3.6 Recommendation Six**

#### **For SWH programme to be sustainable it requires the development of policy guidelines and promulgation of municipal SWH by-laws for management and control.**

The development of the policy to make all beneficiaries understand the renewable energy programmes and the need for such interventions is very critical. Matters of climate change are now enjoying popularity both globally and nationally since the impacts of climate change are being felt, for example, heatwaves (extreme high temperature).

Currently Mbombela Local Municipality is in the process of developing the Municipal Climate Change Response Policy (draft) which is informed by section 10.6 of the



National White Paper on Climate Change Response Policy (2011) requiring all municipalities to have climate change policies and strategies customised to suit domestic needs on climate change challenges. It will be ensured that such policies or strategies will deal with climate change impacts which may be addressed through adaptation and mitigation processes.

Climate change response policy for the municipality should prescribe the importance of renewable energy programmes, solar water heaters in this instance. The policy needs to be explicit on the importance of the reduction of greenhouse gas emissions.

The South Africa's Renewable Energy Policy Roadmaps, (2010:8) states the involvement of Eskom nationally to fast track energy efficiency programmes to deal with demand side management (DSM) that aims to reduce power demand by 10% through the introduction of solar water heaters programme. Furthermore the South African National Solar Water Heating Framework and its Implementation Plan (2014) highlights the importance of the use of the solar water heaters to reduce greenhouse gas emissions while it relieves poverty as far as electricity affordability is concerned. As the municipality promotes the solar water heating programme, the same municipality must have solar water heating programme policy guidelines which will seek to address the following:

- The main aim for such SWH programme intervention
- Advantages of the SWH programme;
- The user-friendly systems put in place for the beneficiaries.

The National Department of Environmental Affairs in collaboration with Cooperative Governance Department developed an informative toolkit which seeks to assist local municipalities to respond to climate change challenges. This toolkit is known as a *"Toolkit to Integrate Climate Change Risks and Opportunities into Municipal Planning"*. This toolkit provides guidelines for municipalities to have an integrated approach in addressing impacts of climate change and these guidelines need to find expression in the municipal integrated development plan (IDP).

South Africa being a member of the United Nations Convention on Climate Change (UNCCC) has an obligation to contribute vigorously towards the reduction of

greenhouse gas emissions. By-laws need to be developed to compel developers in the city to provide solar water heaters in all new buildings as a climate change mitigation measure and to provide rebates to those who save energy below certain recommended kilowatts. The by-laws need to set acceptable emission standards and the fines for law transgressions. Congress of Parties (COP) 21 in Paris strove to compel all polluters to take full responsibility for the effects of such pollution. Adhering to emissions standards by the greenhouse gas emitters will soon be a compliance matter once the COP 21 has finalised the legal framework for greenhouse gas emissions.

### **5.3.7 Recommendation Seven**

#### **Identification of intensive training programme needs to be extended to all local SMME's on the maintenance of SWH.**

The survey conducted in the study revealed that the SWH installed in Kanyamazane Township do not have any maintenance programme and this is affecting the impact of the SWH project. During the investigation it transpired that there were local people who were previously trained to install and maintain the SWH in times of project implementation and could not be recognised after the completion of such project. The lack of SWH maintenance team defeats the actual purpose of the project and the assumption is that the community might develop negative attitude towards the SWH projects. Ultimately the SWH project might not be viewed as a solution to assist the poor communities to have access to hot water without incurring additional costs.

It is recommended that the municipality prescribes in the tender document for SWH installations that the appointed service providers must capacitate all participating local employees in the programme and there should be special training programme from which the reliable maintenance teams must be established which will respond to all complaints from beneficiaries. The municipality needs to register the capacitated entrepreneurs in the local supply chain management data base and be utilised when need arises.



One respondent disclosed during a survey that she used one of the local people who worked in the project to assist her with the repairs of the solar water heater equipment at a reasonable and affordable cost when need arise. This respondent declared that every time when her SWH system is not functional she invited him for the repairs.

### **5.3.8 Recommendation Eight**

**To ensure that all community complaints are properly attended, Customer Care Services System for SWH need to be established.**

The SWH equipment is sophisticated and it may break from time to time. It is recommended that the municipality decides on the maintenance team for the repairs of the solar water heaters. It is further recommended that a system of handling reporting of complaints be devised and that the complaints will be allocated a reference number. It is further recommended that service standards be adhered to such as a response rate of not more than 48 hours after the lodging of a complaint. There should be a toll free number for easy access by the beneficiaries. The customer care service system must be able to take calls night and day. The current control room must be beefed up and be designed to cater for this essential service of SWH programme in the entire municipality.

