

**FACTORS HINDERING THE ADOPTION OF SOLAR ENERGY SYSTEM IN  
ZANZIBAR: A CASE OF UNGUJA ISLAND.**

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## DECLARATION

I, **Raya Issa Mwadini**, hereby declare that this dissertation is my work and it has not been submitted before to any other institution of higher learning for fulfilment of any academic award.

Signed: .....

Date : 18/05/2023

## APPROVAL

This is to certify that, this proposal entitled “factors hindering the adoption of solar energy in Zanzibar” has been done under my supervision and now it is ready for submission.

Signature .....

Supervisors: **Associate Professor Bruno. L. Yawe**

Date : .....

## DEDICATION

I dedicate this Dissertation to my beloved parent, Asha KhiyariUruwa and my late farther IssaMwadiniJuma; my brothers Msellem, Ally, Mustafa, my sister Sada Issa Mwadini; Without forget my lovely husband Rashid Haji Dunia and my lovely son Raheel, Rumaysa, Ruhail, Rifaah and Raqif for their moral support, patience and encouragement for the whole period of my study.

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I also thank my parents especially my late father for supporting me morally and spiritually during the whole period of my studies and during the research study. Their encouragement, advice and support enable me to conclude the study successfully.

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It is completely impossible for me to acknowledge individuals on the help that I have received in articulating the ideas presented here. My lectures, my fellow colleagues past and present and many close friends in Uganda Christian University who has encouraged, criticized and inspired me reach where I am now. However. I cannot hold them responsible for what is in this volume, they taught me most of what I now believe.

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## LIST OF ABBREVIATIONS AND ACRONYMS

EU	European Union
KW	Kilowatts
MW	Megawatts
PV	Photovoltaic
SDGs	Sustainable Development Goals
ZECO	Zanzibar Electricity Corporation
ZURA	Ministry of Water and Energy of Zanzibar

## ABSTRACT

The objective of this study was to investigate the factors hindering the adoption of solar energy system in Zanzibar, specifically to assess the extent to which the financial barriers hinder adoption of solar energy system, to determine the extent to which the government policy hinders adoption of solar energy system and finally to analyze the extent to which the infrastructure hinders adoption of solar energy system. A descriptive research design was employed in the study. Both stratified random and purposively sampling was used to identify a sample size and data was collected using questionnaires, interviews and documentary review. A sample size of 350 villagers and staffs were studied from a target population of 2864. The findings indicated that 69.6% of the respondents were not ready to adopt solar energy because of financial barriers due to their low level of income, also the results revealed that all respondents 100% agreed that the policy allow the installation the solar energy in Zanzibar and finally in the case of infrastructure majority of the respondents 94.6% said that the availability of land space and infrastructure are not friendly to invest solar energy in Zanzibar. The study recommended that Revolutionary Government of Zanzibar should improve rural households' income level by giving them free interest loans which will grows not only their willingness to adopt solar energy system but also improves the overall wellbeing of the family. Also, in order to ensure the adoption of solar energy system in Zanzibar, a government should produce equipment and experts in the solar industry though efficiency and innovation.

# CHAPTER ONE

## 1.0 Introduction

Reliable power supply such as electricity is essential to the sustainable economic development of any country (World Bank, 2018). However, many African countries are suffering from unreliable electricity due to rely on hydroelectric power in the continent Steinbuks & Foster (2009). Depending on hydroelectric power causes many challenges in the continent relating on electricity such as power outages and frequency blackouts. In Zanzibar, electricity is unreliable and blackouts are frequently occurring and sometimes long lasting. Blackouts occur mainly from two reasons; one is the so-called rolling blackout. This is when the electricity company purposely disconnects a certain area from the grid. This is done when demand is higher than supply in order to stop the frequency in the grid to drop under a predetermined value. The other main reason for blackouts is technical failure in the grid. These kinds of failures in Zanzibar are especially common during the rainy seasons, when equipment get wet or flooded and poles are being washed away (ZECO, 2020).

For example, in 2008 and 2010, Unguja, one among the big island in Zanzibar, experienced wide blackouts lasting 3-4 months which took time to be repaired (Burlando, 2010). Therefore, many countries in Africa have installing solar power system as an alternative source of electricity to ensure reliability of electricity and climate change issues. The government of Zanzibar in 2012 carried out a feasibility study with the intention to adopt solar energy as an alternative independent source of electricity in the islands. From that time and until now, the solar energy system has not been adopted in the islands; this influenced research to conduct a

study to examine factors hindering the adoption of solar energy system in Zanzibar.

