A CONSUMER ASSESSMENT OF HOUSEHOLD ATTITUDES, AWARENESS, DRIVERS AND LIKELIHOOD OF INSTALLING SOLAR WATER HEATERS UNDER A MONTHLY PAYMENT SCHEME IN CAPE TOWN, SOUTH AFRICA

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Declaration

I know the meaning of plagiarism and declare that all of the work in the dissertation, save for that which is properly acknowledged, is my own.

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Abstract

This paper reviews how incentive mechanisms impact solar water heater (SWH) technology adoption under both monthly payment scheme (MPS) and non-monthly payment scheme (non-MPS) conditions.

The key research problem is to try understand why consumers[1] have not installed SWHs under non-MPS conditions and whether a MPS can generate better installation rates.

SWHs generate clean energy by using the heat of the sun instead of electricity to heat household water. On average, SWHs displace 30 % of household electricity usage, decreasing both household electricity costs and national electricity supply. South Africa has favourable solar conditions and encouraging policy support in the form of long term targets and subsidy incentive schemes. However, it appears that these mechanisms are unable to rapidly incentivise South Africa's mid to high income households to install SWH units.

This paper reviews the MPS incentive mechanism, to examine if it can create a larger scale adoption of SWHs, with the key research question being: *'How does the monthly payment scheme influence consumer behaviour and their likelihood of adopting solar water heater technologies in the City of Cape Town?'*

An important corollary of the research is to gain an understanding of the nature and successes of MPSs in other SWH markets and industry environments. This paper uses case studies to examine successful MPSs in the US PV residential market and in Tunisia's state-supported SWH program.

In order to determine the likelihood of SWH adoption in Cape Town, existing consumer sentiment towards SWHs must be properly understood. Consumer attitudes, awareness and drivers to adopt SWHs will inform the likelihood of adoption, both under MPS and non-MPS conditions. Therefore, this paper investigates the three variables of attitudes, awareness and drivers and the ultimate likelihood of SWH adoption through a questionnaire targeted at respondents from mid to high income households in Cape Town.

The questionnaire seeks to answer the following questions:

[1] In this paper, the term "consumers" refers to the mid to high income consumer segment (LSM 6 -10).

- What are the **drivers** for consumers to adopt SWHs?
- What are the current consumer **attitudes** towards SWHs?
- How **aware** are consumers about SWHs?
- How **likely** are consumers to adopt a SWH under a MPS?

According to the results of the questionnaire, 90 % of respondents stated cost savings as their primary driver for installing a SWH, approximately 80 % have positive attitudes towards SWHs and 70 % have low awareness of SWH technology.

The paper concludes that the MPS incentive mechanism can positively impact SWH adoption because it overcomes the key adoption barrier of upfront costs. Likelihood of SWH adoption improves from 77 % under non-MPS conditions to 94 % under MPS conditions, with a significant 62 % of respondents stating they would install a SWH in the next 12 months under the City of Cape Town's MPS scheme.

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Acronyms and Nomenclature

AADL	Attitudes, Awareness, Drivers and Likelihood
BDS	Business Driven Solution
CER	Certified Emission Reduction
CIS	City Infrastructure Solution
EPA	Energy Purchase Agreement (solar thermal)
EWH	Electric Water Heater
IDM	Integrated Demand Management
IMEP	Integrated Metropolitan Environmental Policy
MPS	Monthly Payment Scheme
NERSA	National Energy Regulator of South Africa
NSWHP	National Solar Water Heater Programme
PGWC	Provincial Government of Western Cape
PPA	Power Purchase Agreement (Solar PV)
PROSOL	Programme Solaire
PV	Photovoltaic
RFP	Request for Proposals
SEPA	Solar Electric Power Association
SPV	Special Purpose Vehicles
SL	Solar Lease
STEG	Societe Tunisienne de l'Electricite et du Gaz (TUNISIA's power and gas utility.)
SWH	Solar Water Heater
TPF	Third Party Financing
TPFM	Third-Party Financing models

TPO	Third Party Ownership
US	United States

CHAPTER 1 INTRODUCTION

A consumer assessment of household attitudes, awareness, drivers and likelihood of installing solar water heaters under a monthly payment scheme in Cape Town, South Africa.

The research question that this paper explores is '*How does the Monthly Payment Scheme (MPS) influence consumer behaviour and their likelihood of adopting Solar Water Heater (SWH) technologies in the City of Cape Town (CCT)?*' The paper aims to examine consumer behaviour towards adopting SWHs under a monthly payment scheme[2] (leasing scheme). By exploring the MPS, this paper aims to shed light on the likelihood that a MPS can generate high adoption rates for solar water heaters. This is relevant to the current day context since the City of Cape Town aims to implement a monthly payment scheme in the second half of 2013.

This paper shall explore further sub areas of consumer behaviour by reviewing consumer:

1. Attitudes: Including current barriers to adoption under non-MPS conditions
2. Awareness: Knowledge of SWH products and benefits
3. Drivers: Including key motivations for implementing SWH systems
4. Likelihood of Adoption: Assessment of the probability of households implementing SWH systems under MPS conditions

The overarching research theme for this paper is to better understand household sentiments toward SWHs in Cape Town. A literature review is performed examining existing South African papers on consumer attitudes towards SWHs. This research paper performs its own consumer attitude analysis via a questionnaire entitled *'Cape Town Consumer Analysis on Solar Water Heaters 2013'* which assesses consumer attitudes, awareness, drivers and their likelihood of installing SWHs under the new monthly payment incentive scheme.

[2] A monthly payment scheme is when consumers pay for a product or service in smaller monthly payments over a longer time duration thereby making products more affordable and accessible to a wider consumer base. Monthly payment schemes can also be known as rent-to-buy schemes, leasing, hire purchasing or paying for an item via instalments.

An important subsidiary research question that the paper aims to clarify is *'Will Cape Town consumers install SWHs under a monthly payment scheme?'* The paper reviews comparative MPS literature from other renewable markets and investigates how these MPSs influence consumer uptake of solar systems.

To answer the research question '*How does the Monthly Payment Scheme (MPS) influence consumer behaviour and their likelihood of adopting Solar Water Heater (SWH) technologies in the City of Cape Town (CCT)?*' the paper seeks to understand two key issues:

First, to understand existing consumer sentiment towards SWHs, thereby providing a foundation to predict the likely consumer uptake of SWHs under an MPS.

Second, to understand the nature and successes of monthly payment incentive schemes in other SWH markets and industry environments. This provides a comparative benchmark for the likely uptake of SWHs under the CCT's MPS.

In order to understand consumer sentiment, a literature review of South African consumer attitudes towards SWHs will be presented. To address the goal of understanding existing MPSs, a comprehensive literature review will be performed to detail existing MPSs (SWHs in Tunisia Prosol Scheme and the growing United States residential PV market).

The outcome of the literature review helps shape the specific survey questions that need to be asked in order to understand existing consumer attitudes, awareness and drivers towards installing SWHs. Once these consumer characteristics are better understood, the likelihood of adoption under MPS conditions can be better inferred.

See Appendix A for a tree diagram that demonstrates the paper's focus areas.

1.1. BACKGROUND TO THE RESEARCH PROBLEM

Many papers[3] have documented the economic, environmental, energy and societal benefits of widescale adoption of SWHs, yet few countries have achieved high penetration rates. Why have certain countries been able to achieve higher penetration rates than others, e.g. Cyprus, Israel and Spain? What are the factors that influence better uptake rates?

Many variables influence product adoption and in the case of SWHs, these include customer characteristics (attitudes, awareness and product knowledge), motivators and drivers (incentives and penalties), entrepreneurial local businesses, political will and supportive policy instruments. This paper focuses on two of these factors that influence SWH adoption: customer characteristics (attitudes, awareness, and drivers) and public policy instruments /incentive mechanisms (Monthly Payment Schemes).

1.1.1 South Africa's Energy Context

South Africa has one of the highest solar radiation levels in the world with plenty of sunshine and daily average solar radiation levels between 4.5 and 6.5 kWh/m (Department of Minerals and Energy, 2003:20). This is illustrated in *Figure 1: Global Solar Radiation* and *Figure 2: South Africa's solar radiation picture*. Statistics SA state that South Africa experiences more that 2500 hours of sunshine per annum equating to 220 watts per square metre (W/m^2) whereas the US receives on average 150 W/m^2 and Europe only 100 W/m^2 (Statistics SA, 2006). Much of South Africa's population lives in areas with high insolation levels. Solar energy is a free and abundant resource and South Africa has a considerable opportunity to use this rich resource in solar water heating and other solar technologies.

[3] For example: Adams, (2011), City of Cape Town (2013), Department of Energy (2009), Hack (2006), Swanepoel(2010), Ravens (2008) and others.

FIGURE 1: GLOBAL SOLAR RADIATION: WORLD INSOLATION MAP (SOURCE: DOE 2003)

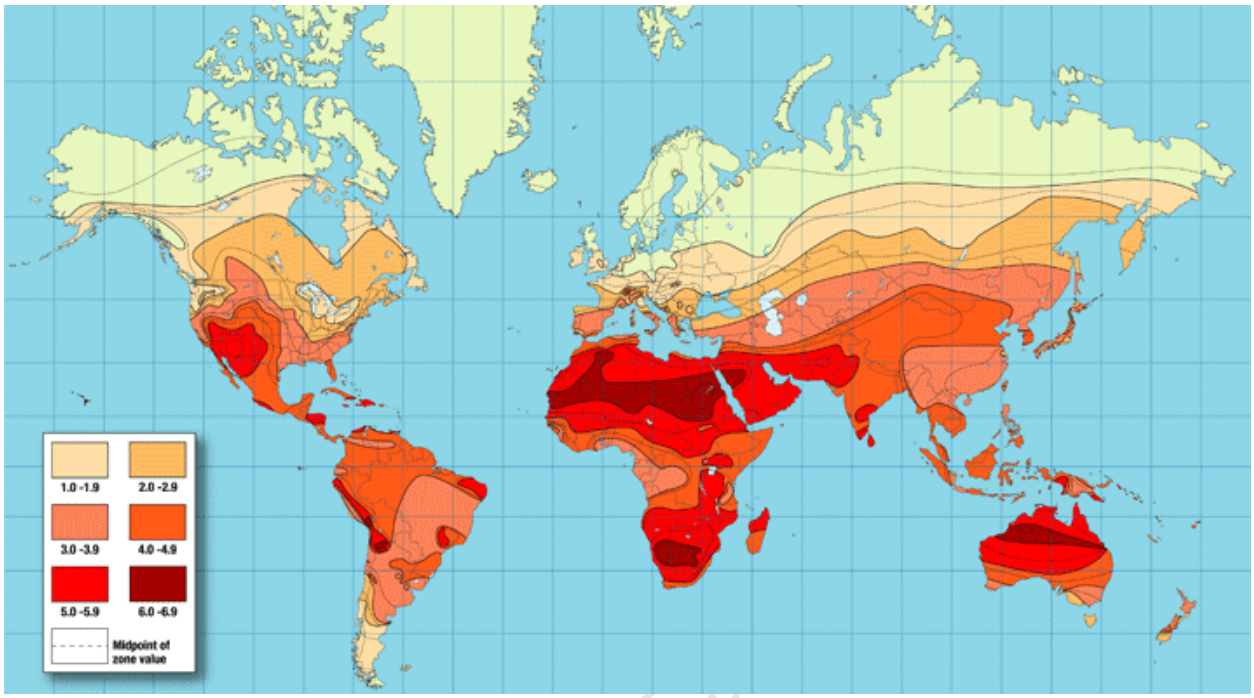
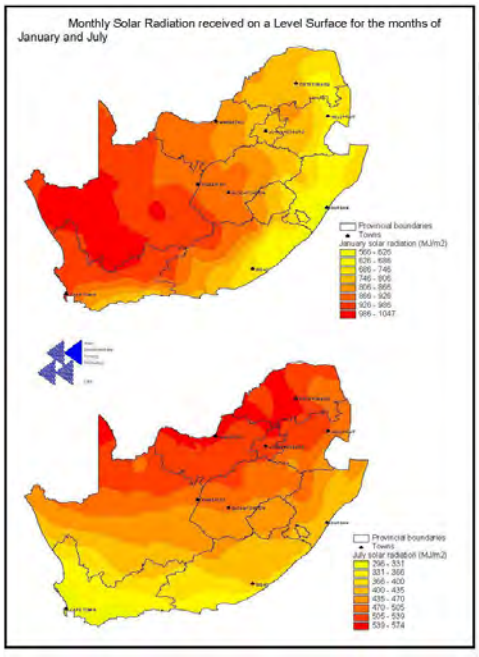


FIGURE 2: SOUTH AFRICA'S SOLAR RADIATION PICTURE: MAP OF THE DISTRIBUTION OF MONTHLY INSOLATION IN SOUTH AFRICA (CSIR: WATER, ENVIRONMENT AND FORESTRY TECHNOLOGY) (SOURCE: SWANEPOEL, 2010)



Subsidies have been a typical public policy instrument used to stimulate the uptake of SWHs (Austria, Italy and Brazil). In South Africa, Eskom implemented their subsidy rebate scheme in 2008 with the target of stimulating adoption. Several prior consumer research papers predicted high uptake rates as a result of a subsidy scheme. Raven's (2008) questionnaire found that 92 % of respondents stated they would install a SWH if there were subsidies and Adams (2011) found an 80 % likelihood of installation with a R5000 tax rebate incentive. Although these represent favourable indications of the likelihood of SWH installation, South Africa has not experienced anything close to 80 % installation rates in reality. The national government has established a target of 1 million SWHs by 2015 (SEA, 2010) and is chiefly utilising subsidies as the policy instrument to promote uptake. Despite these initiatives, installations of high pressure systems which are directly attributable to the subsidy scheme, remain extremely low. Frost and Sullivan (2012) indicate only approximately 45 000 high pressure systems have been installed due to the rebate scheme. South Africa's overall target of 1 million SWHs also appears overly ambitious, since as of August 2012, only 260 000 installations had been achieved (Botes, 2012).

South Africa has favourable solar conditions and encouraging policy support in the form of long term targets and subsidy incentive schemes. However it appears that these are unable to rapidly incentivise South Africa's mid to high income households to install SWH units. The overall effectiveness of only using a subsidy mechanism should therefore be questioned.

Since South Africa is not realising the SWH targets, alternative stimulus methods should be examined. An interesting examination would be exploring the likelihood of improving SWH installations under monthly payment scheme (MPS) conditions. A MPS can be complementary to the existing Eskom rebate scheme and is currently proving effective in other solar markets. The City of Cape Town (CCT) has taken the initiative to implement a MPS in Quarter 3, 2013, to stimulate demand and help kick start the SWH sector (CCT, 2013).

The success of the MPS depends on whether it can better meet consumer needs and thereby overcome those consumer barriers that the subsidy scheme has failed to do. If successful, the MPS scheme may prove an effective additional policy instrument to incentivise mid-high income consumers to install SWHs (CCT, 2013).

1.1.2 Cape Town's Energy Context

Cape Town is highly dependent on electricity power from coal power stations in the Northern Provinces of South Africa, nearly 2000 km away. Although Koeberg Nuclear Power Station is located near the Western Cape, the City is supplied by Eskom's national grid. Eskom's grid consists of 95 % electricity generated from the coalfields in Mpumalanga and 5 % from Koeberg Nuclear Power station. It is difficult to quantify the proportion of electricity the CCT directly receives from Koeberg Nuclear Power Station versus the coal fired power stations. Until recently (2008), electricity in South Africa and Cape Town was relatively cheap[4], resulting in low levels of energy efficiency in households and industrial processes. Since the electricity supply shortages of 2008 and the rise in electricity prices, consumers are now seeking better energy security and energy efficient products to help lower electricity bills. Sourcing electricity from coal power stations in the north of the country results in high transmission and distribution losses, as up to 17 % can be lost in transmission. There are also intensive maintenance costs and the North-South transmission creates a high carbon footprint (CCT ERM, 2009).

The CCT receives only a small percentage of its electricity from renewable and local sources (one wind farm of 5.2 MW and hydro-electric power for peak demand via pumped storage). The CCT produces some of its own electricity, but the majority is supplied by Eskom. The CCT has little independence in its terms of electricity and relies mostly on the national production from Eskom. The residential sector accounts for about 18 % of total energy consumption (CCT, 2010) and households use approximately 30 % of electricity to simply heat water. SEA (2010) estimates 60 % of water heating energy could be displaced by SWHs. This translates roughly into 25 % savings on an average monthly electricity bill. There are approximately 800 000 households in CCT. 550 000 of these are formal dwellings of which 216 000 are deemed suitable for the CCTs MPS (CCT, 2012).

[4] When compared globally to domestic electricity prices (p/kWh) of other countries.

1.2 THE RESEARCH PROBLEM

The key research problem is to try understand why consumers[5] have not installed SWHs under non-MPS conditions and whether a MPS can generate better installation rates. The paper takes a consumer-driven perspective as opposed to an industry or public authority standpoint.

The research problem that exists is that many papers[6] cite the importance and value of achieving widescale SWH adoption in South Africa (mutual benefits to both end users and governing authorities), yet after four years of Eskom's subsidy scheme, installation rates remain low and targets un-met. SWHs benefit both end-user consumers (lower electricity bills and long term cost savings) and the South African government (lower electricity production, job creation, less environmental degradation) yet the sector seems unable to scale up. Why does this situation exist and can a MPS be the solution to better improve installation rates?

This paper assesses three key consumer characteristics namely attitudes, awareness and drivers for installing SWHs. These three sentiments are assessed under the prevailing non-MPS market conditions (i.e. Eskom's existing rebate scheme) to better understand consumer opinions towards SWHs. Once attitudes, awareness and drivers are determined, an assessment of the likelihood of SWH installations under non-MPS is performed. This indicates the probability of future installations under the 'business as usual' scenario. The three previously mentioned sentiments are examined to help inform whether a MPS can address any of the key consumer concerns. The ultimate goal is to infer the degree of likelihood for SWH installations under both MPS conditions (i.e. CCT's MPS) and business as usual scenarios / non MPS conditions (i.e. Eskom's existing rebate scheme).

The likelihood of installation is determined through two approaches. The first approach is to review literature on MPS in other solar markets (i.e. US PV market and Prosol SWH project in Tunisia) and the second, is to conduct a questionnaire that directly investigates consumer opinion. By reviewing the above, an informed inference can be made on the key research question:

[5] The term consumers refers to the mid to high income consumer segment (LSM 6 -10).

[6] Department of Energy (2009), Swanepoel(2010), Sustainable Energy Africa, (2010).

'How does the Monthly Payment Scheme influence consumer behaviour and their likelihood of adopting Solar Water Heater technologies in the City of Cape Town?'

In summary, despite South Africa's superb solar conditions, Eskom's rebate scheme and mutual benefits to both end-consumer and government, adoption of SWHs remains low. The CCT believes the monthly payback scheme (MPS) can be more effective at generating SWH installations. This is due to the MPS being able to overcome certain adoption barriers, namely high upfront costs and the matching of electricity savings with monthly payments. This boosts consumer confidence in suppliers, products and the industry as a whole. The paper takes a consumer driven approach, obtaining direct customer feedback to assess attitudes, awareness, drivers and ultimately the likelihood of installing SWHs. By assessing these consumer traits, this paper obtains a broader and more colourful understanding of consumer attitudes and their likelihood of installing a SWH under the MPS scheme compared to the existing non-MPS scenario.

1.2.2. The Research Objective and Research Questions

The research objective is to determine the existing attitudes, awareness and drivers for consumers to install SWHs and assess their likelihood of doing so under current non-MPS and MPS conditions.

The paper's key research question is:

'*How does the MPS mechanism influence consumer behaviour and their likelihood of adopting SWH technologies in the CCT?*' The research questions can be summarised as below:

1.2.3. The Primary Research Question

How does the MPS mechanism influence consumer behaviour and their likelihood of adopting SWH technologies in the CCT?'

1.2.4. Subordinate Questions

- What are the **drivers** for consumers to adopt SWH?

  → *Why will consumers install SWHs?*
- What are the current consumer **attitudes** towards SWH?

  → W*hat do consumers think of SWHs?*

- How **aware** are consumers about SWH?

  → *What do consumers know about SWHs?*

1.3. PURPOSE OF STUDY

The purpose of this study is to find out how a MPS affects consumer behaviour and their likelihood of installing SWHs. Previous studies have identified high upfront costs as the main barrier to adoption and a MPS has the ability to overcome this barrier. Therefore, this study investigates whether a MPS can help reduce this barrier and increase the likelihood of adoption.

Many papers[7] focus on the economic, environmental and social benefits of SWHs, but neglect householders' actual opinions (drivers, barriers and attitudes) towards SWHs and their likelihood of installing a unit. A key outcome of this study is to take a customer facing approach and obtain the '*voice of the customer*' from the CCT's potential target market (mid-high income households).

The CCT has estimated a target market for middle to upper income households under the proposed MPS scheme. They have an optimistic upper limit (144 000) and a conservative lower limit (60000) adoption scenario (CCT, 2012: 9). A customer questionnaire provides a preliminary market evaluation of the target market's attitudes, awareness and drivers towards SWHs and their ultimate liklihood of installing a SWH due to a MPS. The overal likelihood of adoption of SWHs for the entire target market can also be assessed on the basis of the questionnaire results. Any firm inferences should be made with caution, since the sample is not fully representative of the population. Nevertheless, the questionnaire provides a useful assessment of the potential uptake from CCT households and insight on general consumer behaviour (attitudes, awareness and drivers) towards SWHs.

A few good South African consumer-focused papers exist. These include Adams's (2011) paper, '*South African consumer attitudes towards domestic solar power systems,'* which provides a useful comparison of the differing attitudes between early adopters and non adopters of SWHs. Raven's 2008 paper: '*The attitude, awareness and willingness to pay for solar water heaters in the Cape Town Region'* provides a

[7] Department of Energy (2009), City of Cape Town (2008), City of Cape Town ERM (2009), Sustainable Energy Africa, (2010), Sustainable Energy Africa (2007).

useful, albeit outdated, assessment of Cape Tonians' general sentiments towards SWHs under non-MPS conditions. This research paper seeks to build on these two consumer-focused assessments by narrowing its scope to investigate consumer behaviour under MPS conditions.

1.4. SCOPE AND LIMITATIONS

Scope: This paper limits its scope to assessing the following key, consumer-driven characteristics:

1) Likelihood: *'Will consumers install SWHs under a MPS?'*
2) Driver: *'Why will a consumer adopt a SWH?'*
3) Attitude: *'What do consumers think of SWHs?'*
4) Awareness: *'How aware are consumers of SWHs?'*

These four areas will be examined under both non-MPS conditions and MPS conditions, assessed through a literature review and tested empirically via a questionnaire.

The primary focus of this paper is to determine the likelihood of Cape Town households installing SWHs under a MPS. However, to do so, general consumer characteristics need to be understood and thus a secondary objective is to assess and understand consumer attitudes and awareness of SWHs.

1.4.1. Limitations:

As per CCT's guidance, the questionnaire was limited to households who were eligible for the MPS. Thus respondents had to meet the following conditions (CCT, 2012):

1. The house must have access to roof space to enable SWH installation.
2. The house must be owner-occupied to enable easy sales and operation of the SWH programme.

3. The household should consume more than 450 kWh or R500[8] of electricity per month to financially justify the installation of SWHs (i.e. consumption patterns at this level and above justify the 5 – 7 year payback period whereby electricity bill savings match the monthly instalments).

The questionnaire used the above criteria to select its sample and included an additional selection criterion, asking whether households already had a SWH. A further limitation was clearly determining mid to high income groupings. In this case, a combination of attributes was used to classify respondents into mid to high income groups. These were primarily income, suburb, and monthly electricity expense. A proxy of LSM[9] 6 – 10 was used by asking four LSM questions. These LSM questions increased confidence that the respondents were correctly classified in the mid-high income segment.

1.4.2. Exclusion

The questionnaire focused purely on the adoption of SWHs and excluded installation of heat pumps from the qualitative section of the questionnaire. Due to the CCT amending their tender to include heat pumps, a request was made by the CCT to add a few additional questions on heat pumps in order to test consumer attitudes and awareness about this technology. These questions were included in the multiple choice segment in the 'Awareness' and 'Attitude' sections. The questions have no bearing on the thesis research question.

1.5. RESEARCH METHODOLOGY AND DESIGN

The research method used was a questionnaire with the aim of identifying consumer attitudes, awareness and drivers towards SWHs and assessing their overall likelihood of installing an SWH under MPS and non-MPS conditions.

1.5.1. The Population

The population for this study paralleled the target market for the CCT SWH campaign, which was defined as Cape Townian 'owner-occupied, free- standing households using more than 450 kWh [of

[8] The value of R500 per month is the authors calculation and is based on 111.42 c/kWh as per Eskom's block tariff (Eskoms, Tariffs and Charges, 2013) {see appendix B for more detail}.

[9] LSM stands for the 'Living Standards Measure' and is the most widely used marketing research tool in Southern Africa. It categorises the population into 10 LSM groups, namely 10 (highest) to 1 (lowest).

electricity] per month' (CCT, 2012, 21). Householders had to meet following criteria: 1) access to roof space 2) owner- occupied and 3) utilising more than 450 kWh (R500 worth of electricity per month). Therefore, the questionnaire targeted owner occupied, freestanding households utilising more than 450 kWh (a range of R400 - R500 electricity expenditure is used). These households were also categorised as middle to upper income households (LSM 6 – 10 verified by the LSM questions 12-15 under descriptive statistics section).

1.5.2. Sampling Method

The Sampling Frame provides the criteria for selecting sampled participants. The criteria for selection is:

- Individuals who were householders and lived in Cape Town
- Individuals who were considered middle to upper income
- Individuals who were likely to spend more than R400[10] on electricity monthly

The research design employed both qualitative and quantitative questions. A sampling for convenience and a sampling of judgement methodology was used.

A total of 52 questionnaires were completed, a response rate of 67 %. Qualifying questions were included during the sourcing of eligible interviewees to ensure they met the sample frame.

1.5.3. The Questionnaire Design

Each of the qualitative and quantitative questions were designed along the four main themes of identifying consumer attitudes, awareness , drivers/barriers and likelihood of adopting SWHs. Additional questions include eligibility and demographic-type questions. The Attitudes, Awareness, Driver and Likelihood (AADL) category questions were asked in both a qualitative (open ended style) and quantitative (closed ended questions/ multiple choice question) format.

1.5.4. Research Limitations

This study had a small sample size with a varying degree of awareness and knowledge about SWHs. This provided a broad range of responses. Since this was exploratory research, the sample took a broad and

[10] R400 was selected instead of R500 as this provides a 20 % buffer on possible target market participants.

thin approach across all demographic profiles, namely income (mid to high income groups), age, education, electricity and water usage and geography. The findings from this questionnaire sample are not representative of the 140 000 MPS target market and the data should be used cautiously when making comparisons for the population.

1.6. RESEARCH LAYOUT

The report is structured according to the format below.

Chapter 2: Literature Review

The literature review examines two key concepts: consumer characteristics (attitudes, awareness, drivers and likelihood of SWH adoption) and a description of the MPS. First, a comparative literature review of South African consumer characteristics of attitudes, awareness, drivers and likelihood under non-MPS conditions is performed. This is followed by a detailed analysis of the MPS model evaluating its benefits, drawbacks and applicability to the SWH sector. Empirical case examples are examined and reveal successful growth in response to a MPS model (US residential PV and Tunisia SWH Prosal programme).

The literature review provides the foundation to test possible consumer behaviours (attitudes, awareness, drivers and ultimate likelihood of SWH adoption) in response to the CCT's MPS.

Chapter 3 Methodology

This chapter explains the logic behind the questionnaire's sampling, data collection and data analysis. It explains the rationale for selecting the sample and structuring the questionnaire into qualitative and quantitative sections with a 50:50 split. The chapter reveals the population, sample and sample frame criteria to evaluate the questionnaire respondents.

Chapter 4 Research Results

The results for the key questions are explained. Linkages and comparisons are made between prior literature and interrelated questions within the questionnaire. Microsoft Excel data analysis tools were used to analyse the data.

Chapter 5 Discussion and Recommendations

This chapter reviews how the research results answer the research questions. It describes interconnection and linkages between the four consumer characteristics of attitudes, awareness, drivers and likelihood of SWH adoption and explains limitations and areas for future research.

Chapter 6: Conclusion

This chapter conveys the overall outcome of the research paper and provides a final assessment on the key research question of *'How does the MPS mechanism influence consumer behaviour and their likelihood of adopting SWH technologies in the CCT?'*

Appendices

The appendices include the questionnaire, data tables, graphs, cover letter and additional figures and diagrams.

CHAPTER 2 LITERATURE REVIEW

2.1. INTRODUCTION

This section focuses on past literature examining four consumer assessment themes namely attitudes, awareness, driver and likelihood to adopt SWHs. 'Awareness' examines consumers' general product knowledge of SWHs and current levels of exposure to SWH units. 'Attitudes' examine general perceptions of SWHs namely how positive or negative consumers are towards SWHs. 'Drivers' refers to the key motivators, either push or pull factors that stimulate consumers to install SWHs and likelihood examines current likely levels of adoption and forecasts probable demand under non-MPS and MPS conditions.

By performing a literature comparison, this paper provides background on existing consumer attitudes, awareness and drivers towards SWHs and provides the platform to test the likelihood of adoption under the CCT's MPS proposal.

Four papers highlight the general attitudes, awareness, drivers and likelihood of installations of SWHs in South Africa. They are Eskom IDM[11] (2012), Adams (2011), Ravens (2008) and Swanepoel (2010).

The following chapter presents a literature review of consumer attitudes, awareness, drivers and likelihood of installation, as explained in the four papers listed above.

2.2. SOUTH AFRICAN CONSUMER ASSESSMENT

2.2.1. Awareness

Awareness examines consumers' general product knowledge of SWHs and current levels of exposure to SWH units.

[11] IDM refers to Integrated Demand Management. Eskom's IDM division commissioned Frost and Sullivan consultants to perform a customer behaviour and satisfaction survey on SWHs in South Africa.

One of the stated aims by the CCT (2012:9) for the MPS is to create a market transformation with a goal of establishing householder knowledge. SEA (2007) states that there is a lack of general awareness of the benefits of solar water heaters in South Africa. Ravens (2008: 9) reveals that according to Milton & Kaufman (2005: 13), the general public is largely unaware of some key SWH benefits. These include the facts that SWHs displace electricity (thereby reducing emissions) and provide a cost effective alternative to heat water and reduce air pollution.

Ravens cites Plaza and Linares (2007:13) who claim that there is a widespread lack of knowledge of green electricity. Milton & Kaufman (2005: 20) state that lack of public awareness of SWH is a key reason for the poor SWH adoption rates in Mexico and claim that levels of product knowledge and likelihood of adoption are correlated. Hardie (2010) also claims that low awareness levels of SWH benefits result in low demand for SWH systems and thus a low likelihood of adoption. Swanepoel (2010) details that during a series of interviews conducted with SWH industry experts in the CCT, lack of information (product knowledge and awareness) on SWH units is frequently cited as the most common obstacle for adoption.

Adams (2011) details that according to Berger (2001) and Vollink et al (2002), householders must perform extensive research when purchasing renewable technologies in order to determine the overall benefits of adoption (e.g. energy and environmental savings). Since most renewable technologies are not yet mainstream, many of these benefits are not clearly apparent to the consumer, especially since householder awareness and product knowledge levels are generally low. Adams (2011:77) further indicates that the adoption of renewable energy systems in general often requires significant research by the householder. By implication, marketing and awareness campaigns raise customer knowledge and improve likelihood of adoption. Since different SWH providers offer different products in terms of size, price and returns, a certain level of consumer knowledge is required to make an informed decision (Kaplan, 1999). In his paper interviewing industry experts, Swanepoel (2010:102) concludes that a major obstacle to the wide scale adoption of SWHs in mid to high income groups is the lack of authoritative and independent information sources. This leads to an unstable South African SWH market. Copans (2009) states that making consumers and suppliers aware of SWHs and associated rebate programs remains a big problem. As a result, consumers misunderstand the products and fail to trust the product offerings. Since SWH suppliers are not independent, they are not a reliable source to provide objective customer feedback (Swanepoel, 2010; Copans, 2009).

Swanepoel (2010:102) suggests that a consumer survey should be performed to establish why mid to high income market segments have not bought SWHs and that the survey should specifically test consumers awareness levels. This paper's questionnaire aims to do that.

2.2.1.1. Empirical findings and discussion

Ravens' (2008; 32-35) questionnaire found that the interviewees were largely unaware of their electricity consumption in kWh[12]. To get around this problem, the questionnaire in this paper asks for electricity expense (in Rands) instead of actual consumption in kWh.

90 % of respondents in Ravens' study stated that they were aware that SWHs save electricity and by implication are environmentally friendly. Somewhat surprisingly, 70 % stated that they did not know the difference between SWHs and photovoltaic cells, which will also be tested in this questionnaire.

Adams (2011) found that 95 % of the early adopter sample knew someone who had installed a SWH, with about 60 % indicating knowledge of a person who had a SWH between 13 and 15 years. This is indirectly tested in this questionnaire under:

'*What has the general experience been of people you know with a SWH heater on their roof? --- Happy / Unhappy / Don't know any.'*

'I have never seen a SWH system - Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree'

Adams finds that if consumers have a level of awareness that SWHs function successfully, especially over a 2 to 5 year period, then they are more likely to install a unit.

Eskom IDM (2012:4) discovered that most (85 %) of potential end users are aware of Eskom's rebate. However, the level of knowledge about the rebate and the available products is limited. This led to misperception and rumours, often discrediting the programme and SWH technology. Awareness was achieved through various media sources. Word-of-mouth and direct interaction with SWH suppliers were identified as the most common methods of raising awareness. The CCT programme should learn from the shortcomings of the Eskom rebate campaign.

[12] kWh stands for kilowatts per hour.

Eskom's research paper, Eskom, IDM (2012:14) asks '*Do you consider yourself well-informed on the various products available in the market?'* 50 % stated *'no they do not,'* suggesting that many mid to high income households remain ill informed about SWH product offerings. This questionnaire tests product awareness levels on a scale of 1 to 10, and compares and validates product awareness from current consumers against existing papers. Eskom IDM (2012:12) finds that *'awareness and misperception are areas to work on'* in the SWH industry, with consumers making comments such as *'You never know what and who to believe'* (talking about SWH suppliers and product types) and '*Eskom's communication campaign on the rebate programme is not informative enough. Furthermore, it does not encourage us to go look for more information.'*

In summary, according to Eskom's report, levels of awareness for the Eskom rebate scheme are high (85 %) but product knowledge is low (50%). This seems evident in the data and customer comments. As illustrated above, most of the literature indicates low levels of awareness and product knowledge. In the forthcoming sections, levels of awareness will be tested and compared with prior papers.

2.2.2. Attitudes

This section reviews existing literature on the attitudes of consumers towards solar water heaters. Sub classifications include: positive perception, negative perception, knowledge of product, perceived advantages/disadvantages, and attitudes about product attributes (performance, convenience, durability, trust, affordability, environment and aesthetics).

Adams (2011:16) states that according to ERC (2010), SWHs are considered a mature technology but they still require much policy support to be considered by mainstream consumers. For the most part, SWHs are failing to achieve wide-scale adoption and this is due to several barriers, namely financials (high costs), poor levels of awareness and practical issues such as installation, durability and service reliability (Caird et al, 2008; Faiers, 2006).

Adams (2011) reiterates that the general attitude is that SWHs are an expensive alternative to conventional electric water heating with high upfront costs and financial benefits which typically take long to recoup. Adams (2011:16) illustrates that there is a high cost differential between SWHs and incumbent technologies. For example, on average a high pressure SWH costs R16 000 after the rebate versus R6000 for an electric geyser. This translates to about a 170 % cost differential between a SWH

and an electric water heater (EWH) even after taking into account the 30 % Eskom rebate. It is no surprise that high upfront costs are often listed as the major consumer impediment which often translates into a negative consumer attitude towards SWH products (Eskom, IDM, 2012, Trabacchi et al 2012).

Adams (2011:18) details that there can be confusion amongst consumers over the quality and minimum standards of SWH products. South Africa did not have minimum standards for SWHs until the launch of National Solar Water Heater Programme (NSWHP) in 2010 and now minimum standards are set by South African Bureau of Standards (SABS). Consumer attitudes towards SWH product quality and standards are tested in this paper's questionnaire.

2.2.2.1. Positive Attitudes

Adams (2011: 14) cites several papers to describe that SWHs exhibit several positive features such as affordability (Berger, 2001), compatibility with other technologies (Knudsden, 2002), reduction of pollution (Luque, 2001), technical reliability (Cabraal et al, 1998) and capability of producing savings (Holm, 2005*).*

2.2.2.2. Negative Attitudes

Despite its positive attributes, SWHs remain a grudge purchase for the most part. They are unattractive to householders and low on their list of personal priorities (Timilsina et al, 2000). Long payback periods, high upfront costs, poor confidence in both suppliers and longer term performance result in negative sentiment toward SWHs (Adams, 2011; Timilsina et al , 2000; Hardie, 2010).

"The market is confronted with a barrage of low-quality products from China, which is exacerbated by a lack of skills prevalent in the installation sector. This has resulted in a ***suspicious opinion of solar water heater systems*** *and a subsequent* ***lack of interest*** *by the South African consumer*," (Creamer Media Reporter, 2011).

Media and academic literature cite many shortcomings in the SWH market. Ravens, Adams and Eskom IDM perform a consumer-driven assessment to ascertain household attitudes to SWHs and to try to investigate whether the afore-mentioned shortcomings are recognised by South African consumers.

A key question asked by each paper is *' Do consumers have a negative attitude towards the SWH industry, suppliers and products ?'* This study performs the same examination but under both MPS and non-MPS conditions.

Interestingly, one of the CCT's (2012:9) main stated aims of the MPS is to create a market transformation with a goal of fostering *'trust in the technology.'* This suggests existing consumer distrust in the technology. This is emphasised by the above Creamer Media Report (2011) which states that consumers are suspicious of products and suppliers and remain confused about the correct system to purchase. This lack of trust and low product knowledge is reiterated by Van der Merwe (2011) who states that incorrect product application and poor communication and execution of the Eskom rebate scheme has created a negative reputation for SWHs. Arkesteijn and Oerlemans (2005)[13] assert that trust in the supplier of a product determines customer acceptance of that renewable energy product. Milton (2004: 44[14]) states that in some countries, public perception and general attitudes remain low towards SWH, since many believe that the product is inherently flawed and is not a viable alternative to existing water heating practices. Ravens (2008) and Adams (2011) indicate that certain target groups have negative attitudes towards the aesthetics of the SWH system.

Since a stated intention of the CCT MPS is '*fostering trust in the product'*, a CCT specific questionnaire that determines the existing attitudes of householders, especially trust in the technology, seems appropriate. This questionnaire provides a benchmark from which further follow up surveys can be performed to evaluate consumer attitudes towards SWHs.

2.2.2.3. Empirical findings and discussion

[13] Cited from Ravens (2008:13)

[14] Cited from Ravens (2008:18)

Adams (2011) performed an extensive study on the attitudes of South African householders comparing the differences in attitudes between early adopters and the early majority (those who are considering SWH installation but who have not done so yet). To test South African householder attitudes, Adams (2011:59) included 16 statements about SWHs with respondents having a choice of five options: strongly agree, agree, undecided, disagree and strongly disagree. Adams classified answers as either positive (strongly agree/agree) or negative (strongly disagree/disagree) towards SWH.

TABLE 1: 'EARLY MAJORITY' ATTITUDES TOWARDS SOLAR SYSTEM CHARACTERISTICS (ADAMS 2011)

Solar systems attribute statements	Positive %	Undecided %	Negative%
It takes a long period to recoup the financial benefits	16.13	28.23	55.65
There is a low level of subsidy available for solar geysers	12.9	25	62.1
Solar systems help to reduce pollution	91.2	8	0.8
Solar systems generate savings	84.8	13.6	1.6
Solar systems require the same maintenance as an electric geyser or grid-power source	24.19	50.81	25
Solar systems are hidden away and affect the aesthetics of your home	28.46	21.95	49.59
Solar systems are value for money	54.03	37.9	8.06
Solar systems are an affordable technology	29.27	35.77	34.96
Solar provides a reliable source of power	64.52	29.84	5.65
Solar could develop in the future	97.58	1.61	0.81
Solar systems add value to a property	69.6	24.8	5.6
Solar systems reduce carbon emissions	88.62	10.57	0.81
Solar systems provide a visual statement of beliefs	68.55	26.61	4.84
Solar systems are easy to install	18.55	58.06	23.39
Solar systems are a safe form of power generation	89.52	10.48	0
Solar power is compatible with modern living	91.13	7.26	1.61

Adams' (2011: 78) overall finding was that the early majority householders had a positive attitude towards some of the SWH characteristics, but this was insufficient to convert them to adopt SWH units. The study found that 10 out of the 16 statements were positive. Negative sentiment is shared with early adopters and early majority with regards to long payback period, low subsidy levels and negative aesthetics.

Adams (2011:78) shows that negative attitudes towards the relative advantages (economic payback, affordability and level of subsidy), compatibility (higher maintenance), complexity (ease of installation) and aesthetics (poor aesthetics) of SWH is significant enough to inhibit adoption. These attitudes are tested in this paper's questionnaire. The early majority were largely unsure of levels of maintenance required, unclear about the affordability of systems and undecided/in disagreement if systems were easy to install. These are major potential barriers to adoption. Interestingly, 99 % of early adopters in Adams' study were classified as 'Pro-Solar' either suggesting satisfied customers or a biased sample.

Adams (2011: 58) segmented early majority and early adopters via demographic profiles of education level, age and social status but determined that these are not good predictors for characterising an adoption segment (early or early majority). This questionnaire will use similar profiles to segment respondents but given Adams' findings, these demographic profiles will not be used as predictors.

Adams compares responses between these two groups to determine any statistically significant differences. Key comparisons between early majority and early adopters is that the early majority were more uncertain regarding generating savings, value for money, value to property, affordable technology and ease of installation, whereas early adopters were more positive. This is in line with reality since early adopters have actually installed SWH units. In terms of payback, the early majority's attitudes were more negative than the early adopters suggesting that early adopters might have better knowledge of actual savings and payback periods (Adams, 2011: 58). Both segments express the attitude that SWH systems are intrusive and adversely affect the aesthetics. Ravens (2008:38) finds that 70 % of respondents are not bothered by aesthetics (appearance on roof) with a greater acceptance of SWHs in southern suburbs (90%) than northern suburbs. Although the majority state they are not bothered by appearance, there is a preference for a SWH without exposed storage tanks.

This paper's questionnaire tests 12 of Adams' attitude statements, 6 directly and 6 indirectly (under MPS conditions) and these are compared with Adams' findings to provide a richer assessment of consumer attitudes. Eskom IDM (2012:13) research indicates mostly negative attitudes towards SWHs, especially with regards to affordability. Eskom's paper reveals that the most prevalent reason SWHs are not installed is due to their high upfront costs and cost-efficiency (costs exceed savings) which is summarised in the customer comment '*SWH systems are still too expensive, the rebate is not worthwhile.'* This study aims to review current consumer attitudes with respect to upfront costs and costs efficiencies under MPS.

In summary, general consumer attitudes vary immensely with Adams' study providing the most comprehensive overview of South African attitudes, demonstrating that consumers are generally positive towards the notion of SWHs but are negative towards the upfront costs and affordability.