### **5.3.9 Recommendation Nine**

**Workshops must be continuously conducted to alert departments on the importance of climate change.**

Localised workshops targeted towards politicians, administrators and the community need to be set up in order to bring awareness programmes on climate change. This therefore keeps hope alive that the municipality will extend the rollout of SWH installation to other local townships. Such will be a response to the Kyoto Protocol (1997) deliberations which emphasise the importance of reduction of greenhouse emissions and to create green jobs to alleviate poverty. As the municipality aspires to become a metropolitan city in the next five years (2020), the vision for this municipality is to become a resilient city. A Climate Change Forum will need to be established and



it must include the public and private sectors to address all climate change impacts collectively and in an integrated manner.

#### **5.4. FINAL REMARKS**

The study focussed on the effects of the solar water heaters programme on the socio-economic development of the Mbombela Local Municipality residents. It did not include the actual installation method of the solar water heaters. The study did not focus on the quality of the solar heaters installed whether they are good or not. These areas may be explored in the future research approaches. The study did not cover the effectiveness of the type of the solar water heating equipment used. The other important part which could not be done and must be considered in future studies, is the comparisons on the level of electricity consumption before the installation of SWH in the study area and the developments after the SWH are installed to determine the level of impact as well the suitable effective SWH for the poor communities.

The dissertation has managed to explore the effects of SWH programme on the socio-economic development of the local municipality being studied. The main aim of the study was fulfilled. The literature on the matters of renewable energy and policy were reviewed to contextualise the discussions globally and from a South African perspective. The literature review managed to iterate the state of solar energy supply in the country and the challenges attached to it, bringing the dynamics on the future affordability of the electricity by the poor communities. The researcher found it important to research on the socio-economic status in Kanyamazane Township. It is so because Kanyamazane is the only area within the geographical bounds of the study which benefited in terms of climate change policies and provisions for renewable energy aimed at reducing greenhouse gas emissions and saving the earth for future posterity through the SWH programme.

As the study conducted was a mixture of qualitative and quantitative research approaches, it provided a suitable platform for the researcher to be able to collect facts through interviewing the experienced candidates in terms of the project and to obtain the in-depth study before going to the field for further investigation or survey. The success in visiting 50 households for a survey made it possible to produce at least

valid and reliable data which can be tested by any interested researcher to check if similar type of the results would be obtained. The themes used from the biographical details of the participants, awareness and knowledge on the solar water heaters programme, socio-economic benefit of the project and lastly maintenance of the solar water heaters assisted the researcher to manage to respond to the main aim of the study which is believed to have been fulfilled satisfactorily.

Since the project forms part of addressing climate change challenges in terms of renewable energy programmes to reduce greenhouse gas emissions, proper management of the SWH project at initial stages is key to minimise unnecessary hassles which may affect the impact of the project. The targeted community needed to be consulted by involving them through consultative meetings gradually until the service provider is on site so that they participate in the project freely and with clear understanding of the importance of the SWH project. Most importantly Local Townships need to benefit in a project for equity.

The effective implementation of the SWH project is based on the compatible policies and municipal by-laws that regulate the whole process of having SWH and installation thereof. The local SMME's must be given an opportunity to be responsible for the maintenance of the SWH equipment through an accredited training programme. The municipality's financial policy must be compatible with the arrangements of utilising the SMME's. Systems should be put in place in order for the community complaints to be attended to within a reasonable period of time (not more than 48 hours), and there should be feedback with reference numbers in all complaints received so that the problems are attended early in order to avoid unnecessary high maintenance costs. The continuous workshops of the politicians and administrators on the SWH project will be essential to make these politicians and administrators aware of the importance of ensuring that the SWH project serves as the yardstick to reduce greenhouse gas emissions for a clean ambient air while it assists the people from low income groups to have access to hot water without paying high electricity bills.