## **1.1 Background to the Study**

Solar photovoltaic (PV) systems are said to be one of significant and sustainable alternative of managing global demand of energy sources. PV system is referred to the process of converting solar radiation into electricity through semiconductors in photovoltaic cells. This idea was discovered by French Physicist Alexandre Edmond Becquerel in 1839. Traditionally, solar energy has been used for lighting, drying for agricultural products and clothes. The technological advancement has expanded the uses of solar energy to different uses such as water desalination, weather monitoring, building integrated photovoltaic systems (BIPV), Satellites, water pumping, telecommunication and street light(Sampaio & González, 2017).

In the last decade, wide usage of PV solar technology has demonstrated its importance and it is known as the major sustainable source of power that can range from kilowatts (KW) to hundreds of megawatts (MW). Most of the experts consider PV solar technology as the most promising renewable energy among them all. Many countries in the world especially developed countries are now use solar energy system in their daily life, such countries like America and Australia where one-quarter of Australian uses PV solar system in their home. In addition to that UAE is aimed to produce one-quarter of the country energy from PV solar energy system by 2030 (Alam, Ahmad, Othman, Shaari, & Masukujjaman, 2021).

In Africa which is considered as sun continent combined with the geographical and climatic factors, the number of days of bright sunlight allows the potential of bringing solar power to much of Africa without large scale grid infrastructure. The theoretical reserves of Africa's solar energy are estimated at 60,000,000 TWh/year

which accounts for almost 40% of the worldwide total, thus definitely making Africa the most sun rich continent in the world (Liu, 2015). Despite the highest solar energy potential and compelling advantages solar power offers, penetration of solar power in Africa's energy sector is still very low (Itai, 2006).

Africa is capable of substantial renewable energy resources. The continent has 1.1 Gigawatts of hydropower capacity, 9000 Megawatt of geothermal potential and abundant biomass, solar and significant wind potential (Karekezi and Ranja, 1997). The renewable energy resource potential in Africa has not been fully exploited, mainly due to the limited policy interest and investment levels. In addition, technical and financial barriers have contributed to the low levels of uptake of renewable energy technologies in the continent (Karekezi and Ranja, 1997). However, there are prospects for the wide scale development and dissemination of renewable energy technologies in the region. Recent interest in renewable energy in Africa is driven by, among others, the following important developments. The first is the recent increase in oil price when Africa's convertible currency earnings are very low due to poor world market prices and decreased volumes of its commodity exports.

The second important development that has increased interest in renewables in the continent is the political crises faced by most power utilities in the region. For example, Ethiopia Kenya, Nigeria and Tanzania faced unprecedented power rationing which adversely affected their economies. The rapid development of renewables is often mentioned as an important response option for addressing the power problems faced by the region. Two important global environment initiatives have also stimulated greater interest in renewables in Africa. The first was the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in 1992. At this Conference, an ambitious environment and

development document entitled "Agenda 21" was reviewed by one of the largest gatherings of Government Heads of States and, perhaps more importantly, was endorsed by a large number of multi-national companies. Agenda 21 sought to operationalize the concept of sustainable development.

In addition, the Rio Conference provided the venue for the second important event, the signing of the United Nations Framework Convention on Climate Change (UNFCCC) by 155 Governments (United Nations, 1992). The Convention came into force in early 1994 after ratification by 50 States. Renewables featured in both Agenda 21 and the Climate Change Convention (United Nations, 1992). Because of the important role of fossil fuels in the build-up of greenhouse gases in the atmosphere (it is estimated that the energy sector accounts for about half the global emissions of green-house gases) and concomitant climate change concerns, renewables are perceived to constitute an important option for mitigating and abating the emissions of greenhouse gases (Socolow, 1992). The above perspective was, however, not initially shared by the many energy analysts in Africa. In contrast to the industrialized world which is worried by the long-term global environmental impact of current patterns of energy production and use, African countries are largely pre-occupied with the immediate problems of reversing the persistent decline of their centralized power systems as well a meeting the long-standing and pressing demands for a minimum level of modern energy services for the majority of their poor - many of whom have no electricity and continue to rely on inefficient and environmentally hazardous unprocessed biomass fuels.

There are many barriers hindering adoption of solar energy including but not limited to financial barriers, government policy and infrastructure to increase the total generated electricity worldwide. Although, the developed countries have done much better than developing countries in this regard, most of the developing



countries face significant barriers in the adoption of solar power system. According to the International Energy Agency (IEA) (Daly & Walton, 2017), 1.2 billion people have gained access to electricity since year 2000, nearly all of them have gained access through connection to the main grid, with almost 70% of the people getting access with electricity generated from fossil fuels (45% from coal, 19% from natural gas, and 7% from oil).