2.2.3. Drivers and Barriers

Drivers and barriers to adoption are interrelated, since lowering barriers of adoption assists in improving drivers to purchase. Ackerman (2013:10) details three key drivers when purchasing SWHs namely cost savings, word of mouth or peer pressure and environmental concerns. Ackerman further lists several main barriers namely total cost of SWHs, upfront payments, uncertainty about product type, supplier confidence, trialability of product and aesthetics. This section focuses on the drivers that facilitate purchases.

Herring, Caird & Roy (2007: 1892) indicate that 80 percent of their respondents state that their drivers for using a SWH are saving energy, reducing fuel bills and addressing environmental concerns.[15]

Swanepoel (2010) expresses a common point of view that an increasing number of consumers, particularly high income earners, are driven to act out of environmental concerns rather than simply cost savings. However Eskom IDM (2012:15) states that *'Green consciousness is rated quite high, but we believe it will never be a switching criteria on its own except for very few convinced green-savvy home owners.'* Swanepoel further expresses that proper market research is required to accurately determine the motivation for different people to install SWHs. One theme of this study is to investigate the drivers of consumers to install SWHs through the consumer assessment questionnaire.

Adams (2011: 15) expresses concerns that adoption levels may not increase significantly even if awareness levels rise, information becomes freely available and costs are reduced. A particular concern, based on Filippini's (1999) findings from Switzerland, is that electricity price increases actually play a small role in discouraging residential consumption due to the price inelastic nature of electricity. This is relevant as South Africa is utilising both subsidy levers (reduction of upfront cost of SWH units) and electricity price levers (anticipation of future electricity price increases) as a motivating factor for adoption of SWHs. Eskom IDM (2012:29) believes otherwise and states that the primary motive for

[15] Cited from Ravens (2008:13)

switching to SWHs is the expected increase in electricity costs and the potential to make significant cost savings through solar water heating.

2.2.3.1. Empirical findings and discussion

Adams (2011: 78) states that a key driver for consumers to adopt SWHs is for them to understand the potential savings that the system can generate on a monthly basis. Consumers must feel empowered that their system is working at its full potential and they are indeed achieving full benefits from their investment. Providing this data is a driver for adoption. Adams suggests that solving the upfront cost barrier via innovative financing and clearly communicating consumer savings are key drivers for adoption. Eskom IDM (2012: 16) reiterates this point stating that financial incentives remain the key motivator to assist potential end-users to switch from their existing setup. Ravens (2008: 17) lists several potential incentive mechanisms to do so, such as rebates, low interest loans, supplier accreditation and education campaigns whilst Eskom IDM (2012: 4) stresses that any measure that can remove the key obstacles of high upfront cost, cost efficiency (savings greater than costs) and long payback periods will drive consumer purchases. This paper tests if a MPS can effectively overcome these types of barriers.

Eskom's (2012: 15) study reveals that the key drivers for inducing a switch to SWHs is increasing electricity costs (25 %) , cheaper SWH prices (24%) and green consciousness/ savings on electricity bill (15%). This is illustrated in the following consumer comments: *"My main reason for switching to a SWH would be cost savings"* and *"I would possibly switch to a SWH if prices would be more around R5, 000."*

In summary, current literature suggests there is no single driving factor for installing a SWH, but rather a combination of increasing electricity costs, cheaper SWH prices and environmental concerns. This paper asks similar 'driver' questions, performs comparative research analysis with existing literature and tests consumer drivers under both MPS and non-MPS conditions.

2.2.4. Likelihood

Likelihood or the probability of adoption relies upon many factors. To boil it down to something simple is tricky due to the many separate variables effecting individual consumer decision-making. However to improve likelihood, the first step is to remove the key barriers of adoption and the second is to demonstrate a compelling value proposition to the end user. Prior consumer assessment literature provides estimates of the likelihood of consumer adoption under non-MPS conditions. The data from prior papers is valuable as it provides a baseline for assessing the likelihood of adoption under a MPS. This study reviews the findings of these papers and tests the likelihood of adoption under both non-MPS and MPS conditions.

Ravens (2008:9) states that according to Arkesteijn and Oerlemans (2005: 193), increasing the likelihood of adoption of renewable sources relies on a high level of trust in the supplier and an ease of integration of that green energy source into household operations. This is fairly intuitive and suggests the importance of building trust and confidence in the SWH supplier and facilitating an easy installation and adoption process to improve installation rates. Arkesteijn and Oerlemans (2005: 195) indicate the likelihood of adoption of greener electricity sources increases with high levels of basic knowledge of renewable energy and perceived responsibility for the environment, suggesting that knowledge and capacity-building campaigns could serve in the interests of the CCT MPS campaign. Knowledge and likelihood of adoption are clearly correlated. Unfortunately , Plaza and Linares (2007:13) claim that lack of green electricity knowledge is widespread and Milton & Kaufman (2005: 20) reveal that lack of public awareness of SWH is a key reason for the poor adoption rates of SWHs.

The low level adoption of SWH is largely due to high upfront costs, lack of confidence in system performance and long payback periods. Lowering or overcoming these barriers improves the likelihood of adoption (Adams 2011: 75 and Timilsina et al 2000). Ravens (2008: 15) cites Milton and Kaufman's research (2005:18) which reveals that likelihood of adoption increases with incentives, rising costs of electricity and better awareness levels. As of August 2012, 260000 SWHs (both low and high pressure systems) had been installed in South Africa since the inception of Eskom's 2008 rebate scheme. However, only 45000 of these SWH installations involved high pressure systems and took place in

households that were mid to high income (Botes, 2012). The remainder of the installations occurred in primarily low income households which received low pressure systems.

TABLE 2: SOUTH AFRICA'S SWH PENETRATION RATE

Mid to High Market: **Mid and high income households as at DOE, 2009:24.**	3000000
Number of rebates offered as at August 2012 (optimistic scenario) **(Eskom IDM, 2012)**	45000
Penetration Rate	1.50%

A market size of 3 million households (DOE, 2009) and only 45 000 Eskom high pressure rebates issued (Eskom, 2012) corresponds to an approximate penetration rate (likely rate of adoption) of ~[16] 1.5 % percent of the potential mid to high income market. The existing Eskom rebate scheme for the mid-high income households (with high pressure units) appears to be falling well short of the national target of 1 million SWHs by 2015 (both low and high pressure units). It is unclear what proportion of this target is to be met by high pressure and low pressure units. The author made several attempts to determine this but Eskom was unable to furnish the relevant data. Nevertheless, 45 000 high pressure rebates is fairly insignificant when compared to a potential market of 3 million households.

Many factors play a role in the low levels of SWH penetration and these factors will also influence future adoption. The key factors are high upfront costs, lack of confidence in system performance and long payback periods. Subsidiary barriers include aesthetics, trust in suppliers, product technology and general levels of awareness and product knowledge. The key research question in this paper is whether a MPS can improve the likelihood of adoption of SWHs in the City of Cape Town.

[16] " ~ " stands for approximately.

2.2.4.1. Empirical findings and discussion

Ravens' (2008:46) study found the 50 % of respondents considered installing a SWH (before the Eskom Rebate of 2008), and that this jumped to 92 % if they were offered a SWH subsidy (the majority indicating that a 50 % rebate of costs is necessary for adoption). This 92 % likelihood of adoption is an exceptionally high figure and the study's findings are contradictory to what actually occurred in reality. The difference between stated intention and actual action is difficult to measure in a single questionnaire. Follow up questionnaires by CCT may be able to expose these differences. Ravens' (2008) paper suggested a high likelihood of adoption under a subsidy/rebate scheme (i.e. non- MPS conditions).

An interesting question is how to assess the difference between what consumers say they will do and what they actually do. This should be taken into consideration when evaluating the findings from the MPS questionnaire. Similarly Adams (2012) identifies that a majority (80 %) of respondents would adopt a SWH if offered a R5000 rebate, however only 50 % would adopt it if the R5000 rebate is split over 5 years. The reduction in likely installation due to the split over 5 years is significant when assessing the MPS which delivers its value over a monthly frequency through realised electricity savings and not through a once-off rebate payment made at the time of purchase (Adams 2011: 57).

The Eskom IDM (2011:4) study discovers that a good majority (66 percent) of their sample are keen to install a SWH in the future. This number is vague as the 'future' is indefinite and no mention is given about MPS or subsidy levels. The key barrier inhibiting adoption rates is high upfront costs which the MPS aims to overcome.

Trabacchi et al (2012:13) reveals a positive likely adoption rate under Tunisia's Prosol MPS. Prosol MPS was effective in increasing adoption levels delivering a five fold increase in SWHs installed over 5 years and increasing installations to 135 000 residential units. Adams (2011:57) discovers an interesting correlation that 80 % of those that had recently installed a SWH had known someone for over 5 years with a SWH suggesting that awareness and the length of usage of SWH plays a role in likelihood of adoption of SWH.

In summary, likelihood of adoption relies on methods that overcome barriers of adoption. Consumers stated claims of likelihood of adoption should be examined sceptically since 92 % of Ravens'

respondents stated they would install a SWH under a subsidy scheme and 80 % in Adams' study. This has clearly not materialised in reality. This questionnaire asks a similar question about likely adoption due to the CCT's MPS. However, caution should be used when assessing results in light of these previous studies where respondents' claims do not match what actually takes place in reality.

2.3. MONTHLY PAYMENT SCHEMES

2.3.1. Introduction

Financial and fiscal incentive mechanisms have been used to provide assistance to a variety of industries. This chapter reviews the range of mechanisms used to stimulate demand in the solar sector. It narrows in on a monthly payment scheme (MPS) which is enabled by Third Party Financing (TPF). The CCT aims to implement a MPS by Quarter 3, 2013 to stimulate consumer demand and grow the SWH sector.

2.3.1.1. Incentivising Consumers

Linder and Di Capua (2012) state in Bloomberg's New Energy Finance Report that:

'New business models are emerging with an emphasis on third-party financing. New investors, including institutional players, are entering. And new financing vehicles such as project bonds and other securities are being assembled to tap the broader capital markets.'

In the article '*The Secret to Solar Power,' Himmelman* (2012*)* expresses similar sentiments stating that *'A lot of major players in the economy get it, and they are betting on the potential of renewables and on the power and profitability of the residential solar-lease arrangement* (MPS).*'* Himmelman (2012*)* inserts a caveat that solar companies can make all the financial and clean-energy arguments they want but the key success factor is to **impel the average consumer** to switch to solar energy*.* An incentive scheme must address consumer needs by overcoming the key barriers to adoption in order to improve the likelihood of adoption.

Incentive mechanisms make it easier for the average consumer to switch to solar. Consumers require a reason, i.e. a strong value proposition to adopt a new technology. Currently solar technologies have several adoption barriers. For the solar sector to expand, these barriers must be overcome. As it appears, a MPS might provide a suitable mechanism to overcome such barriers and drive consumer demand. Himmelman (2012) reveals that in 2007, third party owned systems or MPSs accounted for almost none of the residential solar market in the US. By first quarter 2012, 63 percent of new solar systems in California were third party owned and the figure for Colorado was 80 percent.

Himmelman (2012) states that *'the solar lease has been a key driver for the explosive growth in the residential solar market in California and, increasingly, across the country,'*

In their 2012 Quarter 3 report, SEIA also shares this view stating that *'The residential third-party financing model continues to gain steam in every market where it has been introduced.'*

As in any industry, a product requires a compelling value proposition to entice a consumer purchase. Subsidies and other mechanisms attempt to bolster this value proposition. MPS/TPF models are going one step further by eliminating initial upfront costs and generating consumer savings by matching or exceeding their monthly bill savings with the monthly instalment expenses. Solar companies that employ MPSs are now aiming to create a solar product that becomes a 'no-brainer' purchase. One such offer is purchasing a solar system under a MPS whereby you can lock in cheaper electricity with no down payment (Himmelman, 2012). A key value proposition for the MPS system is that it offers solar products with no upfront costs and a net zero monthly expense (by matching or exceeding electricity bill savings with monthly instalments). Variations to this model exist and will be explained later in this chapter. MPSs enable customers to easily adopt solar systems by guaranteeing cheaper monthly electricity costs, with no down payments or payments for the solar equipment. This seems a compelling value proposition and is proving successful at driving demand.

An effective financing incentive mechanism /policy instrument overcomes consumer barriers of adoption and makes solar installations more attractive. Subsidies lower the upfront cost and have been a traditional mechanism to stimulate SWH demand. This has proven fairly successful in locations like Cyprus, Austria and China (ENERDATE, 2012). However in South Africa, subsidies alone have not generated large scale adoption of SWHs. Some regard Eskom's rebate scheme as failing to fully stimulate sufficient consumer demand (Frost and Sullivan, 2012) and suggest that subsidies are either

not compelling enough to stimulate demand or that some other market barriers are preventing consumer adoption.

Although SWHs are a mature technology, diffusion in global markets (residential and otherwise) remains limited. Menanteau (2007:7) cites that this is due to market failures and economic barriers such as high upfront costs and long payback periods. Public policy and financial economic instruments like subsidies, low interest loans, tax incentives and mandatory policies have been used to support the uptake of SWHs. Newer mechanisms such as monthly payment schemes, fee-for-services and other variations are also quickly evolving.

These newer mechanisms complement subsidies and they aim to work together at better satisfying customer needs. The focus of this section is examining the MPS/TPF model, since this is the mechanism that the CCT aims to employ in late 2013. Other incentive mechanisms will be described but not in the same level of detail as the MPS.

Menanteau (2007:1) classifies four types of incentive mechanism that promote SWH adoption namely subsidies, tax credits or incentives, low interest loans and third-party financing. Hack (2006) adds one more which is mandatory implementation (i.e. regulation). This paper describes the five types of incentive mechanisms but focuses its attention on MPS (also known as leasing, contracting or third party financing [TPF]) since this is the most relevant to the CCT experience.

Within the Cape Town context, Eskom rebates have been in place since 2008. Critics claim these have been ineffectual at stimulating large scale uptake of SWHs (Frost and Sullivan, 2012). The CCT seeks to bolster demand by complimenting the subsidy scheme with a MPS model. A MPS enables monthly payments thereby overcoming consumer adoption barriers (high upfront costs and affordability) and helping to kick-start SWH demand. The following chapter highlights different types of incentive mechanisms. This is followed by case examples of successful MPS in other solar markets (US PV and Tunisia SWHs).

2.3.2. Types of incentive mechanisms

There is no universal approach for employing SWH incentive mechanisms. Different countries have employed different policies and financial incentives to stimulate SWH demand[17]. A brief explanation of different financing incentives is given below:

1. Subsidies (direct grants, rebates)
2. Tax incentives
3. Low interest loans
4. Fee -for-service
5. Third-party financing

In reality, these models are often used collaboratively and not in isolation. In the same way, demand for SWHs can be stimulated both separately and collectively by the aforementioned mechanisms (see appendix C and D).

A brief explanation of each mechanism is provided, followed by a more detailed examination of the MPS[18].

2.3.2.1. Subsidies (direct grants, rebates)

Subsidies are financial instruments that reduce the upfront cost of a product and shorten its payback period. These two factors are the key barriers to adoption in SWH markets. Subsidies can also be used to demonstrate a public authority's commitment towards the SWH industry. It can also provide a mechanism to accredit suppliers thereby raising quality standards for products and suppliers, which indirectly boost consumer confidence (Menanteau, 2007:7).

2.3.2.1.1. Effectiveness

[17] Appendix C and D illustrates difference policy measures per country.

[18] MPS and TPF (Third Party Financing Schemes) are used interchangeably. A MPS is often enabled via TPF.

Subsidies are currently the main lever to promote solar water heating (ENERDATA, 2012). Hardie (2011: 45) indicates that subsidising the costs of SWHs assists in making them cost competitive against the existing or incumbent technology because it reduces upfront costs and the payback period. Trabacchi et al (2012:30) detail that subsidies are the most prevalent financing mechanism used to promote SWH uptake. Several countries subsidise SWHs as a function of their performance namely Cyprus (largest SWH capacity per capita), Austria, India, Brazil and China (ENERDATA, 2012) (See appendix C and D for an exhaustive list of countries).

Menanteau (2007: 27) reveals that between 1997 and 2004, the SWH industry In Tunisia experienced rapid growth due to an ambitious SWH programme that included direct subsidies and the introduction of quality standards. When the programme ended and subsidies were no longer available, penetration rates dropped significantly. This illustrates that subsidies can also create short-lived and reactionary benefits for the SWH industry. To develop the SWH industry long term, subsidies should promote sustainability of the industry and not be used to simply gain a few thousand installations. Tunisia subsequently implemented a MPS known as Prosol, which together with the subsidy scheme helped grow the SWH industry. Prosol will be discussed in detail in the forthcoming chapter.

In Austria, subsidies have been a key fiscal policy. Direct grants reduce the upfront costs of SWHs on average by 25 percent. The rebate helped stimulate the Austrian market (Hardie, 2011). Other factors such as the environmentally conscious Austrian culture and tax exemptions have also assisted in SWH uptake. Subsidies have also been implemented in China and India to assist meeting their ambitious solar thermal policies of 300 million m² by 2020 and 20 million m² by 2022 respectively (ENERDATA, 2012).

Menanteau (2007:7) indicates that Taiwan subsidised SWHs between 1986-91 and 2000-04 and experienced a growth in SWH installations. The degree of effectiveness of subsidies at meeting their stated targets is not disclosed.

2.3.2.1.2. Ineffectiveness

Menanteau (2007:8-9) highlights that subsidies can also have negative consequences in the long term, namely:

- High transaction costs, especially for individual systems.

- Costs of providing subsidies, especially for large scale applications.
- Negative impact on industry if withdrawn, as consumers delay their purchases whilst waiting for higher subsidy levels. This can lead to sporadic and uneven surges in demand.

SEA (2010:17) states that subsidies have led to problems in several countries because they can distort SWH markets (e.g. when subsidy funds ran out in Tunisia, the number of SWHs sold dramatically reduced). This caused instability in demand and a disruption in the industry. In Australia, the anticipation of a SWH rebate scheme resulted in a collapse of SWH sales due to consumers delaying purchases. Instances where SWH rebates have been successful are found in mainly developed countries as they have more reliable access to funds. It should be stressed that subsidies in these cases are often part of a suite of SWH incentives such as low interest loans, public awareness campaigns, tax rebates, and production and import incentives.

2.3.2.1.3. South Africa's Subsidy Experience

In 2008, Eskom applied to National Energy Regulator of South Africa (NERSA) to approve a SWH rebate programme (Nano Energy, 2008). Eskom's SWH rebate scheme formed part of the Power Conservation Programme and aimed to convert 900 000 electric geysers to SWHs over a five year period. The programme was aimed at mid-high income households. The rebate amount depended on the size of the potential electricity saving as per SABS calculations. The rebate between 2008 and 2010 ranged from 15 to 30 percent of the installed costs (Swanepoel, 2011 & Eskom SWH FAQ, 2010). The Eskom rebate initiative only created limited demand with less than 1000 installations in 2008, the first year of the scheme (South African Government, 2009a, 15-16 & Hardie, 2011). By January 2011, only 55 000 units had been processed through the rebate programme with best case predictions that only half a million units would by installed by 2014 as a result of the rebate incentive. This is well short of the target of one million units by 2015 (Cronje, C 2011:1). Frost and Sullivan (2012) claim that the SWH rebate program has met its goal of stimulating the market but that a different tactic is now needed to develop the market further. They propose a mandatory building code stating that '*the focus now needs to be shifted from rebates as the primary market mechanism to mandatory building codes.'* South Africa has now undertaken new energy efficient building codes for all new buildings in South Africa. In addition to

building codes, a MPS that compliments the existing rebate is planned for 2013 in the CCT (Cronje, C 2011:1). It is hoped that this measure will be a better stimulus than the prevailing subsidy scheme.

The overall success of Eskom's subsidy scheme is debatable. It has brought focus and attention to the SWH industry and enabled public financing of SWH systems via the rebate scheme. However overall adoption has been slow and has not met initial milestones.

2.3.2.2. Tax incentives

As with subsidies, tax incentives aim to reduce the initial investment cost and thereby improve the return on the investment. Notably, tax incentives do not overcome the barrier of upfront costs and are better suited for higher income earners who seek to limit their tax expense (Menanteau, 2007). Tax deductions allow the beneficiary to subtract those costs from his income in his income tax return (Hack, 2006). Tax incentives can be achieved via lowering VAT on SWHs or by purchases being offset against annual income tax. Tax authorities experience a loss in tax revenue rather than the additional expenses that pertain to a subsidy model (Hardie, 2011). Other tax incentives include tax reduction on equipment and installation costs, reduced tax rates on imported equipment, shorter write off periods and tax credits.

Currently certain US states have a 30 percent tax credit for solar PV which is helping the solar leasing (MPS) model. Solar companies often seek out investors who can benefit from using these tax benefits to provide financing at lower costs than from conventional direct borrowing (Lowman and Medina, 2013: 2). Through tax reductions, Greece was able to raise SWH capacity per thousand of inhabitants from 20 m^2 in 2005 to 360 m^2 in 2009, as this reduced investment costs in SWH by up to 30 % for households (ENERDATA, 2012 and Trabacchi et al 2012:30).

2.3.2.3. Low interest loans (interest subsidy/ concessionary loans)

Hardie (2011: 46) states that low interest loans provide an important financing mechanism to overcome the barrier of high upfront SWH costs. Access to credit and interest rates that are lower than market rates provide incentives for end users to adopt SWHs. Menanteau (2007) notes that the effectiveness of

low interest loans depends on interest rates that are lower than market rates. Low interest loans often complement a subsidy scheme as they further assist in consumer uptake.

There are a variety of different low interest loan models. One model is for government to pay the difference in the interest differential between the low interest rate offered and commercial lending rates. By doing so, government provides a more enticing low interest loan, through the partial subsidisation of the interest rate (Swanepoel, 2010). Other cases include low interest loans for the complete credit period or interest-free periods for certain credit periods. A successful example of low interest loan applications is the Tunisian Prosol example which was able to reduce interest rates by almost 50 % (12 % to 6 %), thereby matching instalment payments with monthly electricity bill savings (Trabacchi et al 2012).

2.3.2.4. Other Incentive Mechanisms

Other incentive mechanisms include a fee-for-service program, market-based mechanisms, mandatory policies and Energy Purchase Agreements (EPAs).

Fee-for-service programs are used to stimulate large scale SWH adoption through an Energy Service Company (ESCO) model. The ESCO purchases, installs and operates the SWH at its own cost, whilst retaining ownership. The end user experiences no upfront costs, operating or maintenance risks and pays only for the service of receiving hot water. This model is operating on a small scale in certain parts of South Africa (Trabacchi et al 2012:30).

Market-based mechanisms namely Renewable Energy Certificates (RECs) have been used to stimulate demand in Australia. **Mandatory polices** of SWHs have been used in countries like Israel, Spain and China with good success[19]. The policy usually requires all new building constructions and restorations to install SWHs instead of conventional geyser systems. India is also planning to make solar water heaters mandatory on new buildings coupled with preferential loans (ENERDATA, 2012).

[19] *'In Spain, subsidies and mandatory implementation of SWHs on new buildings raised the capacity per thousand of inhabitants from 13 m2 in 2005 to 47 m² in 2010.'* (ENERDATA, 2012).

The recent third party **Energy Purchase Agreements (EPAs)** are becoming a more prevalent financing tool. EPAs are similar to Power Purchasing Agreements (PPAs) commonly found in solar PV. The end-user pays for the amount of energy used instead of a flat monthly instalment as in a leasing scheme. The ESCO installs, owns and operates the system thereby eliminating end-user barriers such as upfront costs, operation and maintenance costs and associated operating risks. Lastly, in certain locations, the SWH sector has developed **without financial or fiscal intervention.** Palestine is a good example of this, where the economics of installing solar water heating simply make it the most cost competitive option (Trabacchi et al 2012:30).

2.3.3. Monthly Payment Schemes: An Explanation

2.3.3.1. Introduction

Monthly Payment Schemes (MPSs), otherwise known as leasing or third party financing schemes, have been used for the last century by many industries (airlines, railroads, utilities, oil and gas, and others) as a means to finance expensive equipment. In the US, equipment leases and their derivatives account for approximately USD 600 billion of business annually. This equates to approximately half of all investments into business and non-profit goods in the US each year. Thus, MPSs are not an uncommon instrument and by implication could be expected as a financing mechanism within the solar sector. Financing mechanisms are implemented to allow customers easier accessibility to products. They open the market to a broader segment of income levels and purchasing characteristics. This principle follows for customers in the solar sector. TPF enables customers to purchase solar energy (thermal or PV) without having to pay the large upfront cost of the equipment. Equipment leases are also currently used to finance other domestic energy production industries and sectors such as housing, airline, oil and gas and others. These established financing structures can serve as a benchmark for the newly formulated MPS models in the solar sector (Lowman and Medina, 2013: 1).

In an article for Forbes entitled '*Solar Leases Will Drive Solar Home Growth to $5.7B,'* Wang (2013) states that the new solar leasing financing mechanism makes solar energy affordable and will accelerate the growth of the United States residential market from USD 1.3 billion in 2012 to USD 5.7 billion in 2016. Why are MPSs driving such growth and how do these 'new' business models operate?

2.3.3.2. Description of Monthly Payment Schemes

There are several variations of a MPS. Essentially a MPS enables monthly payments; however the underlying mechanisms behind the monthly payment amount and allocation of risks differ. This paper focuses on two primary MPS models, namely the solar lease model and the contract models (PPA/EPA). Variations and different flavours of each of these models exist and will be briefly described at the end of the chapter.

Hack (2006) summarises the differences between leasing and contracting models.

Leasing: The leasing model is structured in the following way: The lessor (installation company) provides the product, i.e. solar system. The lessee (customer) is the power producer. The lessee pays a compensation fee (typically fixed monthly leasing fee) to the lessor for the duration of the contract period. In most respects, the solar leasing scheme is comparable to a tenancy agreement. The risk of maintenance and servicing liability differs depending on contract type, but generally the liability rests with the lessor. Depending on contract terms, the lessee may have the option to purchase the solar system at the end or during the contract period, whereby the lessee then becomes the full owner of the solar system. If the lessee fails to exercise their purchasing right, then the solar system remains the property of the lessor (Hack, 2006).

Contracting (PPA/EPA): Contracting models are similar to leasing models except that the monthly payment fee is conditional on the amount of energy produced by the product. The price can also be a combination of a fixed monthly provision fee (capacity charge) and a price per energy unit produced. In Solar PV, contracting models are known as Power Purchase Agreements (PPAs) and in solar thermal, they are known as Energy Purchase Agreements (EPAs). In contrast with the leasing model, the contracting model attaches the rights and responsibilities of the product (solar system) with the investor (installation company). Consequently, the customer does not have a right of purchase or ownership of the solar system (Hack, 2006).

Both leasing and contracting models have their advantages and disadvantages. The choice of model depends on personal circumstances and value judgements that are individual to each customer. What both models provide is a mechanism to overcome the barrier of high upfront costs of the solar system. In leasing or contracting the customer is freed from paying the high upfront cost by paying for the product/service on a monthly basis. For leases, the customer pays a monthly fee and for contracts, the

monthly fee is variable based on the energy output. On the back-end of the financing model, an investor typically finances the system by providing the necessary capital and locks in a steady monthly revenue stream through the MPS model. MPS enable economies of scale for the installation company as they are able to purchase higher volumes of equipment at lower prices (Hack, 2006).

Interestingly, Hack (2006) states that 'leasing and contracting models appear not very reasonable solutions at the household level' and therefore his paper does not focus on them. This may have been the case in 2006 when the paper was written, however these two models are now growing in prominence and accelerating the uptake of solar systems. In particular, US residential solar PV is growing at generous rates, whereas MPS for SWH is only now catching on.

Citing a GTM research report, Wang (2013) states that solar leases or MPS/TPF models were rare five years ago but are now available in 14 US states and account for almost 70 % of all residential installation in California, Arizona and Colorado. Himmelman (2012) puts the number at 63 percent of new solar system installations in California and 80 percent for Colorado and stresses that solar leases have been the key driver for the explosive growth in residential solar markets.

Although MPSs are a relatively new model for the solar sector, they appear to be already generating rapid increases in residential PV installations for certain US states. Key questions explored in this paper's literature review section are:

- Why are customers adopting Solar PV under a MPS model?
- How do MPSs operate?

2.3.3.3. Why are customers adopting Solar PV under a MPS model?

'Third-party financing models offer customers the benefit of a solar system without the upfront cost' (Linder and Di Capua, 2012:7).

'You get cheaper electricity! Full stop '(Lyndon Rive, the head of SolarCity) (Himmelman, 2012).

Linder and Di Capua (2012:1) detail that irrespective of income groups, most homeowners find the upfront cost of a solar system unaffordable. Solar companies have begun acting on this by developing MPSs utilising third-party financing models (TPFM). This allows consumers to 'go solar' with little or no money down. This makes it possible and easier to install solar panels on their roofs.

'*Instead of forking over, say, $20,000 to install and own the equipment, they pay a fee each month for using the electricity produced from the panels*' (Wang, 2013).

By employing such a business model, solar companies eliminate the barrier of high upfront costs and ensure that the monthly payment scheme attracts a wider consumer base. A MPS also benefits investors who now have the opportunity to invest directly in solar with predictable long term revenue streams.

Linder and Di Capua (2012: 7) state that many residential users are unwilling to use their own equity or arrange debt and simply cannot afford the initial upfront costs of solar systems. The literature on MPS state that the key reasons customers adopt monthly payback models is to eliminate upfront costs, match cost-savings with monthly payments and transfer operating and maintenance responsibilities to the installer. These are the major drivers for accelerating growth of US residential PV installations under the monthly payment model.

As stated by Lyndon Rive, the head of SolarCity,: "People don't buy gas stations. People don't buy utilities. Why are we having them buy solar equipment?" (Himmelman, 2012).

2.3.3.4. How do MPSs operate?

There are different types of MPS. In the solar PV market there are two distinct models: 1) Power Purchase Agreement (contract) and 2) Lease (direct lease). In PPAs (contract), the monthly payments vary according to the amount of electrical energy produced. On the other hand, leases involve the payment of a fixed monthly fee (Himmelman, 2012).

In the SWH industry, MPS models (leasing and PPA/EPA) have not grown as dramatically as the PV market[20]. MPSs currently exist in the SWH sector but on a smaller scale. The few examples include Prosol in Tunisia, SolarRent and Teljoy Solar in South Africa and Skyline Innovation in the United States[21]. Tunisia's Prosol example will be examined in depth in proceeding chapters.

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[20] An interesting question is investigating 'why' this is the case. However that is beyond the scope of this paper and is a recommendation for future research.

[21] See Swanepoel (201 : 40) and Geldenhuys. (2010) for additional information on South African MPS examples (Teljoy Solar and SolarRent).

Similar to Hack (2006), SEIA (2012) describes two primary MPS models. Firstly a power purchase agreement (PPA), which Hult (2006) describes as 'contracts,' and secondly solar leases (i.e. a conventional lease agreement). As described by SEIA (2012) in the PPA model, the installer/developer (contractor) builds the solar energy system on the customer's property (typically a roof). This is done at no cost and the solar energy from the solar system offsets the electricity previously used. The result is a lower electric utility bill and cost savings. In the case where net metering is permitted, the excess electricity generated by the solar system can be sold back to the utility at an agreed upon rate. Customers also have the option to purchase the system or extend the PPA contract on expiration. PPA payments are linked to the system's performance with a monthly fee of 'x' USD/kWh.

The lease model differs in the sense that the customer pays a fixed fee rather than paying for the power produced. The customer signs a contract with the installer/developer to pay for the solar energy system over a fixed period of years. Leasing models vary such that customers can either pay no upfront costs, partial system costs, or choose to purchase the entire system before the end of the lease term. Leasing payments are a fixed monthly fee of 'x' USD/month with the monthly fee heavily determined by the life time of the contract, typically 10 – 25 years.

These two MPS financing models (PPA and leasing model) are the most popular in the US PV solar residential sector. However several variations exist in this business model: vertical, semi-vertical and financial market structure. These will not be examined in the paper but can be reviewed in Appendix E and F.

Himmelman (2012) provides an easily understood anecdotal description of the potential benefits and motivations for using the monthly payment model instead of upfront purchase:

'The basic value proposition is this: Say you have been paying your utility, on average, $100 a month. The solar company installs solar panels on your roof, maintains them, monitors them and repairs them for the life of the lease. The output will reduce your utility bill to roughly $20 a month, and you pay around $65 a month to lease the equipment (and the power the equipment produces, along with maintenance). You're now paying $85 a month total, 15 percent less than you were, the installer has a revenue stream that it can use for cash flow or sell off to an investor and everybody is playing his part in reducing the burning of fossil fuels.'

Goossens (2013) states that the savings are more in the region of 10 percent from their current electricity bill. Even though third party financing is an established method in other industries, it is less

than a decade old in the solar PV market. Nevertheless, it is quickly becoming the most popular method that consumers use to adopt solar energy. A key reason for this is that it meets consumer needs by overcoming the high upfront costs of SWH units. MPSs and its variations are growing in the US PV sector and enabling many customers to employ and enjoy the benefits of solar systems with no upfront costs. This model has the potential to substantially expand the residential solar sector especially through its ongoing evolution of innovative financing mechanisms (Linder and Di Capua, 2012:2). Further case studies of SWH financing models will be provided in detail in the following chapters.

2.3.4. Case Example: MPS US residential PV

2.3.4.1. Introduction:

As described above, the MPS is a relatively new business model for the solar industry and has developed in the United States only in the last 5 years. Subsequently, the US residential PV market has experienced significant growth.

The MPS model in the US PV industry is examined to provide insight into consumer/industry behaviour within a MPS model framework. It is believed that the PV sector provides a fair comparison to the SWH sector when examining the effect of a MPS model, as both SWHs and PVs share many product similarities: both require roof top installation, deliver energy from the sun, exhibit high upfront costs, have low consumer awareness and are environmentally friendly. Examining the success of the US PV residential MPS model can assist in drawing comparisons to the CCT's MPS.

With the exception of the Tunisia Prosol Case, there is only limited case literature for MPS in the SWH sector. For this reason, a fairly detailed analysis of the US PV MPS is performed. The analysis will provide an additional benchmark to examine the proposed CCT SWH MPS. Tunisia's Prosol SWH case will be examined in the following chapter.

2.3.4.2. Why is the MPS model growing in the US residential PV sector?

Greentechmedia (2013) reports that due to the MPS model there is great optimism about the future of US residential solar sector. In 2013, several positive news stories reached major news publications. Goossens (2013) from Bloomberg reported '*US Home Solar Financing to Reach $5.7 Billion by 2016,'*

Wang (2013) from Forbes reported that '*Solar Leases Will Drive Solar Home Growth'* and Greentechmedia (2013) reported *"There is virtually limitless growth potential relative to the current size of the market"*[22].

These favourable statements suggest that MPSs[23] will play an important role in accelerating growth in the US solar PV sector. A key question is whether the success of the MPS in US residential PV is replicable in the SWH sector.

The business model seems to favour both end consumers and investors, since it allows investors to fund companies that develop solar projects and permits householders to purchase solar systems without upfront cost. The long term security of a steady stream of monthly payments (revenue flows) is valued by investors, making the investment product desirable. The lack of upfront costs and matching of bill savings with instalment payments make the scheme a low financial burden and small hassle for consumers/households. This arrangement benefits both parties (Goossens, 2013). The MPS seems to address the consumer barriers of upfront costs and affordability through monthly payments, thereby improving the likelihood of adoption.

Greentechmedia (2013) states that before 2010 there were only a handful of MPS third party operators (TPOs)[24]. However in the last three years, due to the successes of companies like Sunrun, Sunpower and SolarCity, there has been an increase in new entrants. At present, there are about ten TPO companies with several more trying to establish themselves. An interesting question is why the SWH sector has not adopted the MPS model and if they will follow in the footsteps of the PV sector.

Greentechmedia (2013) further reports that each TPO company has their own unique version for the residential financing model. This can be seen in Appendix F (Bloomberg Vertical and semi vertical) and Appendix G (PV market players' business models). These differences include financing models, financing sources, installation services, relationship with solar installers and their geographical footprint. Greentech (2013) believes that these differences create a healthy, vibrant and competitive market for TPO companies in the residential solar sector (See Appendix F and G for more details).

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[22] According to Shayle Kann, vice president of research at GTM

[23] solar leasing/ third party ownership

[24] Note in this context MPS can be used interchangeably with TPO and TPF

2.3.4.3. How is the US residential PV sector growing under the MPS?

Greentechmedia (2013) highlights the recent steady growth in residential Solar PV due to MPSs, by remarking that MPSs are now the predominant business model in the residential US PV market today. MPSs comprise more than 50 percent of all new residential solar installations in California, Arizona, Colorado and Massachusetts, with a growing market share in several other places such as Connecticut, Delaware, Maryland, New Jersey, New York, Oregon, Texas, Vermont, and Washington. Wang (2013) suggests higher penetration levels of around almost 70 % of for residential installation sin California, Arizona and Colorado. Goossens (2013) reports that according to a GTM research report, investors will provide $5.7 billion annually to finance residential solar systems by 2015 - an increase from 1.2 billion in 2012.

MPSs are now providing an attractive investment opportunity for the banking sector. SEIA (2012) indicate that over USD 600 million for new financing of solar investments was received in Q2 2012. Appendix H shows that the project finance raised by TPO providers in the US was in excess of USD 2 billion for the top listed companies. By implication, this growing influx of investment into the MPS residential solar industry suggests a growing approval of solar leases and other monthly payment schemes. The SEIA (2012) expects further growth in MPS installations in future quarters.

How has the US MPS been able to stimulate consumer demand and what lessons can be learnt for the CCT MPS programme? The US residential PV MPS model has 1) increased number of installations (50 % of all new residential installations in US are due to TPF[25]) 2) attracted investor financing (Quarter 2, 2012 over USD 600 million) and 3) generated favourable market size projections (market growth expectations from 1.2 billion in 2012 to 5.7 billion 2016). A key question is whether the evident growth in the PV sector under TPF models is replicable in the SWH sector. Should these favourable indicators for US PV be viewed as demonstrable proof that the TPF monthly payment model is successful? Does this US experience suggest that the MPS is indeed the desirable business model to meet consumer needs? Are there any peculiarities or specific particulars that need to be accounted for when replicating TPF for the SWH sector?

[25] For US States where the solar market is established.

Goossens (2013) reports *"There is virtually limitless growth potential relative to the current size of the market,"*[26] and Lashinky (2013) reports from Lyndon Rive (Solar City CEO) that *'this is a different business, with a growth potential that is almost infinite based on the market size. We'll let investors grow with us.'* This suggests a promising future for solar PV under a MPS model. If consumers are receptive to a MPS for PVs, could there be a comparable SWH consumer market that is receptive to a similar MPS offering for SWHs? MPS positive sentiment is re-iterated by SEIA (2012) who state that *'residential third-party financing models gain steam in every market where it is introduced.'* Could an MPS have the same impact in the SWH sector?

SEIA (2012:4) has also cautioned that although MPSs for residential systems is increasing in states where the option is available, the model is not available in all markets. Doubt exists if the MPS is growing by winning market share from the direct ownership sector or by expanding the total solar market. The best case for MPS models is if it expands the market to new segments rather than cannibalising the existing direct ownership solar segment. This uncertainty over the MPSs' market growth needs to be addressed before we can determine the success of the model in attracting new PV customers and the possibility of replicating it in the SWH sector. A key objective for the CCT and its MPS is to install 140 000 SWHs. This can only be attained by reaching new customers through expanding the overall SWH market and not by cannibalising the already small direct ownership segment. Growing the entire SWH market is a key outcome for the CCT in implementing the MPS model.

2.3.4.4. Addressing Customer Needs

As illustrated by the CCT (2013:2), *'customers will be offered the opportunity to have a ready-made scheme that provides a SWH to be paid-off by monthly instalments over a period of up to 7 years.'* A study for Eskom by Frost & Sullivan (2012: 9) identified two main reasons why consumers have not yet purchased a SWH. It found that high upfront costs and low cost efficiency (i.e. efficiency savings) are the major barriers to adoption.

From the above literature, it appears that the MPS in the US PV sector addresses these two consumer concerns through the MPS model by 1) eliminating upfront cost via monthly payment model and 2)

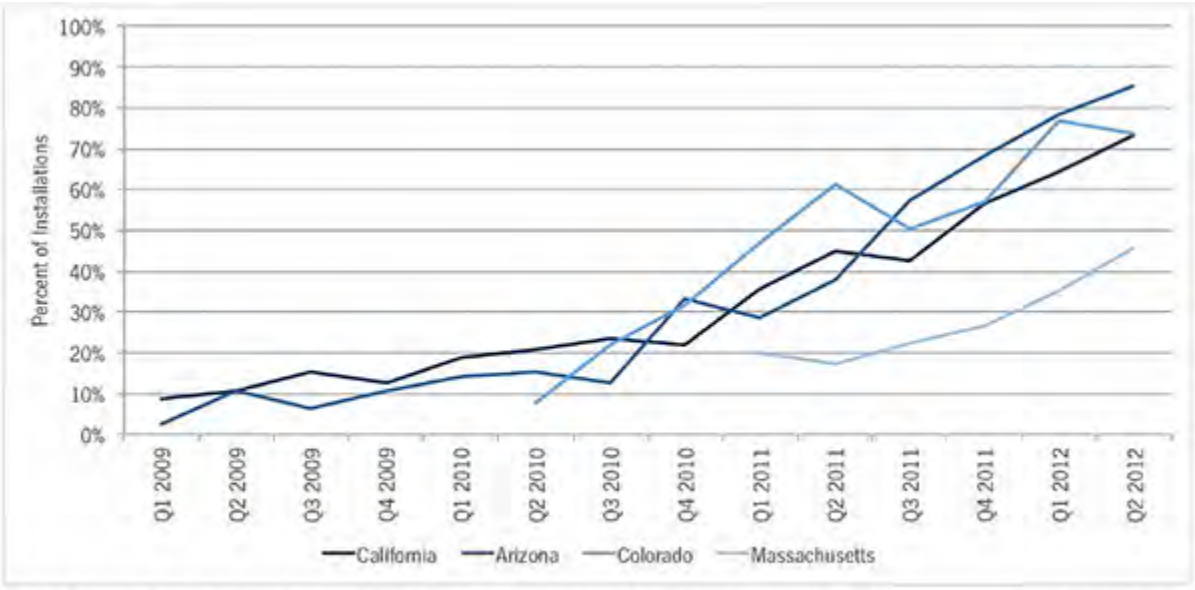
[26] Shayle Kann vice president of research at GTM

electricity savings (ensuring monthly electricity savings outweigh monthly expenditure) (Goossens, 2013 & Trabsih, 2012). The Solar PV MPS model appears to be successful at driving US residential PV market growth. This success is largely attributable due to a MPS model overcoming the two major barriers of high upfront costs and cost efficiencies. A key component is relative price of electricity in each market as this impacts pay back periods, monthly affordability and in turn customer behaviour. The question is can it work if replicated to the SWH sector? Detailed assessment of local electricity prices, governmental incentives (subsidies and tax rebates) and their proportional impact on consumer behaviour were deemed out of scope for this paper and is recommended as an area for future research.

SEIA (2012:5) clearly states that the MPS is dramatically changing residential solar space. *'Third-party ownership has taken the residential solar space by storm, particularly in the last year and a half'.* SEIA states that the US PV MPS enables monthly payments that are appealing to many homeowners who seek to decrease their monthly energy costs but cannot afford the large upfront payment for the entire system. Consumers are also attracted by the opportunity to reduce their environmental footprint whilst being able to shift responsibility to the installation company for monitoring, operating and repairing the solar equipment for the duration of the lease/PPA.