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**ANNEXURE A**  
**LETTER FOR AUTHORISATION TO CONDUCT A STUDY**

**8 PALM STREET  
PO BOX 7060  
MBOMBELA  
12000**

**16 MARCH 2015**

The Office of the Municipal Manager  
Mbombela Local Municipality  
PO Box 45  
**MBOMBELA**  
1200

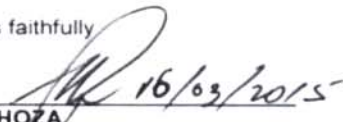
Dear Sir,

**APPLICATION FOR A PERMISSION TO CONDUCT RESEARCH IN KANYAMAZANE FOR THE STUDY ON THE EFFECTS OF SOLAR WATER HEATERS PROGRAMME ON THE SOCIO-ECONOMIC DEVELOPMENT OF THE MBOMBELA LOCAL MUNICIPALITY RESIDENTS: MPUMALANGA PROVINCE**

I VP Khoza, pay number SS0160 employed as the Senior Manager: Energy, Sustainable Development and Expanded Public Works Programme, currently studying in University of Limpopo, (Student number 201428440) Master's degree in Public Administration (MPA) programme, has been assigned to prepare a research proposal on the field of choice where an intensive study will be conducted to develop a dissertation as part of the pre-requisite for the completion of the Master's Degree. A request is being made to conduct a study in Kanyamazane Township.

Kanyamazane Solar Water Heaters (SWH) installation project which was done in 2008/9 financial year has been selected for the study. The main purpose of the study is to determine if the community of Kanyamazane Township benefited on the socio-economic status. A request is therefore being made for the study to be undertaken. The results of this study will assist the municipality to be able to implement the similar type of the project in other areas without problems while the information contributes to the body of knowledge academically.

Yours faithfully

  
**VP KHOZA**  
**SENIOR MANAGER:**  
**ENERGY, SUSTAINABLE DEVELOPMENT**  
**AND EXPANDED PUBLIC WORKS PROGRAMME**  
**082 600 8716**



**ANNEXURE B**  
**AUTHORISATION LETTER FROM THE EMPLOYER TO CONDUCT A**  
**STUDY**

**MBOMBELA LOCAL MUNICIPALITY**

Civic Centre  
1 Nel Street  
Nelspruit  
1201  
South Africa



P O Box 45  
Nelspruit  
1200  
South Africa  
Tel: +27 (0) 13 759-9111  
Fax: +27 (0) 13 759-2070

YOUR REF  
OUR REF      *FS SIBOZA*  
ENQUIRIES    *(013) 759 2262*

**16 March 2015**

Mr VP Khoza  
8 Palm Street  
West Acres Suburb  
P.O. Box 7060  
**MBOMBELA**  
**1200**

Dear Sir

**AUTHORISATION LETTER TO CONDUCT THE PROPOSED RESEARCH**

Mbombela Local Municipality has acknowledged your interest in conducting the study in Kanyamazane Township regarding the effects of solar water heaters programme on the socio-economic development of Mbombela Local Municipality residents. It is appreciated to learn that the outcome of the study will provide solutions for the municipality to be able to ensure that the future solar water heaters installation projects of the similar nature will be implemented successfully.

An authorisation is hereby granted for the intended study to be conducted in Kanyamazane Township as requested.

Yours faithfully

  
\_\_\_\_\_  
N M SEANEKO  
MUNICIPAL MANAGER

*16/03/2015*  
\_\_\_\_\_  
DATE

## ANNEXURE C

### INTERVIEW SCHEDULE FOR THE THREE OFFICIALS WHO WERE INVOLVED IN THE INSTALLATION OF THE SOLAR WATER HEATERS IN KANYAMAZANE TOWNSHIP.

#### ASSESSING THE EFFECTS OF THE SOLAR WATER HEATERS PROGRAMME ON THE SOCIO-ECONOMIC DEVELOPMENT OF THE MBOMBELA LOCAL MUNICIPALITY RESIDENTS, MPUMALANGA PROVINCE - REPUBLIC OF SOUTH AFRICA

Dear Sir/Madam

The aim of the study is to determine the effects of the solar water heaters programme in enhancing the socio-economic status of the Kanyamazane Township residents. The unstructured interview will be conducted to determine whether the relevant authorities involved the beneficiaries in their decision to install the solar water heaters and to determine if systems were put in place to ensure that the solar water heating equipment is being maintained to achieve its maximum intention.