Different studies have shown that one of the main barriers to implementing solar energy projects is often the absence of long-term financing (Maarita, 2002). This challenge is complicated by competition for limited budgeted funds by the various projects and becomes critical if the country is operating under unfavourable macro-economic conditions. The challenge of financing projects for solar energy system projects is to develop models that can provide these technologies to consumers (including the very poor) at affordable prices while ensuring that the industry remains sustainable. Most advanced and electrical solar energy systems are not affordable to majority of the population in Africa who are poor.

Government policies are an important factor in terms of their ability to create an enabling environment for solar energy system dissemination and mobilising resources, as well as encouraging private sector investment (Karakezi et., al, 2002). Most governments do not have a clear-cut policy on the development and promotion of solar energy systems which continue to be undertaken within an energy planning and policy vacuum. As a result, solar energy system development follows an ad hoc path, with no clear link to national power master plans, which are rarely available, or out of date (Karakezi et., al, 2002). Limited policy support for adoption of renewable energies including solar energy is further demonstrated by the low budgetary allocations in most African countries.

The current Tanzanian power system (Zanzibar included) depends on Large-hydropower with generation capacity 64% of the total generated electricity in 2016, whereas the government started building new large-hydropower plants. Yet, against the backdrop of an expected ten-fold growth of power generation electricity from large-hydropower is expected to reach only 20% of the total electricity generation by 2040 (*Power System Master Plan, 2016*). Under this scenario, the adoption of other renewable source of electricity is very important since much of the electricity growth would come from coal and gas.

The only reliable alternative source of electricity is a solar power which represent the renewable energy source (other than large-hydropower) and has the highest techno-economic potential in Tanzania (Grothoff, 2014; Personal Communications, 2016). Although some of the identified barriers may be relevant to the deployment of solar power at all scale, many of the identified barriers are specific to the deployment of large-scale solar power such as policy frameworks, financial mechanism and networking infrastructure for large-scale solar power projects.

Zanzibar is a semi-autonomous constituency in Tanzania which is located in the equatorial region in Africa. The electric power uses in Zanzibar are purchased from TANESCO in Tanzania Mainland. For example, from July 2019 to March 2020, Zanzibar purchased total units of 399, 997, 236kWh whereas in 2020-2021 total units purchased was 383, 282, 476 kWh and in 2021-2022 total units purchased was 445,566,579 (ZECO Business Plan 2021-2023). On the other hand, Zanzibar relies on hydroelectric power from Tanzania Mainland through submarine cables. The hydroelectric dams in Mainland sometimes experiencing drought during low rainfall seasons and submarine cables are out dated technology to transfer electricity which result power outages in many areas in Tanzania. In 2008 and 2010, for example, Unguja experienced wide blackouts lasting 3-4 months due to faults of

submarine cable, which took time to repair due to the absence of specialized maintenance contractors in the region (Burlando, 2010).

Due to this scenario, solar energy has the maximum potential to be installed as an independent source of reliable electricity in Zanzibar. Therefore, in 2013, the government conducted feasibility study assessment for renewable energy (2012) as mitigation of long-lasting blackouts within the islands. Despite the government's efforts on solar energy initiatives, solar energy system has not been yet adopted. Under this circumstance, it became significant to conduct a study in order to investigate the factors that impede the adoption of solar energy in Zanzibar.

## **1.2 Statement of the Problem**

It is estimated that 13% of the world's population, especially in the sub-Saharan Africa and South Asia regions, lives without access to electricity (World Bank, 2022). This is due to various factors, such as the lack of financial capability to extend the grid, population density and dispersion characterized by low electrical energy consumption that makes grid-extension infeasible, and other social and cultural aspects (Zebra, 2021).

Many small islands developing states like Zanzibar, consume a form of Renewable energy (RE) that is installed and operated at sea and requires connection to offshore grid and distribution systems. As renewable energy is comparatively environment friendly, more countries are using Renewable Energy (RE) sources as their energy source (Bhuiyan et al., 2022). But producing renewable electricity is still more expensive than coal, the same price as fossil methane, and cheaper than conventional oil. The dramatic fall in RE's cost and price promotes the alternative use of fossil fuels by RE in electricity generation (Kåberger, 2018).

The desire of adopting solar energy system in Zanzibar as independent source of electricity is up most important since it relies on hydroelectric power from Tanzania Mainland through submarine cables. The hydroelectric dams in Mainland experience drought during low rainfall seasons and submarine cables are out dated technology to transfer electricity which result power outages in many areas in Tanzania. In 2008 and 2010, for example, Unguja experienced wide blackouts lasting 3-4 months due to faults of submarine cable, which took time to repair due to the absence of specialized maintenance contractors in the region (Burlando, 2010).