As demonstrated in Figure 3, the MPS model is driving the US residential solar PV growth. For the fifth consecutive quarter, the U.S. residential PV market grew incrementally. In Q2, the residential market grew by less than one megawatt overall with key growth in mature markets namely Arizona, California and Colorado. Currently, in Massachusetts the MPS companies outnumber those that offer cash only sales (SEIA, 2012).

FIGURE 3: PERCENTAGE OF THIRD-PARTY OWNED RESIDENTIAL INSTALLATIONS IN AZ, CA, CO & MA, 2009 - Q2 2012 (SOURCE: SEIA, 2012)



Note: Granular market share percentages as well as third-party/direct-sale installed price comparisons are available in the full version of the U.S. Solar Market Insight report.

The graph indicates steady uptake of Solar PV in the major solar states where a MPS model is offered. This positive outlook and growth in the US residential PV, suggests that a MPS model appeals to customers by overcoming the adoption barriers of high upfront costs and poor cost efficiencies.

2.3.4.5. Conclusion

The MPS successes in the US PV market provide a strong indicator that a similar model could prove influential in the SWH sector. However, certain unique particulars exist in the SWH sector. When creating an MPS model for the SWH sector in the CCT, additional variables must be taken into consideration such as country specific characteristics, subsidy levels, consumer characteristics (culture, risk appetites, income levels, awareness), economics (costs, revenues, financial viability) and electricity prices to list a few. The preliminary successes of the MPS model in the US PV sector bode well for a comparable MPS SWH model in CCT. However before testing actual consumer attitudes towards the CCT MPS, a case study on Tunisia's application of a MPS model for SWHs will be performed.

2.3.5. Case Example: MPS Tunisia Prosol SWH Programme

The Tunisia Prosol case provides a great learning case for the CCT's SWH monthly payment initiative and illustrates how a MPS can correctly address customer needs. Prosol is the first large scale SWH project that used a credit financed MPS model to stimulate SWH installations. Tunisia's government realised that many benefits exist from a widescale installation of SWHs, both for government and citizens. Tunisia has favourable solar conditions and a national priority for energy conservation with a specific goal of transitioning households away from expensive fossil based fuels to SWHs that run on 'free' solar energy (Touhami and Hannane (2011:2) and Trabacchi et al (2012:1)).

Although the MPS model continues to grow in the Solar PV sector, fewer examples exist in the SWH sector. The Tunisian Prosol case is one of the few examples that provide a clear examination of a MPS in the SWH sector. Trabacchi et al's (2012) paper '*San Giorgio Group Case Study: Prosol Tunisia Report by Climate Policy Initiative'* is an excellent paper that illustrates the challenges and success in implementing a MPS in the SWH sector. It demonstrates how the MPS is able to overcome the market barriers of high upfront costs and subsidies for fossil-fuel alternatives (Trabacchi et al 2012:1) by providing financing. This creates a more accessible and affordable SWH product. Tunisia realised that the SWH industry faced several existing challenges including high upfront costs, poor financing availability and a heavily subsidised fuel alternative of LPGs. With the help of UNEP and other NGOs, they tackled these challenges through the MPS Prosol Programme which sought to address these consumer barriers and stimulate the SWH sector.

Trabacchi et al (2012:9) details three key reasons which led to a successful widescale adoption of SWHs under the Prosol initiative: the repayment terms (monthly and longer terms), the softened credit conditions (low interest rates) and the capital cost subsidy**.** These measures translated into the levelised cost of energy (LCOE) for SWHs decreasing, such that they were cost competitive against the existing water heating technologies. A critical measure that helped Prosol's success was that the MPS provided direct benefits to the consumer (householder) by ensuring lower upfront costs and improved profitability through a reasonable payback period for the SWH. Subsidies and the MPS reduced the upfront SWH costs to be equivalent or less than conventional water heater prices. They improved both the overall profitability and the payback period of the SWH when compared to LPG alternatives. Consumer purchasing decisions were also affected by higher energy independence, environmental

benefits and future energy price expectations. Local stakeholders reported that Prosol also induced tangible cultural changes in households, particularly their energy awareness (Trabacchi et al (2012:11).

Trabacchi et al (2012:29) clearly state that Prosol and the MPS model have been effective at addressing the multiple barriers that previously prevented the widescale adoption of SWHs in the Tunisian market. They conclude that it provides a successful example to inform other similar initiatives (e.g. CCT MPS). Prosol resulted in a transformation of the SWH industry and resulted in a 'state of change' in how we think about financing renewable technologies, due to the newly implemented MPS initiative which effectively addressed consumer needs. It engaged many stakeholders and overcame multiple barriers that held previous SWH initiatives back. Most importantly, it addressed consumer needs by overcoming the two key barriers of high upfront costs and the lack of access to credit (Touhami and Hannane, 2011:10).

Prosol provides a successful example for other SWH monthly payment projects that wish to expand their installation rates. Currently we are witnessing Prosol-type initiatives being replicated and launched in Montenegro, Macedonia, Egypt and Morocco (see Appendix I) (Trabacchi et al, 2012: 29). The CCT should take heed of the learnings from the Prosol case study when devising their MPS, recognising the role that a MPS can play in improving the likelihood of adoption by overcoming the key barriers of upfront costs and system affordability.

2.3.6. Variations of SWH MPS Financing Models

2.3.6.1. Introduction

This paper has drilled into the details of a MPS model in the US residential Solar PV market and SWH Prosol case. The MPS model is helping to deploy solar on a wider scale and several variations on the MPS exist. These variations will be briefly discussed as they will assist in growing the solar market. (Linder and Di Capua, 2012:2). These variations include loan-centred models, solar thermal energy services companies (ESCO), third-party shared revenue projects with utilities and third party Energy Purchase Agreements (akin to PPAs).

A report released by SEPA[27] in 2012 titled *"Heating Up: The Impact of Third Party Business Models on the US Market for Solar Water and Space Heating,"* profiled new and existing third party options that are emerging in financing solar water heating. Unfortunately the report was not freely available, costing USD 500. SEPA did not respond to the request for a free report to be used in this academic paper. As described by Paul (2012), the TPF/ MPS model has the potential to revolutionise the SWH market, however there are still a number of challenges before wider acceptance occurs.

Five variations of the MPS/TPF will be discussed. It remains to be seen which model best suits each market and whether a customised approach is better for country-specific applications. The CCT may wish to evaluate whether variations on the MPS are better suited for certain market segments (e.g. residential versus commercial).

2.3.6.2. Loan Centred Models:

Under this model, a commercial customer is able to obtain a low interest loan either from their utility provider or local government. This program assists the customer, since they can pay for their SWH system over ten to twenty years. In the US, the program is often governed by a utility or local government loan programme. Two such programmes currently exist. The number of loan centred programmes is expected to increase as utilities and local governments become more familiar with the model and witness proven benefits (Paul, 2012).

2.3.6.3. Solar thermal energy service companies (ESCO)

ESCOs operate by developing, installing and financing a wide range of energy efficiency improvements for customers. These services include items such as lighting retrofits or SWH implementations. The ESCO's model is based on a shared-savings principle whereby both parties, customer and ESCO, benefit from a percentage of the energy savings. ESCOs often prioritise shorter payback projects in order to generate quicker cash flows. Often this approach is detrimental to the adoption of SWHs that can have payback periods between five to ten years depending on local incentives and energy costs. Historically,

[27] SEPA: Solar Electric Power Association

ESCOs have focused on larger scale projects (large institution or commercial customer) to benefit from economies of scale. This has resulted in the residential and small and medium sized customer segment being underserved (Paul, 2012).

2.3.6.4. Third-Party Shared Revenue Projects with Utility Providers

In this model, utilities work with turnkey third party developers to offer SWHs to the market. The customer pays a flat fee for the service thereby offering stable and reliable future revenue flows. The utility provider and developer each earn a share of the project savings as per agreed percentage splits. This model is being used in two cases in the US (Lakeland Electric and Regensis Solar Power) but has not been expanded to the commercial market place yet (Paul, 2012).

2.3.6.5. Third-Party Energy Purchase Agreements (akin to PPAs)

Energy Purchase Agreements (EPAs) are similar to Power Purchase Agreements (PPAs) in the sense that the customer purchases the energy they use rather than paying a fixed monthly fee to lease the equipment that provides the energy. For EPAs, SWH customers purchase the energy required to heat the water and sign a contract for a period of ten to twenty years. EPA companies install, own, operate and maintain the systems thereby removing upfront costs and operational risks from customers. There is much optimism that EPAs, like PPAs can greatly stimulate SWH demand. The EPA model provides transparency in energy usage and costing and in many respects is closely aligned to customers' actual needs i.e. customers pay for the energy required to meet their needs of hot water (SWH) or electricity (PV). Many solar experts are optimistic that EPAs can help stimulate wide-scale SWH use. Nevertheless there are challenges which include the need to have favourable SWH incentives, good solar resources and the risk of lower priced competition (electricity, LPG). At present, EPAs are often offered selectively in specific locations and to certain customers where the economics make sense. The advantage of EPAs, like many other MPS models, is that they remove upfront costs but also eliminate the need to discuss payback periods as the end-user is always saving a fixed percentage for each unit of energy and not paying off the system costs. Given the success of PPAs in US solar PV and the growing acceptance of using MPS models, it will be interesting to follow the future development EPAs in the SWH space (Paul, 2012).

2.3.6.6. Model Innovations

Skyline Innovations has evolved the EPA mechanism and is pioneering a new financing mechanism that offers price indexed energy costs instead of a standard EPA contract of a three to four percent annual escalation.

Trabsih (2012) performed a case study on Skyline Innovations explaining their business model. Skyline offers no upfront costs (like in other EPAs), however their customers receive a fixed percentage discount off their utility rate for heating water (e.g. 25 % reduction per unit of energy). Skyline states that by using their EPA service, savings on hot water are guaranteed. They measure the BTUs[28] delivered by their SWH system and then charge a fixed percentage discount to what the customer would have paid to the utility provider. The fixed savings can vary between 15 and 35 percent depending on a number of factors such as solar resources, local incentives, existing electric prices, volume of usage, etc. Customers do give up their renewable energy certificates (RECs) and other local incentives to finance the system but they benefit in that they achieve guaranteed energy savings for each energy unit used. Unlike conventional EPAs, Skyline's model benefits customers even if the price of electricity decreases (Paul 2012).

2.3.7. The City of Cape Town's Solar Water Heater Monthly Payment Model

The previous chapter illustrated several alternative MPS models. This chapter describes the MPS model that the CCT selected for their 2013 SWH programme. Detailed below are two types of MPS models that the CCT tested during the initial stages of their MPS implementation process. SEA Cityenergy (2009: 20) explains two types of business models that a city can adopt when implementing a MPS. The city should determine the level of risk and involvement they wish to undertake, as this underpins the selection between the two types of approaches. As per SEA (2009), the first model is known as the City Infrastructure Solution (CIS) and the second is the Business Driven Solution (BDS). SEA Cityenergy (2009: 20) states that the SWH industry is unlikely to take on additional risk to upscale their business operations without some form of backing or assurance from city authorities. This sentiment is also

[28] BTU: British Thermal Unit is the amount of heat energy needed to raise the temperature of one pound of water by one degree Fahrenheit *(http://bbq.about.com/od/gasgrills/g/gbtu.htm)*.

depicted in the Prosol Tunisia case illustrated by Trabacchi et al (2012) and Touhami and Hannane (2011). The greater the city's involvement, the lower the business risk and the more attractive the SWH industry becomes. The two types of business models are explained below.

2.3.7.1. City Infrastructure Solution

This approach offers the least amount of risk to a SWH business. The model operates by the city installing SWH units itself and collecting monthly repayments through the rates bill. This method is being implemented in the City of Johannesburg where the city contracts a SWH service provider to install SWHs in a given area. This was the initial proposal of the CCT under their 2012 Pre-Qualification Tender Document. Under the terms of the tender proposal, the CCT would provide the core functions of organising financing, purchasing SWHs[29] and receiving Eskom's rebates. This would reduce the overall unit costs. SWHs would be installed by the CCT in participating households through their appointed service provider. A key benefit from this approach is the low risk for the SWH service providers and the ability for the CCT to manage and execute the entire project. Challenges include the fact that SWHs are not the core business of governments (SEA Cityenergy, 2009 19).

[29] Generally in bulk to lock in low unit cost rates

FIGURE 4: CITY INFRASTRUCTURE SOLUTION (SOURCE: SEA CITYENERGY, 2009:19)

2.3.7.2. Business Driven Solution (BDS)

This approach places less risk on the City and more on the SWH businesses. This method has been used effectively in Tunisia's Prosol SWH case study.

The City can take varying levels of involvement in this approach. For example, on the most active levels, the City will appoint and approve the SWH implementing agent who then organises financing, bulk procurement of SWHs and collection of Eskom incentives and other carbon financing. On the least active level, the City will not interfere with business selection and will let market forces operate.

Under both the CIS and BDS, the city will provide:

- Monthly collection of SWH repayment via rates bill
- Marketing and awareness raising
- Debt Collection Services

The benefit of the BDS approach is that government can take low risk and businesses can operate according to the manner and business model that suits them best. The challenges in this case are that businesses carry more risk and they might be less inclined to participate. A challenge created by this model is that the City forfeits 30 % of its electricity revenue from households with a SWH. It also has less influence over the programme and there will likely be slower growth under this model (SEA Cityenergy, 2009, 20).

In the CCT's SWH 2012 Pre-Qualification Tender Document, the City used the first approach of a City Infrastructure Solution by tendering for specific suppliers that would operate under certain geographies. More recently, the CCT shifted toward the Business Driven Solution, using this framework as the basis for its MPS. The BDS places less risk on the City, while still playing a role in facilitating the scheme through the monthly collection of SWH payments via the rates bill. The next section provides greater insight into the CCT's MPS.

FIGURE 5: BUSINESS DRIVEN SOLUTION (SOURCE: SEA CITYENERGY, 2009, 20)

2.3.7.3. CCT's MPS Objectives

CCT (2012:5) states that their main objective of implementing a MPS is to provide a product that will yield immediate net financial savings for households from the first month that they contract. In order to do so, the monthly electricity savings for heating water must be greater than the monthly costs of repayment for the SWH unit. This ensures an immediate financial benefit for switching to SWHs. By achieving a situation where the savings from electricity outweigh the monthly instalment costs, the CCT hopes to achieve a widescale adoption of SWHs and reap the associated benefits of displaced electricity. The economic and environmental benefits achievable from the bulk provision of SWHs in the CCT include economic development, job creation, industrial development, improved electricity reliability, lower pollution levels and less environmental degradation and greenhouse gases (CCT, 2012:5).

The overall target is to install over 144000 SWHs in the next 5 years. The ultimate long term goal of the scheme is to achieve a market transformation such that the SWH market failures are overcome and the sector can operate effectively without fiscal policy support. The intention is that through this transformation a new supply side emerges that can competitively produce units and price points low enough to generate mass penetration. It is hoped that the demand side grows sufficiently such that consumers start to trust the products, suppliers and technology and that they ultimately develop a good understanding about the full benefits of SWHs. A broader objective of the MPS is to assist the CCT in achieving their goal of reducing electricity consumption by 10 % as per their 2006 Energy and Climate Change Strategy objectives.

2.3.7.4. CCT MPS Details

As previously mentioned, the CCT project was initially structured as per a **City Infrastructure Solution** Model. The CCT has moved to a **Business Driven Solution** under the high active approach where the CCT endorses suppliers but does not appoint them to any particular geography (SEA, 2009).

Under the BDS, the CCT provides an endorsement to suppliers. The changes resulting from the switch from a CIS to a BDS approach largely stem from the internal mechanics of the model, i.e. the risk relationships between internal stakeholders (City, Banks and Suppliers). The consumer value proposition essentially remains the same. Consumers participate in a MPS where immediate monthly savings exceed

or match the monthly instalment payments, thereby overcoming the barrier of high upfront costs and lack of access to capital (CCT Roll Out Campaign, 2013).

By shifting from a CIS to a BDS, the risk allocations of the project change. Under the new BDS, the level of risk shifts from the CCT towards business, since the CCT does not guarantee loans or directly contract with suppliers but merely endorses their capabilities to run the scheme (CCT Roll Out Campaign, 2013). Figure 6 reveals the funding channels and stakeholder relationships.

FIGURE 6: TENDER DOCUMENT DETAILING THE FUNDING AND BUSINESS MODEL (SOURCE: CCT, 2012: 11).

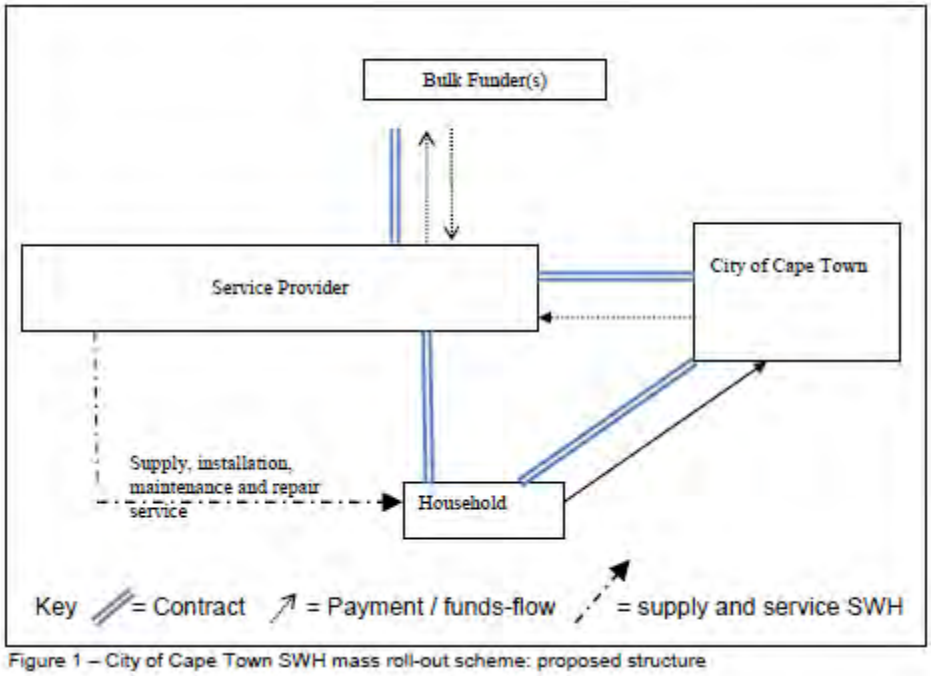


Figure 1 – City of Cape Town SWH mass roll-out scheme: proposed structure

Under the BDS, the CCT no longer procures anything for its own use but merely facilitates stakeholder interactions to promote SWH adoption. This is deemed a public good and is aligned with the city's strategic principles. The CCT will not receive revenue from the endorsed service provider and will not pay for their participation. Any expenditure incurred by the CCT will be recovered. The CCT plays a support role and will not bear any financial risk (CCT Roll Out Campaign, 2013.) (See Appendix J for a detailed explanation).

The support mechanism that the CCT offers for enabling the SWH sector to grow remains largely the same between both models (City Infrastructure Solution and Business Driven Solution). Although there

is a shift from the CIS to a BDS MPS, the end value proposition to the consumer does not change. That is the MPS will still offer its key value propositions of:

1) Monthly payments to overcome high upfront costs.

2) Monthly payment to overcome lack of personal credit financing.

3) Immediate monthly savings by structuring the scheme such that electricity savings offset or exceed the monthly instalments.

4) A shorter payback period, reduced from an 8 -10 year period to a 5-7 year period, upon which all savings accrue directly to the home owner.

The CCT (ERM, 2009) states that to date high pressure systems aimed at mid-high income households have not achieved high market penetration due to several reasons. The main reasons are high upfront costs and lack of financing for SWH systems. The CCT's MPS will support widescale adoption of SWHs in the CCT. This scheme is very similar to the successful MPSs in the US PV and Tunisia Prosol market and it is also funded by the associated electricity bill savings from the end user. A key support to the project is the CCT providing their billing system service where customers can pay for their SWHs via their consolidated rates bill. The benefit of the scheme is that householders' have no upfront costs and typically pay less for the SWH due to solar energy being used to heat water and not electricity. The city will endorse and support the suppliers that meet their criteria for quality products, reliability in service, warranty and maintenance. SWHs are also a good hedge against increasing electricity prices, which make solar water heating more attractive and results in higher savings and quicker payback periods (Smith, 2012).

The goal of the city is to achieve widescale adoption in mid-high income households in 5 years so that the market transforms from low-volume, high-margin to high-volume, low-margin. In order to do so, household awareness and trust in the technology needs to be fostered. CCT ERM (2009) and Smith (2012) state that SWH recipients will be able to pay off their SWHs monthly and this removes the major barrier of the upfront costs. Once the SWH is paid for, it continues to displace electrical energy and generates in-pocket savings for the households.

2.3.7.5. Consumer Benefit Case

The US PV and Prosol cases illustrate that the main consumer benefit from a MPS is that it overcomes the two main adoption barriers of high upfront costs and lack of access to credit. This is achieved by reducing the initial purchase price through monthly payments and accessing credit markets to fund the scheme. This improves the business case for replacing a working EWH with a SWH. However, it is only through the recent increase in electricity prices in South Africa that SWHs have become financially viable. Consumers are now considering more energy efficient applications to limit their electricity costs (Frost & Sullivan, 2012). As recently as 2007/2008, retrofitting SWHs did not provide a compelling financial business case (SEA Cityenergy, 2009). According to the study, mid-high income households would have about an 8 year payback period when retrofitting a SWH system (see Figure 7 for an unfavourable payback analysis). For most households, this is not appealing enough as they seek between 3 – 7 years (SEA Cityenergy, 2009). A more compelling business case is required in the retrofitting scenario as compared to the new build or replacement scenarios. Unlike new builds or replacements, retrofits require additional expense because SWHs are used to replace fully functioning EWHs. SEA Cityenergy (2009: 9) found that the average payback period for retrofitting SWHs in 2009 was 8 years. This long payback period deters many households from installing a SWH system.

The CCT (2012) stipulates that under their MPS, the electricity saved must be greater than the monthly cost of repaying the SWH and that the payback period must be between 5 and 7 years. This provides a more compelling case for consumers to install SWHs, purely based on financials and money in the pocket (CCT, 2012:5). The CCT's MPS aims to ensure that the benefits to the consumer become a clear *'no brainer.'* A SEA (2010) report reveals a more favourable payback picture under higher electricity prices and low interest rate conditions. Under these conditions, consumers can achieve immediate savings from the first month and receive payback periods as low as 4 years (see Figure 8 for a favourable payback analysis). The CCT's MPS clearly stipulates that their goal is to '*yield net financial savings for the household immediately from the first month of the contract.'* If immediate savings and short payback periods are achieved, then this provides a promising proposition to incentivise consumer demand. The next step is to ascertain consumers' actual attitudes, awareness, drivers and likelihood to install under these MPS conditions. The financial and energy savings sound good on paper, but will consumers positively react to these value propositions in real life?

Ascertaining actual consumer attitudes towards SWHs assists in determining the likelihood of SWH installations under MPS conditions. Consumer behaviour and likelihood of adoption is discussed in more detail in the following chapters: Methodology, Results and Discussions.

FIGURE 7: FINANCIAL ANALYSIS FOR RETROFITTING. UNFAVOURABLE BUSINESS CASE PAYBACK PERIOD OF 8 YEARS (SOURCE: SEA CITYENERGY, 2009: 10)

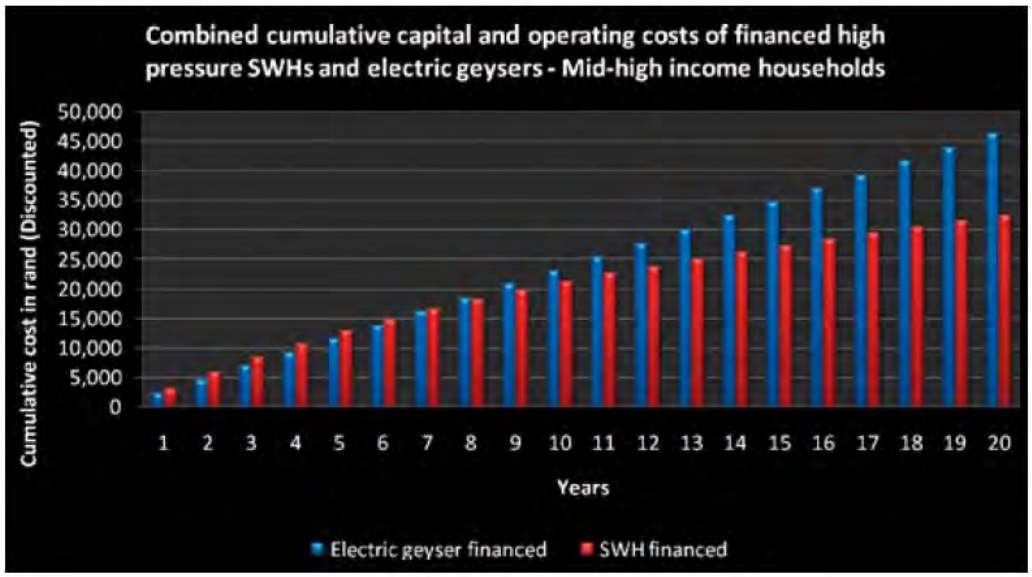
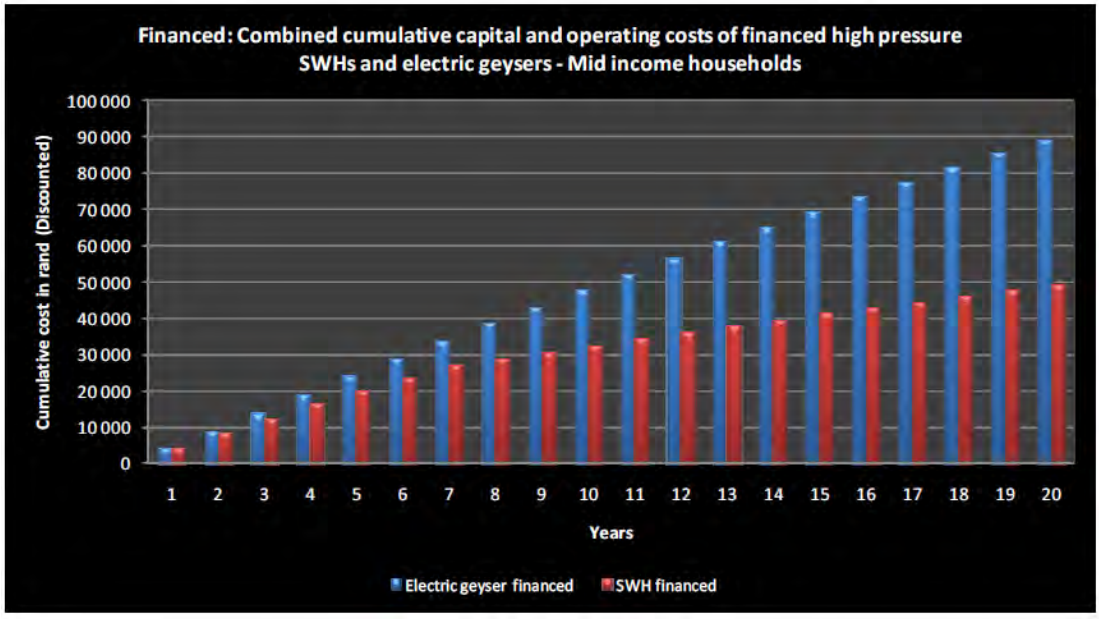


FIGURE 8: FINANCIAL ANALYSIS FOR RETROFITTING: FAVOURABLE BUSINESS CASE, PAYBACK PERIOD OF 4 YEARS. MONTHLY ELECTRICITY SAVINGS EXCEED MONTHLY REPAYMENTS (SOURCE: SEA, 2010)



2.3.8. Theoretical Framework

The framework for the dissertation is depicted below and explores two key concepts, namely incentive mechanisms and technology adoption. The purpose of this paper is to examine incentive mechanisms (MPS and non-MPS) and how they impact technology adoption by affecting consumer behaviour (attitudes, awareness) and barriers to adoption (drivers). The paper zooms into MPS incentive mechanisms and explores how a MPS can address traditional barriers of adoption that have typically not been overcome by non-MPS mechanisms..

FIGURE 9: DISSERTATION THEORETICAL FRAMEWORK

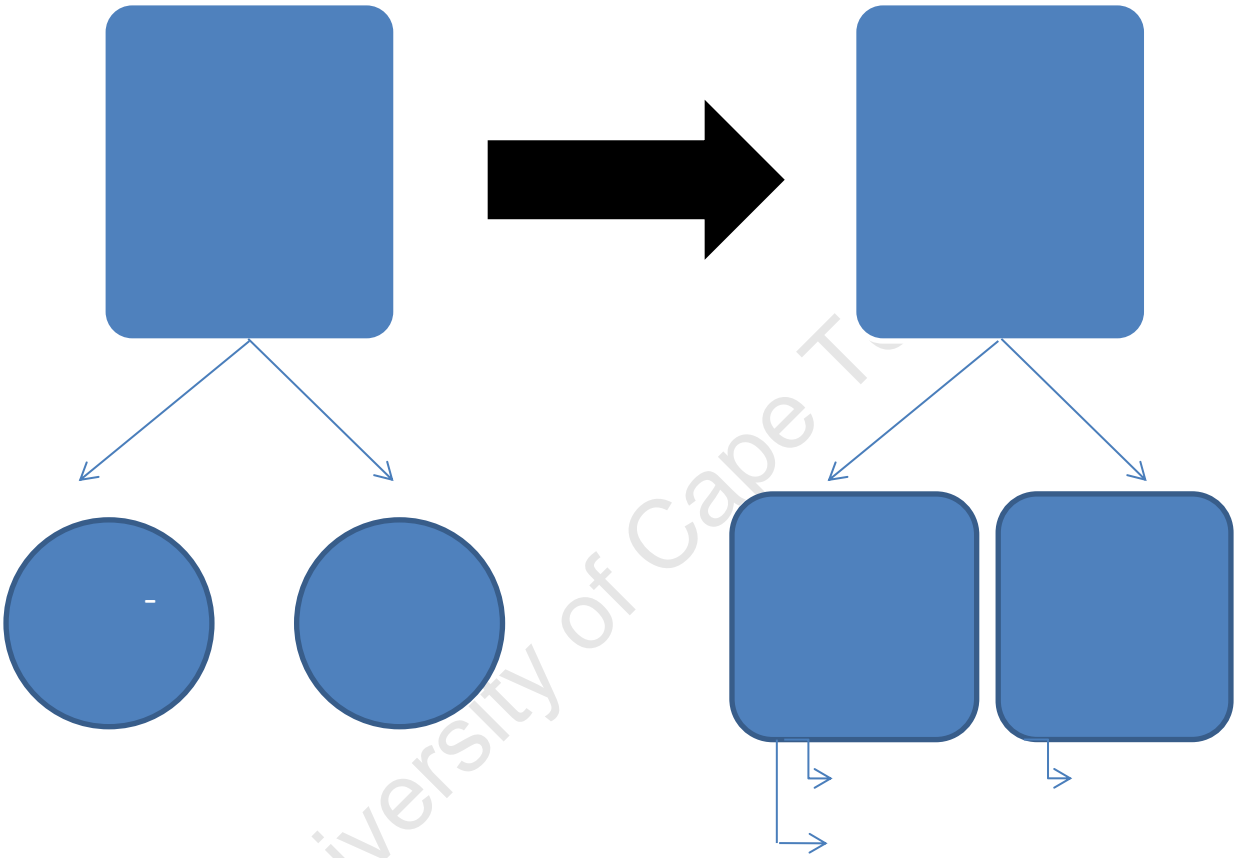
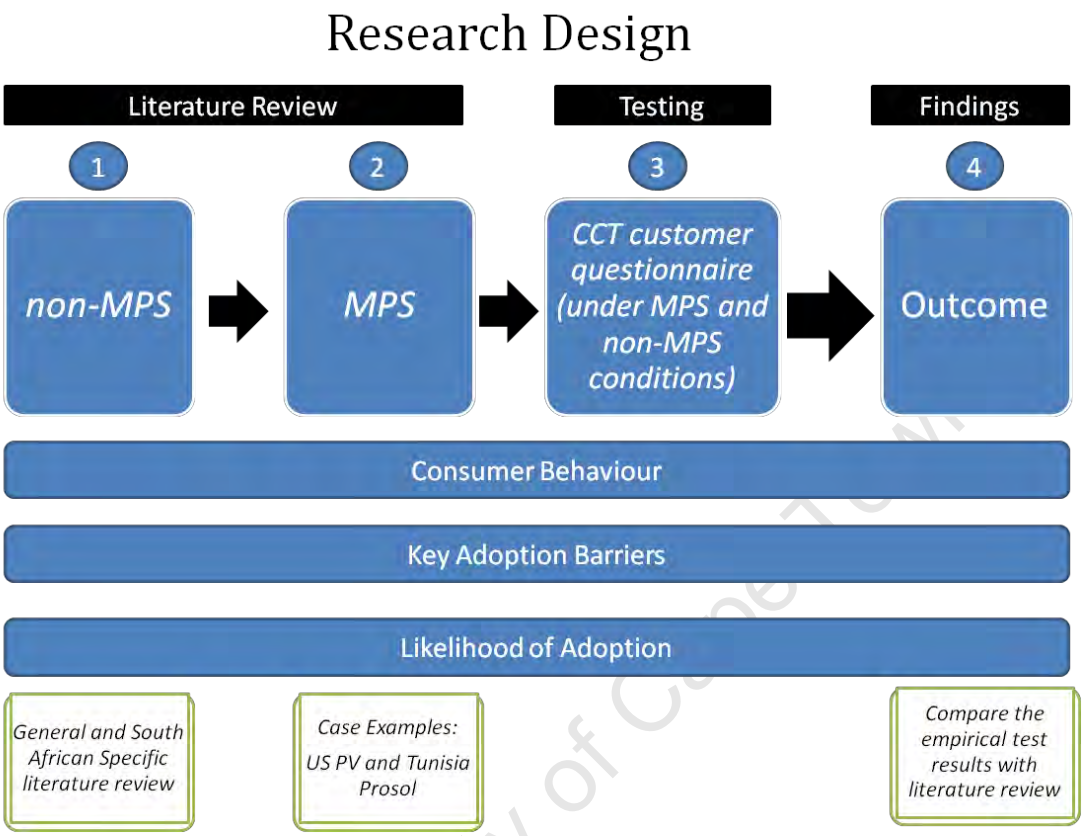


Figure 9B graphically depicts the research design for the paper and shows that three main variables (consumer behaviour, key adoption barriers and likelihood of adoption) are examined in all main stages of the research paper i.e. the literature review (under Non-MPS and MPS conditions), empirical testing and findings. See Figure 9B for more detail.

FIGURE 10: DISSERTATION RESEARCH DESIGN



2.3.9. Conclusion of Literature Review

The Prosol and US PV sector case studies highlight the importance of incentive mechanisms in overcoming consumer barriers. A MPS incentive mechanism must address consumer needs to have any chance of kick starting SWH demand. Consumer attitudes, drivers and awareness levels of SWHs provide a richer picture of their behaviour which is necessary to infer the likelihood that they will install SWHs under MPS conditions.

This paper will perform a consumer assessment via a questionnaire to identify consumer attitudes, awareness, drivers and likelihood of installation under both MPS and non-MPS conditions. This provides a consumer driven perspective of whether the MPS provides a compelling value proposition and thereby an opportunity to infer the likelihood of SWH installations under MPS conditions.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The research method used was a questionnaire with the aim of identifying consumer attitudes, awareness and drivers towards SWHs and assessing the overall likelihood of consumers installing a SWH under MPS and non MPS conditions.

The research was conducted primarily through face to face interviews and the sampling methodology was designed to include responses only from middle to high income homeowners with freestanding houses that did not have a SWH installed.

The aim of the research was to gain a better understanding of consumer attitudes, awareness, drivers and likelihood (AADL) under non MPS conditions (i.e. the existing subsidy scheme). This was followed by testing AADL under MPS conditions (i.e. the proposed CCT's MPS). A key goal was to forecast the likelihood that Cape Tonians would install a SWH due to the CCT's MPS.

3.2. The Population

The population for this study is also the target market for the CCT SWH campaign, which is defined as *'owner occupied free standing households using 450 kWh per month with geysers'* (CCT, 2012, 21). Households had to meet the following criteria: 1) access to roof space 2) owner occupied and 3) utilising more than 450 kWh (R400[30] worth of electricity per month). This study has targeted owner occupied, freestanding households utilising more than 450 kWh (R400). The sample for this study is also categorised as middle to upper income households (LSM 6 – 10 verified by the LSM questions 12-15 under descriptive statistics section).

[30] 450kWh translates to R500 under current tariffs. However for this questionnaire a threshold of R400 expenditure was used for eligibility to the CCT's SWH MPS.

3.3. Sampling Method

The Sampling Frame

- Individuals who are householders and live in Cape Town
- Individuals who are considered middle to upper income
- Individuals who are likely to spend more than R400 on electricity monthly

The research design employed both qualitative and quantitative questions. A sampling for convenience and sampling of judgement methodology was used, to ensure the sample met the sampling frame. This is described by Marshal (1996:523) as a technique that has less rigour and involves selection of the most accessible subjects, and is often less costly in time, money and resources for the researcher. The drawback of the sampling for convenience and sampling of judgement methodologies is that they have less intellectual credibility. Employing a judgement sample (also known as a purposeful sample) means that the researcher actively selects a productive sample to answer the research question. In this case, interviewees were pre-selected according to the three sample frame conditions and identified through existing networks (family, friends, places of work) and randomly selected in certain suburbs that fit the sampling frame conditions. By preselecting sample participants a trade-off between randomness and effective time and cost management was made. Future researchers should attempt a more random sampling of selected participants to ensure improved representation and less biasness of sampled respondents.

The research study aims to test Cape Tonians' attitudes, awareness, drivers and likelihood of adopting SWH specifically under the MPS. Although the sampling technique has a low likelihood of being representative for the population, a trade-off was made for improved time and cost effectiveness.

78 separate attempts were made via email, phone or face to face discussions to complete the questionnaire. A total of 52 questionnaires were completed, a response rate of 67 %. Qualifying questions were asked during the sourcing of eligible interviewees to ensure they met the sample frame. Three questions were posed:

1) Do you have a Solar Water Heater?

2) Are you a homeowner?

3) Is your home a freestanding property?

3.4. Determining the Sample Size

Raosoft[31] and The Research Advisors[32] were used to try to determine an adequate sample size. At a 5 % confidence interval and 5 % margin of error, a sample size for the effective target group of 144 000 households is 384 and for the critical mass target of 60 000 the sample remains 384. During pilot testing of the survey, the average response took 45 minutes. Thus running 384 surveys would take 288 hours or a total of 50 days or 10 consecutive weeks. As the author did not have the resources to do this, a decision was made together with the CCT and thesis supervisor to aim for a sample of 68 (confidence interval of 90 % and error margin of 10%), although a sample of 50 would be acceptable due to the heavy qualitative nature of the questionnaire. Marshal (1996:2) states that sampling methods differ between quantitative and qualitative research. Since the questionnaire was a combination of both types of research, it needed to balance quantitative and qualitative sampling methodology. Marshal argues that an appropriate sample size for qualitative research is one that adequately answers the research question and states that quantitative research often fails to value the usefulness of studying smaller samples. Given the mixed nature of the questionnaire, it was agreed that the sample would not be fully representative. However, the questionnaire still provides practical value for the CCT in the form of an initial pilot of questions. More importantly, it meets the academic credentials of answering the research question:

'How does the Monthly Payment Scheme influence consumer behaviour and their likelihood of adopting Solar Water Heater technologies in the City of Cape Town?"

3.5. The Questionnaire Design

[31] http://www.raosoft.com/samplesize.html.

[32] http://research-advisors.com/tools/SampleSize.htm.

Each of the qualitative and quantitative questions were designed according to the four main themes of identifying customers attitudes, awareness , drivers/barriers and likelihood of adopting SWHs. Additional questions include eligibility and demographic-type questions. The AADL category questions were asked in both a qualitative (open ended style) and quantitative (closed ended question/multiple choice question) format.

Customer attitudes: 26 attitude questions were asked to gauge the general attitudes of householders towards solar water heaters. Sub classifications include: positive or negative perception, knowledge of product, perceived advantages/disadvantages, and attitudes about product attributes (performance, convenience, durability, trust, affordability, environment and aesthetics). An overall assessment of customer attitudes on a scale of 1 – 10 was performed.

Awareness: 15 awareness questions were asked aimed at determining the level of awareness (i.e. exposure) to SWH products and also actual product knowledge (i.e. how the system operates). An overall assessment of customer awareness on a scale of 1 – 10 was performed.

Drivers: 9 driver questions were asked to understand the primary drivers for deciding to install SWHs. Customer drivers can be segmented into 1) drivers under subsidy scheme and 2) drivers under the monthly payment scheme.

Barriers: 2 Barrier questions were asked under the section relating to the subsidy scheme. One was an open ended question and the other sought to prioritise the most significant barriers to adoption.

Likelihood: 6 Likelihood questions were asked in order to bring some real world practicality to the questionnaire. An important goal of this questionnaire was to help inform the CCT whether the MPS did indeed improve the likelihood for adoption. Although this sample is non-representative, it was deemed as a worthwhile exercise in preparation for a more robust and comprehensive survey in late Q2 of 2013. The pilot questionnaire could be used to test certain question types, the process for data-capturing interviewee responses and the methodology used for sampling. Likelihood was tested under both non-MPS and MPS conditions. A 1 to 10 ranking scale was used to try to gauge if, and by how much, the MPS improves likelihood of SWH adoption.

The questionnaire is divided into four parts: (see Appendix K)

3.6. Sectional Outline

- **Section 1: Eligibility and Awareness**

This section is a streamer section to ensure that the interviewee candidate fits the profiled target market for the CCT's MPS campaign. It includes 7 questions specifically testing eligibility and 7 questions ascertaining levels of SWH awareness. It is important to classify the interviewees' perceived levels of awareness as their resulting opinion and answers can then be gauged against their level of awareness and knowledge of SWHs.

- **Section 2: Qualitative Questions: Attitudes, Awareness, Drivers and Likelihood**

Section 2 consists of 21 questions which form the bulk of the survey. These open-ended qualitative questions are asked in order to obtain the full range of the possible answer set.

Qualitative questions consist of the following breakdown of question categories:

- Attitude: 5 Questions
- Awareness: 4 Questions
- Drivers: 6 Questions
- Likelihood: 6 Questions
- Barriers: 2 Questions

After consultation with the CCT and UCT supervisor, it was decided to incorporate a more detailed qualitative section with open ended questions. This was done for two reasons. First, the nature of this study is exploratory research. Adams (2011), Ravens (2008) and Eskom IDM (2012) had performed research about consumer AADL, however they had utilised mainly closed ended questions and not qualitative open-ended questions. It was decided to employ open ended questions to capture the full range of possibilities from consumer responses, instead of limiting their answer set to pre-defined closed ended questions. It is thought that this might contribute more value to the inquiry on consumer AADL than previous research papers. Second, it would be extremely difficult to obtain a statistically representative quantitative survey. After discussions, a statistically representative questionnaire was

deemed out of the scope of this thesis due to time, resource and cost limitations. It was decided that more value could be achieved through exploratory qualitative research as opposed to a purely quantitative research exercise.

- **Section 3: Demographics**

Section 3 examines householder demographic profiles examining 11 categories namely gender, age, household number, education, income, water usage, geysers, prepaid or credit, electricity payment type, LSM and suburb.