**NB: *Be informed that the information provided will be treated with high confidentiality. It is therefore not necessary to give your particulars if you wish to remain anonymous***

1. Your occupation in the office

Manager	Senior Manager	Service provider appointed by Eskom

2. The service period in the office

02 – 05 years	05 – 10 years	10 years and more

3. Age

4. Race

African	Asian	Coloured	White	Other (specify)

5. What was the intention of the institution (Mbombela Local Municipality/ Eskom) to install the solar water heaters in Kanyamazane Township?

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6. Did Mbombela Local Municipality enter into any agreement with Eskom regarding solar water heaters installation in Kanyamazane and other related matters?

YES	NO

7. If the answer is yes, in question 6, is there any evidence in the form of the copy of the signed agreement.

**Briefly explain the agreement content**

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8. Did Eskom appoint a local competent company to install solar water heaters?

YES	NO
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Briefly explain your response

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9. Was there any attempt to ensure that all beneficiaries become involved on the installation of the solar water heaters programme?

YES	NO

10. If yes in question 9, what was the approach?

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11. Which criteria was used to select these 1200 household for the project out of 15 000 households in Kanyamazane Township?

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12. Does Mbombela Local Municipality intend to extend the solar water heaters project to other local township?

YES	NO

Briefly explain the approach

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13. What was the expectation of the municipality or Eskom Company after the installation of the solar water heaters?

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14. Was the equipment used to install solar water heaters procured from local suppliers?

YES	NO

Briefly explain your response

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15. Did the Mbombela Local Municipality or Eskom make any arrangements for the maintenance of the solar water heating equipment?

YES	NO

16. If the answer is yes in question 15, explain the type of the arrangements made for the maintenance of the solar water heaters.

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17. Are you receiving mechanical related complaints from the beneficiaries?

YES	NO

18. If yes how often?

Always	Sometimes	seldom

19. Any suggestions from your side.

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20. Any comments.

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**THANK YOU FOR YOUR PARTICIPATION**



## ANNEXURE D

### THE QUESTIONNAIRE FOR THE STUDY (ENGLISH VERSION)

#### ASSESSING THE EFFECTS OF THE SOLAR WATER HEATERS PROGRAMME ON THE SOCIO-ECONOMIC DEVELOPMENT OF THE MBOMBELA LOCAL MUNICIPALITY RESIDENTS, MPUMALANGA PROVINCE – REPUBLIC OF SOUTH AFRICA

Dear Sir/Madam

The aim of the study is to determine the effects of the solar water heaters programme in enhancing the socio-economic status of the Kanyamazane Township residents. The study will identify challenges the residents are faced with and proposal will be provided to address the identified problems.

Please fill in this questionnaire to the best of your ability. Your objective response in answering questions is essential as it will be used to determine the effectiveness of the solar water heaters project.

**NB: *Be informed that the information provided will be treated with high confidentiality. It is therefore not necessary to give your particulars if you wish to remain anonymous.***

A. **BIOGRAPHICAL DETAILS:** Please put an X where appropriate.

1. What is your occupation?

General worker	Professional	Civil servant	Pensioner	Unemployed	Other (specify) -----

2. Educational level?

None	Primary	Secondary	Tertiary	Other,(specify)
01	02	03	04	05

3. Race

African	Asian	Coloured	White	Other,(specify) -----
01	02	03	04	05

4. Age

5. Sex

Male	Female
01	02

6. Marital Status

Single	Married	Divorced	Widowed	Other.(specify) -----
01	02	03	04	05

7. Number of dependants

8. Gross- income level per month per household in rands

0 - 1000	1001 - 3000	3001- 6000	6001 - 9000	9001and above
01	02	03	04	05

**B. AWARENESS OF THE KANYAMAZANE RESIDENTS ON SOLAR WATER HEATERS PROGRAMME**

9. Kanyamazane community was consulted regarding the installation of solar water heaters.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

10. If answer is yes in question 9, explain how the residents were consulted.

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11. In your knowledge, who are the stakeholders who consulted you, list them.

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**C. KNOWLEDGE ON THE SOLAR WATER HEATERS PROGRAMME**

12. Do you benefit from the solar water heaters programme

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

13. Has the life of the Kanyamazane residents changed for better since the introduction of the solar water heaters programme?

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

14. If yes in question 13, in what way the life has changed.

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15. The project to install solar water heaters was imposed on the beneficiaries in Kanyamazane.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

#### D. SOCIO-ECONOMIC BENEFIT OF THE PROJECT

16. Local people were employed during the implementation phase of the solar water heaters project.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

17. If the answer is **yes** in question 16, did the project create enough jobs to alleviate poverty among the destitute residents of Kanyamazane?