The long blackouts have a huge negative impact on the island economy development. The risk of extended supply outages remains a reality due to faults that may occur on submarine cables and drought in hydroelectric dams in Mainland. The European Union has guaranteed three million Euros towards the exploratory of wind and solar energy system in order to mitigate the risk of power outages in Zanzibar (Dean, 2020). Many studies which have been done such as (Zulu, Zulu and Mwansa, 2021) in South Africa only looked at the factors influencing the establishment of solar energy system where there is no study conducted focusing on the factors hindering the adoption of solar energy in Zanzibar. This was the reason to carry out this study so as to fill gap.

## **1.4 Objectives of the Study**

### **1.4.1 General objective**

The general objective of this study was to investigate factors hindering the adoption of solar system in Zanzibar

### **1.4.2 Specific objectives**

- i. To assess the extent to which the financial barrier hindering the adoption of solar system

- ii. To determine the extent to which the government policy hindering the adoption of solar system
- iii. To analyze the extent to which the infrastructure hindering the adoption of solar system

### **1.5 Research Questions**

- i. To what extent does the financial barrier hinder the adoption of solar system?
- ii. To what extent does the government policy hinder the adoption of solar system?
- iii. To what extent does the infrastructure hinder the adoption of solar system?

### **1.6 Justification of the Study**

Zanzibar is a semi-autonomous constituency in Tanzania which depends solely on hydroelectric power supply from Tanzania Mainland through submarine cables with the capacity of 100 WM in Unguja and 25 MW in Pemba. The demand of electricity in Zanzibar is approaching its maximum and the cables are also approaching the end of its technological life and started to experience dependability and maintenance challenge in one hand and the hydroelectric plants in mainland also experience drought during low rainfall seasons that drying many of the hydroelectric dams in other hand.

These situations may cause Zanzibar to experience other long-lasting outages as it has been experienced in 2010. The mitigation against this threat, the government of Zanzibar carried out a feasibility study with the intention to adopt solar energy as an alternative independent power in the island since that time an island experienced long lasting power outages. Therefore, the study intended to fill the

gap by investigating the factors hindering the adoption of solar energy systems in Zanzibar.

### **1.7 Significance of the Study**

The study findings are helpful to the Revolutionary Government of Zanzibar in its struggles for an independent source of power in Zanzibar. It is also useful to the Ministry of Water and Energy in Zanzibar which may use to formulate good policies relating to energy matters. Indeed, the information from the study are helpful to energy corporation who want to invest in Zanzibar and finally to society who will understand substitute product of electricity.

### **1.8 Scope of the Study**

#### **1.8.1 Time Scope**

The researcher in this study mainly focused on the factors hindering the adoption of solar system since 2012 to date. The reason behind chosen this time is that Zanzibar experienced four weeks and three months power outage in 2008 and 2010. Due to that scenario, the government conducted feasibility study to adopt solar energy system as an alternative source of energy in Zanzibar.

#### **1.8.2 Geographical Scope**

The study was conducted at Zanzibar with the particular focus at the Ministry of Water and Energy and the three villages of Matemwe, Makunduchi and Bambi from South, Central and North A' Districts in Unguja. The reason behind this area, the ministry is responsible to oversee all matters related to energy in Zanzibar and in these districts the government conducted visibility study with the aim of adopting solar system in these areas.

### **1.8.3 Content Scope**

The content scope of the study refers to the specific aspects or dimensions of a topic that will be explored and addressed within the research study. In the case of the research title "Factors Hindering the Adoption of Solar Energy Systems in Zanzibar: A Case of Unguja Island," the content scope can be explained as follows:

**Geographic Focus:** The research focuses on Zanzibar, specifically the Unguja Island. This geographical limitation sets the boundaries for the study and implies that the findings and conclusions will be specific to this particular region.

**Research Topic:** The research investigates the factors that hinder the adoption of solar energy systems. This suggests that the study aims to identify and analyze the barriers, challenges, or obstacles that prevent individuals, communities, or organizations in Zanzibar (Unguja Island) from adopting solar energy as a viable alternative.

**Solar Energy Systems:** The research specifically centres on solar energy systems. This implies that the study explored various aspects related to the use, implementation, and challenges associated with solar energy technologies.

**Adoption of Solar Energy:** The focus of the study is on the adoption of solar energy systems. This suggests that the research investigated the factors influencing the decision-making process and the reasons behind the acceptance or rejection of solar energy technologies by individuals, households, businesses, or institutions in Zanzibar (Unguja Island).