- **Section 4: Quantitative Questions: AADL**

Section 4 consists of 37 statements relating to SWHs. Interviewees are asked to select one of five options: strongly agree, agree, undecided, disagree, and strongly disagree. This is known as a Likert Scale and is used to measure responses via these five predetermined options. Adams (2011:48) specifies that the Likert Scale has the advantage of being easy to administer and it is regarded as having reliability and validity in social research. Six questions were selected directly from Adams' 2011 paper to test the consistency of responses. The remaining 31 were devised by the author, CCT and supervisor to adequately test consumer AADL. The segmentation of questions is illustrated below.

Attitude: 21 questions

Awareness: 4 questions

Driver: 3 questions

Likelihood: 3 questions

Heat Pumps: 3 questions

Five other decision priority statements were also used to test attitudes and awareness (e.g. 'happy, unhappy, don't know').

Finally, three heat pump questions were included as requested by the CCT; however these questions had no meaningful bearing on the research question.

3.7. Questionnaire Distribution and Interviewing

The majority of interviews, 92 %, were conducted face to face with the remaining 8 % via telephone. Interviews were conducted either at respondents' homes or place of work and all were performed by the author. A covering letter was used to provide legitimacy, informed consent and explain the purpose of the questionnaire. (See Appendix L)

78 emails or phone calls were made to solicit interviews with 52 responses, providing a response rate of 67 %. Work commitments and lack of resources (time, money and people) meant that only a smaller, non-representative sample was achievable. The findings from this questionnaire sample are not representative of the 140 000 MPS target market and the data should be used cautiously when making comparisons for the population. The average time length of the questionnaire ranged between 23 minutes to 67 minutes. The questionnaire was piloted on eight people including four from the CCT's SWH campaign in order to test understanding of the question, wordings and terminologies, questionnaire structure, duration of questionnaire, data capturing techniques (voice recording and live note taking) and face to face interview technique. By running these pilots, several iterations on the questionnaire could be made, ensuring a better final questionnaire. A specific outcome from the CCT pilot was to ascertain how best to ask qualitative questions and capture answers to them.

3.8. Data Analysis

The responses were computed directly into Excel. Considerations were given to using online survey software such as Survey Monkey. This was disregarded since most face to face interactions did not have easy access to the internet, limiting the possibility of using web-based survey software. Excel was selected as the best input medium and was used to compute the interviewee responses. The responses were later analysed by formulas, functions and statistical tools contained in Excel and later converted to meaningful data tables and graphs for easy visual interpretation.

3.9. Research Limitations

The small sample size with varying degrees of awareness and knowledge about SWHs provided a broad range of responses. Since this was exploratory research, the sample took a broad and thin approach across all demographic profiles, namely income (mid to high income groups), age, education, electricity and water usage and geography. In future, a more deep and focused analysis into one of these demographic groups may provide better insight and value. Adams (2011, 51) highlights four potential limitations related to questionnaires, namely measurement error, voluntary response error, self-selection bias and non response error.

CHAPTER 4 RESULTS

This chapter provides the results of the data analysis of interviewee responses from the completed questionnaires.

4.1. Overall Findings: Highlights

- **Likelihood under MPS conditions:** 94 % of respondents stated they would be more likely to install a SWH under the MPS.
- **Likelihood under MPS conditions**: 62 % stated they would install an SWH in the next 12 months.
- **Barriers**: The main barrier cited is the high SWH upfront expense (40 %) which is consistent with prior literature.
- **Driver**: Under MPS conditions, the largest motivator mentioned was 'no upfront costs' at 46 %.
- **Attitudes**: 90 % state 'costs saving' as their primary purpose for installing a SWH.
- **Attitudes**: ~ 80 % have positive attitudes towards SWHs.
- **Awareness**: 70 % of respondents answered 'low awareness' or 'I don't know anything' about SWHs.

4.2. Section 1: Eligibility and Awareness

4.2.1. Key Findings

- **~ 90 % of all interviews were conducted face to face with ~ 10 % via telephone.**
- **All interviewees met the sample frame criteria due to judgement sampling methodology.**
    - **i.e. 100 % were homeowners, with no SWHs, in freestanding houses.**
- **~ 70 % of respondents had monthly electricity bills greater than R400 making them eligible for the CCT's MPS.**

4.2.2. Summary

Section 1 contains streamer questions to ensure that the respondents are eligible and fit the sample frame. Since the sampling method used is both a sample of convenience and judgement (Marshal, 1996), a first level screening of participants already took place prior to making direct contact with them. On the first email/ telephone-call interaction, it was specified that in order to take part, they must be a home-owner of freestanding property and must not have a SWH. The first four questions of the survey clarified whether the respondents fit the sample frame.

4.2.3. Electricity Spending

Question 6 covers the amount of electricity spent per month and provides an indicator of whether the respondent fits the criteria for the CCT's MPS. As stated (CCT, 2012:20), 450 kWh per month is an acceptable cut-off point for eligibility for the MPS. This translates to approximately R500 per month at current electricity tariffs (See appendix M). For purposes of this paper, a range of R400 and upwards was deemed suitable to be eligible for the CCT MPS, due to monthly variability in electricity spend. Thus a margin of 20 % was applied to the R500 'cut-off' amount resulting in R400 being the questionnaire's cut-off for eligibility. 70 % of respondents had monthly electricity bills above R400 per month and they were eligible for the CCT MPS. Interestingly, 44 % had greater than R700 electricity spend, making them especially well suited for the MPS.

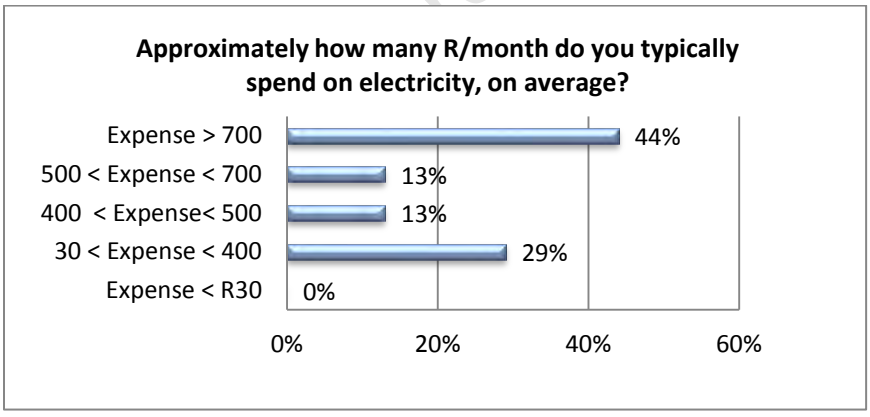


FIGURE 11: DISTRIBUTION OF AVERAGE MONTHLY ELECTRICITY EXPENDITURE

33 % of respondents stated that they were the sole decision-maker on whether to install a SWH or not, with the remaining being those that made the decision together with their spouse (See Appendix 0 for Eligibility Question Table).

4.3. Section 3: Demographics

4.3.1. Introduction

Section 3 examines householder demographic profiles by looking at 11 categories namely gender, age, household number, education, income, water usage, geysers, prepaid or credit, electricity payment type, LSM and suburb.

4.3.2. Key Findings

- **66 % of respondents were male**
- **77 % were above 35 years of age**
- **60 % received a middle income salary (R307 000 to R 1.2 million)**
- **85 % of people had only one geyser.**
- **There is strong confidence that the majority of the sample are within the middle to high income grouping (LSM 6 – 10).**

4.3.3. Summary

Two thirds of respondents were male and one third female. 77 % were above 35 years of age with 40 % being older than 50. 44 % were two member households with 12 % one member households. Three member households and more comprise the remaining 44 %. Households with more than three members were more suitable for the MPS as they were likely to utilise more hot water and thus incur higher electricity expenditure. 60 % received a middle income salary (R 307 000 to R 1.2 million) with 8 % being in a high income bracket (R 1.2 million or more) and 32 % receiving lower than R 307 000 per annum. The large majority had two or more showers per day (82 % - see below graph for split).

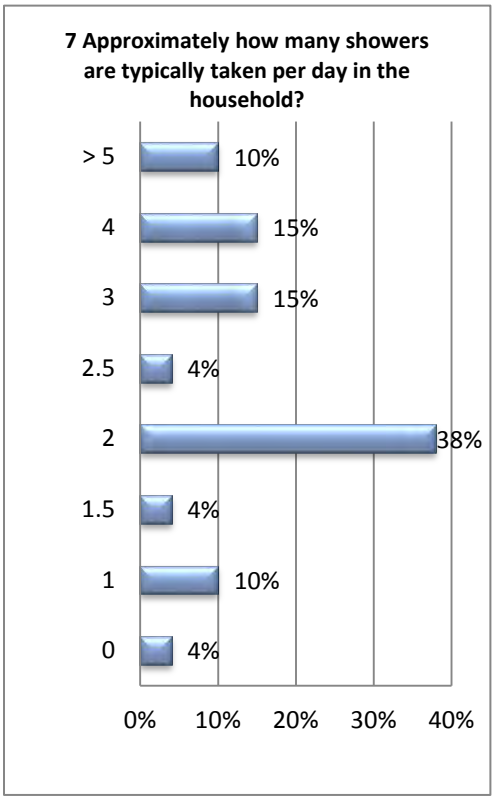


FIGURE 12: NUMBER OF SHOWERS IN THE HOUSEHOLD

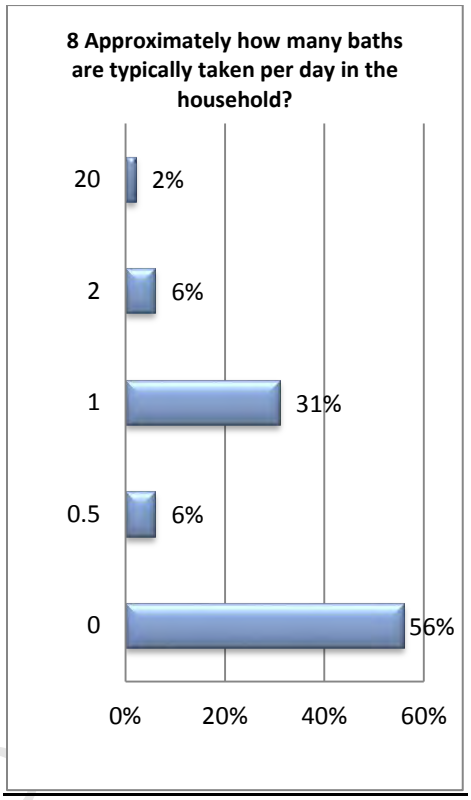


FIGURE 13: NUMBER OF BATHS IN THE HOUSEHOLD

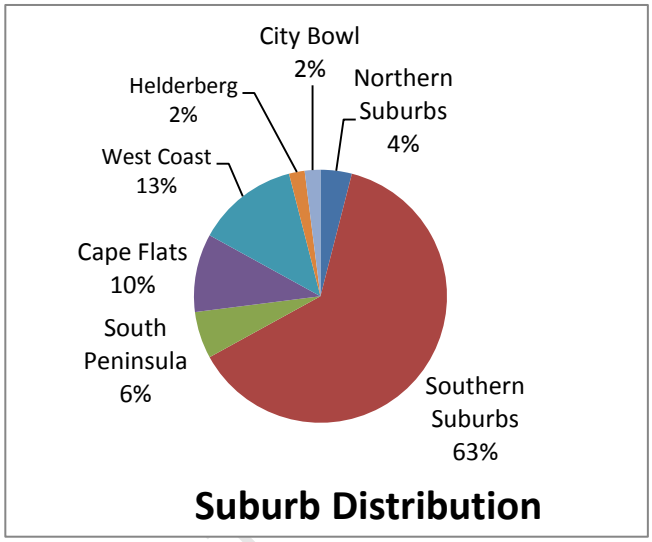
85 % of people had only one geyser and it was a 60:40 split between prepaid and credit electricity meter, with a similar 60:40 split between 'I pay' versus 'spouse pays' the electricity bill. For the sake of this study, it provides better credibility if the payer of the electricity bill answers the questionnaire as there is more ownership of the electricity bill. There were four LSM questions to help identify if respondents were indeed in the LSM 6 – 10 groupings. On a balance of probabilities, all respondents were likely to be LSM 6 and above since they all had their own vehicles and a computer in the house with 71 % having DSTV and 62 % having a dishwashing machine.

Although the sample was too small to be representative for the CCT, attempts were made to ensure that the questionnaire targeted a fair distribution of Cape Town Suburbs. Below illustrates the wide distribution of CCT suburbs in just 52 samples. 31 out of 52 interviewees represented unique suburbs in the CCT and there was a 60:40 split between southern suburbs and non-southern suburbs as illustrated by the following pie chart (See Appendix P for Demographic Question Table).

TABLE 3: SUBURB DISTRIBUTION

Q4A		
What suburb do you live in?	%	No.
Newlands	12%	6
Kirstenhoff	10%	5
Claremont	6%	3
Plumstead	6%	3
Rondebosch	6%	3
Grassy Park	4%	2
Kenilworth	4%	2
Melkbostrand	4%	2
Muizenberg	4%	2
Retreat	4%	2
Table view	4%	2
Bothasig	2%	1
Durbenville	2%	1
Fish Hoek	2%	1
Harfield	2%	1
Kenwyn	2%	1
Lakeside	2%	1
Michels Plein - Strandfontein	2%	1
Milnerton	2%	1
Observatory	2%	1
Parklands	2%	1
Pinelands	2%	1
Rondevlei park	2%	1
Ruyterwacht	2%	1
Sandrift	2%	1
Seawind - Steenberg	2%	1
Somerset west	2%	1
Southfield	2%	1
Walmer estate Upper Woodstock	2%	1
Wynberg	2%	1
Zeekovlei	2%	1
Total Responses	100%	52

FIGURE 14: PIE CHART OF THE SUBURB DISTRIBUTION



60:40 split occurred between Southern Suburb locations and other Cape Town suburbs as displayed in the graph above. 31 separate suburbs were represented in the questionnaire

4.4. CONSUMER BEHAVIOUR

4.4.1. Attitudes

4.4.1.1. Introduction

Twenty seven attitude questions were asked to gauge the general attitudes of householders towards SWHs. Sub classifications include: positive perception, negative perception, knowledge of product, perceived advantages/disadvantages, and attitudes about product attributes (performance, convenience, durability, trust, affordability, environment and aesthetics). An overall assessment of customer attitudes on a scale of 1 – 10 was performed. Six qualitative and 21 quantitative questions were asked.

4.4.1.2. Key Findings:

- **90 % state 'cost savings' as the primary purpose for installing a SWH.**
- **~ 80 % have positive attitudes to SWHs and**
- **~ 90 % state they are positive about the future of SWHs in South Africa**
- **93 % think SWHs are the way of the future.**
- **In general, customers have favourable attitudes towards SWH products and this is consistent with previous literature (Adams, Ravens and Eskom IDM)**.

4.4.1.3. Qualitative Questions

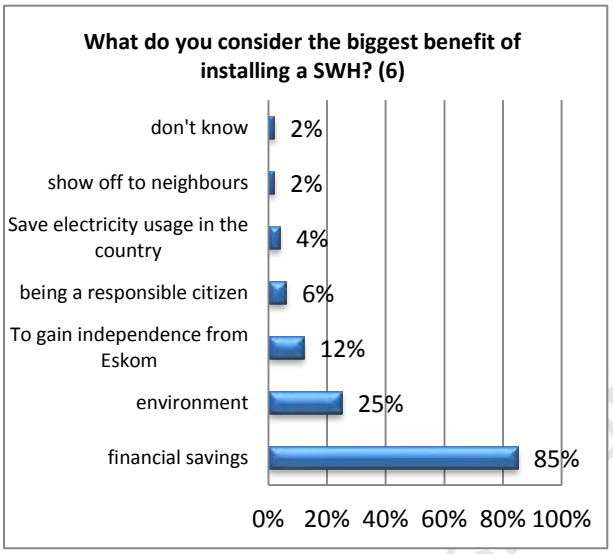
To test general perceptions and attitudes towards SWHs the following qualitative questions were asked:

- *In your opinion, what is the primary purpose for installing a SWH?* (8)[33]

[33] Numbers in parenthesis represent actual question numbers from the questionnaire.

- *What do you consider the biggest benefit of installing a SWH?* (6)
- *What do you consider the biggest disadvantages of SWHs?* (7)
- *How would you summarise your general attitudes towards SWHs currently?* (9)

90 % of respondents answered that the primary purpose for installing a SWH is cost savings, whereas only 27 % cited the environment and 13 % cited saving electricity usage in the country (note that respondents could answer more than one option) [34].



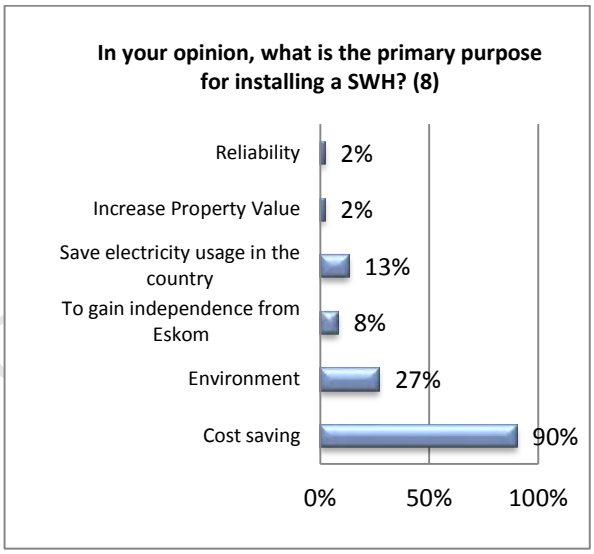


FIGURE 15: BIGGEST BENEFIT OF INSTALLING A SWH

FIGURE 16: PRIMARY PURPOSE FOR INSTALLING A SWH

Similarly, the biggest benefit cited for installing a SWH is financial savings (85 %), environment (25 %) and to gain independence from Eskom (12 %). It is clearly evident that monetary benefits are the main driver for installing SWHs. This is further supported in the "Likelihood" section when respondents are asked *'why would you install a SWH?'*; the key response is 'cost savings.' Negative attitudes were tested through the question *'what do you consider the biggest disadvantages of SWHs?'* The main grievance cited is that they are 'too expensive' (29 %), followed by 'still uses electricity in winter or night' (13 %) and 'aesthetics: looks ugly' (13 %). Overall attitudes towards SWHs were obtained through question 9

[34] Note percentages are calculated for the number of times a category response was mentioned per interviewee. Thus the total must be viewed per category and not collectively. i.e. 90 % of all participants mentioned costs whereas only 27 % mentioned environment.

asking *'How would you summarise your general attitudes towards SWHs currently?'* The overwhelming majority, 81 %, have a positive opinion (positive or very positive) of SWHs with many stating that it is a good idea or that they are pro-solar. Other general attitudes cited were that they 'need more knowledge about it' (15 %) and negative attitudes (8 %) such as 'the economics were not convincing' and they are 'not convinced to switch.'

Below represents a few qualitative answers (both positive and negative) to question 9 which asked *"How would you summarise your general attitudes towards SWHs currently?"* Note these are anecdotal expressions from interviewees and do not represent the full sample.

4.4.1.4. Positive Attitudes

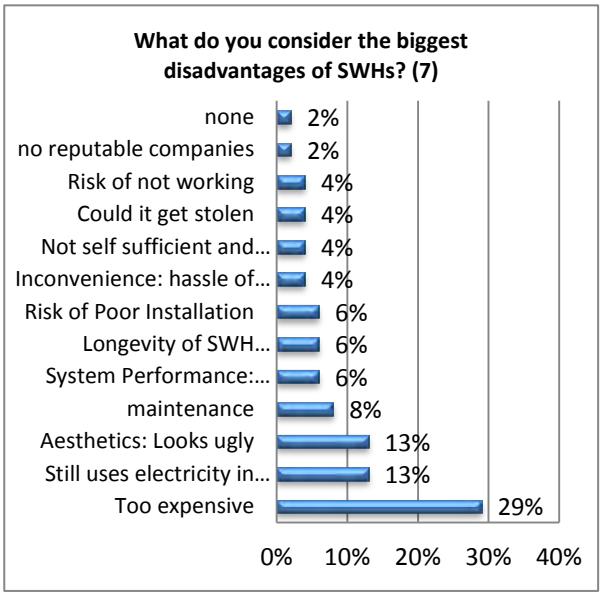
FIGURE 17: QUOTES ILLUSTRATING POSITIVE ATTITUDES

> *"Think it is fantastic, if more people could use it, it would be better for everyone."*
>
> *"I think I am positive about it. It's something that has to be done!"*

4.4.1.5. Negative Attitudes

FIGURE 18: QUOTES ILLUSTRATING NEGATIVE ATTITUDES

> *"The guys that install, the companies - they are total idiots."*
>
> *"I am confused about SWHs. There are three or four options and not sure what is best to use?"*



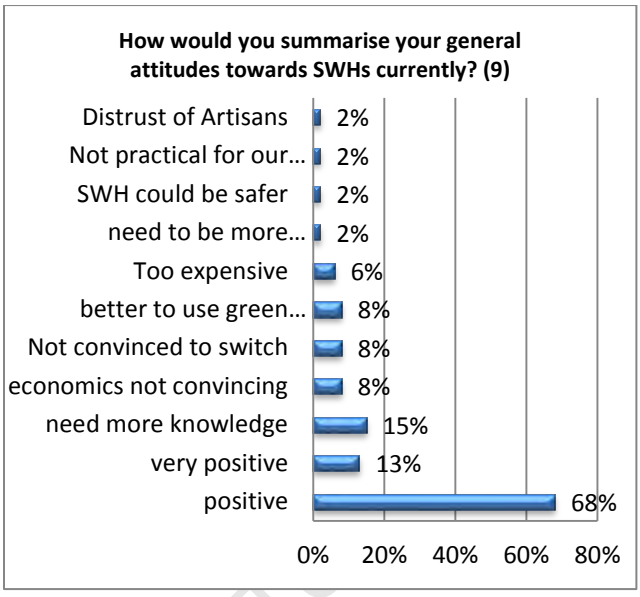


FIGURE 19: BIGGEST DISADVANTAGES OF A SWH

FIGURE 20: GENERAL ATTITUDES TOWARDS SWHS

4.4.1.6. Direct Questions

A direct ranking question was asked to explicitly ascertain interviewees' attitudes towards SWHs. Question 11 asked *'On a scale of 1 – 10 how positive are you about the future of SWHs in SA?' (testing attitudes towards SWH).* 93 % of interviewees were positive/very positive (greater than 6/10) about the future of SWHs, however it will be interesting to examine whether positivity translates into purchasing. Consumers may have a positive opinion of SWHs but what is their actual likelihood of purchasing a SWH?

Monthly Payment Scheme

One question asked about respondents' attitudes towards the MPS. This was Question 16 which asked *'Any questions, comments or concerns about the Monthly Payment Scheme?*' The main queries raised were 'What happens when you sell? '(37 %), 'What is the monthly cost?' (13 %) and 'Can I pay it off quicker?' (10%). There was also a wide distribution of concerns. Thirty four unique and separate concerns were raised by the 52 respondents, suggesting that consumers have complex and varied interests in this issue (see Appendix Q1 for full list of questions).

TABLE 4: MAIN COMMENTS ABOUT THE MPS

Question 16	MPS
'Any questions, comments or concerns about the Monthly Payment Scheme?'	
No	37%
What happens when you sell?	13%
What is the monthly cost?	10%
Can I pay in money (e.g. R1000) to pay it off quicker?	8%

4.4.1.7. Quantitative Questions

Twenty quantitative attitude questions were asked, seven of which can be compared with Adams' paper (in bold).

TABLE 5: CLOSED ENDED QUANTITATIVE QUESTIONS[35]

No.	Quantitative Questions	Strongly Agree/ Agree	Undecided	Strongly Disagree/ Disagree
4	With a SWH there would be no change in my quality and availability of hot water	60%	31%	10%
5	**Under MPS, it takes long to recoup the financial benefits**	**44%**	**13%**	**42%**
6	**A SWH requires the same amount of maintenance as an electric water heater**	**8%**	**52%**	**40%**
7	SWHs last many years and have trustworthy and reliable warranties	27%	65%	8%
8	If required, it will be easy to get my SWH fixed	31%	50%	19%
9	I think the CCT programme will have quality SWH units	58%	37%	6%
10	**Installing a SWH under a monthly payment scheme is value for money**	**67%**	**21%**	**12%**

[35] Higher than 40 % weighting are shaded in red.

11	Under the monthly scheme, it is cheaper to install a SWH than continue to use an Electric Water Heater and pay higher electricity costs	67%	21%	12%
12	Under the CCT proposed MPS, the SWH supplier guarantees maintenance and service during the 5 year payback period. Would this be a big factor for me installing the SWH unit?	92%	6%	2%
13	Outside of the MPS, would you consider a SWH expensive?	73%	17%	10%
17	SWHs reduce electricity consumption	85%	12%	4%
19	**SWHs reduce electricity expenses**	**90%**	**6%**	**4%**
20	**SWHs are the way of the future**	**92%**	**8%**	**0%**
21	SWHs should be mandatory for all replacements of conventional geysers	46%	23%	31%
23	SWH will become more prevalent in SA	88%	12%	0%
24	**Solar systems are intrusive and affect the aesthetics of your home.**	**31%**	**21%**	**48%**
25	**SWH reduce carbon emissions**	**71%**	**17%**	**12%**
27	The way our household takes showers and baths would not be different with a SWH	69%	15%	15%
31	SWHs remain too expensive and will not become prevalent in SA	19%	21%	60%
34	Which organisation would you trust the most to endorse a list of accredited suppliers of SWHs under MPS?	27%	19%	54%

4.4.1.8. General Comparison with previous studies

Question 6 stated: *'A SWH requires the same amount of maintenance as an electric water heater.'* As with Adams, this paper finds similar results that most people are undecided if SWHs require more maintenance (52 % versus 51 % from Adams). However, this paper finds that many more disagree with this statement (40 % versus 25 %), suggesting that more people in this sample think SWHs do require more maintenance. Consistency of answers was evident again in Question 19: *'SWHs reduce electricity expenses'* where 90 % agreed with this statement and in Adams paper, 85 % agreed with the statement

'*SWHs generate savings*.' This reveals that the author's sample is aware and shares the attitude that SWHs do create savings. 48 % believe that SWHs do not adversely affect the aesthetics of your home compared to 70 % from Ravens' paper who are 'not bothered' by the aesthetics of SWHs and 50 % from Adams paper. It is interesting to note that a smaller, yet significant number, 31 %, are bothered by the aesthetics of SWHs and the market needs to account for this segment.

71 % agree that SWHs reduce carbon emissions compared with 87 % in Adams's study. This 16 % difference may be due to the sample group, since Adams' sample (respondents) had already enquired about SWHs and were already part of the SESSA mailing list and thus may have had higher levels of awareness.

4.4.1.9. Comparison of attitudes under MPS and non-MPS conditions

Question 5 stated '*Under a MPS, it takes long to recoup the financial benefits*.' In this sample, 44% believe it does and only 42 % believed it doesn't, whereas under non-MPS conditions in the Adams study, a greater majority of 55% believed it did not take long to recoup the financial benefits. This is somewhat concerning as a key intention of the leasing scheme is to demonstrate financial benefits. Under the non-MPS conditions (subsidy scheme) of Adams' study, 54 % think that SWHs are value for money whereas 67 % believe that SWHs are value for money under the MPS conditions of this study. This suggests an improved attitude toward SWHs due to the MPS mechanism. It is difficult to make statistically relevant comparisons between these data sets as sample sizes and sampling methodologies differ, however we can reveal crude differences and make general inferences. In this case, it appears the MPS creates a better business case for demonstrating value since more respondents agree that SWHs under a MPS are value for money, as opposed to SWHs under non-MPS conditions[36] (Adams).

4.4.1.10. Conclusion

On the whole, customers have favourable attitudes towards SWH products with consistency in answers between Adams and this paper's findings. 90 % state they are positive about the future of SWHs in South Africa with 93 % positively agreeing that they think SWHs are the way of the future.

4.4.2. Awareness

[36] Note: Non-MPS conditions and subsidy scheme can be used interchangeably

Levels of awareness were generally low. These were tested with 11 qualitative questions and 4 quantitative questions. Qualitative questions were asked both indirectly i.e. asking awareness based questions to infer the respondents level of awareness (7 questions) and directly i.e. openly asking respondents to rate their level of awareness in Question 10 (words) and Question 11 (ranking). The answers to both indirect and direct questions indicated low levels of awareness.

4.4.2.1. Key Findings

- **70 % of respondents answered 'low awareness' or 'I don't know anything' about SWH products.**
- **~ 65 % scored themselves lower than 5/10 on awareness level ranking.**
- **Worryingly, only ~ 40 % were confident that SWH supplied hot water in the night or on cloudy days.**

4.4.2.2. Direct Questions

Question 10 asked: *'How would you describe (in words) your general levels of awareness of current SWHs products?*' 70 % responded 'I don't know anything' or 'low awareness.' Similarly, when asked in Question 12, '*On a scale 1 - 10 how aware do you feel about current SWH products*? ', 65 % scored lower or equal to 5. This demonstrates that the sample felt largely unaware about SWH products.

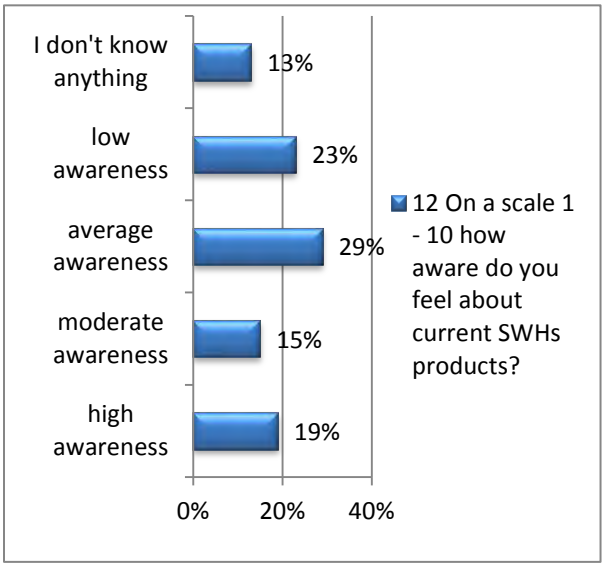


FIGURE 21: AWARENESS LEVELS ON A SCALE OF 1 - 10

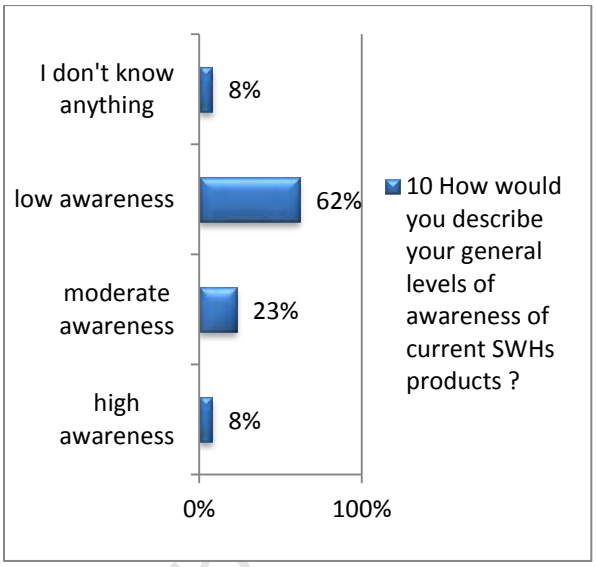


FIGURE 22: GENERAL AWARENESS LEVELS

4.4.2.3. Indirect Questions

Seven indirect questions were asked to ascertain respondents' levels of awareness.

4.4.2.4. Results

Question 9 asked: **'***What does a SWH replace in a house?'* 77 % of respondents knew that a SWH either replaces or supplements the geyser, with the remaining 23% unsure what it would replace. Question 10 asked: '*How do you think a SWH works?*' 73 % understood that SWHs operate with the sun heating water, however 18 % thought the sun generated electricity that then heated the water and 10 % did not know. The data reveals that at least ~ 30 % were unsure whether SWHs use solar thermal energy to heat water.

In response to Question 11: "*Does the entire SWH system unit use any electricity?,"* 60 % knew that SWHs use electricity, with ~ 20% stating 'no' and ~20% unsure. According to the findings of this question, almost 40 % could not conclusively express that SWHs use electricity in non-solar conditions to heat water.

Question 12: '*If you switch to a SWH and you install a SWH system, will it provide hot water in the night time or on cloudy days, when you turn on the tap?'* Only 42 % answered confidently that they would get hot water. Another 42 % answered 'yes' but they were unsure of their answer, with the remaining 18 % stating 'no' or they did not know if it would supply hot water. 20 % seems a rather high figure and it is

concerning that this proportion of the potential target market are unaware that SWHs still supply hot water, irrespective of weather conditions, due to an electrical backup. A follow up question *'And how?'* was asked to gauge levels of understanding with only 44 % understanding that a SWH has an electrical element. The remaining 56 % were unsure or thought that insulation would keep the water warm, further suggesting low levels of product knowledge. The implication of this is that current consumer markets do not have a basic level of product knowledge, especially the fundamental understanding that SWHs have the capacity to supply hot water in the night or in winter months. It is unlikely that many consumers would be seeking out SWHs when 58 % of people are uncertain if it provides hot water in non-sunny conditions.

Questions 14 asked '*Does it have an electrical back up?*' Interestingly, when asked directly if a SWH has an electrical backup, the number of positive responses jumped from 60 % (Question 11) to 91 % (Question 14). The way the question is framed *'Does it have an electrical back up?*' might have helped interviewees infer that SWH must have an electrical backup. The learning from this is that future studies must carefully phrase their questions to test levels of understanding. Indirect questions such as '*Does the entire SWH system unit use any electricity?* versus the direct question of *'Does it have an electrical back up?'* test the same outcome of whether consumers have the product knowledge that SWHs have electrical backup systems. However, the direct question in this case helped respondents infer the correct answer.

Question 15 asked '*Are you aware of the difference between a SWH and a photovoltaic cell?*' This question aimed to ascertain the level of understanding of the solar market and its associated products. In Ravens' study, 70 % did not know the difference between SWHs and PV cells. Similarly, in this study, 67 % did not know the difference, confirming Ravens' findings and suggesting that general solar industry knowledge has not really improved since the 2008 study. The implication is that market knowledge is low and hence confusion is higher. Adams (2011) cites Alba and Hutchinson (1987) who state that when a consumer has minimal experience with the product, it is difficult to describe its relevant attributes and thus hard to evaluate the product. Therefore the consumer's opinion about the product may not have high predictive validity. In this case, positive indicators for high levels of awareness is the fact that 77 % understood a SWH replaces or supplements a geyser and 91 % inferred that the unit has an electrical backup. Negative indicators include the 20 % that believe you could not get hot water from a SWH

system in non sunny conditions. General industry knowledge was fairly low with 67 % unsure about the difference between PV and SWH systems.

4.4.2.5. General Levels of Awareness

Question 14 asked '*Have you heard about Eskom's SWH rebate scheme?*' The Eskom IDM (2012:11) study of 50 households found that 84 % had heard of Eskom's SWH rebate whereas in this study only 65 % had. As expected, only a very small percentage - 13 % - answered 'yes' to Question 15, '*Have you heard of the City of Cape Town's proposed monthly SWH payment Scheme ?,*'with 87 % stating they had not. Although print and online media have mentioned the proposed CCT MPS, the large majority of people interviewed are unaware. This, in addition to only 65 % knowing about the Eskom rebate scheme (20 % reduction over Eskom's study), suggests that a strong marketing and communications campaign should be initiated to promote the MPS scheme for Cape Tonians.

4.4.2.6. Quantitative Questions:

TABLE 6: CLOSED ENDED QUANTITATIVE QUESTIONS

No.	Quantitative Questions	Strongly Agree/ Agree	Undecided	Strongly Disagree/ Disagree
12	SWHs are becoming more visible in my neighbourhood (15)	42%	4%	54%
13	SWHs help reduce pollution in the environment (16)	85%	8%	8%
14	I have never seen a SWH system (18)	6%	0%	94%
15	I know how to find and select a supplier to install an appropriate SWH at my residence (28)	46%	12%	42%

Four quantitative questions aimed at testing awareness were asked. The results indicate a mixed distribution on whether '*SWHs are becoming more visible in neighbourhoods,'* with an almost 50:50 split between agree and disagree with the statement of Question 15. The overwhelming majority agree that SWHs reduce pollution in the environment (85 %) and almost all respondents had seen an SWH (96 %). For *"I know how to find and select a supplier to install an appropriate SWH at my residence,"* 46 %

agreed they do. However42 % disagreed, suggesting that many are unaware of how to even contact or initiate purchasing of a SWH unit, an area worth addressing for the CCT's MPS campaign.

4.4.2.7. Conclusion

Average awareness levels are fairly low on both direct and indirect questions. Approximately 70 % of respondents scored themselves lower than 5 out of 10 on levels of awareness. Furthermore, fewer respondents in this sample had heard of Eskom's rebate scheme (65 % versus 84 %) compared with the Eskom IDM study. Finally, levels of product knowledge were also relatively low with 42 % unsure how SWHs provide hot water during the night time or cloudy days. These factors, in addition to the 87 % of respondents being unaware of the proposed CCT MPS, suggest an overall assessment of 'low awareness' for this sample group.

4.4.3. Drivers

4.4.3.1. Introduction

Eight driver/motivation questions were asked to understand the primary drivers for householders deciding to install a SWH. Customer drivers can be segmented into 1) drivers under non MPS conditions and 2) drivers under the MPS conditions. There are five qualitative questions and three quantitative questions.

4.4.3.2. Key Findings

- **~ 60% of respondents state that cost savings is their main driver for installing a SWH.**
- **~40% state that the threat of rising electricity costs is the greatest stimulating factor for deciding to undertake an installation. This corresponds to the Eskom IDM (2012) findings.**
- **Largest drivers under MPS conditions are no upfront costs (46 %), monthly payback (15 %) and pay it back from electricity savings (13 %).**

4.4.3.3. Qualitative Questions

Question 3, *'Why would you ever get a SWH?,'* reveals that, under existing conditions (non-MPS), cost savings (60%) followed by environment (25%), sound financial business case (17%) and rising electricity costs (13 %) are the key drivers for adoption of SWHs.

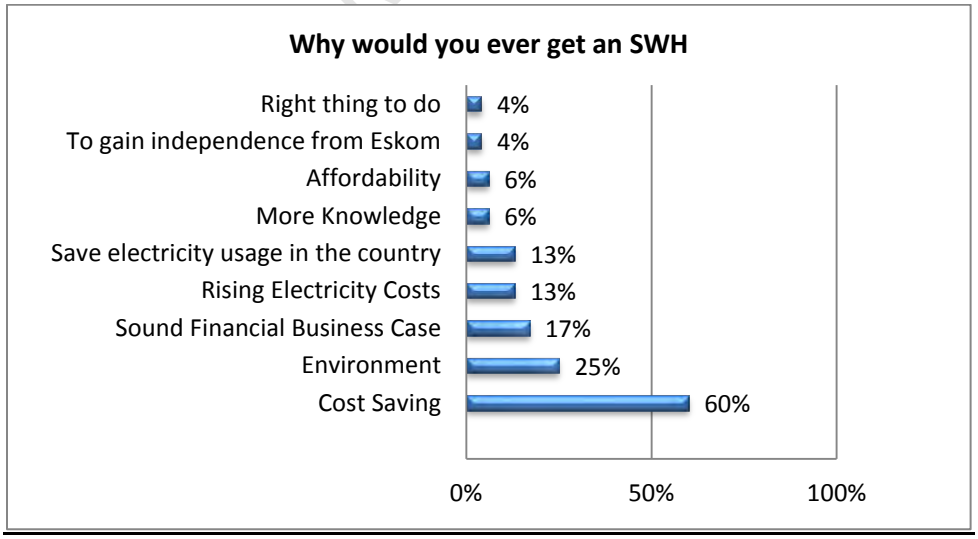


FIGURE 23: MAIN DRIVERS AND MOTIVATORS TO INSTALL A SWH

A follow up question later in the survey tested the same driver characteristic and was selected from the Eskom IDM paper for comparability purposes. Question 8 asked '*What would really induce you to install a SWH in the future?'*

The difference in answers between this study and the Eskom IDM study are revealed below.

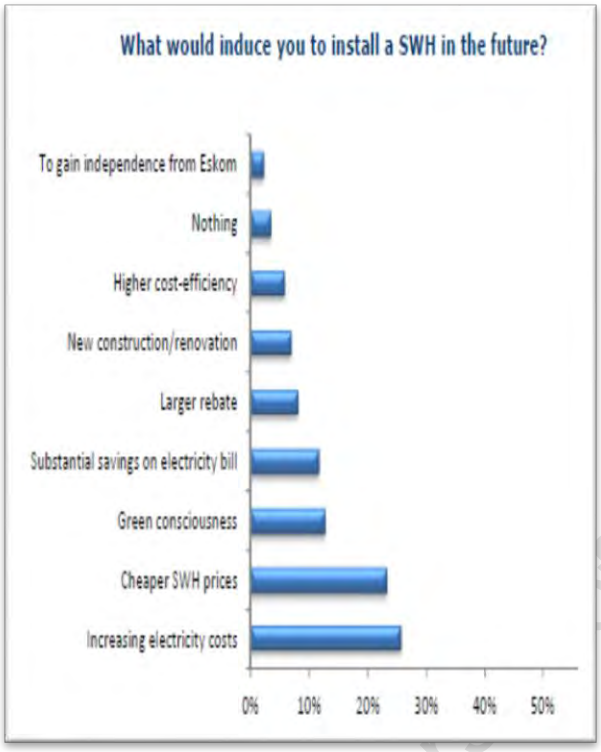


FIGURE 25: ESKOM IDM QUESTIONNAIRE 2012: MOTIVATORS TO INSTALL A SWH

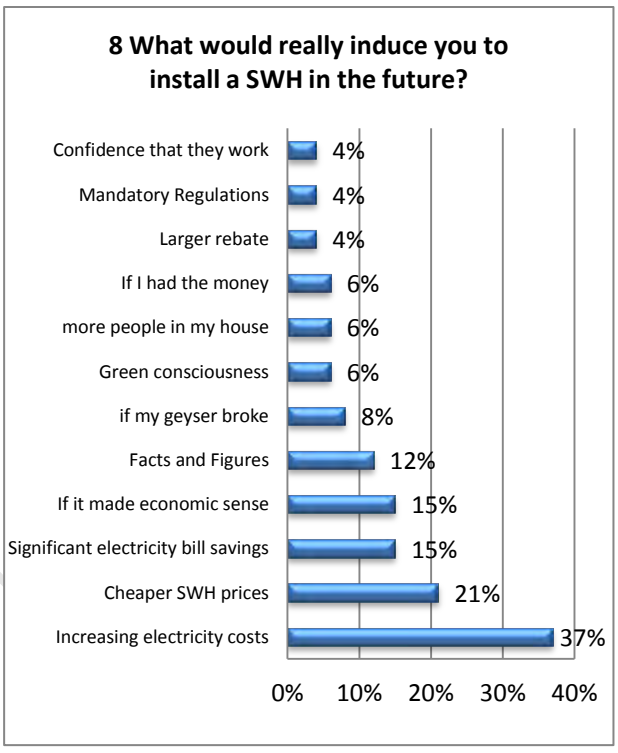


FIGURE 24: RESEARCH QUESTIONNAIRE: MOTIVATORS TO INSTALL A SWH

As illustrated above, this paper's results almost mirror Eskom findings, as increasing costs and cheaper SWH prices represent the two most important drivers in both tests. It is clear that in both instances, the threat of increasing electricity costs is the primary driver to invest in a SWH which will assist in a cost reduction.