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18. The solar water heaters project is a good solution to reduce poverty in the community of Kanyamazane.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

19. The use of solar water heaters has brought relief to people who cannot afford the cost of using convectional electricity.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

20. Low income earners beneficiaries are now able to afford other basic needs rather than to spend their little financial resources on electricity.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

21. The consumption of electricity went down since the installation and use of solar water heaters.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
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01	02	03	04	05
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22. Since the installation of solar water heaters I use less electricity than before.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

**E. MAINTENANCE OF SOLAR WATER HEATERS**

23. The solar water heaters are maintained by technically qualified people.

Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	02	03	04	05

24. Since the solar water heaters were installed, how often were mechanically breakdowns attended to for repairs.

Always	Sometimes	Never
01	02	03

25. Suggestions

What suggestions can you offer to improve on the use of solar water heaters to provide relief to those who can't afford the cost of the convectional electricity?

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26. Any other comments

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**THANK YOU FOR YOUR PARTICIPATION**

## ANNEXURE E

### THE QUESTIONNAIRE FOR THE STUDY (SISWATI VERSION)

#### IMIPHUMELA OHLELWENI YESOLAR WATER HEATER KWEFTUTHUKO YETENHLALO NETEMNOTFO EMBOMBELA LOCAL MUNICIPALITY ESIFUNDAZWENI SASEMPUMALANGA – KU MZANSI AFRIKA

Kuwe Mnumzane/Nkhosatane

Inhloso yalesifundvo ngekutsi kutfolakale imiphumela yekushisisa emanti ngekusebentisa imshini lesebentisa lilanga. luHlelo lokutfufukisa simo senhlalo nesemnotfo sebantfu baKanyamazane. Lemfundvo itawuveta tineselela lesibukene nato futsi kutawuniketwa siphakamiso kuze kulungiswe letinkhinga letitfoliwe.

Sicela uphendvule kule lemibuto ngalokukhulu kutimisela. Injongo yetimphendvulo takho tibalulekile njengoba itosetjentiswa kucacisa kuphumelela kweSiphehlagesi sekushisisa emanti.

NB: Yati kutsi lolwati losinika lona litogcinwa luyimfihlo. Ngakho-ke asikho sidzingo sekutsi usinike imininingwane yakho uma ufisa ukuhlala ungatiwa.

#### A. YEKUCHUMANA KOKUPHILA. Sicela ufake "X" lapho kufanele.

1. Yini luhlobo lwemsebenti wakho?

Sisebenti jikelele	Sisebenti lesifundzile	Sisebenti semphakathi	Umuntfu lohola impesheni	Umuntfu longasebenti	lokunye (chaza)

2. Lizinga lemfundvo?

Ayikho imfundvo	Libanga leliphansi	Libanga lelikhulu	Libanga leliphakeme	Okunye (chaza)
01	02	03	04	05



3. Yini buhlaga bakho

umAfrika	Ubuve baseAsia	umKaladi	umMlungu	Okunye (chaza)	
01	02	03	04	05	

4. Umnyaka noma budzala

5. Ubulili

Umlisa	Usifazane

6. Simo semshado

Uwedvwa	uShadile	Uhlukene	Umfelokati	Okunye (chaza)

7. Inomboloyebantfu labancike kuwe

8. Lizinga lemholo lenyanga ngendlu ngayinye ngemaLandi?

0-1000	1001 - 3000	3001 - 6000	6001 - 9000	9001 & ngetulu
01	02	03	04	05

**B. KUCAPHELA KWEBAHLALI BAKANYAMAZANE NGESPHEHLAGESI SEKUSHISISA EMANTI.**

9. Ingaba uMphakathi waKanyamazane waboniswa yini mayelana nekufakwa kwesiphehlagesi sekushisisa emanti?

Uyavuma Kakhulu	Uyavuma	Ngenasiciniseko	Ungavumelani	Abavumelani nakancane nalokhu
01	02	03	04	05

10. Uma impendvulo yakho inguyebo kumbuto 9, chaza kutsi ingabe bahlali batsintsiwe /babutiwe yini.

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11. Ngelwati lwakho , bobani lalabakhulu labatsintse wena? Babhale ngeluhlu lwabo.