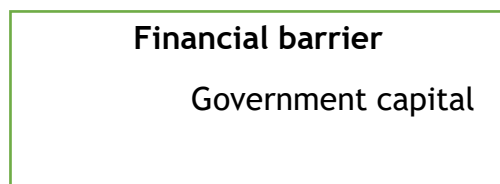
### **1.9 Conceptual Framework**

Fellows and Liu (2008) describe conceptual framework as the approach that shows the important variables to be studied in the research either in graphical or

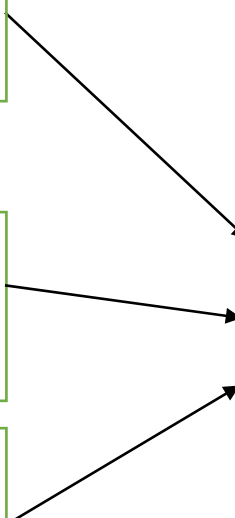
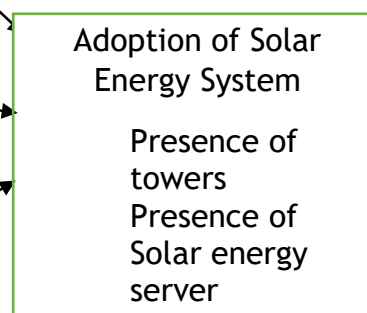
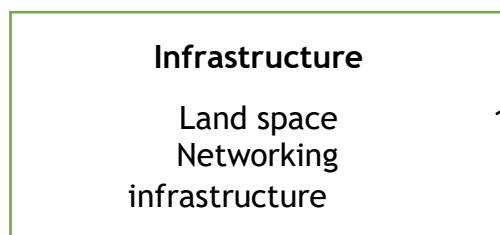
narrative form. Conceptual framework in research is also used as a foundation and pillar of dependent and independent variables and how they are related to each other between such variables.

**Figure 1: A conceptual framework**

**Independent Variables**



**Dependent Variable**



*Source: Adopted from Keriri (2013) and modified by Researcher*

Figure1 shows that, the dependent variable is the adoption of solar energy system which the researcher wants to verify whether it hindered by: financial barrier, government policy and infrastructure. The level of finance plays a vital role in promoting the adoption of solar energy as sources of electricity in Zanzibar. When a level of income is dormant or at a low level in the society creates significant challenges to the adoption of solar energy system. Also, when the government policy allows Energy Corporation to invest in solar energy sector without any obstacles, it will be easy to adopt solar energy system and otherwise will not. The infrastructure is another variable in the adoption of solar energy system in terms of land space and networking infrastructures.



## **1.10 Summary of chapters of the research report**

The research was organised and constituted with six chapters. Chapter one presents the overview of the study, including historical background, the research problem, objectives, research questions and justification of the study. The significance and the scope of the study were also included in chapter one and finally conceptual framework and summary of chapters of the research report. Chapter two is the literature reviews that discuss various theories and other related empirical studies conducted within and outside Tanzania in relation to the study that enabled a researcher to find the research gap which has been filled in by this study. Chapter Three, the researcher explained the research design, population, sample size, and sampling techniques and the instruments employed to collect data. The quality error and methodological were also included and the last part of this chapter discussed the methods used to present, analyse and interpret data obtained from the field and ethical consideration. Chapter four presented the analysis and interpretation of the findings whereas chapter five explained the discussion which was in accordance to the findings. Finally, chapter six presented conclusion and recommendations based on the study findings.

## **1.11 Conclusion**

Chapter one was focused on the overview of the factors hindering the adoption of solar energy system in Zanzibar and was arranged by looking background of the study followed by the problem statement and objectives, the questions, scope and finally the summary of the chapters of the research report.

# CHAPTER TWO

## LITERATURE REVIEW

### 2.0 Introduction

This chapter outlines the reviewed literature. The literature is presented under sub-headings derived from the study's objectives. The sub-headings are: literature review and research gap.

### 2.1 Definition of the key terms

#### 2.1.1 Solar Energy System

A solar energy system refers to a set of technologies and infrastructure designed to capture sunlight and convert it into usable energy. These systems typically utilize photovoltaic (PV) panels, which convert solar radiation directly into electricity, or solar thermal collectors, which absorb sunlight to generate heat for water heating or space heating applications (Kulkarni and Edwards, 2022). Solar energy systems can be installed on rooftops, ground-mounted structures, or integrated into building facades, and they can vary in size from small-scale residential installations to large utility-scale solar farms.

Solar energy systems play a crucial role in harnessing renewable energy and reducing dependence on fossil fuels. They offer numerous environmental benefits, such as reduced greenhouse gas emissions, and can contribute to sustainable development and energy independence.

#### 2.1.2 Financial Barrier

A financial barrier refers to a situation where an individual or group is unable to access or afford a particular service or product due to a lack of financial resources (La Rovere et al., 2018). Overcoming the financial barrier to a low emission development strategy in Brazil.

International Economics, 155, 61-68.). This can include things like electricity, healthcare, education, housing, and other essential services that require payment. Financial barriers can prevent people from obtaining necessary resources and can contribute to social and economic inequality.