4.4.3.4. Direct Questions

Monthly Payment Scheme

During this portion of the interview, I read a brief statement detailing the key features of the CCT's MPS (See Appendix Q2). After reading the key terms and conditions of the proposed CCT MPS, the question *"What from the offer now motivates you to install a SWH?"* was asked. The answers helped identify

what customers believed to be the most important propositions that the scheme offered. 46 % of respondents mentioned that no upfront costs was the largest motivator followed by smaller drivers of monthly payback (15 %), pay it back from electricity savings(13 %) and financial savings (12 %) . The elimination of upfront costs appears to be the biggest driver for installing SWHs and is comparable to the literature from the US PV market and Tunisia Prosol case which highlight upfront costs as the largest barrier to adoption. To identify missing items that could bolster the MPS campaign, Question 21 was posed: *"What might be missing from the offer or what more might you require such that you'll now install an SWH?"* This identified that 'more knowledge on the scheme' (17%) and 'actual costs' (10 %) were the most important missing pieces of information.

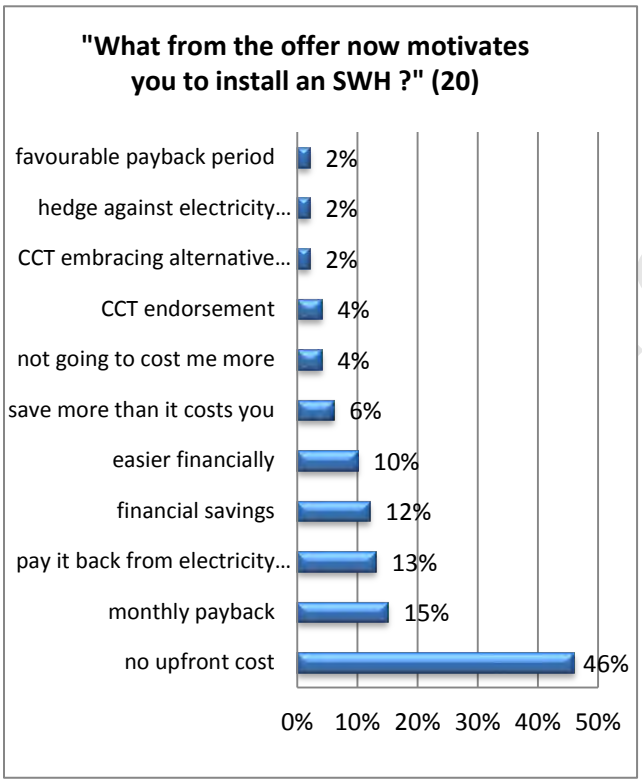


FIGURE 26: MOTIVATION TO INSTALL A SWH UNDER MPS CONDITIONS

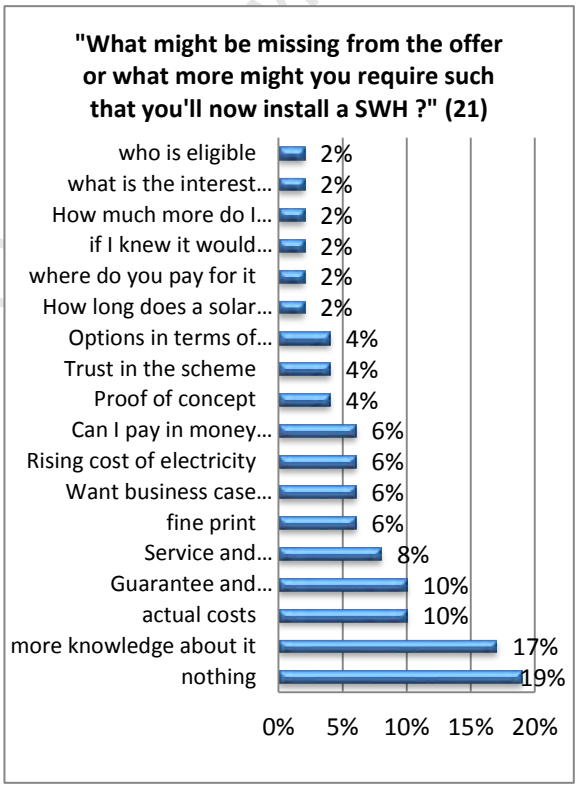


FIGURE 27: POSSIBLE FACTORS MISSING UNDER THE MPS

4.4.3.5. Quantitative Questions

TABLE 7: CLOSED ENDED QUANTITATIVE QUESTIONS

		Strongly Agree/ Agree	Undecided	Strongly Disagree/ Disagree
6	Solar systems add value to a property (26)	71%	23%	6%
7	If my monthly payments for a SWH are more than my savings in electricity bills, then I would not install a SWH (29)	54%	25%	21%
8	If my monthly payments for a SWH are less than my savings from electricity then I would definitely install an SWH (32)	85%	10%	6%
9	If electricity prices increase such that my electricity bill is double the amount in 4 years' time, then I would definitely install a SWH (33)	81%	17%	2%

Findings from Question 6, '*Solar systems add value to a property,'* are almost identical to Adams' findings (71 % versus 69 %) who believe that a SWH adds value to your property. Converting this to 100 % may improve the drivers to install a SWH. The majority of respondents agree that they will not install a SWH if they pay more than they save on a monthly basis (54 %). However, 45 % are undecided or disagree, suggesting that many people will still consider installing SWHs even if they do not realise immediate monthly savings. As expected, a significant majority agree that they will definitely install a SWH if their monthly savings are greater than their expenses (85%). This supports the literature from the US PV market where they offer guaranteed reduced electricity expenses from installing residential PV. 81 % state that they would definitely install SWHs if their electricity bill doubled, highlighting the link between increasing electricity costs as a major driver for action. However, one should examine this finding with caution, as Ravens' past research indicated that 92 % of respondents would install SWHs if they were subsidised. This has clearly not materialised in the real world and an interviewee response bias may exist.

Question 8, '*If my monthly payments for a SWH are less than I am saving from electricity, then I would definitely install a SWH*' is both a driver and indicator of likelihood. It indicates that '*if monthly payments are less than savings*' then this becomes a big driver to install a SWH under the MPS, and thereby implies a higher likelihood of adoption.

4.4.3.6. Conclusion

In this study, there are three significant drivers for undertaking SWH installation. Pursuit of cost savings (60 %), reducing upfront costs (45 %) and rising electricity costs (37 %). Cost savings and elimination of upfront costs are relevant both under MPS and non-MPS conditions. Under MPS conditions, the key driver for installation is elimination of upfront costs (45 %). An overwhelming majority of 85 % of respondents agree that they would definitely install a SWH if the monthly costs were less than the subsequent electricity savings. These findings suggest that there could be significant demand for SWHs if the CCT and SWH industry can get their business case together to ensure that monthly savings exceed costs. A future recommendation would be to include a ranking question: *"How motivated/driven are you to install an SWH on a scale of 1 – 10?"*

4.4.4. Barriers

4.4.4.1. Introduction

Two barrier questions were asked under the non-MPS conditions. One was an open-ended question and the second sought to prioritise the most significant barriers to adoption.

4.4.4.2. Key Findings

- **The main barrier cited is the high SWH upfront expense (40 %) which is consistent with past literature (Eskom IDM, 2012).**
- **No pressing need to install a SWH (25%) is cited as the second highest barrier, suggesting a lack of incentives, penalties or a value proposition to install a SWH.**

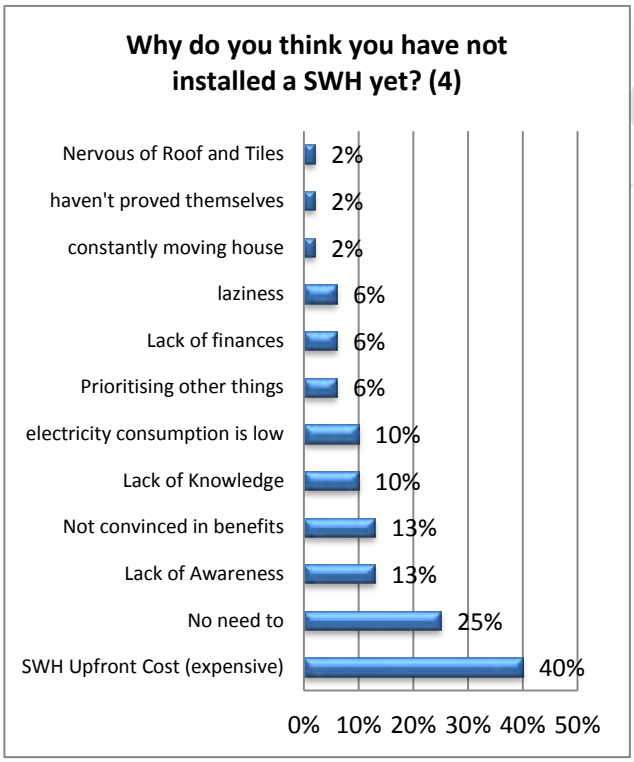


FIGURE 28 RESEARCH QUESTIONNAIRE: REASON FOR NOT INSTALLING A SWH

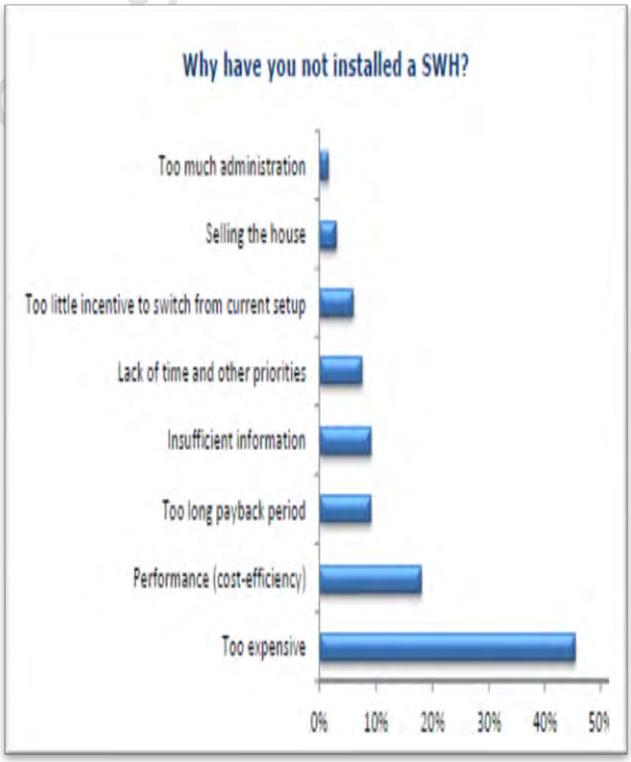


FIGURE 29: ESKOM IDM QUESTIONNAIRE: REASONS FOR NOT INSTALLING A SWH

4.4.4.3. Summary

Comparing barriers of adoption between this questionnaire and the Eskom IDM research (2012) reveals a consistency that the key adoption barrier for both is the SWH expense. This study reveals that 40 % believe that upfront expenses are their key reason for not installing a SWH compared with 45 % in Eskom's study. A significant difference between the two research papers is that in this study '*no need to*' is the second highest (25 %) stated reason for non-installation whereas for Eskom's paper it is one the lowest stated reasons at 10 %. Other barriers cited as significant obstacles for adoption are the lack of awareness, not being convinced of benefits and lack of product knowledge.

When asked to prioritise their primary barrier, many respondents stated there were no priority barriers for adoption, and simply answered 'no' as indicated in the table below. However, as somewhat expected, 'Affordability' (finances) ranked as the highest priority barrier, followed by a wide range of other factors indicated below.

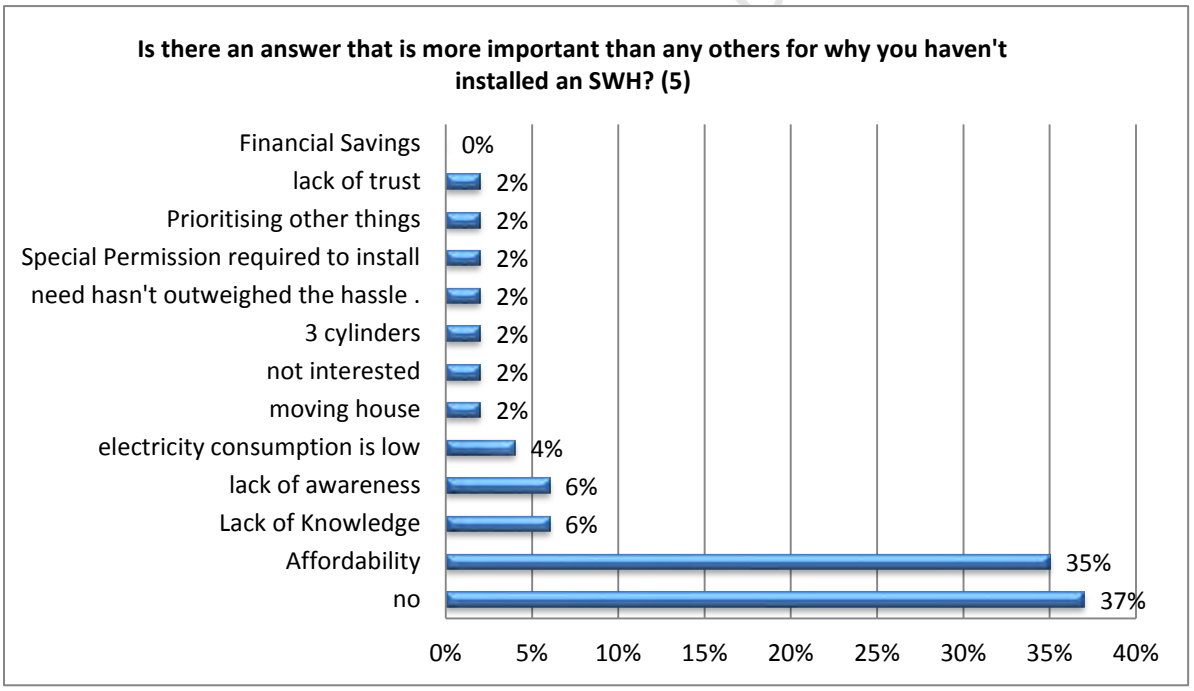


FIGURE 30: PRIMARY REASONS FOR NOT INSTALLING A SWH

4.4.5. Likelihood

4.4.5.1. Introduction

Nine likelihood questions were asked in order to bring some real world practicality to the survey. An important agenda for this questionnaire was to help inform the CCT whether the MPS did indeed improve the likelihood for adoption. Although this sample is non-representative, it was deemed as a worthwhile exercise in preparation for a more robust and comprehensive survey in late Q2 of 2013. The pilot's aim was not only to ascertain households' AADL under both non-MPS and MPS conditions, but to provide the opportunity to perform a live test on specific questions. Other items tested through the pilot were the question types, structure of the questionnaire, process for data capturing responses and the methodology used for sampling. Likelihood was tested under both the subsidy and monthly payment scheme. A 1 to 10 ranking scale was used to ascertain if, and by how much, the MPS improves likelihood of adoption. There were five qualitative questions and four quantitative questions related to likelihood.

4.4.5.2. Key Findings:

- **Under MPS conditions, a significant 94 % stated they were more likely to install a SWH and 62 % stated they would install a SWH in the next 12 months. This is a dramatic improvement.**
- **Under non MPS conditions (subsidy scheme), 39 % stated they would purchase a SWH in near term (within 3 years).**

When asked Question 1, '*Do you want a SWH?,'* 83 % responded 'yes' and a follow up question "*Would you ever get an SWH?"* demonstrated that 77 % would get a SWH. The difference between Questions 1 and 2 is that Question 2 requires commitment from the interviewee that they will get a SWH. The drop of 6 % from 83 % to 77 % is rather negligible. It would be interesting to investigate in the future whether this verbal expression of intent translates to a purchasing action.

4.4.5.3. Direct Questions

Subsidy Scheme

A direct question, Question 13, '*On a scale of 1 – 10, how likely are you to purchase a SWH in the near term?',* reveals that 39 % are likely (greater than 5 out of 10) to purchase a SWH in the near term (next 3

years). 61 % rate themselves below 5 in likelihood of purchasing a SWH, suggesting a lack of incentive, penalty or value proposition to switch to a SWH.

Under MPS Conditions

A significant 94 % of respondents stated they would be more likely to install a SWH under the MPS. However, when asked to rate their likelihood on a scale of 1 – 10 to install a SWH within the next 12 months, commitment levels dropped significantly. 62 % respondents rated themselves as having an above average likelihood of installing a SWH in the next 12 months (greater than 5 average likelihood) and 38 % had a less than average likelihood of installing a SWH (lower than 5 average likelihood).

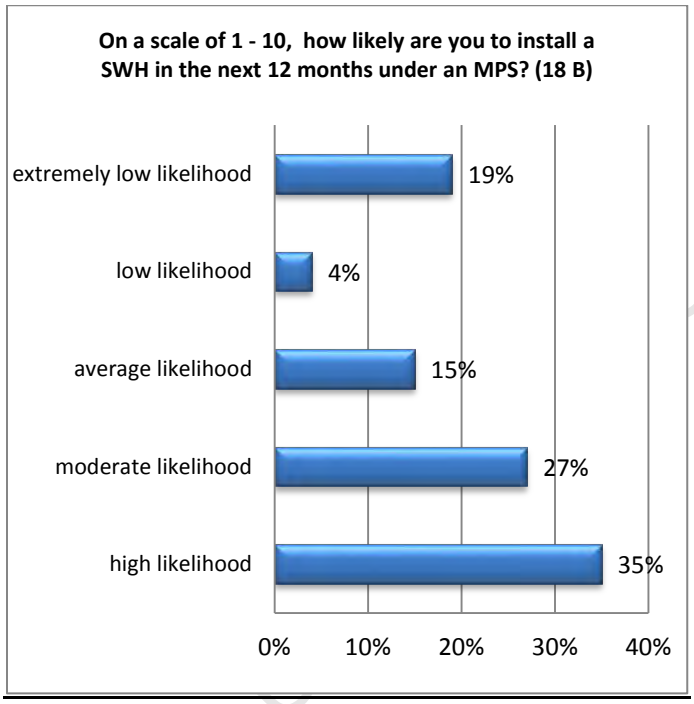


FIGURE 31: LIKELIHOOD LEVELS ON A SCALE OF 1 – 10

4.4.5.4. Section 4 Quantitative Questions

TABLE 8: CLOSED ENDED QUANTITATIVE QUESTIONS

		Strongly Agree/ Agree	Undecided	Strongly Disagree/ Disagree
7	The monthly payment scheme is just not enough to make me purchase a SWH (14)	27%	15%	58%
8	Installing a SWH makes perfect sense under the MPS (22)	67%	23%	10%
9	Installers of SWHs are trustworthy and capable (30)	17%	73%	10%

Question 14, '*The monthly payment scheme is just not enough to make me purchase a SWH,'* reveals about a 60:40 split between likely adoption and non adoption due to the MPS. It was hoped that there would be higher disagreement on this statement, however many interviewees expressed that there was still too much uncertainty regarding the programme (costs, finer details, quicker pay-off, guarantees etc) for them to be explicitly in favour of the MPS initiative.

Question 22, '*Installing a SWH makes perfect sense under the MPS,'* was a follow up question to test consistency of the likelihood of adoption due to MPS. 67 % stated they thought that installing a SWH under MPS made perfect sense, illustrating consistency with Question 14. This reveals that approximately 60 % of this sample felt that the MPS made sense and is consistent with the qualitative question finding that 62 % are likely to install a SWH under the MPS in 12 months.

The final questions of whether SWH installers are trustworthy and capable attempt to identify market perception of installer creditability. 73 % are undecided suggesting most consumers do not have a firm opinion on installer's credibility. This must be improved in order to increase the likelihood of adoption under the CCT MPS.

4.4.5.5. Conclusion

Non MPS conditions: Ravens' papers found a 92 % likelihood of installing a SWH with subsidies and Adams found an 80 % likelihood with a R5000 tax rebate incentive. This paper identified a 39 % likelihood of installation under a Non MPS conditions / subsidy scheme (within 3 years) which is a considerable difference. It is not possible to determine why there is such a variance in likelihood under a subsidy scheme, since both samples are not representative and thus it is difficult to make any sort of meaningful comparative inference. This demonstrates the importance of employing a larger representative sample such that subsequent research can be adequately compared against existing research findings. Nonetheless, it appears there is a low likelihood that Cape Tonians will install SWHs under prevailing conditions.

MPS conditions: Under MPS conditions, the likelihood of adoption increased to 62 % from 39 % under non-MPS conditions. This suggests that when informed about the MPS proposition, respondents are positively influenced towards SWH adoption. As indicated in the "Driver Section," the main value proposition from the MPS is the elimination of upfront costs. Together with the other benefits (monthly payback, pay via electricity savings, financial savings), elimination of upfront costs is driving higher likelihood of installation under MPS conditions (See Appendix R for summary response data).

CHAPTER 5 DISCUSSIONS

5.1. Key findings

The key research question of this paper is '*How does the MPS mechanism influence consumer behaviour and their likelihood of adopting SWH technologies in the CCT?*' This section explores the research question by reviewing four key concepts, consumer attitudes, awareness, drivers and likelihood, under both MPS and non-MPS conditions. It discovered that a MPS improves the likelihood of adoption from 77% to 94 % mainly due to the fact that the scheme overcomes the barriers of high upfront costs and affordability through its monthly payment offering (Appendix S for qualitative responses from interviewers).

5.2. Attitude Discussion

Attitudes: *What do consumers think of SWHs?*

"I think it's fantastic, if more people could use it, it would be better for everyone."

"I think it is a very good thing,
just think it is out of the reach, financially, for the average person."

Adams (2011) provides a comparison between early adopters and early majority for technology adoption. He finds that the early adopters are essentially change agents that are willing to overcome the bugs and glitches of new technologies whereas the early majority wish to buy a fully functioning productivity improvement. In this study, the sample focused on early majority and thus for the technology to be easily adopted, the early majority should have a general positive attitude towards the functional attributes of SWHs.

For the most part, the questionnaire respondents had a positive opinion towards SWHs. Approximately 80 % of the respondents in this study have positive attitudes towards SWHs and approximately 95 % are positive about the future of SWHs in South Africa. However, the product knowledge of Cape Town's consumers is quite low given that 60 % were unsure whether SWHs provide hot water in the night or on

cloudy days. Only 40 % were confident that SWHs supplied hot water under the afore-mentioned conditions. This finding indicates a severe lack of knowledge to make an informed purchasing decision. Adams (2011) asserted that the early majority wish to buy a fully functional product and do not wish to debug glitches. They desire a product that works properly and seek evolution and not revolution. Kaplan (1999) states that adoption of renewable energy is not simple and often requires extensive research by consumers. This underscores the importance of customer education and awareness programmes which are described in further detail in the 'Awareness' section. These low levels of product knowledge need to be overcome.

5.2.1. Attitudes under non-MPS Conditions

Besides doubts about the efficacy of SWHs, consumers have also raised concerns about the affordability of SWH systems under non-MPS conditions. This is reflected in the following comment from a questionnaire respondent: "I *think it [a SWH] is a very good thing, just think it is out of the reach, financially, for the average person."* The most common reason for non-adoption of SWHs, as stated by questionnaire respondents (40%), was high upfront costs (Question 4). By and large, questionnaire respondents believed that SWHs did not make financial sense. The questionnaire investigated whether introducing a MPS would change consumer attitudes about the financial viability of SWH installation.

5.2.2. Attitudes under MPS Conditions

Respondents' attitudes towards the perceived value or financial viability of SWHs improved under a MPS condition. The effect of a MPS on consumer perceptions of SWH is demonstrated by the responses to Question 10, *"Installing a SWH under a monthly payment scheme is value for money."* 67 % believe that SWHs are value for money compared with Adams' findings of 54 % under non-MPS conditions. Furthermore, Question 13: *"Outside of the MPS, would you consider a SWH expensive?"* reveals that only 27 % consider SWHs not expensive (i.e. 'value for money') compared with the 67 % under MPS conditions. These relative comparisons suggest an improved attitude toward SWHs under MPS conditions.

Non-MPS Condition*: "It is just not cost effective and the payback period is too long."*

MPS Condition: *"The only reason I haven't done it is the upfront costs and I can now justify it [the purchase]."*

The responses from the questionnaire appear to be aligned with the empirical case literature from the US Solar PV market (Himmelman, 2012; SEIA, 2012) and Tunisian SWH programme (Trabacchi et al, 2012; Touhami and Hannane, 2011) in that consumers have a more favourable attitude towards SWHs under a MPS condition. This is especially true with regards to overcoming the barriers of upfront costs and affordability.

5.3. Awareness Discussion

Awareness levels: How aware are consumers of SWHs?

"I am not very aware - haven't seen any advertising or promotions. I would have to Google."

"I know it is out there and I know it exists but I haven't put it to the test."

Awareness levels were tested only under non-MPS conditions as conducting the actual questionnaire was a form of creating awareness about the CCT's MPS. The consumer awareness levels in this study are compared to the awareness levels in the research of Adams, Ravens and Eskom IDM, which also took place under non-MPS conditions.

This study found that awareness levels were exceptionally low with 70 % of respondents stating *low awareness* or *I don't know anything* when asked *'How would you describe (in words) your general levels of awareness of current SWHs products?'* Furthermore, approximately 65 percent rated themselves less than 5 /10 on an awareness ranking scale. Knowledge and awareness about the product are interrelated and Adams (2011: 78) states that consumers need to feel empowered about product knowledge, overall performance, methods of operations, environmental benefits and energy savings before committing to a purchase. In this sample, low levels of awareness are connected to low motivational drivers to install SWHs, since the large majority remain uncertain about the actual financial savings and environmental benefits. This is illustrated by an interviewee response on what would really induce them to install a SWH: *"What is my guaranteed saving when I go and do it? No one can tell how much I am going to save. They say you can save 40 % of your electricity but are you really saving it?"* It has been discovered that under both non-MPS and MPS conditions, many respondents answered they required more information before making a purchasing decision. A critique for the quantitative section is that many could not answer certain questions due to a lack of awareness and product knowledge. This

is illustrated by the following comment: *"Need more facts and figures - in the end it is all about facts and figures."* For Question 4, "*Why do you think you have not installed SWH yet?",* lack of awareness and knowledge comprise 23 % of responses (3rd highest). Adams cites Kaplan (1999) saying that the adoption of new renewable energy systems requires increased marketing and customer education programmes to incentivise and improve the customer decision-making process.

Improved education programmes are clearly required as in this sample, 70% are unaware of the difference between PV and SWHs, 40 % are unsure if SWHs have electrical backup systems and 60 % are unsure if you get hot water in the night or in cloudy conditions from a SWH system. Improved awareness campaigns should also be initiated since only 65 % were aware of Eskom's rebate scheme (compared with 84 % from Eskom's study) and only 13 % were aware of the CCT's planned MPS.

Given the low awareness and product knowledge, a recommendation would be for the CCT's campaign to initiate a strong marketing and communications campaign to promote the MPS scheme to Cape Tonians. Here are a few customer comments in response to *'How would you describe your general levels of awareness of current SWH products?':*

"Not too sure, never explored it properly."

"Don't know ….. since very few friends have it so [I have] limited experience."

5.4. Drivers Discussion

Drivers: *Why will consumers install SWHs?*

"What is my guaranteed saving when I go and do it? No one can tell how much I am going to save. They say you can save 40 % of your electricity but are you really saving it?"

"I would want some help on the whole issue ……. we have a quagmire of information to navigate through."

5.4.1. Non- MPS Conditions

As illustrated by this paper's findings, the primary driver for installing a SWH is cost savings (60%) with the key lever being the threat of rising electricity prices (40%). This corresponds to the literature cited in Adams' paper by Luque (2001) which states that solar energy will not become competitive without rises in electricity prices and cheaper solar systems. Luque's (2001) assertions are directly evident in the

responses to Question 8: *'What would really induce you to install a SWH in the future?'* The two biggest factors cited are increasing electricity costs (37 %) or cheaper SWH prices (21 %). Question 33 illustrates that rising electricity prices are a major driver with 81 % of respondents stating that they would definitely install a SWH if their electricity bill doubles in four years' time. Chapman (1998) demonstrates that purchasing a SWH system under non-MPS conditions generally results in immediate negative impacts due to the high upfront costs and lengthy payback period. Typical consumers discount the long term positive outcomes and focus on the negative consequence of the high upfront cost, often resulting in delaying or devaluing a purchase. Most consumers focus on the attainment of immediate positive impacts and postpone the negative impact of a capital cost outlay. Conversely, the biggest barrier cited by responses to Question *4, "Why do you think you have not installed a SWH yet?",* is 'upfront costs' (40%). This demonstrates the interrelationship between drivers, since cheaper SWH unit costs reduce the barrier of high upfront costs.

5.4.2. MPS Conditions

Chapman's (1998) description illustrates typical consumer behaviour under non-MPS conditions. Often under MPS conditions, the negative consequences of a cash outflow can be mitigated or eliminated completely, if the monthly electricity savings match or exceed the monthly expenses. Eskom IDM (2012: 4) stresses that any measure that can remove the key obstacles of high upfront cost, cost efficiency (savings greater than costs) and long payback periods will drive consumer purchases. Trabacchi et al (2012:22) state that one of their key successes in the Tunisia SWH case was overcoming the hurdle of high upfront costs via a MPS. The programme was structured such that the electricity bill savings matched or exceeded the monthly instalments. CCT (2013) states that they intend to structure their programme so that immediate monthly savings exceed or match the monthly instalment payments. This should overcome the barrier of affordability and the negative consequences of the immediate, high upfront cash outflow. The achievement of this is crucial to the success of the programme as illustrated by Question 32 which reveals that 85 % of respondents would definitely install a SWH if monthly payments for the system are less than electricity savings. Another complexity is the interconnection between all the four components of AADL. In this case, a driver for installation is the elimination of upfront costs and matching of monthly savings with expenses. This in turn improves the likelihood of installation. In one respect, it could be inferred that 85 % of respondents would install SWHs if savings

matched or exceed monthly costs and thus a key driver for installation is the matching of electricity savings with costs.

The CCT has two main levers for driving demand. The first is raising electricity prices and the second is matching monthly expense with savings to ensure affordability. Using either or both of these levers will drive consumer uptake of SWH. The following comment from an interviewee supports this assertion: *"[What would motivate me to install a SWH] is certainly continued increasing electricity prices, lower initial costs and perhaps less complicated ways of buying."*

5.5. Likelihood Discussion

Likelihood: *How likely are consumers to install a SWH?*

"I think I will install….. but people don't always give you the same answers .You hear so many different things…"

"Yes I will install one but it depends on price, [be]cause you know it's expensive - quite a lot of outlay."

5.5.1. Non-MPS Conditions

This study found that under non-MPS conditions, 77 % stated they would want to get a SWH in the future but only 39 % of respondents stated they would purchase a SWH in the next 3 years. Previous papers have predicted the likelihood of SWH installations in South Africa under non MPS conditions. Eskom IDM (2012) discovered that 90 % of respondents stated '*possibly or yes*' to considering installing SWHs in the future. This compared with 92 % in Ravens and 80% in Adams's paper. However, these large likelihood numbers have not translated to installations in reality. This leaves room for scrutiny and doubt over interviewee response bias. Criticism of the investigation of likelihood in previous papers is that their questions were not time bound and thus provided the respondent an easy opportunity to state that they would install a SWH without having to commit to the purchase. This is illustrated by the positive but non committal responses by respondents such as "*I think I will install*" and "*Yes, I will install one but it depends on price, [be]cause you know it's expensive.*"

5.5.2. MPS Conditions

As demonstrated in the literature review, a MPS (or TPF scheme) can increase demand for SWHs by removing the barriers of upfront costs and making the purchase more affordable through access to credit (Touhami and Hannane, 2011:10). This appears to be illustrated in the results since likelihood for installation increased from 39 % under non-MPS conditions to 62 % under MPS conditions. Data from Question 20, *'What from the offer now motivates you to install a SWH?',* reveals that no upfront costs and monthly payback are the two highest ranked answers. Trabacchi et al (2012:9) state that a critical measure that helped SWHs to be successful in Tunisia's Prosol rollout was the offering of direct benefits to the consumer (householder), namely in the form of lower upfront costs and improved profitability and payback of the SWH. This finding is confirmed in the findings of Question *32: 'If my monthly payments for an SWH are less than my electricity savings, then I would definitely install an SWH.'* 85 % of the sample agreed with this statement whereas only 46 % of respondents would consider installing an SWH if their payments were greater than their monthly payments.

In this study, the likelihood of installations improved from 39 % in non MPS conditions to 62 % under MPS conditions. The biggest barrier to adoption, as illustrated in this study, is the high upfront costs of SWHs (40 %). In this case, the MPS is effective at addressing this barrier (upfront costs and affordability) via monthly payback. Trabacchi et al (2012:9) state that their MPS campaign was successful due to it overcoming upfront costs and making units more affordable through access to credit. This is nicely illustrated by a quote from one of the respondents:" *What motivates me is the fact that there are no upfront costs, and it is not going to cost me more than what it is now costing me to heat water."*

Conclusion: Adams, Ravens and Eskom find a 90 % likelihood of installation versus 77 % in this study, for a non time-bound commitment under non MPS conditions. However under the MPS, 62 % of respondents state they would install a SWH in the next 12 months. Furthermore, the likelihood of installation improved from 39% under non-MPS conditions to 62% under MPS conditions. Given the relative improvement (39 – 62 %), the overcoming of key barriers (upfront costs and affordability), and the demonstrated success of the Tunisia Prosol case, this study concludes that consumers in this sample are receptive to the new MPS.

The remarks of respondents below reveal their motivations and indicate some level of likelihood to install a SWH under MPS conditions.

"Sounds very easy - not going to cost you more than you currently pay so why wouldn't you do it?"

"You actually have a saving and you purchase from the saving."

5.6. Shortcomings of the questionnaire

The questionnaire ascertained a degree of awareness, general attitudes and likelihood of adopting SWHs; however, it did not obtain quantifiable measures for drivers. Neither a direct nor indirect question about the degree of motivation (driver) to install a SWH was asked. This can be inferred, somewhat, from the ranking question (1 – 10) on the likelihood of installation. However, likelihood and drivers are not directly comparable. In future, a direct ranking question should be asked to understand exactly how motivated/driven respondents are to install a SWH. The question could read: *'On a scale of 1-10, how motivated are you to install a SWH?'*

The paper did not identify what information participants would like to know the most about SWHs. This could assist in identifying consumer needs and revealing the gaps in knowledge and awareness levels. Although this can be inferred by certain questions such as the biggest disadvantages/advantages, in future, a question such as "*What information would you like to find out most about SWHs?"* should be asked.

Although the key research question of the likelihood of installation under MPS is directly asked, the degree of confidence regarding actual installation is questionable. A future recommendation would be to take the respondents' contact details and perform a follow up questionnaire in 12, 18 or 24 months to test if respondents have actually installed a SWH. This would be valuable in assessing the conversion rate from those that state they have a high likelihood of installing a SWH to those that actually go through with the installation.

5.7. Research Limitations and Proposed Recommendations

The key limitation of this questionnaire is that the sample is not representative of the population. Given infinite resources, 384 people should have been interviewed to obtain a representative sample. Furthermore, a non-biased sampling should be performed to ensure an even distribution of respondents

according to geography and income group (LSM 6 – 10). If deemed value-adding, further sampling distribution could be performed via other segmentation categories such as age, education, gender, etc.

The sample by judgement and self selection can further skew the final results; however due to time and cost constraints, a trade-off was made between a more randomised sample versus efficient sample gathering. A rigorous statistical analysis was therefore not performed as the sample was unrepresentative (in terms of size and sampling methodology). Although half the questions were qualitative questions, a future recommendation would be to utilise a statistical package to analyse and interpret the data. This would provide more statistically relevant data results and probably be more time efficient than using Excel to compute the data. Future studies (that have greater scope and resources) could perform a more in-depth study on understanding consumer behaviour (motivators and risks), especially towards different contractual approaches in the contracting process (i.e. longer term contracts versus shorter term contract and the associated higher or lower monthly payments).

It is difficult to draw statistically rigorous comparisons between previous SWH studies by Ravens, Adams and Eskom due to inconsistencies in sample sizes, data sampling techniques and variations in how questions were asked. A future recommendation would be to align the sampling and questions directly with a previous study to ensure better comparability.

Another recommendation would be to iterate and improve this questionnaire such that it can be distributed to a wider audience. First, the number of questions and total time taken should be reduced. Currently, the questionnaire consists of 86 questions and takes on average 35 minutes to complete. This is typically too long for most interviewees and the author's experience is that most respondents felt that it was too long. A trade-off between asking critical questions as opposed to a gamut of different questions will need to be performed for follow-up research. The CCT has utilised this questionnaire as a framework for a CCT questionnaire, which consists of approximately 20 questions and takes on average 17 minutes to complete. This seems a more acceptable amount of time for a random respondent to answer a questionnaire. A final recommendation would be to perform a similar questionnaire which tests consumer AADL toward Solar PV. Since residential Solar PV is growing in the US and EU markets, it is foreseeable that this growth could expand to South Africa, especially due to the increasing electricity tariffs and high solar irradiance conditions.

5.8. Main Contribution

The main contribution of this paper is bridging the research gap between SWH consumer research under non-MPS and MPS conditions. Previous South African SWH consumer studies (Ravens, Adams and Eskom IDM) were performed only under non-MPS conditions, leaving consumer AADL un-reviewed and untested under MPS conditions. The contribution of this study is that it specifically aims to examine consumer responses towards a MPS in terms of attitudes, drivers and likelihood of SWH adoption. It then compares its findings with prior empirical studies by Ravens, Adams and Eskom IDM, its own empirical non-MPS findings and other SWH literature.

This study makes comparisons between attitudes, drivers and likelihood of SWH adoption under non-MPS and MPS conditions. The report concludes that the MPS incentive mechanism positively impacts SWH adoption because it overcomes the key adoption barrier of upfront costs. By addressing upfront costs, a MPS improves likelihood of adoption from 77 % under non-MPS conditions to 94 % under MPS conditions, with a significant 62 % of respondents stating they would install a SWH in the next 12 months under the CCT's MPS scheme. Comparability with Ravens, Adams and Eskom IDM were difficult due to the differences in how the questions on likelihood were phrased. The previous studies did not make their questions time-bound. They asked more general, future oriented questions with no commitment date to install a SWH. This did not provide much ability for interpretation, as the respondent lacked a commitment date and could not be properly compared with the 1 and 3 year time periods from this study (see Questions. Several other attitudes and drivers were tested under MPS and non-MPS conditions, revealing that respondents believed SWHs had better value for money under a MPS (67 % versus 54 %).

The investigation of attitudes, drivers and likelihood under a MPS had not been performed in a South African context. This adds to the body of knowledge, both theoretically and practically, especially since the CCT aims to implement the MPS by Quarter 3, 2013. Further contributions include a more quantitative and precise measurement of consumer attitudes, awareness and likelihood of SWH adoption under non-MPS conditions. Forced ranking questions of 1 – 10 and open ended qualitative questions were asked to help capture a broader range of responses from consumers. Adams, Ravens and Eskom had incorporated more closed ended questions. Half of this questionnaire consisted of open ended questions, providing the opportunity to capture a much broader range of responses.

CHAPTER 6 CONCLUSION

This research question for this paper is '*How does the Monthly Payment Scheme (MPS) influence consumer behaviour and their likelihood of adopting Solar Water Heater (SWH) technologies in the City of Cape Town (CCT)?*' This thesis finds that the Monthly Payment Scheme improves the likelihood of SWH adoption because it overcomes the primary barriers of high upfront costs and affordability. A MPS removes the initial upfront costs and matches electricity savings with monthly expenses, thereby making SWH installations more financially viable. Case literature from the US Solar PV and Tunisia SWH sector demonstrate that MPSs have been successful when implemented into these markets. MPSs[37]are relatively new for the solar sector, even though they have been in existence in other industries for decades. This study investigated consumer behaviour under a MPS and discovered that the likelihood of installing a SWH unit in the short term increases by 23 % (from 39 % to 62 %) compared to non-MPS conditions. The study determined that 94 % of respondents are likely to install a SWH due to a MPS and 62 % state they will install a SWH within the first 12 months of the scheme.

Investigating consumer behaviour, i.e. attitudes, awareness and drivers, under a MPS reveals that 60% of questionnaire respondents state that cost savings are their biggest **driver** for installing SWHs and 40 % list the threat of ever-rising electricity costs as their reason for switching to solar energy. 90 % of respondents state that cost savings is the primary purpose for installing a SWH unit. This research revealed that 83 % people do want SWHs but lack a driver (a real need or conviction) to change from their existing setup. Environmental drivers are not a strong motivator for people to switch to SWHs

Awareness levels are significantly low (70%) although **attitudes** are largely positive towards SWHs and their future (approximately 90 %). Consumer attitudes towards the CCT's MPS were largely positive; however, some people remained sceptical about whether the scheme would be properly implemented. Consumers were also sceptical about actual cost savings and product performance.

The main **barrier** to adoption of SWHs is the high upfront costs (40 %), no real urgency to switch (25%), insufficient evidence demonstrating cost savings (13 %) and a lack of product knowledge and awareness (13%). A MPS can assist in stimulating demand by overcoming upfront costs and improving

[37] MPSs are also known as 'Leasing Schemes', 'Third Party Financing' or 'Third Party Ownership'.

affordability but other factors such as drivers (rising electricity prices/ lower priced units) and attitudes (product performance, quality of installers, trust of scheme) should also be considered.

Although not representative and is based on sample of convenience, this sample does provide a good indication that many Cape Tonians favour the MPS offering. The CCT has a target of installing SWHs in 144,000 households out of a total market of 216 000 over the next 5 years (i.e. 66% penetration rate). 62 % of respondents state they will install a SWH within the first 12 months of the MPS scheme. If this holds true, the CCT could come close to meeting its target of 144,000 households in its very first year. It should be noted that this sample is not representative, and thus a representative sample with similar likelihood questions should be asked to ascertain the actual likelihood of installation under the proposed CCT's MPS.

This study has demonstrated that a MPS is a good mechanism to drive SWH adoption in South Africa. However, simply creating a MPS is not enough to boost the household market for SWHs. Consumers need to be educated about the benefits of SWHs and about the ease and affordability that a MPS provides. The core message that needs to be communicated is that SWHs perform just as well as EWHs (40 % in this study were unsure or disagreed) and that SWHs reduce costs (90 % stated that the purpose of SWHs is to save costs), if installed under a MPS. Once consumers fully understand the value proposition of installing a SWH under a MPS, SWH uptake should increase. Methodological reflections on the study reveal the need to increase the overall sample size and improve the randomness of participant selection to ensure statistically relevant sampling and inferences.

In conclusion, the examination of consumer attitudes, awareness, drivers and likelihood of SWH adoption has revealed that the MPS improves the likelihood of installation because it overcomes the main adoption barriers of upfront cost and affordability. The successful widescale adoption of SWHs under the MPS depends on demonstrating clear cost savings to consumers, removing upfront costs and improving consumer product knowledge.