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**C. LWATI LWELUHLELO LWESPHEHLAGESI LWEKUSHISISA EMANTI**

12. Ingabe ungazuza yini kuloluhlelo?

Uyavuma Kakhulu	Uyavuma	Ngenasiciniseko	Ungavumelani	Abavumelani nakancane nalokhu
01	02	03	04	05

13. Ingabe imphilo yetakhamuti taKanyamazane tagucuka kancono yini kusukela kwatfulwa leluhlelo lesiphehlagesi sekushisisa emanti?

Ngiyavuma Kakhulu	Angivuma	Anginasinciseko	Angivumelani	Angivumelani nakancane nalokhu
01	02	03	04	05

14. Uma uvumelana nembuto 13, ngabe lemphilo ingucuke ngayiphi indlela?

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15. Loluhlelo lwekufakwa kwesiphehlagesi sekushisa emanti asatiswanga kubahlali baKanyamazane

Ngiyavuma kakhulu	Angivuma	Anginasiciniseko	Angivumelani	Angivumelani nakancane nalokhu
01	02	03	04	05



**D. INZUZO IBHODULUKO LETOKUHLALISANA – NETOMNOTFO  
KWALEPHROJEKTHI**

16. Bantfu bendzawo bancashwa ngesikhatsi seluhlelo sekufakwa kwesiphehlagesi sekushisisa emanti.

Ngiyavuma Kakhulu	Ngiyavuma	Anginasiciniseko	Angivumelani	Angivumelani nakancane nalokhu
01	02	03	04	05

17. Uma impendvulo inguyebo kumbuto 16, lephrojekthi ikhile na ematfuba emisebenti ngokwanele ukunciphisa ububha phakatsi tetakhamuti beswela eKanyamazane?

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18. Loluhlelo lwesiphehlagesi sekushisisa emanti ngabe lusisombululo lesincono sekunciphisa buphuya emphakatsini Kanyamazane

Ngiyavuma Kakhulu	Ngiyavuma	Anginasiciniseko	Angivumelani	Angivumelani nakancane nalokhu
01	02	03	04	05

19. Kusetjentiswa kwesphehlagesi sekushisisa emanti, kuletse kukhululeka kubantfu labakhoni kukhokhela tindleko tekusebentisa gesi.

Ngiyavuma Kakhulu	Ngiyavu ma	Anginasicinise ko	Angivumelani	Angivumelani nakancane nalokhu
01	02	03	04	05

20. Basenti labahola kancane sebayakhona nyalo kwenta tidzingo letibalulekile kunekutsi basebentise imali yabo lencane kugesi.

Ngiyavuma Kakhulu	Ngiyavu ma	Anginasicinisi eko	Angivumelani	Angivumelani nakancane nalokhu
01	02	03	04	05

21. Ukusetshentiswa kwagesi kwehla kusukela kufakwa lokusetshentiswa kwesiphehlagesi sokushisisa emanti

Ngiyavuma Kakhulu	Ngiyavu ma	Anginasiciniseko	Angivumel ani	Angivumel ani nakancane nalokhu
01	02	03	04	05

22. Kusakela kufakwe lesiphehlagesi sokushisisa emanti, kusebentiswa kwagesi sekungaphansi kuna ngaphambilini.

.Ngiyavuma Kakhulu	Ngiyavu ma	Anginasicinisek o	.Angivumela ni	.Angivumelani nakancane nalokhu
01	02	03	04	05

### E. KUGCINWA KWESPHEHLAGESI SEKUSHISISA EMANTI

23. Lesiphehlagesi sekushisisa emanti sincinwa bochwephesha labanelukhono

.Ngiyavuma Kakhulu	Ngiyavu ma	.Anginasicinise ko	.Angivumelani	.Angivumelani nakancane nalokhu
01	02	03	04	05

24. Kusakela kufakwe lesiphehlagesi sekushisisa emanti, bebavame kuta kangaki bekulungisa lomshini wemanti?

Njalo	Ngasikhatsi	Abazange
01	02	03

25. Imibono

Nguyiphi imibono longayiniketa kuze kube ncono kusebenta kwesiphehlagesi sekushisisa emanti kuniketa kukhululeka laba labangakhoni kubhadala gesi

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26. Lomunye umbono?

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Ngiyabonga sikhatsi sakho