## **2.2 Literature Review**

To address the aim of the research, it was important to establish a sound literature base around which the study was built. This section presents a review of the literature related to the purpose of the study. The review was undertaken in order to eliminate the duplication of what has been done and provide a clearer understanding of the existing knowledge base in the problem area. More so, these empirical literature reviews covered the global, regional and local studies as depicted below in accordance to the specific objectives of the study.

### **2.2.1 Objective one: The extent to which the financial barrier hindering the adoption of solar system**

The study of Kessy (2018) analysed factors affecting adoption of solar energy technology in Tanzania, based on determination of household income on adoption of solar technology and the role of government policy on adoption of domestic solar technology using Arumeru District as the case study. This study employed the cross-sectional research design by applying both qualitative and quantitative research approach. The determined sample size used in this study was 97 from the population of 2,978 for quantitative data and only 90 questionnaires were returned and using descriptive statistics data was analysed. The study findings revealed that 90% of respondents agreed that income affects the adoption of technology. On other hand, the government supports affects solar technology the respondents agreed. This implies that, the government policy is supportive on solar energy adoption. This study recommended that the government and other service

providers ensure the delivery of the lighting services to the users, providing loan for the purchase of the lighting system.

Coming to the study conducted by Laura et. al (2020) examined the barriers to implementing solar energy systems in buildings with the resident's perspective in Malaysia. The study conducted a survey questionnaire to solicit views from Malaysian homeowners on the barriers for installing solar energy system for domestic use. A total of 300 questionnaires were distributed to the respondents. The study findings revealed that majority of the respondents said that the main barriers to adopting solar energy system are financial limitations followed by limited solar suppliers in the region.

According to the study conducted by Ng'eno (2014) investigated the factors affecting the adoption of solar power technology for domestic power usage in Kajiado County Kenya. The study employed a descriptive survey design using questionnaire to collect data. A sample of 365 households was obtained from a target population of 6733 households using stratified sampling technique. Only 300 household heads responded which represented 82.5% of the targeted population. The findings of this study indicated that the community has not adopted much into solar technology with only 32% using solar in the region. The reason behind this was due to the level of income of households which negative impact on adoption of solar technology.

Peimani et al (2018) conducted a study on the expansion of solar energy in all the Asian countries. The study indicated that the financial factor has been the single major factor determining whether or not a country opts for such energy. The study added that this is notwithstanding awareness about the unsustainability of fossil energy dominated energy mixes, both for environmental and economic reasons. It

showed that government reluctance to finance has been the major barrier to the expansion of solar energy in Asia. The study concluded that an addressing the financing challenge is both possible and necessary to remove the barrier to solar energy expansion in Asia.

This study carried out by Amini et., al, (2017) commissioned to assess the practicality of disseminating solar home lighting systems to remote rural villages in southern Tanzania, to identify specific barriers that may hinder adopting of such systems by wider communities in rural areas and recommend practical counteractive measures. The analysis used facts collected from key informants, focus group discussions and primary household-level data from 200 households in remote rural villages of Lindi and Mtwara regions. The study explored technical requirements, economic viability, and the policy and planning issues which may contribute to success or failure of an intervention. The findings of the study observed that the majority of respondents (80%) were enthusiastic towards acquiring solar kits for lighting their homes, especially those who happen to know these systems and were willing to pay between TAS 5000.00 (\$3.3) and 10,000.00 (\$ 6.6) as initial deposit to acquire a solar system.

In addition, they were willing to pay TAS 5000 (\$ 3.3) every month until the cost of the system is recovered. The payment is slightly lower than the cost they incur to buy kerosene and torch batteries for lighting. Despite, the willingness to acquire the lighting systems, it was observed that, success of such an intervention to large extent rely on availability of secure after sale services. The study could not identify any intentional government or other stakeholders' strategies or policy measure to ensure sustainability of such interventions. Therefore, the study recommends training of local people especially women who are deep rooted in the

village and is unlikely to migrate from their villages to urban areas. The training should cover installation, repair, maintenance and spare parts procurement.

### **2.2.2 Objective two: The extent to which government policy hinder the adoption of solar energy system**

The study conducted by Karakaya & Sriwannawit (2015) examined the barriers to the adoption of photovoltaic systems revealed that there is no sufficient and effective policy that supports stakeholders who are willing to invest in the solar energy industry. Within the policy category, the researchers identified a lack of stability of incentives for the adoption of photovoltaic; they mentioned some of the examples include inconsistencies between policy measures and socioeconomic factors, or the sudden removal of existing subsidies. While most countries have policy measures to support renewable energies, the market loses trust when policy decisions are reversed, such as the recent retrospective reduction of feed-in tariffs in Italy and Spain. The study concluded that failure to involve all the relevant stakeholders in energy policy planning and regulatory issues, such as difficulties acquiring building permits and lengthy decision processes, constituted further barriers to adoption.