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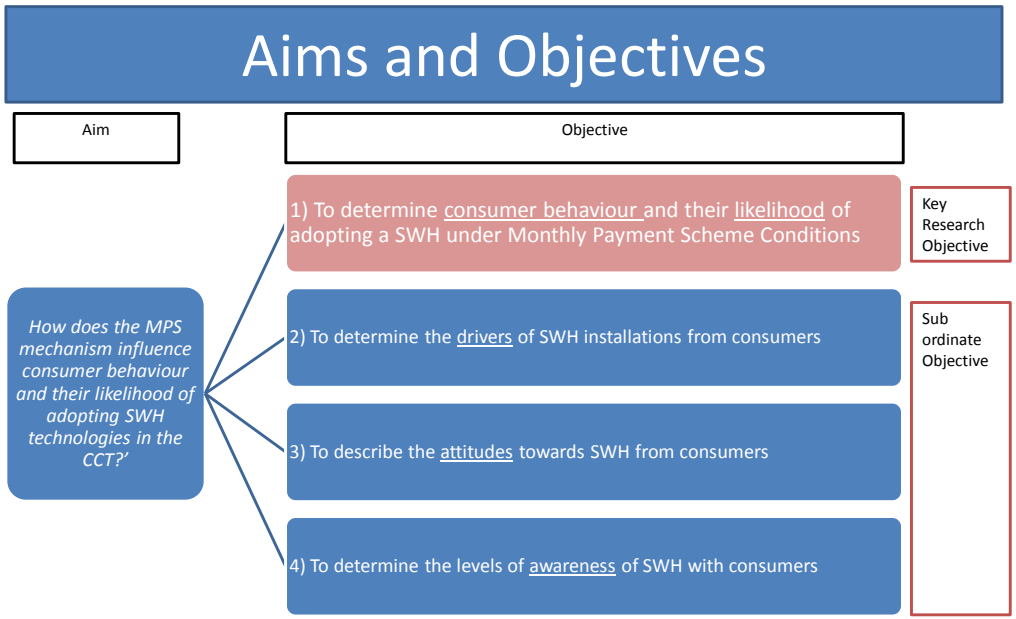
APPENDICES

Appendix A: Aims and Objectives Issue Tree Diagram (Source: Authors Diagram)



Appendix B: Eskom Tariff Price Blocks (Source: Eskom's Tariffs and Charges, 2013)

	Energy charge*[c/kwh] (incl environmental levy charge)	**Increase applied**
Block 1 [≤50 kWh]	60.83	5.5%
Block 2 [>50 - <350 kWh]	75.09	13.5%
Block 3 [>350 - <600 kWh]	111.42	16%
Block 4 [>600 kWh]	122.21	16%
* Included in the energy charge is the environmental levy charge 1 April 2012 = 2 c/kWh		
* Included in the energy charge is the environmental levy charge 1 July 2012 = 3.5 c/kWh		

Appendix C: Promotion policies for solar water heating in Europe (selected countries) (Source: ENERDATE, 2012)

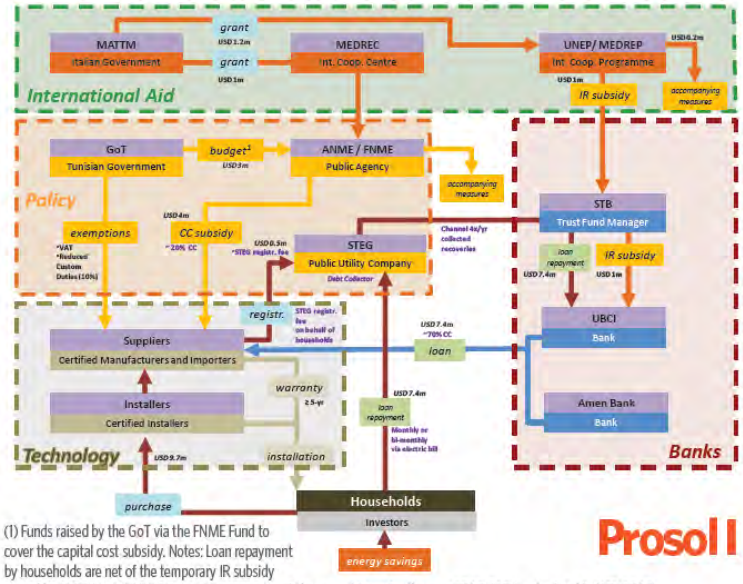
Country	Type of measures	Target	Expected CO_2 emission reduction $(ktCO2)^2$
Austria	Rebates Subsidies	169 ktoe by 2020	1,000
Cyprus	Subsidies	90 ktoe by 2020	1,000
France	Tax credit Investment grants	927 ktoe by 2020 4 million homes equipped with SWH by 2020	3,100
Germany	Preferential loans Subsidies	1,245 ktoe by 2020	4,400
Greece	Tax reductions Minimum solar contribution to the hot water supply	355 ktoe by 2020 60% of hot water needs from solar	1,100
Italy	Tax credit Subsidies	1,586 ktoe by 2020	5,000
Portugal	Subsidies Tax reductions Preferential Loans Mandatory SWH system on new buildings	160 ktoe by 2020 + 100,000 m^2/year until 2020 1 m2/occupant in new buildings	510
Spain	Minimum solar contribution to the hot water supply	644 ktoe by 2020 10 million m^2 by 2020	2,300
Source	ENERDATA, from National Renewable Energy Action Plans, International Energy Agency and REN21		

Appendix D: Promotion policies for solar water heating in the rest of the world (selected countries) (Source: ENERDATE, 2012)

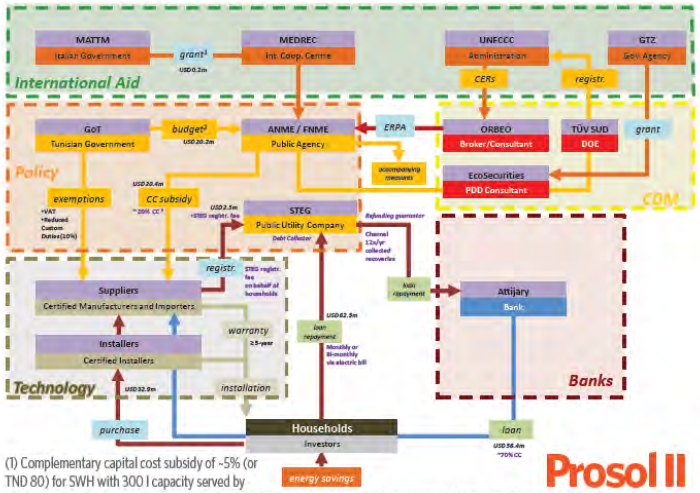
Country	Type of measures	Target	Expected CO_2 emission reduction (ktCO2) [2]
Morocco	Subsidies	1.7 million m^2 by 2020	450
Tunisia	Subsidies Preferential loans	2.5 million m^2 by 2020	670
South Africa	Tax reductions Rebates	4 million homes equipped by 2020	
Lebanon		1.05 million m^2 by 2020	290
Israel	Mandatory SWH system on new buildings		
United States	Tax credit		
Brazil	Subsidies	15 million m^2 by 2015	3,700
Mexico		1.8 million m^2 by 2012	500
India	Subsidies Investment grant	15 million m^2 by 2017 20 million m^2 by 2022	4,100 5500
China	Subsidies	300 million m^2 by 2020	54,500
Taiwan	Subsidies	6 million m^2 by 2020	1,100
South Korea	Subsidies	342 ktoe by 2020 1,882 ktoe by 2030	1,100 6,000
Australia	Renewable energy certificates Tax credits Rebates, Subsidies	12% of homes equipped with SWH by 2020	
Source	ENERDATA, from REN21 and the International Energy Agency		

Appendix E: Stakeholder relationships and business models for Prosol SWH MPS Example (Source: Trabacchi et al 2012::7)

Figure 2. Key stakeholders involved in Prosol I and Prosol II and their linkages.



(1) Funds raised by the GoT via the FNME Fund to cover the capital cost subsidy. Notes: Loan repayment by households are net of the temporary IR subsidy served by MATTM via UNEP. Financial flows represent the sum of flows for the year 2005-2006, actualized to USD 2005.



(1) Complementary capital cost subsidy of ~5% (or TND 80) for SWH with 300 l capacity served by MATTM until exhaustion of funds. (2) Funds raised by the GoT via the FNME Fund. Notes: Decree no. 362 modified the GoT capital cost subsidy, establishing a fixed amount of between USD 153 and USD 306 (200 and 400 TND) varying according to SWHs' surface area. Financial flows represent the sum of flows for the year 2007-2010, actualized to USD 2007.
Source: CPI elaboration based on various sources (see Reference section). CC = Capital Cost; IR = Interest Rate.

Appendix F: Different Business Model Structures for TPF [Source: Bloomberg New Energy Finance (Linder and Di Capua, 2012)]

Figure 10: Vertical model

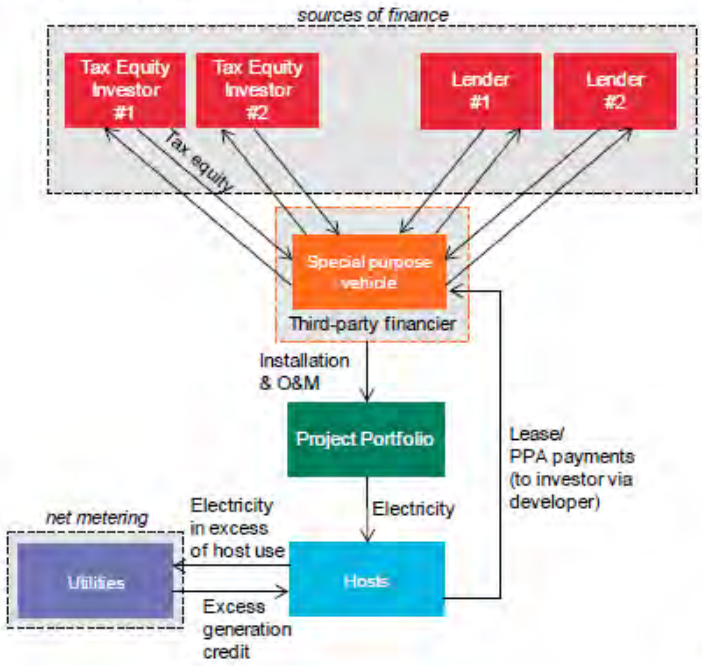
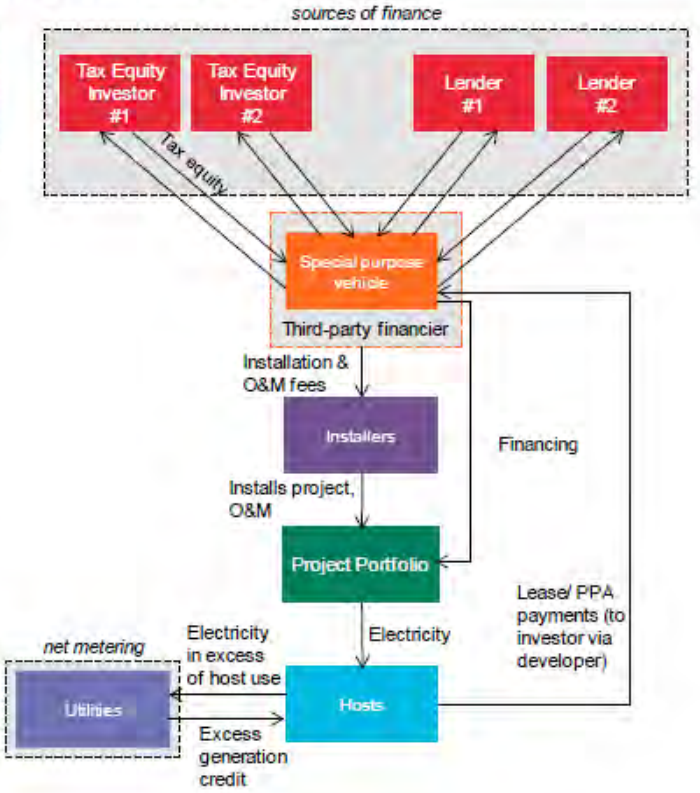
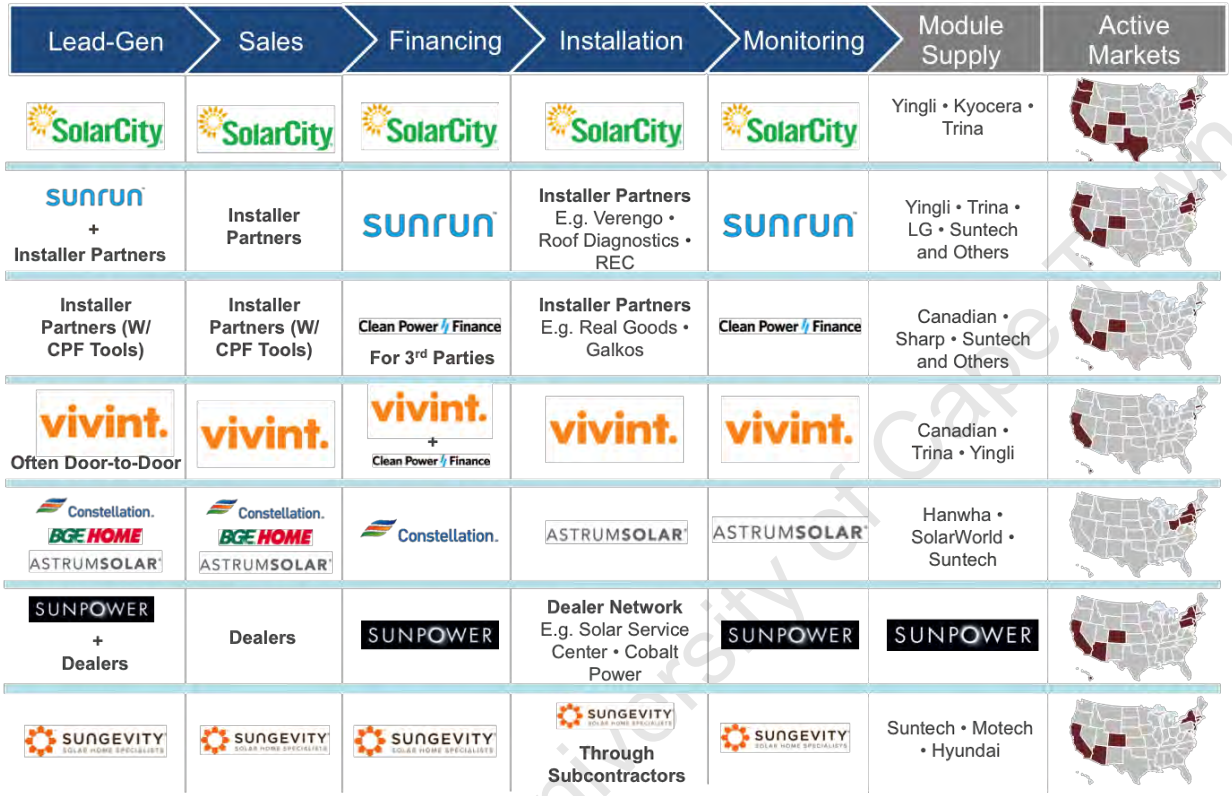


Figure 11: Semi-vertical model

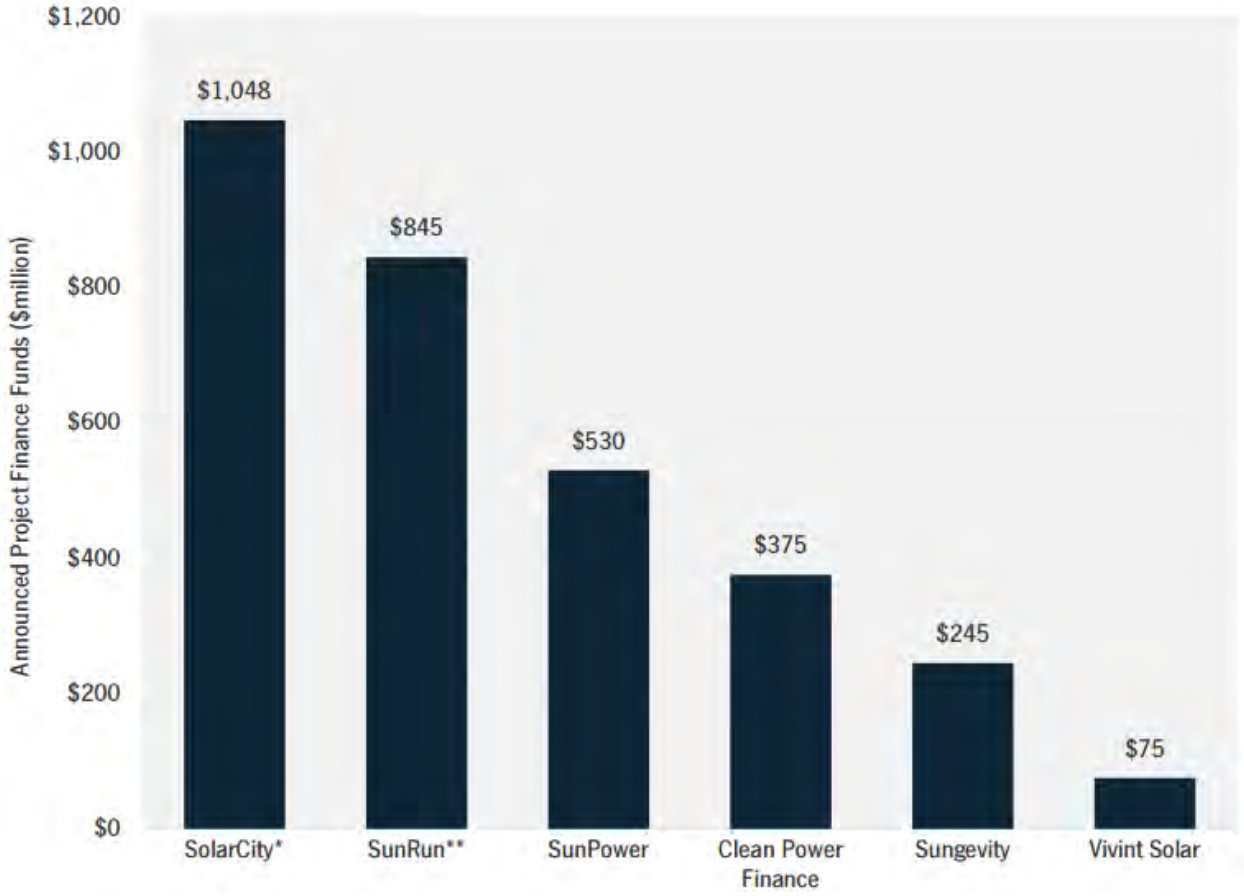


Source: Bloomberg New Energy Finance

Appendix G: GTM Research U.S. Residential Solar Finance Landscape Map (residential monthly payment schemes) (Source: Greentechmedia, 2013)



Appendix H: Announced Project Financing Raised by Residential TPO Providers (demonstrating the amount of financing being supplied in the PV industry) (Source: SEIA, 2012)



Appendix I: Other SWH Incentive Programs (Source: Trabacchi et al 2012: 57)

Appendix C - Other SWH Incentive Programs

Table 6. Examples of SWH support Programs in the MENA and Balkan Region.

Country	Mechanism	Time frame	Target audience and objectives	Financial Support Measures	Demand-side finance actors	Accompanying Measures	Financing Entity	Investment (USD mn)	Achievements
MOROCCO	PROMASOL	I 2002-2008 II 2012-	1. Institutional customers 2. Industry and private businesses 3. Residential obj. 100,000 m²	1. Agreements 2. Leasing 3. Currently under discussion within PROMASOL II (2012-onwards) **Solar Industry Accompaniment** (SIA): to covers 20% of all expenses related to the purchase and installation of the SWH **Commercial Partnership Insurance'** (CPI): to insure up to to 80% of the commercial risks incurred by the parties e.g. late payment or non-payment	• Leasing companies • FOGEER Guarantee Fund: to guarantee up to 70% of the credit granted and a bonus of 1.5% point	• Product quality certification • Installers quality certification • Awareness raising and capacity building • VAT Reduction, from 20% to 14%	Funded by: • FGEF • CDER - Center for Development of Renewable Energies • UNDP • GoM • Government of Andalusia • ONE - National Electricity Office	43.3*	• SWH Deployment: +140,000 m² (obj. reached) • Value chain: + 25 manufacturing companies • CO_2 avoided: 1.3 million tons (2002-2008)
	PROSOL Loan and Leasing Facility	2005-2008	Tertiary: Hotels -> obj.: 80	• Temporary **Interest rate subsidy**	• Local Commercial Banks • ONE collecting agent and guarantor de facto	• Product quality certification performance guarantee • CDM	• MATTM • UNEP • ONE - National Office of Electricity	12	17 hotels
EGYPT	Egysol Leasing and Loan Guarantee Mechanism	March 2010-	Tertiary: Hotels (mainly) -> obj. 100	• **Capital cost subsidy:** 25% up to 250 m² • **Maintenance cost subsidy:** USD 4/m2/year for the first 2 years of operation and USD 3/m2/year for the remaining two • **Leasing meachanism:** Target: hotels in operation and with no credit problems The facility will provide a subsidy of 15%, to reduce the total down payment (to 20%) • **Loan Guarantee Mechanism** Target: hotels with facilities under contraction and/or with financing problems Hotels can get a loan guarantee as well as partial interest rate subsidy (6% vs. 13%) for the cost of the SWH. The loan contracts would have a term of 5 years and the down payment will be negotiable.	• Local Commercial Banks	• Awareness raising and communication camparing • Capacity building • Accreditation and quality control standards for SWH suppliers (50% of certification costs borne by UNEP)	• MATTM • UNEP • NREA - New and Renewable Energy Authority of Egypt	0.5	12 hotels or 2000 m² of solar collectors
MONTENEGRO	Montesol	2011-	Residential: Households -> obj. 3,500 to 4,000 m²	• **Interest rate subsidy** Concessional line of credit to be paid out to the bank in monthly interest-free annuities over 3, 5 or 7 years duration	• 2 Local banks: NL Bank and HypoAlpeAdria Bank	• Awareness raising and communication campaigns • Capacity building • Accreditation of suppliers • Warranty period of at least 5 year • CDM	• MATTM • UNEP • GoMo - Ministry of the Economy of Montenegro	1	several households (?)
MACEDONIA	MACESOL Still in assessment phase	2011-	na	Under development in partnership with local stakeholders	na	• Awareness raising and communication campaigns • Capacity building	• MATTM • UNEP • GoMa	na	na

Source: CPI elaboration based on various sources (see Reference section).

Appendix J: Role of City of Cape Town Post City Infrastructure model. (Source: CCT Roll Out Campaign, 2013:3)

THE PROPOSED NEW PROCESS – A CITY OPEN ENDORSEMENT SCHEME

1. It is contended that the SCM Regulations are applicable to processes involving PROCUREMENT and are COMPETITIVE for the awarding of a "prize." So the key to moving outside the SCM regulatory constraints is NOT to involve the procuring of assets, consumable goods or services or by granting a concession involving Council-owned assets or service obligations along with holding a competitive selection process.
2. It is considered that an ENDORSEMENT SCHEME that sets reasonable criteria for **awarding City Council endorsed status** would avoid the use of a competitive process as all who apply must simply meet the criteria in order to achieve the "**prize**. As a checklist it should be noted that:
   - The City is not PROCURING anything for its own use but is FACILITATING and ENABLING a project that it considers to be for the public good in line with the project's objectives and the Council's own stated strategic principles (the Five Pillars)
   - The City will **not be RECEIVING** revenue from the endorsed service providers nor will it be PAYING them to participate in the project
   - Any expenditure incurred by the City would be in performing its **SUPPORT ROLE** and will be subject to the normal municipal budgetary processes
   - Any **COSTS** incurred by the City in directly assisting individual service providers will be **recovered** through the charging of an administration fee
   - The scheme will **not** involve the City bearing any **FINANCIAL RISK**
   - In short, the best aspects of the original concept can be retained but the process is simplified

Appendix K: Questionnaire: City of Cape Town's Monthly Payment Scheme for Solar Water Heating

Solar Water Heater Questionnaire

Description

The aim of the survey is to perform a consumer assessment on Cape Town householder's general attitudes and opinions towards solar water heaters. The survey consists of open ended and closed ended questions and should take 30 minutes to complete. I am collaborating with The City of Cape Town who are investigating new policy measures to better promote solar water heaters. My aim via this questionnaire is to find out what you really think about Solar Water Heaters.

I am a master's student at the Energy Research Centre, University of Cape Town and am completing my dissertation in Energy and Development Studies. This research project and questionnaire is a requirement for the successful completion of the programme. The point of the questionnaire is to get your honest opinion and to test your levels of awareness, knowledge and attitudes towards SWH product. There is no right or wrong answer and I am just finding out your thoughts on SWH.

All information is kept strictly confidential and all data will be kept anonymous.

Any Questions?

This questionnaire is divided into 4 sections:

1) Introduction and knowledge of SHW systems

2) General Attitude and Awareness

3) Personal Details - who you are

4) MCQ - closed ended questions finding out your general attitudes, awareness of SWHs

The first part of the survey is open ended questions. For this reason, I plan to record and capture your answers as we speak, is that okay with you.

Part 1 Introduction and knowledge of SHW systems

A	*Interview Conduct by telephone or person*	*1) Telephone* *2) Person*
1	Are you currently using an operational SWH system?	Yes/No
2	Are you a homeowner or renter?	Homeowner / renter
3	What type of property do you live in?	1) freehold 2) apartment 3) townhouse 4) other - if so explain
4	Does your house have access to roof space for easy SWH installation	Open Ended Question Possible Answer Categories: a) Yes b) No c) Maybe
5	Approximately how many R/month do you typically spend on electricity, on average?	1) Expense < R30 2) 30 < Expense < 260 3A) 390 < Expense< 500 3B) 500 < Expense < 670 4) Expense > 733
6	Who would be the person making the final decision whether or not to purchase/install a SWH for your household?	Me / my spouse / me and my spouse / my parent / other

Part 2 A: General Attitude and Awareness: Qualitative Questions

7	In your opinion, what is the primary purpose for installing a SWH?
8	What does a SWH replace in a house
9	How do you think a SWH works
10	Does the entire SWH system unit use any electricity?
11	If switch and install a SWH system, will it provide hot water in the night time or cloudy days, when you turned on tap?
12	And how?
13	Does it have an electrical back up?
14	Are you aware of the difference between a SWH and a photovoltaic cell? Explain Briefly:

Part 2 B: General Attitude and Awareness: Qualitative Questions

1	Do you want a SWH?
2	Would you ever get a SWH?
3	1 A (YES) Why or 1 B (NO) why not?
4	*If needed: This is an open ended questionnaire, please take your time to answer:* Why do you think you have not installed a SWH yet?
5	*Follow up Question:* Is there an answer that is more important than any others for why you haven't installed a SWH?
6	What do you consider the biggest benefit of installing a SWH
7	What do you consider the biggest disadvantages of SWHs
8	What would really induce you to install a SWH in the future?

9	How would you summarise your general attitudes towards SWHs currently
10	How would you describe your general levels of awareness of current SWHs products?
11	On a scale 1 - 10 how positive are you towards the future of SWHs in SA
12	On a scale 1 - 10 how aware do you feel about current SWHs products?
13	On a scale of 1 - 10 how likely are you to purchase a SWH in the near term? ***(I.e. 12 months - 3 years)*** ?
14	Have you heard about Eskom's SWH rebate scheme?
15	Have you heard of the City of Cape Town's proposed monthly SWH payment Scheme?

<u>The Monthly Payment Scheme:</u>

To be read out in order to advise Interviewers of the Monthly Payment Scheme (MPS): I will now read out the City of Cape Town's new Monthly Payment Scheme, aimed to assist households to install SWHs.

Quote

"The City of Cape Town wants to promote SWHs and they aim to do this by implementing a Monthly Payment Scheme.

So in basic terms the CCT endorses a SWH supplier, who installs a SWH on your house at no upfront cost and you pay them back through your electricity savings from the system"

There are four key features of the scheme.

1) The scheme is intended to save you more than it costs on an average monthly basis. What this means is the money you save on electricity from having a SWH is more than you would spend paying off the SWH. You saving more money than it costs you.

2) There are no upfront costs for the SWH since this is a monthly payment scheme.

3) Easy Payments: Households can pay via the City billing system and the payback period is between 5 - 7 years, after which the household benefits from all electricity savings.

4) CCT Endorsement: - the City selects suppliers for endorsement according to strict criteria for product and service quality and then monitors and assists where households have problems with suppliers. However, the legal contact is between the household and the supplier.

In brief the scheme provides:

1) There are no upfront costs

2) Monthly savings are greater than the repayments.

3) Pay through the city billing system and

4) The CCT endorses suppliers

Any Questions?

Unquote

16	Any Questions comments concerns about the Monthly Payment Scheme?
17	After hearing about the monthly payment scheme details, would you be more likely to install SWH?
18	On a scale of 1 - 10 how likely will you install a SWH in the next 12 months under a MPS? "
19	What from the offer now motivates you to install a SWH?
20	What might be missing from the offer or what more might you require such that you'll now install a SWH?

3. Personal Details Questions

2	Gender?	Male/Female
3	How old are you?	15-24 25-34 35-49 50+
4	How many people live in your house, including yourself?	open question
5	What suburb do you live in?	open question
6	What is your level of education?	Tick Box Matric, Artisan Certificate, Diploma or short course, university degree, post graduate degree, other

7	Which category best describes your annual household income according to SA CENSUS data?	As per SA Census: 1) 0 - 76800 2) 76801 - 307200 3) 307201 - 1228800 4) 1228801 and more
8	Approximately how many showers are typically taken per day in the household?	open question
9	Approximately how many baths are typically taken per day in the household?	open question
10	How many operating geysers do you have in your home?	keep
11	Are you on a pre-paid or credit electricity meter?	Y/N
12	*[If pre-paid]* Are you the one who typically buys electricity for the household? / *[if credit]* Are you the one who typically pays the electricity bill for the household?	
13	How many cars in your household?	open question
14	Do you have DSTV?	Y/N
15	Is there a dishwashing machine in the household?	Y/N
17	Is there a computer in the household (desktop or laptop)?	Y/N

Question	**Open Ended Answers**
1 Do you want a SWH?	
2 Would you ever get a SWH?	
3 YES WOULD GET - Why?	
3B (Maybe would get) Why would you ever get a SWH?	
4 Why do you think you have not installed a SWH yet?	
5 Is there an answer that is more important than any others for why you haven't installed a SWH?	
6 What do you consider the biggest benefit of installing a SWH?	
7 What do you consider the biggest disadvantages of SWHs?	
8 What would really induce you to install a SWH in the future?	
9 How would you summarise your general attitudes towards SWHs currently?	
10 How would you describe your general levels of awareness of current SWHs products?	
11 On a scale 1 - 10 how positive are you towards the future of SWHs in SA (testing attitudes of SWH)?	
12 On a scale 1 - 10 how aware do you feel about current SWHs products?	

13 On a scale of 1 - 10 how likely are you to purchase a SWH in the near term?	
14 Have you heard about Eskom's SWH rebate scheme?	
15 Have you heard of the City of Cape Town's proposed monthly SWH payment Scheme?	
16 Any Questions comments concerns about the Monthly Payment Scheme?	
17 After hearing about the monthly payment scheme details, would you be more likely to install SWH?	
18A On a scale of 1 - 10 how likely will you install a SWH in the next 12 months under a MPS?	
18 B On a scale of 1 - 10 how likely will you install a SWH in the next 12 months under a MPS?	
19 On a scale of 1 - 10 how likely will you install a SWH in the next 12 months under a MPS?	
20 What from the offer now motivates you to install a SWH?	
21 What might be missing from the offer or what more might you require such that you'll now install a SWH?	

4. Quantitative Closed Ended Questions

This is the last section and MCQ with tick box questions which rank answers. It shouldn't take more than 10 minutes

Please answer with your complete honesty, as the point is to find out what people really think.

1	What has the general experience been of people you know with a SWH heater on their roof?	Happy / Unhappy / Don't know any
2	Compared to an electric water heater, the ease of having a SWH installed is…	Easier / Harder / Same / Don't know
3	Compared to an electric water heater, the current price of SWH is…	More / Less / Same / Don't Know
4	With a SWH there would be no change in my quality and availability of hot water	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
5	Under MPS, it takes long to recoup the financial benefits	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
6	A SWH requires the same amount of maintenance as an electric water heater	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
7	SWHs last many years and have trustworthy and reliable warranties	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
8	If required, It will be easy to get my SWH fixed	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree

9	I think the CCT programme will have quality SWH units	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
10	Installing a SWH under a monthly payment scheme is value for money	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
11	Under the monthly scheme, It is cheaper to install a SWH than continue to use an Electric Water Heater and pay higher electricity costs	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
12	Under the CCT proposed MPS, the SWH supplier guarantees maintenance and service during the 5 year payback period Would this be a big factor for me installing the SWH unit.	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
13	Outside of the MPS, would you consider a SWH expensive?	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
14	The monthly payment scheme is just not enough to make me purchase a SWH	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
15	SWHs are becoming more visible in my neighbourhood	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
16	SWH help reduce pollution in the environment	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
17	SWH reduce electricity consumption	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
18	I have never seen a SWH system	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
19	SWH reduce electricity expenses	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
20	SWHs are the way of the future	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
21	SWH should be mandatory for all replacements of conventional geysers	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
23	SWH will become more prevalent in SA	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
24	Solar systems are intrusive and affect the aesthetics of your home.	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
25	SWH reduce carbon emissions	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
26	Solar systems add value to a property	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
27	The way our household takes showers and baths would not be different with a SWH	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
22	Installing a SWH makes perfect sense under the MPS	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
28	I know how to find and select a supplier to install an appropriate SWH at my residence	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree

29	If my monthly payments for a SWH are more than my savings in electricity bill, then I would not install a SWH.	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
30	Installers of SWH are trustworthy and capable	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
31	SWH remain too expensive and will not become prevalent in SA	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
32	If my monthly payments for a SWH is less than I am saving from electricity then I would definitely install a SWH.	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
33	If electricity prices increase such that my electricity bill is double the amount in 4 years' time, then I would definitely install a SWH	strongly Agree / Agree / Undecided / Disagree / Strongly Disagree
34	Which organisation would you trust the most to endorse a list of accredited suppliers of SWH under MPS?	Eskom / CCT / independent academics & experts / SWH Industry association that sets standards for its own members
35	Have you heard of heat pump?	Yes / No
	A heat pump is similar quality and similar price alternative to a SWH where a SWH is not suitable (e.g. not enough sun, roof not right)	
36	If you learned that a SWH would not be suitable for your residence, would you consider installing a HP instead?	Yes / No / Don't Know
37	If you learned that a HP would save you more electricity than a SWH, would you consider installing a HP instead?	Yes / No / Don't Know

Appendix L: Questionnaire Cover Letter (Source: Authors Document)

A covering letter was used to provide legitimacy, informed consent and explain the purpose of the questionnaire.

University of Cape Town

Energy Research Centre (ERC)

Cape Town

March 2013

Introduction: Solar Water Heater Questionnaire

Thank you for agreeing to participate in this survey which should take about 30 minutes to complete. I am a master's student at the Energy Research Centre, University of Cape Town and am completing my dissertation in Energy and Development Studies. This research project and questionnaire is a requirement for the successful completion of the programme.

The aim of the survey is to perform a consumer assessment on Cape Town householder's general attitudes and opinions towards solar water heaters. The City of Cape Town is investigating new policy measures to better promote solar water heaters. This survey aims to gain the 'voice of the customer' and assess what Cape Town householders really think about Solar Water Heaters.

The results of this thesis will be published by the University of Cape Town and assist the City of Cape Town to better promote their solar water heating campaign.

Informed Consent

Your participation in this survey is voluntary and you may withdraw at any time. By completing the survey you indicate your voluntary participation in this research. All data collected during this research will be kept strictly confidential. Participants will remain anonymous and any contact details obtained during the study will be kept confidential and not solicited to solar suppliers. The summary of these results can be obtained by requesting them from me or my research supervisor on the below contact details.

Researcher: Timothy Paul

Email: tdmpaul@gmail.com

Cell: +971 56 6811423

UCT Supervisor: Dr Britta Rennkamp

Email: britta.rennkamp@uct.ac.za

Cell: 021 650 2829

UNIVERSITY OF CAPE TOWN

Appendix M: kWh electricity consumption comparison and ZAR electricity expense (Source: Authors Table)

Source: (Eskom, Tariffs and Charges,2013) Authors own electricity calculations							
				kWh used		ZAR Expense	
		CCT target bracket	**Price (in cents)**	**min**	**max**	**min**	**max**
Eskom Tariff Blocks	Consumption levels insufficient to be Eligible for MPS	Block 1 [≤50 kWh]	60.83		50	0	30.415
		Block 2 [>50 - <350 kWh]	75.09	50	350	37.545	262.815
		Block 3 - Mid Income 350 < Kwh < 450	111.42	350	450	389.97	501.39
	Eligible for MPS	Block 3 - Mid Income 450 < Kwh < 600	111.42	450	600	501.39	668.52
		Block 4 -Higher Income greater than 600 KWJ	122.21	600		733.26	0

Appendix O: A data table representing the questions and answers on eligibility.

	Category	Streamers	Answer 1	Answer 2	Answer 3	Answer 4	Answer 5
1	Eligibility	1 Method of conducting interview Telephone or Person	Telephone	Person			
		percentage	92%	8%			
2	Eligibility	Are you currently using an operational SWH system?	Yes	No			
		percentage	100%	0%			
3	Eligibility	Are you a homeowner or renter?	Homeowner	Renter			
		percentage	100%	0%			
4	Eligibility	What type of property do you live in?	Freestanding	Sectional Title	Semi-detached	Other - if so explain	
		percentage	88%	4%	8%		
5	Eligibility	Does your house have access to roof space for easy SWH installation	Yes	No	Maybe		
		percentage	100%	0%	0%		
6	Eligibility	6 Approximately how many R/month do you typically spend on electricity, on average?	Expense < R30	30 < Expense < 400	400 < Expense< 500	500 < Expense < 700	Expense > 700
		percentage	0%	29%	13%	13%	44%
7	Eligibility	7 Who would be the person making the final decision whether or not to purchase/install a SWH for your household?	Myself	my spouse	me and my spouse	my parent	other
		percentage	33%	4%	62%	0%	2%

Appendix P: A data table representing the questions and answers on demographics.

o.	Category	Descriptive Statistics	1	2	3	4	5	6	7	8
1	Gender	1 Gender	male	female						
		percentage	67%	33%						
2	Age	2 How old are you?	15-24	25-34	35-49	50+				
		percentage	0%	23%	37%	40%				
3	Household number	3 how many people live in your house, including yourself?	1	2	3	4	5	6	7	30
		percentage	12%	44%	17%	13%	10%	0%	2%	2%
4	Household number	separate TAB								
5	Education	5 What is your level of education?	matric	artisan	diploma	degree	post graduate degree	other		
		percentage	10%	2%	35%	29%	25%	0%		
6	Income	6 Which category best describes your annual household income according to SA CENSUS data	0 - 76800	76801 - 307200	307201 - 1228800	1228801 and more				
		percentage	0%	33%	60%	8%				
7	Water Usage	7 Approximately how many showers are typically taken per day in the household?	0	1	1.5	2	2.5	3	4	> 5
		percentage	4%	10%	4%	38%	4%	15%	15%	10%
8	Water Usage	8 Approximately how many baths are typically taken per day in the household?	0	0.5	1	2	20			
		percentage	56%	6%	31%	6%	2%			

9	Geysers	9 How many operating geysers do you have in your home?	1	2	3					
		percentage	85%	12%	4%					
10	Prepaid or Credit	10 Are you on a pre-paid or credit electricity meter?	Prepaid	Credit						
		percentage	60%	40%						
11	Electricity Payment Type	11 [If pre-paid] Are you the one who typically buys electricity for the household? / [if credit] Are you the one who typically pays the electricity bill for the household?	I Pay	spouse	both					
		percentage	63%	33%	4%					
12	LSM	12 How many cars in your household?	1	2	3	4	5			
		percentage	17%	58%	15%	10%	0%			
13	LSM	13 Do you have DSTV?	yes	no						
		percentage	71%	29%						
14	LSM	14 Is there a dishwashing machine in the household?	yes	no						
		percentage	62%	38%						
15	LSM	15 Is there a computer in the household (desktop or laptop)?	yes	no						
		percentage	100%	0%						

Appendix Q1: Commentary on Monthly Payment Scheme

Question 16	MPS
16 'Any questions, comments or concerns about the Monthly Payment Scheme?'	
No	37%
What happens when you sell?	13%
What is the monthly cost?	10%
Can I pay in money (e.g. R1000) to pay it off quicker?	8%
How much of the savings cover the monthly cost?	6%
Is it a fixed monthly cost or variable?	6%
Is there service and maintenance during the 7 year payback period?	6%
Is it worth it for me (usage and electricity bill)?	6%
How do they quantify the savings?	4%
How long does a solar water heater last?	4%
Who is accountable if system doesn't work, CCT or installation company?	4%
Is there a guarantee and how long does it last?	4%
What happens if installation goes bankrupt?	2%
Can new builds use this option or is it only retrofits?	2%
Can you get different options for payoff time (4 - 7 years)?	2%
Where do I get more information on this?	2%
If something goes wrong do you fix it with a contractor or must you go through the CCT?	2%
How much does it cost overall?	2%
Do you have choice of SWHs?	2%
Are there any other costs involved?	2%
How do I know it is working effectively?	2%
Do they assess on monthly/annually basis to check it is working?	2%
What is the cash price?	2%
What if savings are not greater than the repayments?	2%
How much maintenance is required for SWH?	2%
Is it a plumber or a SWH technician that fixes SWH?	2%
If paying back from electricity savings, how do you pay back on pay as you go systems?	2%
If installer fails to fix unit what recourse do I have?	2%
Do you put this on your household insurance?	2%

Who finances it?	2%
Who underwrites it?	2%
Who are the installation companies?	2%
Do they want any monies upfront?	2%
Who assists in the debt collection?	2%
If it breaks during first 5 years do they fix free of charge?	2%

Appendix Q2: Monthly Payment Informational Statement

To be read out in order to advise Interviewers of the Monthly Payment Scheme (MPS): I will now read out the City of Cape Town's new Monthly Payment Scheme, aimed to assist households to install SWHs.

Quote

"The City of Cape Town wants to promote SWHs and they aim to do this by implementing a Monthly Payment Scheme.

So in basic terms the CCT endorses a SWH supplier, who installs a SWH on your house at no upfront cost and you pay them back through your electricity savings from the system"

There are four key features of the scheme.

1) The scheme is intended to save you more than it costs on an average monthly basis. What this means is the money you save on electricity from having a SWH is more than you would spend paying off the SWH. You saving more money than it costs you.

2) There are no upfront costs for the SWH since this is a monthly payment scheme.

3) Easy Payments: Households can pay via the City billing system and the payback period is between 5 - 7 years, after which the household benefits from all electricity savings.

4) CCT Endorsement: - the City selects suppliers for endorsement according to strict criteria for product and service quality and then monitors and assists where households have problems with suppliers. However, the legal contact is between the household and the supplier.

In brief the scheme provides:

1) There are no upfront costs

2) Monthly savings are greater than the repayments.

3) Pay through the city billing system and

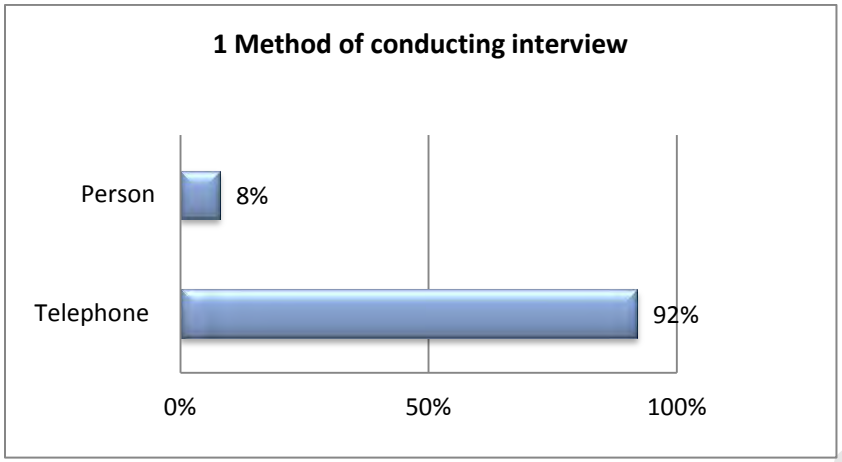
4) The CCT endorses suppliers

Any Questions?

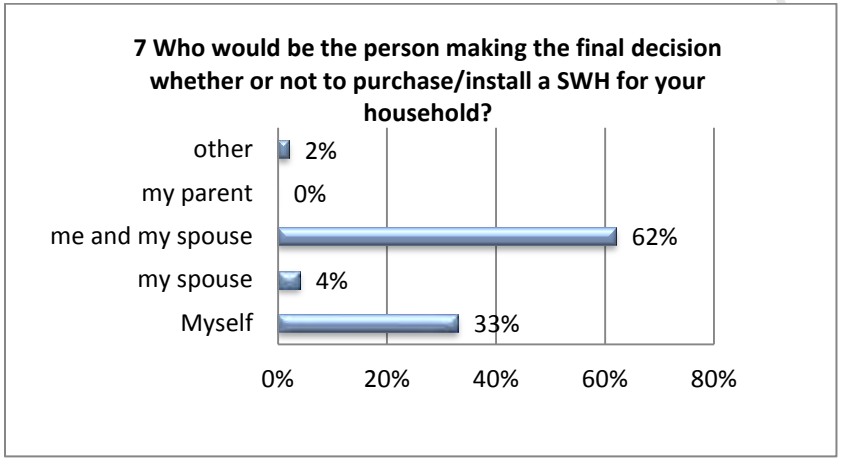
Unquote

Appendix R: Summary Response Data

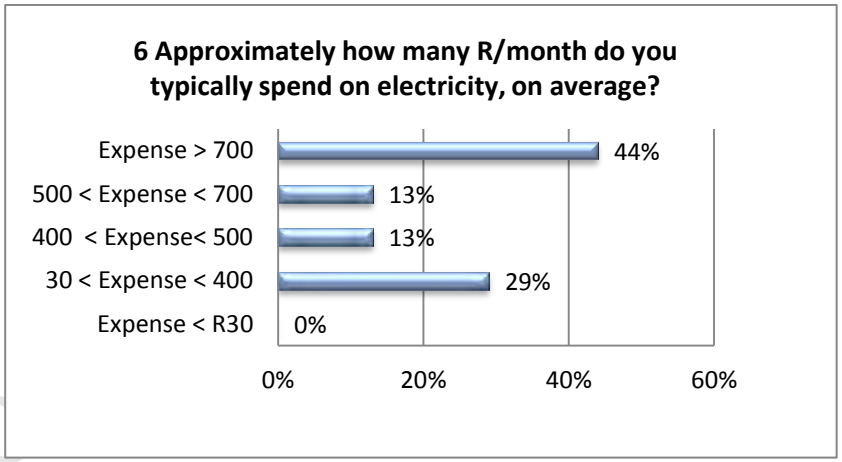
FIGURES R 1: ELIGIBILITY INTERVIEW METHOD



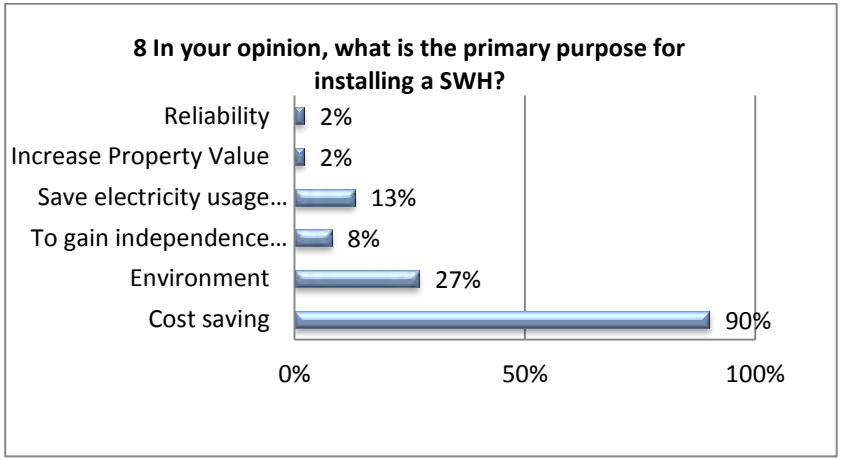
FIGURES R 2: ELIGIBILITY: DECISION MAKER TO INSTALL SWH



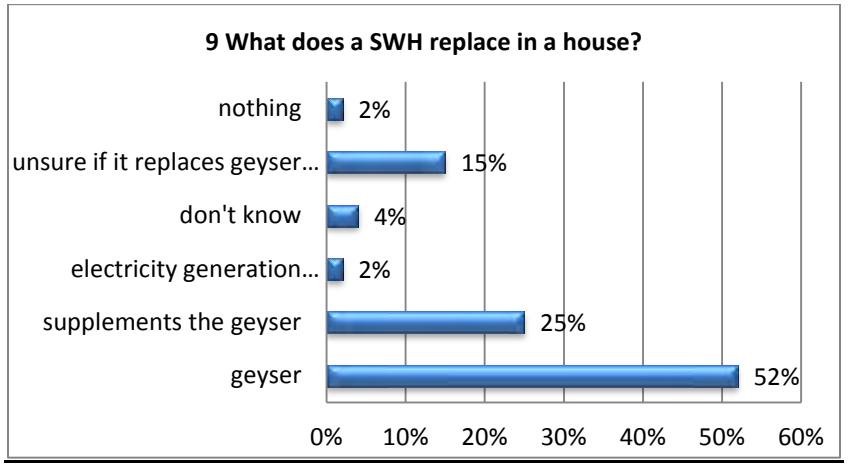
FIGURES R 3: ELIGIBILITY: MONTHLY ELECTRICITY EXPENDITURE



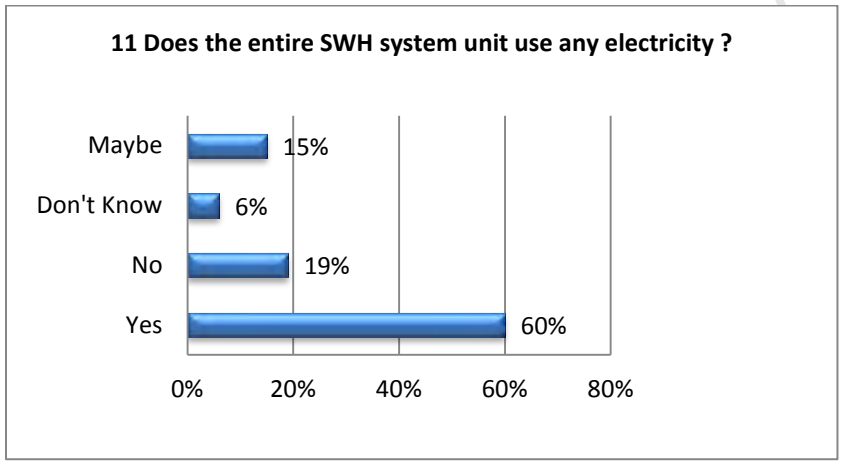
FIGURES R 4: ELIGIBILITY: PURPOSE OF INSTALLING SWHS



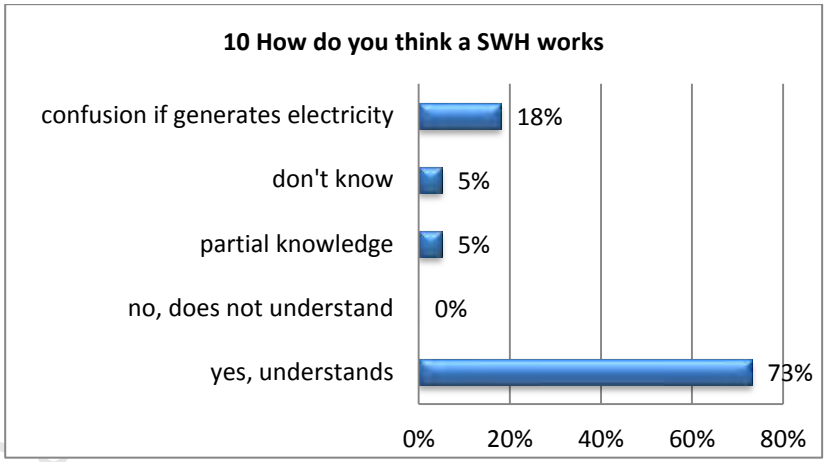
FIGURES R 5: AWARENESSS: PRODUCT KNOWLEDGE



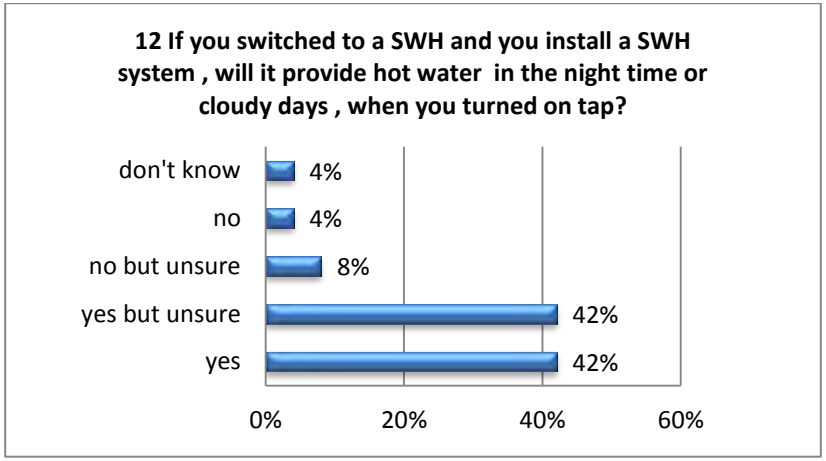
FIGURES R 6: AWARENESS: UNDERSTANING SWH USE ELECTRICITY



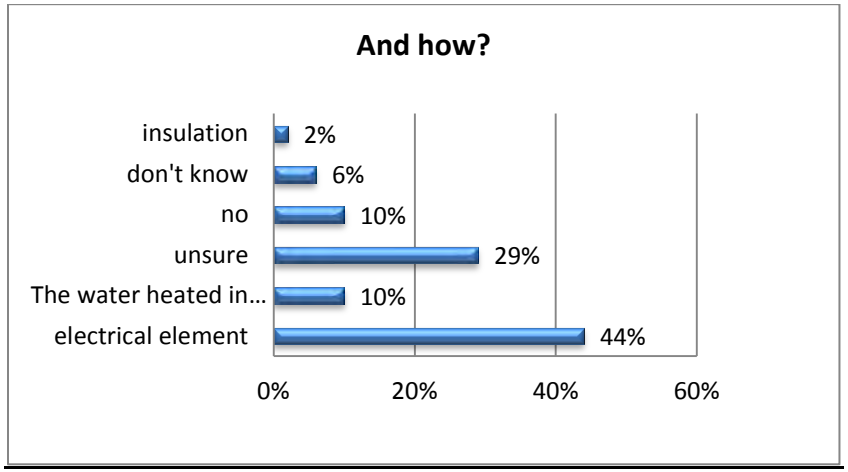
FIGURES R 7: AWARENESS: GERNEAL PRODUCT KNOWLEDGE



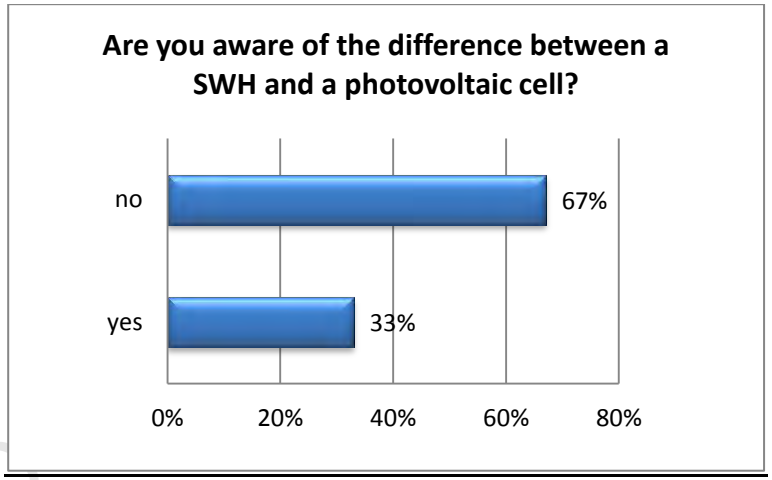
FIGURES R 8: AWARENESS: UNDERSTANDING HOW WATER IS HEATED



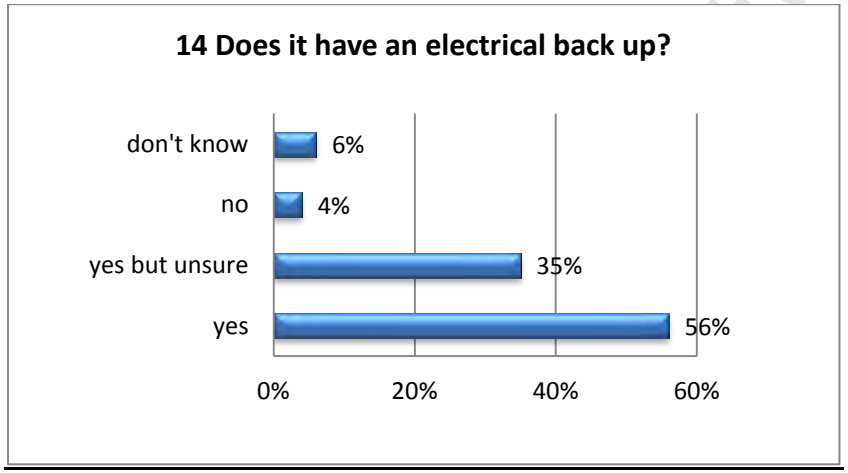
FIGURES R 9: AWARENESS: HOW DO YOU HAVE HOT WATER AT NIGHT?



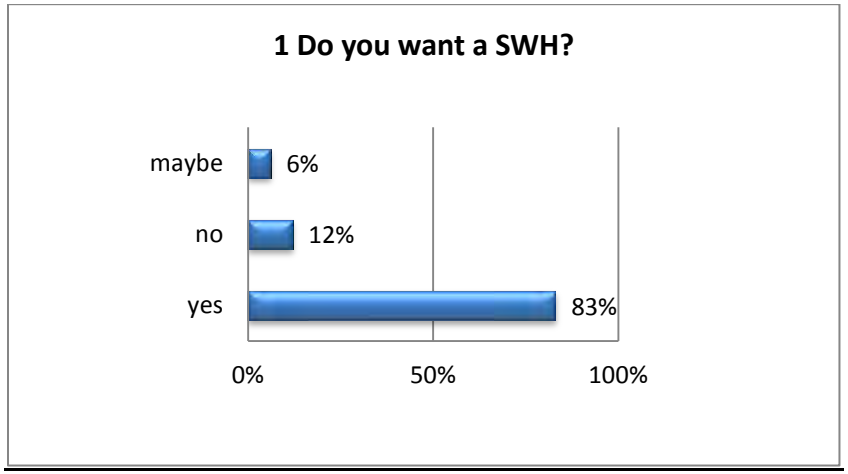
FIGURES R 11: AWARENESS: PV AND SWH DIFFERENCE



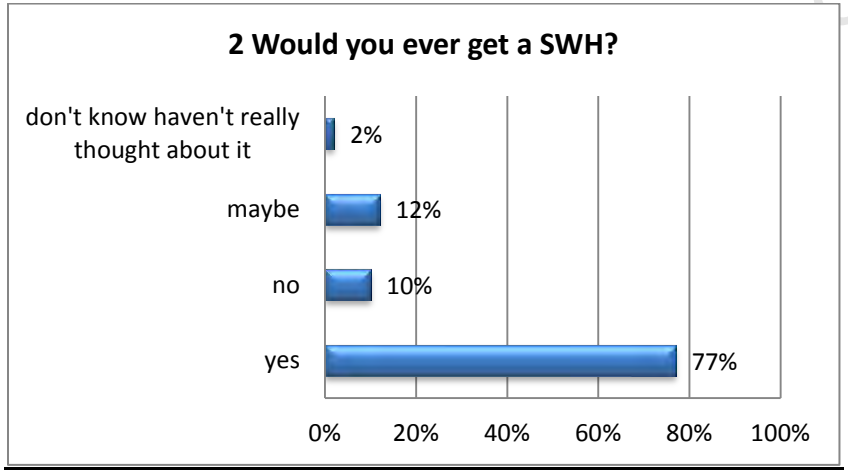
FIGURES R 10L: AWARENESS: DOES IT USE ELECTRICITY BACKUP



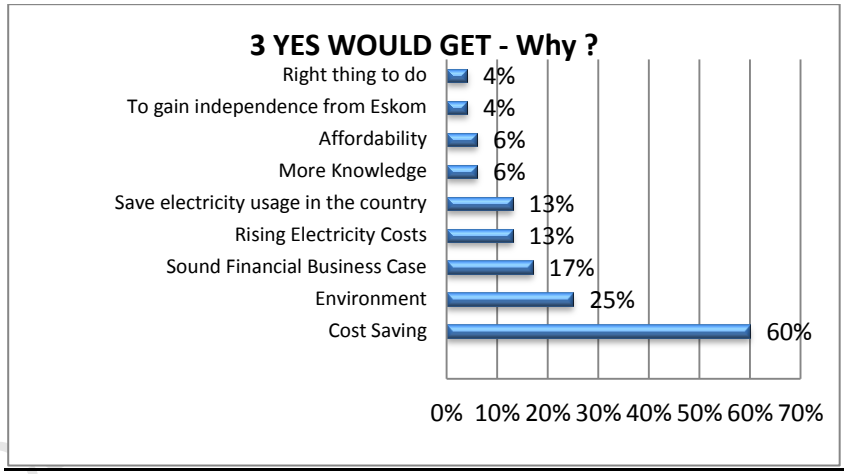
FIGURES R 12: LIKELIHOOD: DESIRE FOR SWH



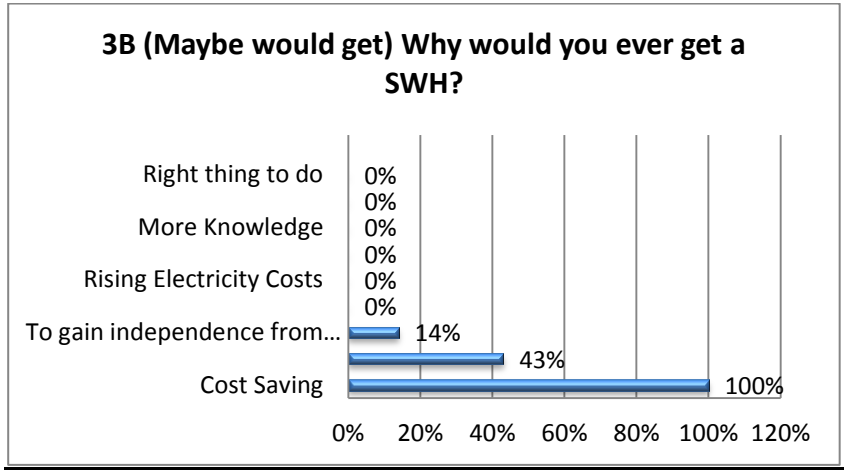
FIGURES R 13: LIKELIHOOD: COMMITMENT TO INSTALL A SWH



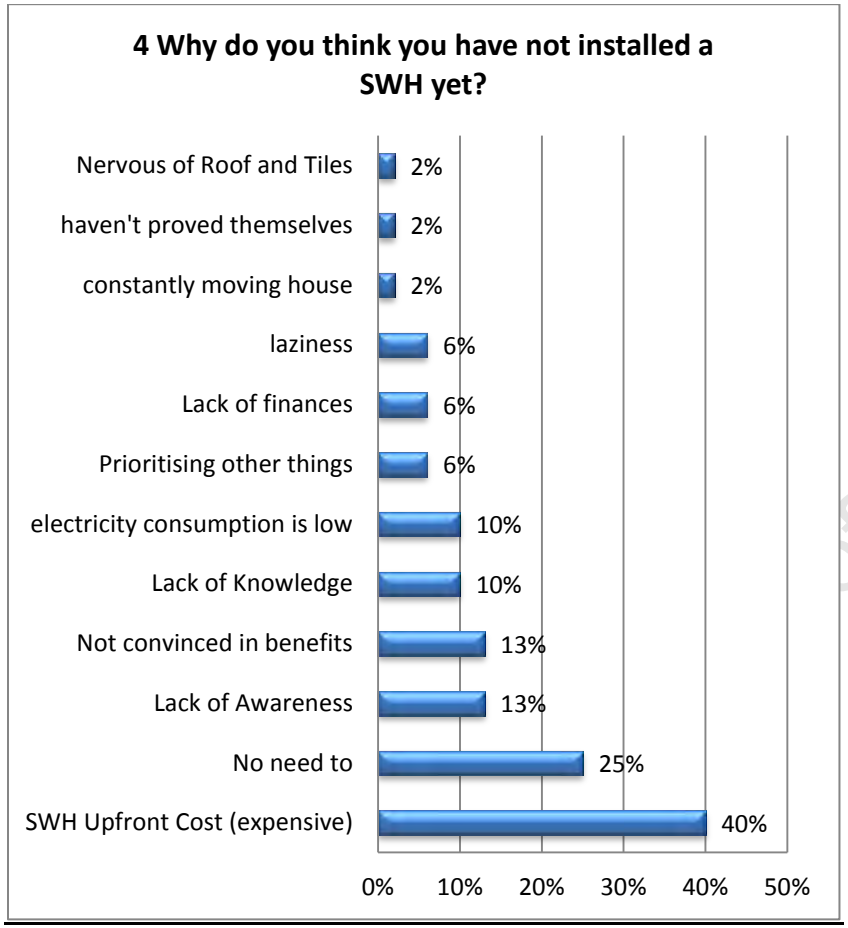
FIGURES R 14: DRIVER: REASONS FOR INSTALLING A SWH



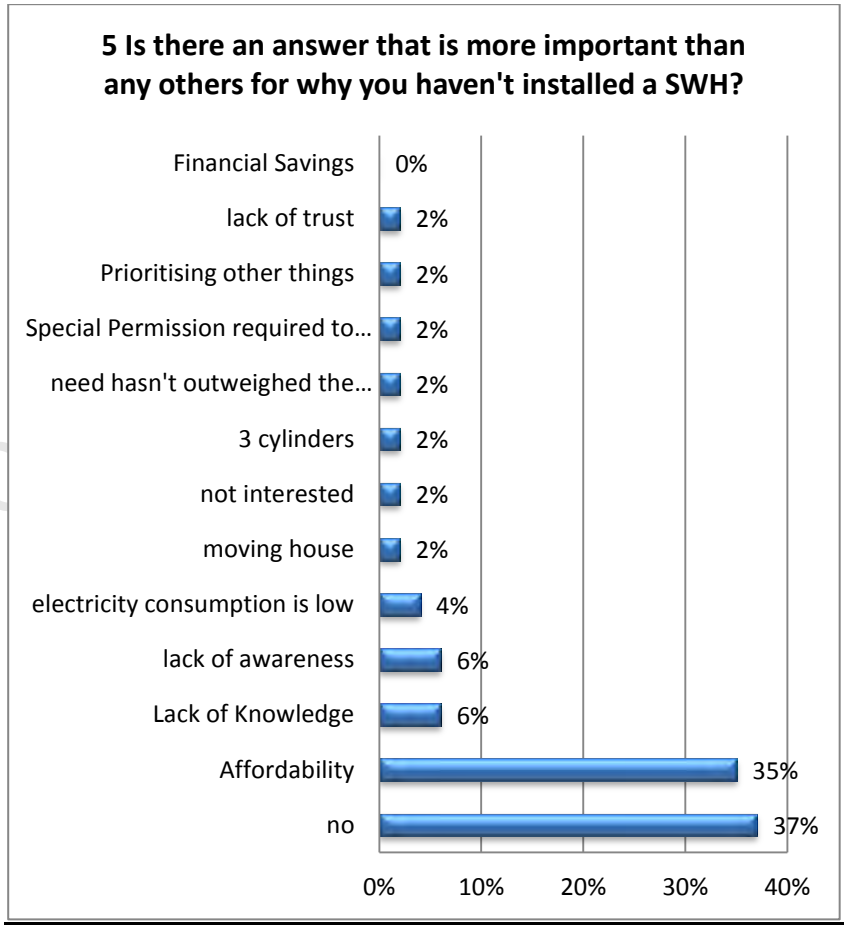
FIGURES R 15: DRIVER: REASONS FOR INSTALLING A SWH



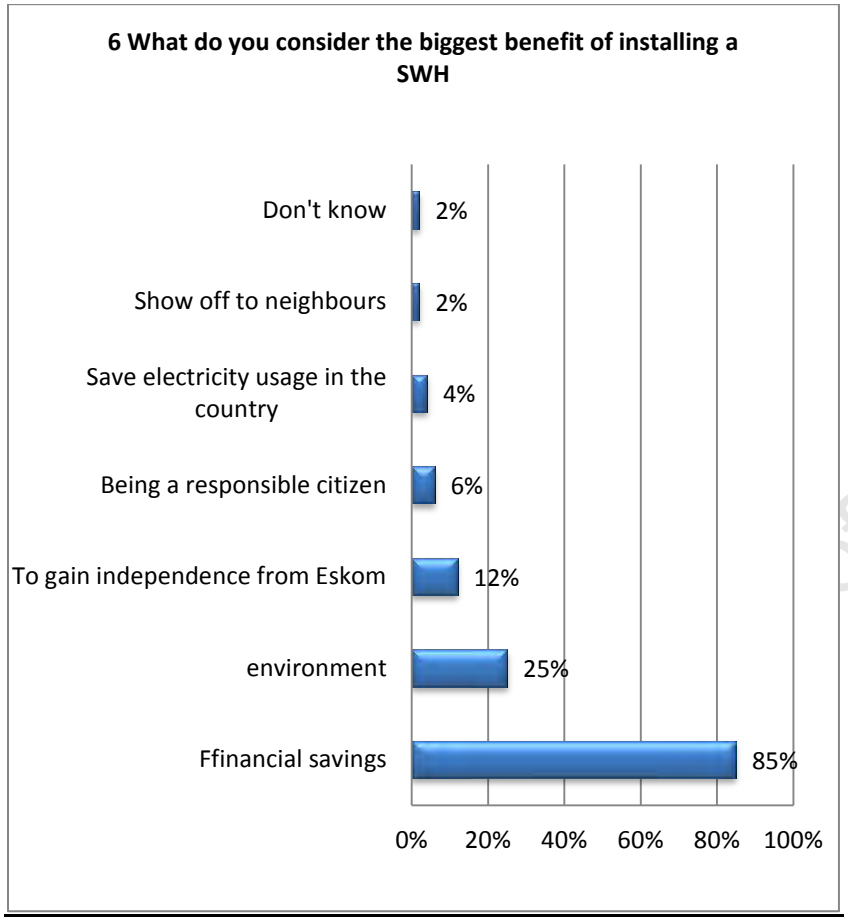
FIGURES R 16: BARRIERS: RESASON FOR NOT INSTALLING A SWH



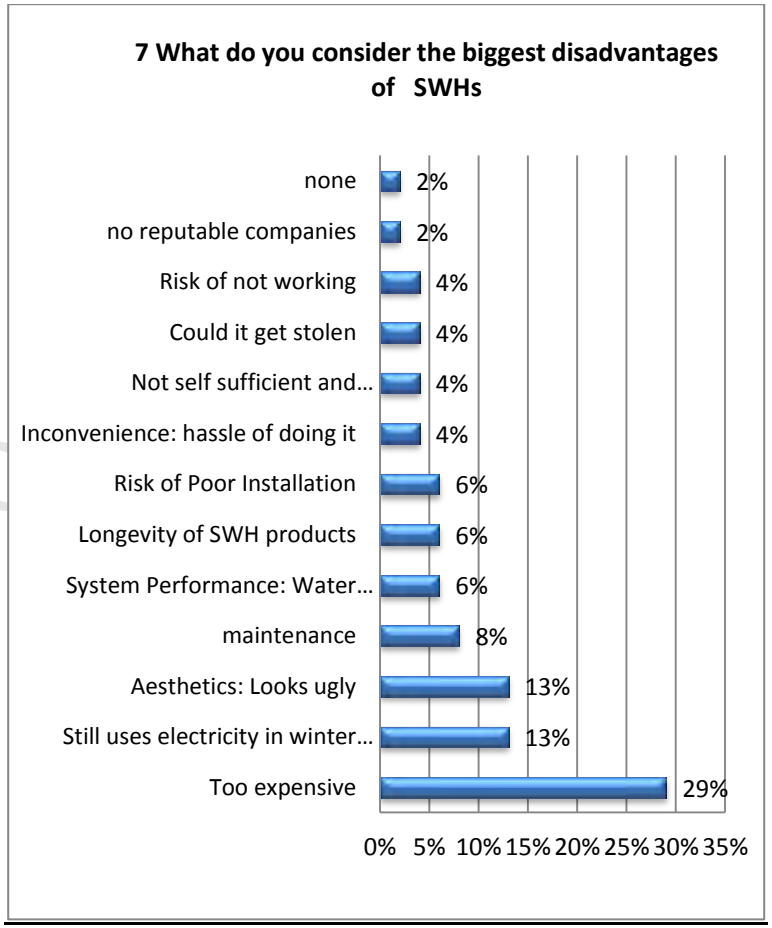
FIGURES R 17: BARRIERS: MAIN REASON FOR NOT INSTALLING A SWH



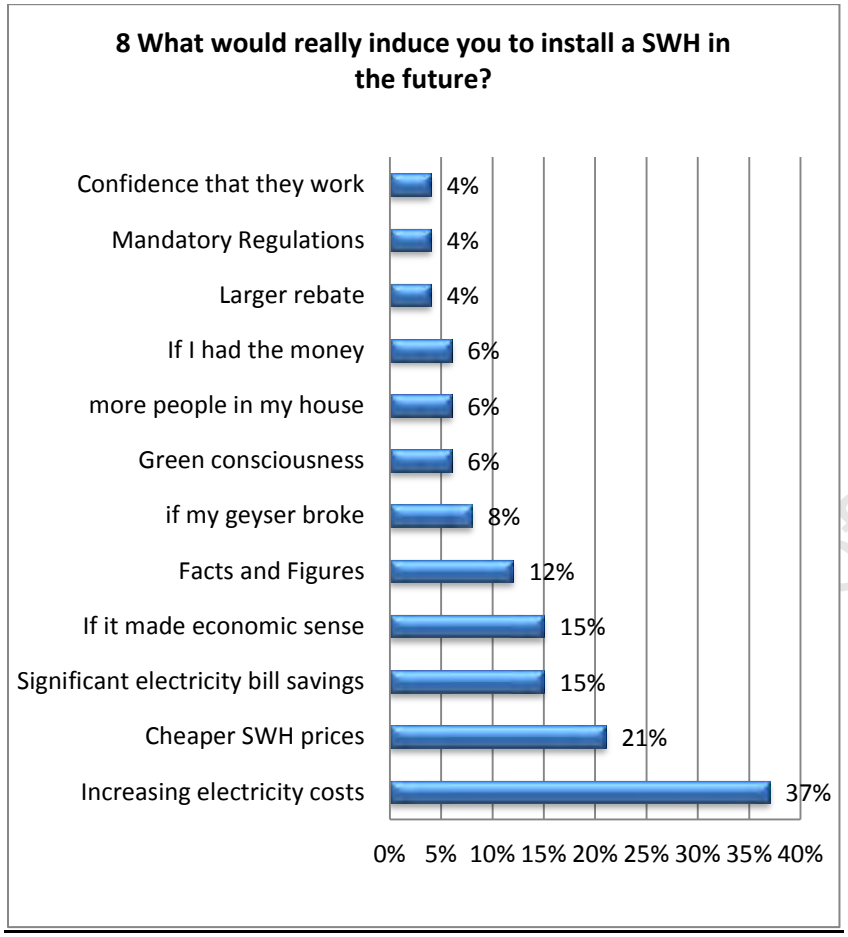
FIGURES R 18: ATTITUDE: BIGGEST BENEFIT OF SWHS



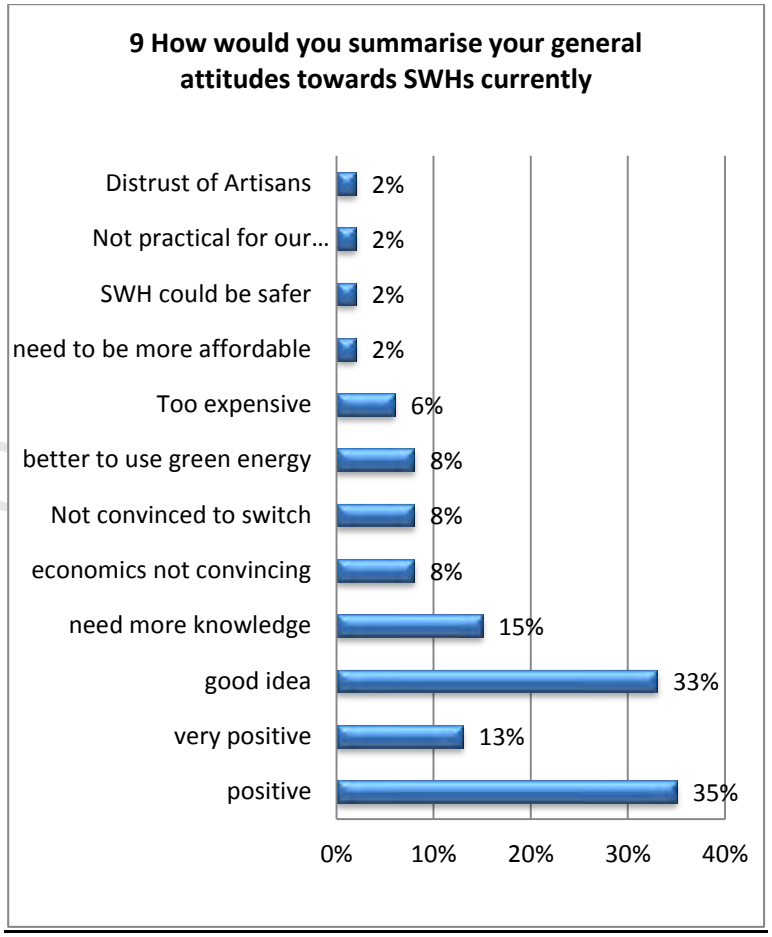
FIGURES R 19: ATTITUDE: BIGGEST DISADVANTAGE OF SWHS



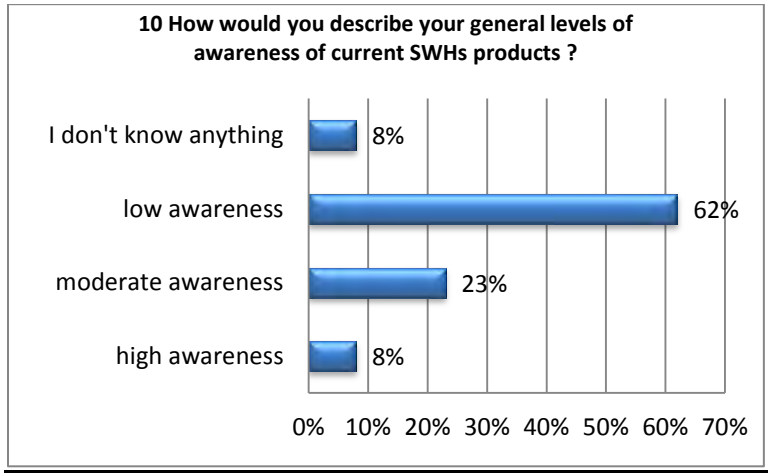
FIGURES R 20: DRIVER: INDUCE TO INSTALL SWHS



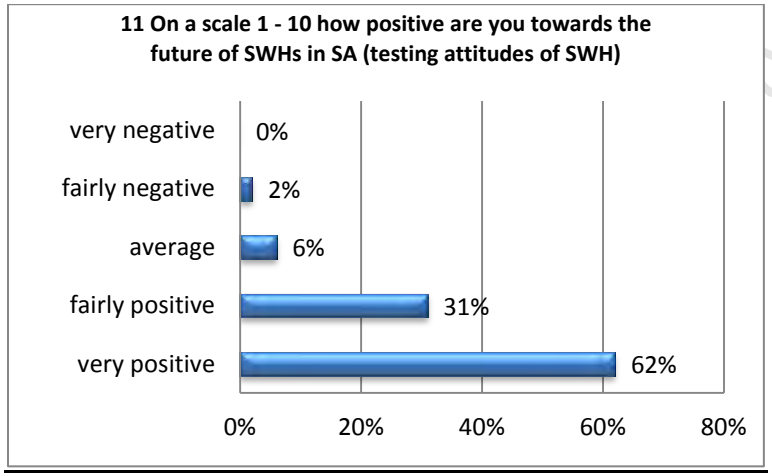
FIGURES R 21: ATTITUDES: GENERAL ATTITUDES TOWARDS SWHS



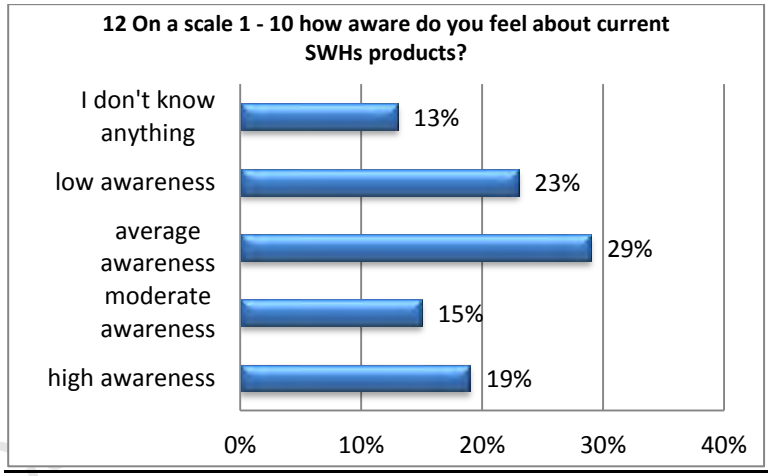
FIGURES R 22: AWARENESS: GENEREAL AWARENESS LEVELS



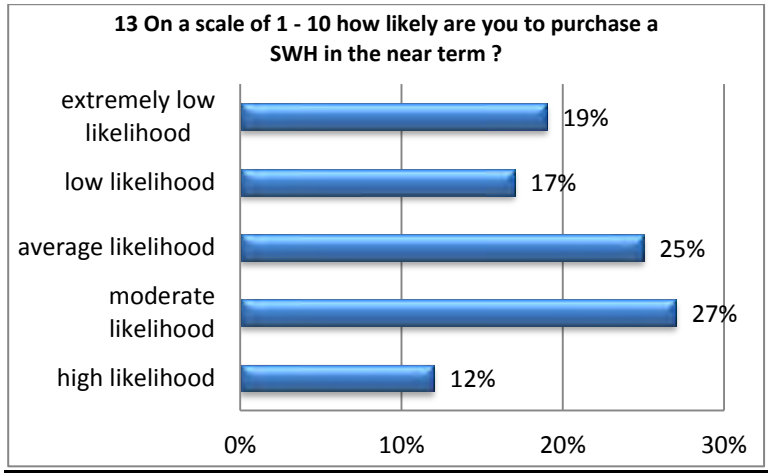
FIGURES R 23L: ATTITUDES: POSITIVE ON SCALE 1 TO 10



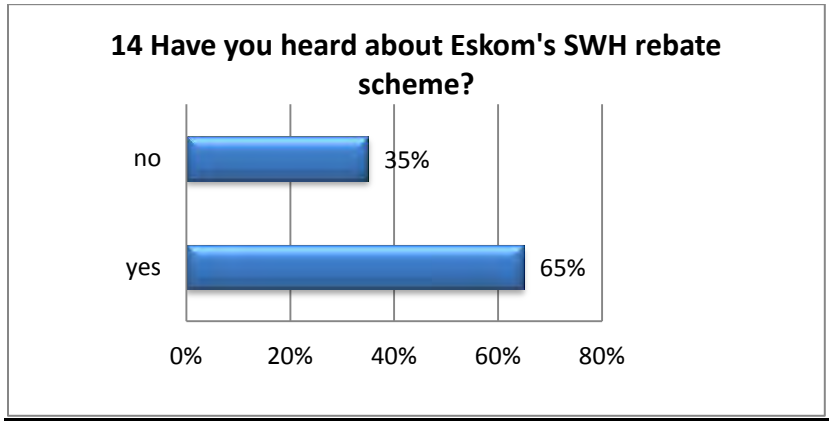
FIGURES R 24: AWARENESS: SCALE ON 1 TO 10



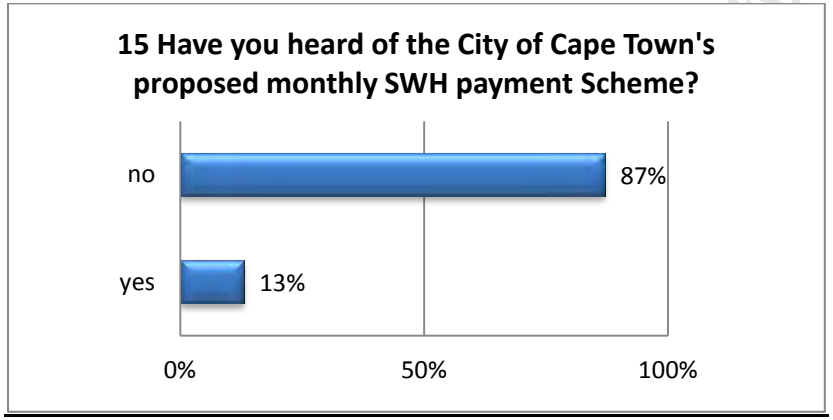
FIGURES R 25: LIKELIHOOD OF INSTALLING SWHS IN NEAR TERM