These findings have been supported by other authors in their studies such as Vasseur, Kamp, & Negro, (2013) who conducted their study in Netherlands and Zhai, (2013) conducted in U.S.A. Their studies recommended that, governments should review their policies which will attract corporation and energy firms to invest in solar energy industry which will be the appropriate solution for the barriers to the adoption of photovoltaic systems (Karakaya & Sriwannawit, 2015).

In addition to that, the study conducted by Margolis & Zuboy (2006) in U.S.A revealed that the lack of government policy and regulation that can support the development of solar energy system and other renewable energy are among the

barriers that hinder the adoption of solar energy systems. The same findings shown in the study conducted by Wyllie, Essah, & Ofetotse(2018)who started that the lack of policy or regulation framework as a significant barrier in Barbados and at that periods the draft of national energy policy for Barbados 2017-2036 and waiting for approval.

Moreover, the study conducted by Jamila et. al (2018) examine the barriers of solar energy uptake and the potential for mitigation solutions in Barbados found that +significant policy barriers still exist at the country level which have reduced the effectiveness of concerted national efforts to deploy renewables.

The study conducted in Nigeria, by Abdillahi et al (2017) indicated that Nigeria has abundant sunshine throughout the year, making it full thirst for solar energy generation. Even though, the country's solar energy projects have not realised a fair result over the years, due to many barriers associated with initiatives implementation. The entire power sector remains incapacitated to generate, transmit and distribute a clean, affordable and sustainable energy to assist economic growth. Therefore, this research integrated five African counterpart's solar energy initiatives, barriers, policies and strategies adopted as a lesson learned to Nigeria. The study concluded that inadequate solar initiatives, lack of technological knowhow, short-term policies, lack of awareness and political instability are the major barriers that made the implementation of solar initiatives almost impossible in Nigeria.

The study carried out by Denis et, al (2020) on Ghana's solar energy policy target of 10% other renewables besides hydroelectricity in her total energy mix by 2020 as a case analysis, this study identified and ranked the barriers to renewable energy development. Overall, twenty-three barriers were finalised and categorised fewer than six broad headings, including technical, economic and financial, social,

political and regulatory, institutional, and geographical. Subsequently, the proposed Multi-Objective Optimisation based on Ratio Analysis (MULTIMOORA) integrated with the Evaluation based on Distance from Average Solution (EDAS) method was applied to rank barriers and sub-barriers. The results of this study revealed that the political and policy barriers ranked highest among the six categories, while corruption and nepotism emerged as the most critical hurdle within the sub-barriers. The findings suggest that specific renewable energy standards, grid connection quotas and simplification of certification procedures are required. A bottom-up approach to renewable energy policy formulation is preferable for inclusiveness and sustainability. Moreover, the study has developed a framework for the assessment of how each barrier impedes renewable energy development.

### **2.2.3 Objective three: The extent to which infrastructure hinder the adoption of solar energy system**

(George, 2019) conducted a study about challenges facing small scale industries are cost of solar appliances, the capacity of solar appliances and the small-Scale Industries awareness of solar technology towards adoption of solar energy. According to him, high percentage of entrepreneurs in small scale industries are capable of paying the cost of solar appliances sold in the market for operating their industrial activities but not comfortable with the payment system. In terms of infrastructure, the solar appliances available have low capacity compared to their manufacturing needs.

Samoita et al., (2020) in their study of “Barriers and solutions for increasing the integration of solar photovoltaic in Kenya’s electricity mix” addressed the barriers for increasing the integration of solar photovoltaic are technological barriers, economic barriers including costs and infrastructure, institutional barriers (policy



experience from Africa, university- industries linkage and grid access) and political barriers. Both scholars clearly agree that there is a combination of factors affecting adoption of solar.

Ezugwu(2015) stated that economic benefits arising from adoption of renewable energy such as attracted by renewable energy projects to areas where they are located, as most projects are located away from large urban centres and suburbs of the capital cities. These economic benefits arise from increase in the use of local services as well as being a Centre for tourism and it is free, since it comes from the sun. This means that the use of solar heavily relies on availability of the sun to function. The lack of it may cause a functional technicality solution.

The study conducted by Siddharth et al (2018) focussed on the trajectory of renewable energy development in two Western Indian states, Rajasthan and Gujarat by highlighting how regional particularities and path dependence have shaped the emergence of solar energy, which is often in ways that run counter to both expected and hoped for results. The results of this study showed that the idea of energy justice is subsequently introduced as a way to evaluate whether solar energy infrastructural growth in its present form is best serving the multi-pronged needs of climate justice, economic development, and social equity. The findings further revealed that by combining a political economy of renewable energy that accounts for the political and institutional factors conditioning the growth of solar capacity with the normative arguments embedded in the energy justice literature, this study contributes to a growing understanding of the intersection of solar power and development.