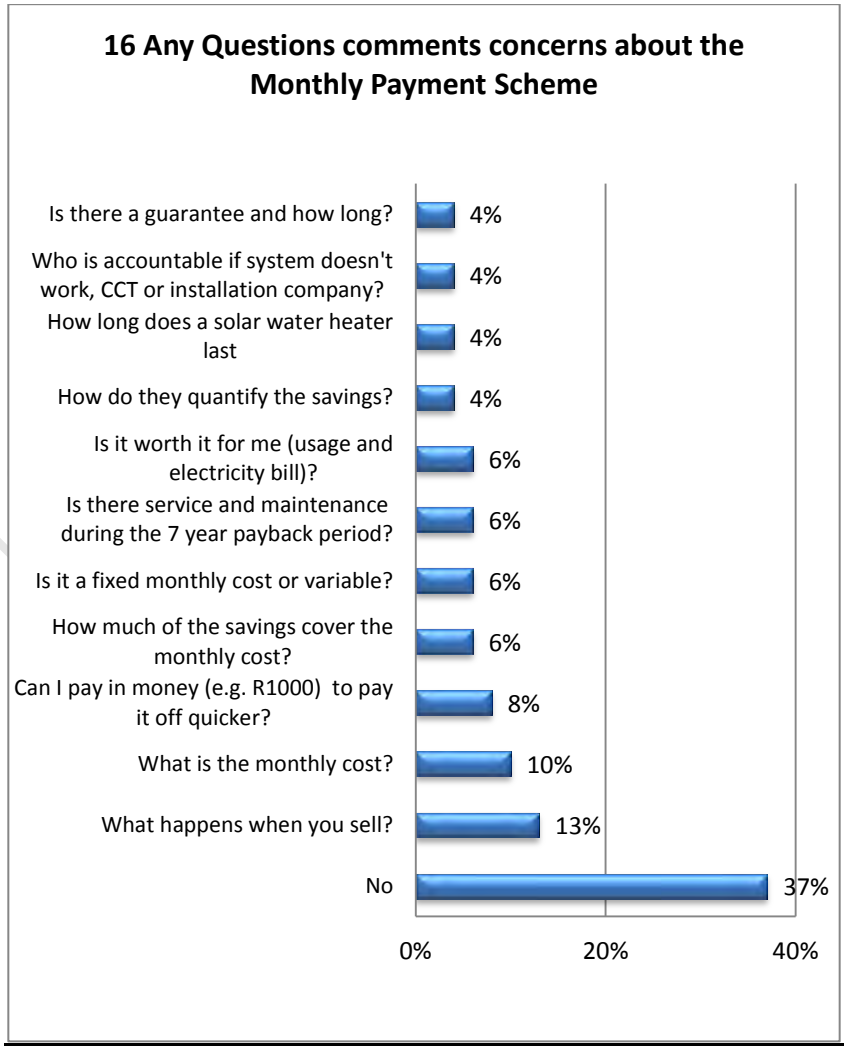
FIGURES R 26: AWARENESS: ESKOM REBATE



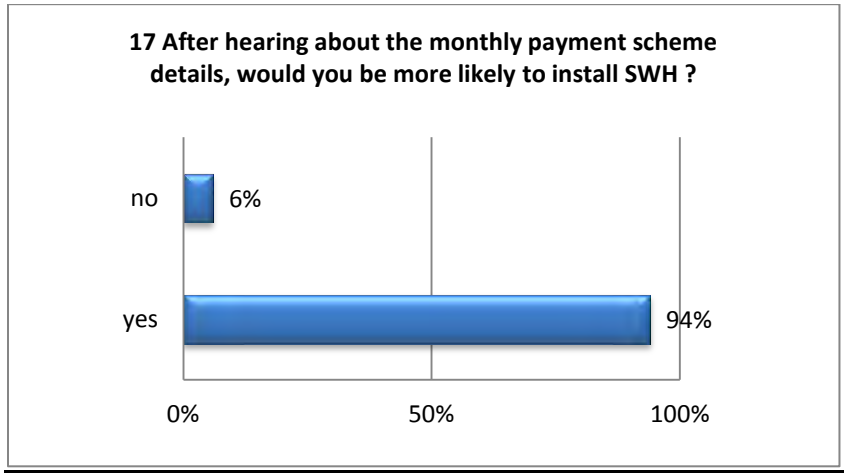
FIGURES R 27: AWARENESS: CITY OF CAPE TOWNS MONTHLY PAYMENT SCHEME



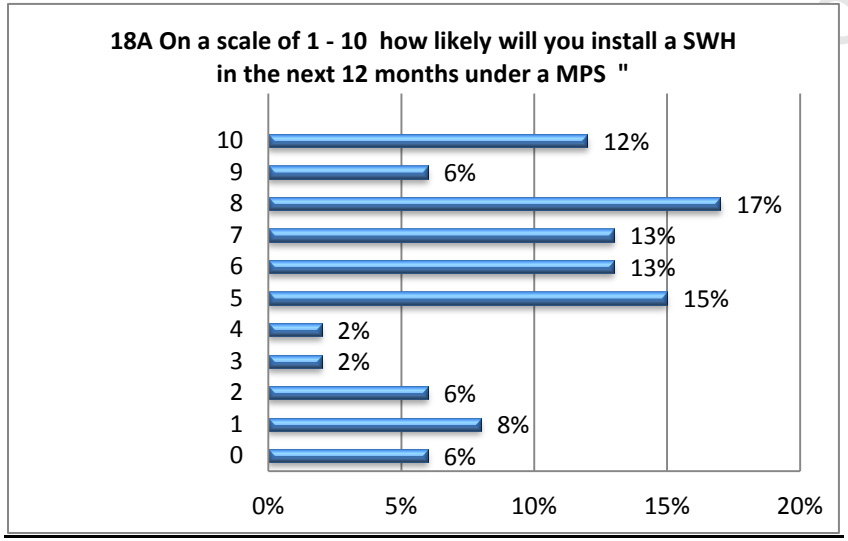
FIGURES R 28: ATTITUDES MONTHLY PAYMENT SCHEME



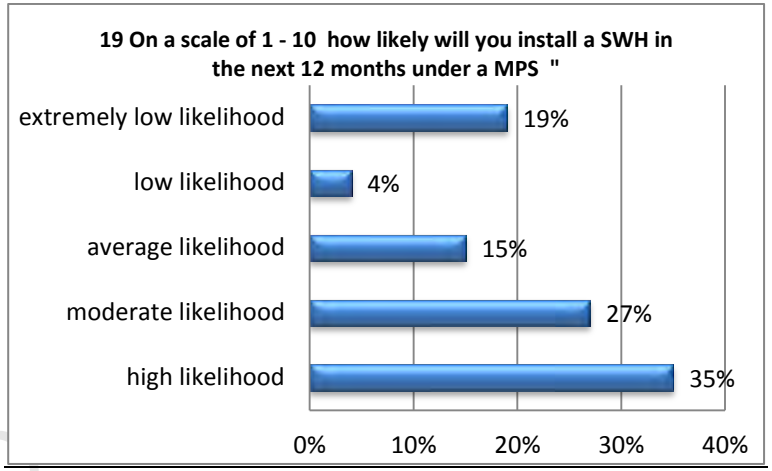
FIGURES R 29: LIKELIHOOD TO INSTALL A SWH UNDER MPS



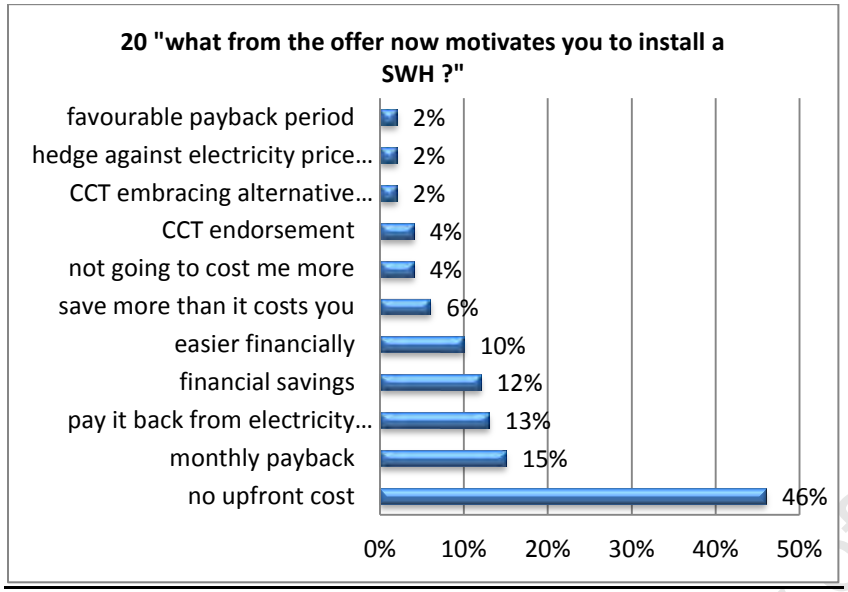
FIGURES R 30: FIGURES R 30: LIKELIHOOD TO INSTALL A SWH ON SCALE 1-10 UNDER MPS



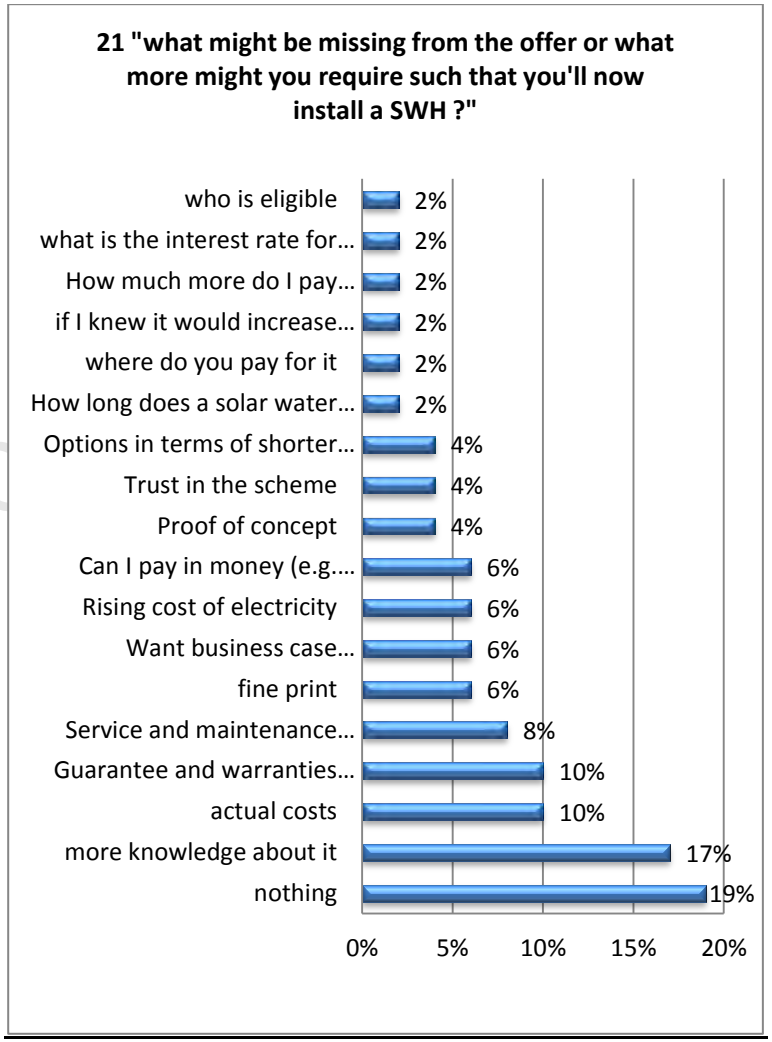
FIGURES R 31: LIKELIHOOD TO INSTALL A SWH ON SCALE 1- 10 UNDER A MPS



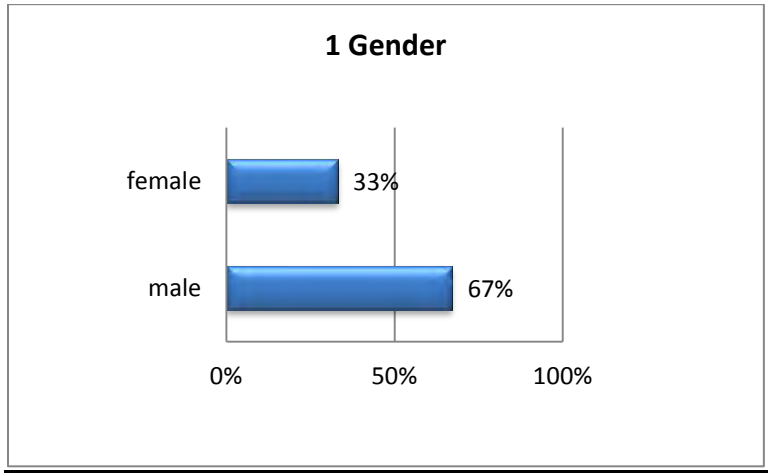
FIGURES R 32: DRIVERS: MOTIVATIONS UNDER A MPS



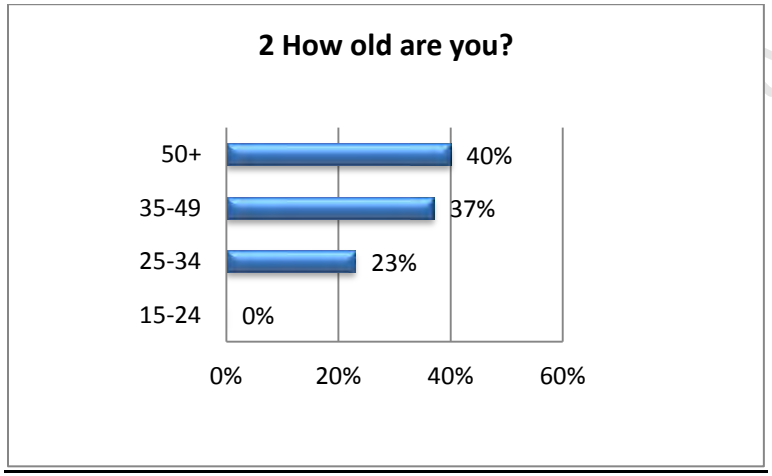
FIGURES R 33: DRIVER: ANY OTHER MOTIVATORS



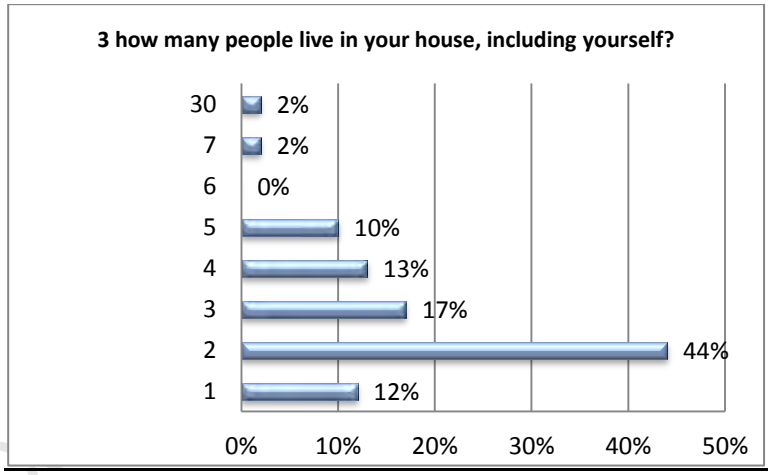
FIGURES R 34: PROFILE: GENDER



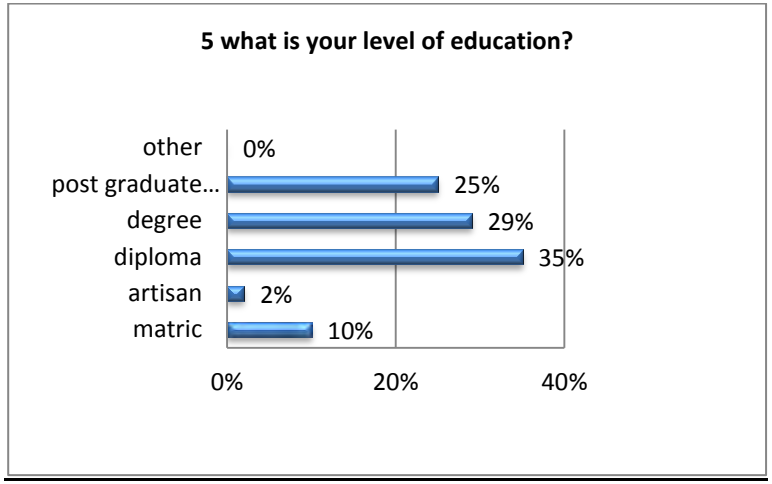
FIGURES R 35: PROFILE: AGE



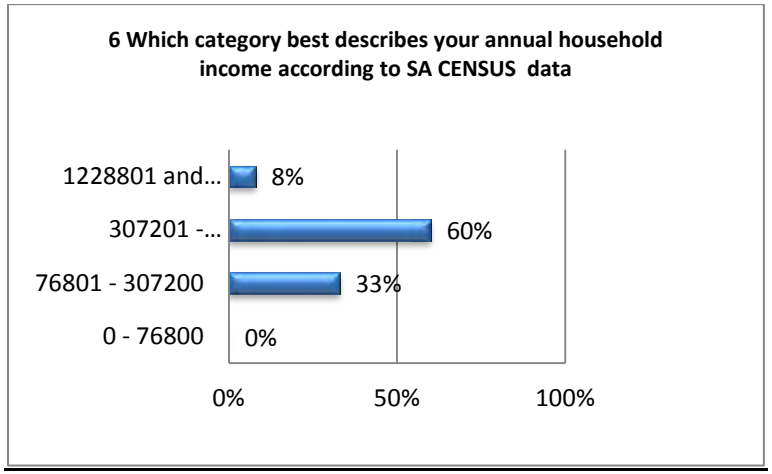
FIGURES R 36: PROFILE: NUMBER IN HOUSEHOLD



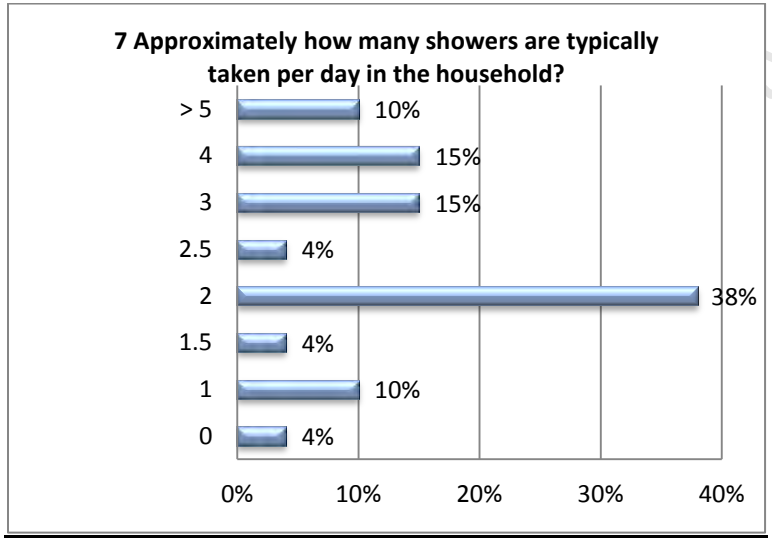
FIGURES R 37: PROFILE: EDUCATION



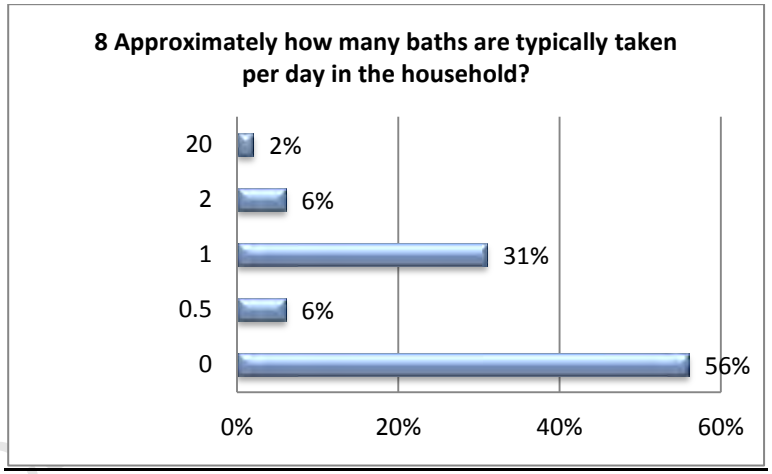
FIGURES R 38: PROFILE: INCOME



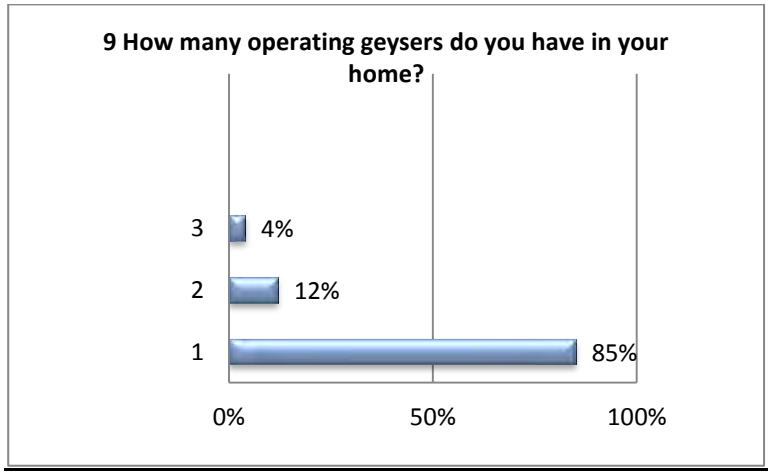
FIGURES R 39: PROFILE: NUMBER OF SHOWERS



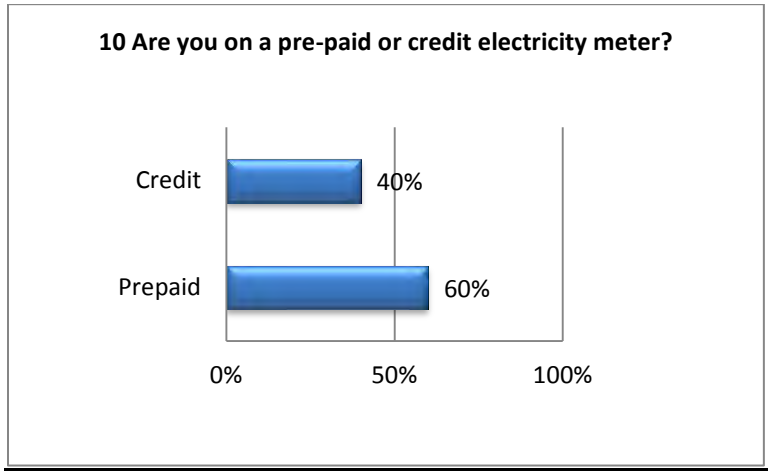
FIGURES R 40: PROFILE: NUMBER OF BATHS



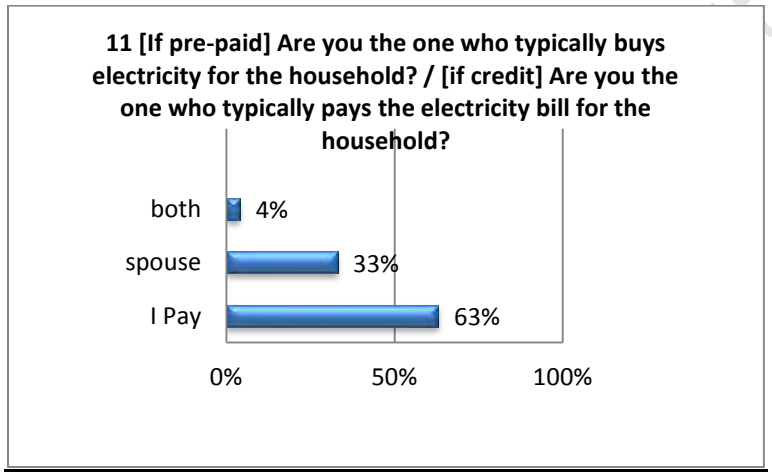
FIGURES R 41: PROFILE: NUMBER OF GEYSERS



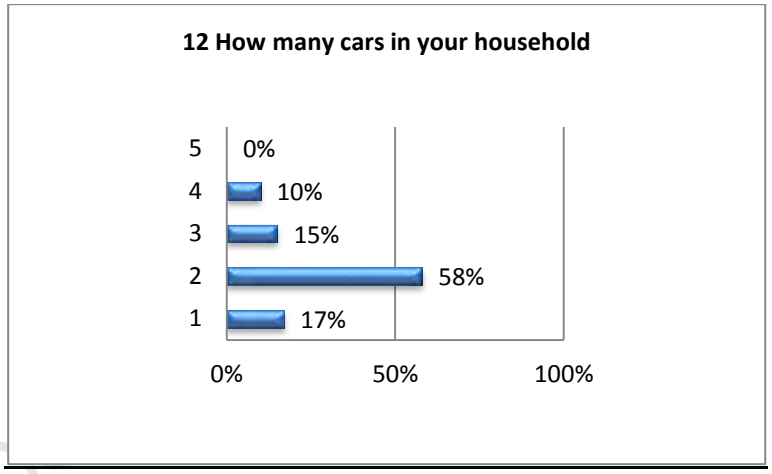
FIGURES R 42: PROFILE: PREPAID OR CREDIT METER



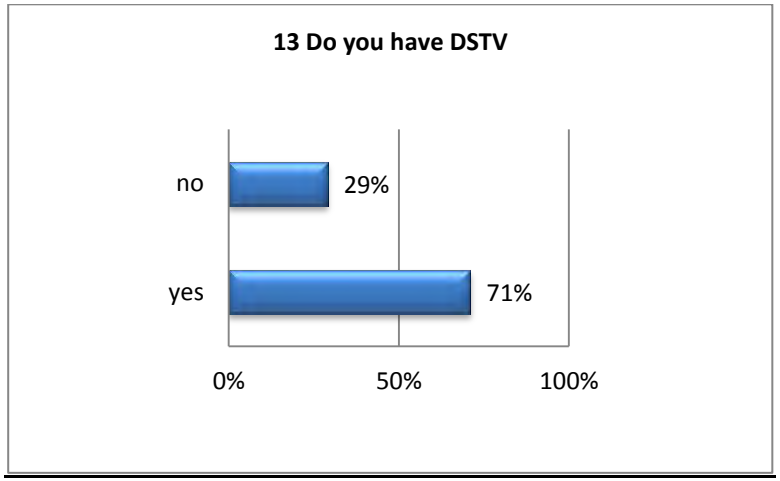
FIGURES R 43: PROFILFE: PAYER OF ELECTRICITY



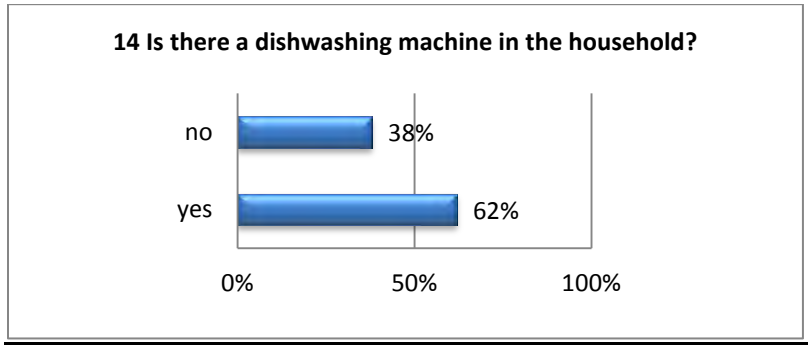
FIGURES R 44: PROFILE LSM: CARS



FIGURES R 45: PROFILE LSM: DSTV



FIGURES R 46: PROFILE LSM: DISHWASHER



FIGURES R 47: PROFILE LSM: COMPUTER

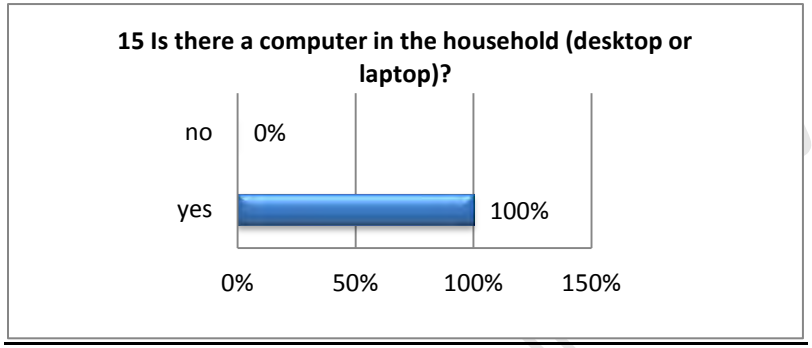


TABLE R 1: QUANTITATIVE CLOSED ENDED MULTIPLE CHOICE QUESITONS

Part 4: Quantitative Section – 37 Questions

Category		Quantitative	1	2	3	4
Attitude	1	1 What has the general experience been of people you know with a SWH heater on their roof?	happy	unhappy	don't know	
		percentage	48%	12%	40%	
Attitude	2	2 Compared to an electric water heater, the ease of having a SWH installed is…	Easier	Harder	Same	Don't Know
		percentage	17%	15%	27%	40%
awareness	3	3 Compared to an electric water heater, the current price of SWH is…	more	less	same	don't know
		percentage	60%	2%	2%	37%

A) 5 Answer Bands (strongly agree, agree, undecided, disagree, strongly disagree)

Category	No.	Question					
			Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Attitude	4	4 With a SWH there would be no change in my quality and availability of hot water	15%	44%	31%	6%	4%
Attitude	5	5 Under MPS, it takes long to recoup the financial benefits	10%	35%	13%	42%	0%
Attitude	6	6 SWH require the same amount of maintenance as an electric water heater	2%	6%	52%	40%	0%
Attitude	7	7 SWHs last many years and have trustworthy and reliable warranties	2%	25%	65%	6%	2%
Attitude	8	8 If required, It will be easy to get my SWH fixed	2%	29%	50%	17%	2%
Attitude	9	9 I think the CCT programme will have quality SWH units	6%	52%	37%	4%	2%
Attitude	10	10 Installing a SWH under a monthly payment scheme is value for money	13%	54%	21%	12%	0%

Attitude	11	11 Under the monthly scheme, It is cheaper to install a SWH than continue to use an Electric Water Heater and pay higher electricity costs	17%	50%	21%	12%	0%
Attitude	12	12 Under the CCT proposed MPS, the SWH supplier guarantees maintenance and service during the 5 year payback period Would this be a big factor for me installing the SWH unit.	29%	63%	6%	2%	0%
Attitude	13	13 Outside of the MPS, would you consider a SWH expensive ?	13%	60%	17%	10%	0%
Likelihood	14	14 The monthly payment scheme is just not enough to make me purchase a SWH	4%	23%	15%	52%	6%
Awareness	15	15 SWHs are becoming more visible in my neighborhood	2%	40%	4%	50%	4%
Awareness	16	16 SWH help reduce pollution in the environment	25%	60%	8%	6%	2%
Attitude	17	17 SWH reduce electricity consumption	29%	56%	12%	4%	0%
Awareness	18	18 I have never seen a SWH system	4%	2%	0%	23%	71%
Attitude	19	19 SWH reduce electricity expenses	19%	71%	6%	4%	0%
Attitude	20	20 SWHs are the way of the future	25%	67%	8%	0%	0%
Attitude	21	21 SWH should be mandatory for all replacements of conventional geysers	12%	35%	23%	31%	0%
Attitude	23	23 SWH will become more prevalent in SA	17%	71%	12%	0%	0%
Attitude	24	24 Solar systems are intrusive and affect the aesthetics of your home.	0%	31%	21%	44%	4%
Attitude	25	25 SWH reduce carbon emissions	17%	54%	17%	12%	0%
Driver	26	26 Solar systems add value to a property	8%	63%	23%	6%	0%
Attitude	27	27 The way our household takes showers and baths would not be different with a SWH	8%	62%	15%	15%	0%
Likelihood	22	22 Installing a SWH makes perfect sense under the MPS	13%	54%	23%	10%	0%
Awareness	28	28 I know how to find and select a supplier to install an appropriate SWH at my residence	2%	44%	12%	35%	8%
Attitude	29	29 If my monthly payments for a SWH are more than my savings in electricity bill, then I would not install a SWH.	4%	50%	25%	19%	2%
Likelihood	30	30 Installers of SWH are trustworthy and capable	0%	17%	73%	6%	4%

Attitude	31	31 SWH remain too expensive and will not become prevalent in SA	0%	19%	21%	52%	8%
Driver	32	32 If my monthly payments for a SWH is less than I am saving from electricity then I would definitely install a SWH.	25%	60%	10%	6%	0%
Driver	33	33 If electricity prices increase such that my electricity bill is double the amount in 4 years' time, then I would definitely install a SWH	25%	56%	17%	2%	0%
Attitude	34	34 Which organisation would you trust the most to endorse a list of accredited suppliers of SWH under MPS?	4%	23%	19%	46%	8%
			Yes	No	Don't Know		
Heat Pumps	35	35 Have you heard of heat pump	54%	46%	0%		
Heat Pumps	36	36 If you learned that a SWH would not be suitable for your residence, would you consider installing a HP instead?	62%	10%	29%		
Heat Pumps	37	37 If you learned that a HP would save you more electricity than a SWH, would you consider installing a HP instead?	65%	8%	27%		

TABLE R 2: QUANTITATIVE CLOSED ENDED MULTIPLE CHOICE QUESTIONS GROUPED ANSWERS

B) 3 Answer Bands (strongly agree & agree, undecided, disagree & strongly disagree)

			Strongly Agree/ Agree	Undecided	Strongly Disagree/ Disagree
Attitude	4	4 With a SWH there would be no change in my quality and availability of hot water	60%	31%	10%
Attitude	5	5 Under MPS, it takes long to recoup the financial benefits	44%	13%	42%
Attitude	6	6 SWH require the same amount of maintenance as an electric water heater	8%	52%	40%
Attitude	7	7 SWHs last many years and have trustworthy and reliable warranties	27%	65%	8%
Attitude	8	8 If required, It will be easy to get my SWH fixed	31%	50%	19%

Attitude	9	9 I think the CCT programme will have quality SWH units	58%	37%	6%
Attitude	10	10 Installing a SWH under a monthly payment scheme is value for money	67%	21%	12%
Attitude	11	11 Under the monthly scheme, It is cheaper to install a SWH than continue to use an Electric Water Heater and pay higher electricity costs	67%	21%	12%
Attitude	12	12 Under the CCT proposed MPS, the SWH supplier guarantees maintenance and service during the 5 year payback period Would this be a big factor for me installing the SWH unit.	92%	6%	2%
Attitude	13	13 Outside of the MPS, would you consider a SWH expensive ?	73%	17%	10%
Likelihood	14	14 The monthly payment scheme is just not enough to make me purchase a SWH	27%	15%	58%
Awareness	15	15 SWHs are becoming more visible in my neighborhood	42%	4%	54%
Awareness	16	16 SWH help reduce pollution in the environment	85%	8%	8%
Attitude	17	17 SWH reduce electricity consumption	85%	12%	4%
Awareness	18	18 I have never seen a SWH system	6%	0%	94%
Attitude	19	19 SWH reduce electricity expenses	90%	6%	4%
Attitude	20	20 SWHs are the way of the future	92%	8%	0%
Attitude	21	21 SWH should be mandatory for all replacements of conventional geysers	46%	23%	31%
Attitude	23	23 SWH will become more prevalent in SA	88%	12%	0%
Attitude	24	24 Solar systems are intrusive and affect the aesthetics of your home.	31%	21%	48%
Attitude	25	25 SWH reduce carbon emissions	71%	17%	12%
Driver	26	26 Solar systems add value to a property	71%	23%	6%
Attitude	27	27 The way our household takes showers and baths would not be different with a SWH	69%	15%	15%
Likelihood	22	22 Installing a SWH makes perfect sense under the MPS	67%	23%	10%
Awareness	28	28 I know how to find and select a supplier to install an appropriate SWH at my residence	46%	12%	42%
Attitude	29	29 If my monthly payments for a SWH are more than my savings in electricity bill, then I would not install a SWH.	54%	25%	21%
Likelihood	30	30 Installers of SWH are trustworthy and capable	17%	73%	10%
Attitude	31	31 SWH remain too expensive and will not become prevalent in SA	19%	21%	60%

Driver	32	32 If my monthly payments for a SWH is less than I am saving from electricity then I would definitely install a SWH.	85%	10%	6%
Driver	33	33 If electricity prices increase such that my electricity bill is double the amount in 4 years' time, then I would definitely install a SWH	81%	17%	2%
Attitude	34	34 Which organisation would you trust the most to endorse a list of accredited suppliers of SWH under MPS?	27%	19%	54%
			YES	NO	Don't Know
Heat Pumps	35	35 Have you heard of heat pump	54%	46%	0%
Heat Pumps	36	36 If you learned that a SWH would not be suitable for your residence, would you consider installing a HP instead?	62%	10%	29%
Heat Pumps	37	37 If you learned that a HP would save you more electricity than a SWH, would you consider installing a HP instead?	65%	8%	27%

Appendix S: Qualitative Responses from Interviewees

TABLE S 1: INTERVIEWEES' QUALITATIVE RESPONSES: LIKELIHOOD

		likelihood				
No	Question	1	2	3	4	5
1	**Do you want a SWH?**	I think I will ….. but people don't always give you the same answers - you hear so many different things -	yes - depending on price , cause you know it's expensive - quite a lot of outlay	If it is the best option , if it helps me or there is a shortage of electricity than I will go for it. I like the idea of saving whatever I can.	yes I think probably I do but needs to be a right price - ironically wanted a SWH when bought house and thought about - but now have a brand new geyser - if blew up would consider it	yes , why not if it is going to make things easier for the country as a whole. Obviously costs is always a factor is it actually going to help ?
19	**A2 "what from the offer now motivates you to install a SWH ?"**	'sounds very easy - not going to cost you more than you currently pay so why wouldn't you do it'	the fact that there is no upfront costs, and not going to cost me more than what it is now costing me to heat water	that you actually have a saving and you purchase from the saving	opportunity to pay it off you don't have that initial outlay so don't need to get that kind of cash	I am not person who pays off things nothing really motivates me scared of paying off over monthly
20	**what might be missing from the offer or what more might you require such that you'll now install a SWH ?**	don't think I would want to make changes to the deal, you can't get something for nothing You getting a lot for what is being offered, you getting the rebate, and the way you purchasing based on the saving the electricity . So don't know how else to squeeze the system to get a better deal, beside unit price dropping.	What is the interest on it. Maybe better to buy up front and might be better than paying off over 5 years	I would like the city to take some type of responsibility - I would like them to have some skin in the game.	If the CCT offer a comprehensive outlying of the whole scheme. Assurances of right or wrong.	Pretty much shorter payback terms if you can pay back in full? Gather in a nutshell - the timeframe to recoup the capital outlay and make it profitable. If it is an outlay in 5 years - I think that term is a bit long. Any solid business recoup in 6 months , and not 5 years.

TABLE S 2: INTERIVEWEES QUALITATIVE RESPONSES: BARRIERS

	Barriers					
4	***If needed : This is an open ended questionnaire, please take your time to answer:*** **Why do you think you have not installed a SWH yet?** **If needed - prompt with - Can you list as many ideas as possible?**	For me in the eyes of the consumer, SWH have not yet proved themselves as both technology and business case. Lack of awareness and knowledge is stifling potential uptake as well as concerns over upfront costs, artisans and implementation and duration, reliability of units *There appears a major lack of a driver to switch to SWH. The cost savings are not apparent and the technology is not viewed as fool proof. Electricity cost increases and lower SWH unit prices are viewed as barriers to adoption	For us at the moment there is a lot of cost involved, the initial cost outweigh the long term benefit. Not now, now I am aware of the benefit is a bit more, when first surfaced the initial costs was a concern.	At the end of the day I want to see it tested and be a workable solution first Don' think I have really needed one Lack of awareness " If Eskom subsidised the SWH initial upfront cost then consider"	I am lazy And on the internet they don't tell you the information very easily but they don't give you real evidence on what you will really save - they say it's good for the long term but no real evidence.	there are always technical things that seem daunting and then fall safe position of just doing the same and exploit the current energy way
5	***Follow up Question:*** **Is there an answer that is more important than any others for why you haven't installed a SWH?**	The need hasn't outweighed the hassle.				

TABLE S 3: INTERIVEWEES QUALITATIVE RESPONSES: DRIVERS

	Driver					
8	**What would really induce you to install a SWH in the future?**	I would want some help on the whole issue if a person came around i.e. some dude from CCT came round and told us what to do and gave some info. Need some people to ask what's going on. We have a quagmire of information to navigate through	Where you can save you must save . A fucking great advert - Guaranteed saving when you go and do it no one can tell how much you going to save they say you can save 40 % of your electricity but are you really saving it?	well I really want to , but waiting for my geyser to break, it is like having a very old car - that is a gas guzzler and then deciding trying to buy an need car	if not broken don't fix it, if government comes to me today that 50 % then stick with what I got	certainly continued electricity prices perhaps less complicated ways of buying , various products out their but more knowledge of the types and technical knowledge - different ways of doing and which is the most efficient, least hassle

2	**Would you ever get a SWH?**	*More knowledge , experience with people that know and trust and see that there is evidence that it works then would consider it.'*	it is a consideration - so definitely move away from the geyser when it breaks, will either go heat pump or SWH - did the numbers a few years ago and heat pump was better but depends on heat pump	it would be for a while hear from trustworthy people that is really working if I know for a fact it is working then I would consider More knowledge , experience with people that know and trust and see that there is evidence that it works then would consider it.	yes - depending on price , cause you know it's expensive - quite a lot of outlay	don't know time will tell
3	**Why or**	*if there was enough evidence if I could see the pros and save money and do my own bit*	because in the end I can save more electricity costs And it is huge chunk out of budget	if I could save on electricity bill so if could work out cheaper then would and if guaranteed I would have hot water	to save electricity !3 years ago using 300 Rand now using 900 Believe after a couple of years it saves itself.	To Save electricity 1) Cost - payback 2) Save electricity - Eskom battling with supply

TABLE S 4: INTERIVEWEES QUALITATIVE RESPONSES: AWARENESS

	Awareness					
10	How would you describe your general levels of awareness of current SWHs products ?	I am not very aware haven't seen any advertising or promotions I would have to Google Possible barrier --- lack of promotion. Have to make a real effort to investigate to find out about	know it is out there and know it exists but haven't put it to the test.	'not much, very little knowledge, only the basic idea of what it means'	not too sure, never explored it properly	don't know the ins and out. Average, not adequate since very few friends have it so limited experienced

TABLE S 5: INTERIVEWEES QUALITATIVE RESPONSES: ATTITUDES

	Attitude				
6	**What do you consider the biggest benefit of installing a SWH**	financial savings major benefit - (can elaborate that this is due to reduction of electricity bill)	need sales men to tell you how much you saving	Need more facts and figures in the end it is all about facts and figures	1) Tangible benefit - reduced electricity 2) Intangible benefit - good feeling from having a SWH
7	**What do you consider the biggest disadvantages of SWHs**	Hassle, if retrofit and not new build. normal geyser is just cheaper than a SWH and people don't project the costs for running a SWH.	not sure how long, say for instances you run out of hot water how long it takes to warm up again.	it is just not cost effective and payback period too long * it is not affordable for households	SWH heat up only 1 geyser worth of hot water (potentially insufficient solar hot water unless I oversize my geyser)
9	**How would you summarise your general attitudes towards SWHs currently**	think it is fantastic , if more people could use it, would be better for everyone.	I think I am positive about , it is something that has to be done, and get to appoint where you don't have a choice, you don't have choice, anything that can prevent us our reliance on coal powered electricity generation must be good in the LT, It just need, even environmentally aware people , if you make it easy to do something	think it is a very good thing just think it is out of the reach - financially for average person when it comes to new building it should be compulsory	*the guys that install, the companies they are total idiots

			then makes it a no brainer.		
16	**Any Questions comments concerns MPS**	1) What chance is there that the municipality will get this right 2) How do they quantify the monthly saving - so how do they quantify that amount is and gather if the thing is20 000 rand over what period does it stretch	the only reason I haven't done it is the upfront costs and I can now justify it (the purchase) --- and quite frankly this the first intelligent thing the CCT has done in a long time. So ja , think it's a good idea,	I believe it would be beneficial for my household, if paying out 200 a month - if cutting my electricity bill say 800 - then saving 600	5 to 7 years is a moosa long time frame ,,,, Can you get different options for payoff time . Can I pay in R1000 to pay it off quicker * very good system and that system could work for tenanted households