This study evaluates techno-economic feasibility of adding 100 GW solar power in India by 2022. The study observes disproportionately high focus on SPV technologies and poor growth of CSP technologies in India. The study raises

concerns on capacity addition targets based on large scale thin-film solar power plants, their economic feasibility and its repercussions on the grid and the environment. The study concludes that India's ambitious solar program based on imported cells, modules and other equipment would increase India's energy import dependence and, thereby, jeopardize its energy security. The current study, based on empirical evidences, advocates for revamping state-wise solar capacity addition targets based on solar energy potentials. It also advocates for greater emphasis on CSP technologies and de-centralized applications of solar power. India must create a robust domestic manufacturing base for solar cells, modules and other supporting equipment for self-reliance. The study finally campaigns for all supply and demand side options to bridge the burgeoning demand-supply gap of electricity.

### **2.3 Research Gap**

Research from the various scholars(Zulu, Zulu and Mwansa, 2021) mainly focused on the factors influence the adoption of solar energy system without putting consideration on the factors hampered the adoption of solar energy system particularly in Africa where it is considered as sun continent. This study filled the gap by focusing the factors hindering the adoption of solar energy system in Zanzibar in the main focus on how financial barrier, government policy and infrastructure can be manipulated as hindering factors.

### **2.4 Conclusion**

This section provided is referring to a chapter two in a research report, where the author is outlining the literature that they have reviewed and analyzed in order to support their research. The literature is organized under sub-headings that are based on the study's objectives. In this case, the two sub-headings are "literature review" and "research gap". The literature review section summarizes and

synthesizes the existing research on the topic, while the research gap section identifies areas where further research is needed.

## CHAPTER THREE

### METHODOLOGY

#### 3.0 Introduction

This chapter discusses the methodological framework that was used to conduct the study on the factors hindering the adoption of solar energy system in Zanzibar. It discusses the research design and data collection instruments that used in the study; it shows the area where the study carried out and sampling techniques. The chapter also depicted the relative strength and weakness of the method and instrument chosen and finally the chapter covered analysis of data that was obtained from the respondents.

#### 3.1 Research design

The research was carried out using an approach that is known as descriptive research. According to Kothari (2004), a descriptive research design gives the researcher the ability to describe, record, analyze, and report conditions that are occurring now or that have occurred in the past. Within the scope of this particular investigation, strategies drawn from both the qualitative and quantitative spheres were implemented. In order to explore the factors that are limiting the broad use of solar energy systems in Zanzibar, quantitative data were collected by means of a survey-based questionnaire, and qualitative data were collected by means of the examination of documentary evidence and interviews. Both methods were used to investigate the factors that are preventing the widespread use of solar energy systems.

### **3.2 Area of the study**

The study was conducted in Zanzibar. It was mainly focus on the Ministry of Water and Energy in Zanzibar and three Villages from South, Central and North “A” Districts in Zanzibar where the visibility study has been undertaken for the establishment of solar energy system.

### **3.3 Sources of Information**

The study used both primary and secondary sources of information. The primary source used questionnaire and interview; this means that primary information gathered directly from the respondents. Secondary source was through documentary review which the researcher read articles, newspapers, and document relating with energy in different ministries and institutions in Zanzibar relating with energy such as Ministry of Water and Energy and Zanzibar Utility Regulatory Authority.

### **3.4 Target Population**

The population of the study was comprised by the participants from three villages and staff from the department of Energy in the Ministry of Water and Energy. The villages which were used as the source of data are Matemwe, Makunduchi and Bambi. According to Shehas’ registries Matemwe has 215 villagers whereas Makunduchi has 1377 and Bambi has 315 villagers. On the hand of staff at department of energy consisted of 957 staff. The total number of comprised a total target population in this study.

#### **3.4.1 Sample Selection Criteria**

Through this target population, the sample size criteria which were used in this study are knowledge and place. The knowledge was used to the staff working at

the office responsible for energy such as Ministry of Water and Energy and Zanzibar Electricity Company, the researcher obtained information from this staff. Also, the place was used as criteria to select sample, the researcher focused to place solar energy was adopted in Zanzibar namely; Matemwe, Makunduchi and Bambi.

### 3.5 Sample Size

According to Kothari (2004), a sample size is a certain number of respondents obtained from a given population. It referred to the process the researcher adopted in selecting items for the sample. It was difficult to ascertain a total target population, therefore it was important to decide on sampled population and use as study respondents. Using scientific of determining sample size, this study used the Solvin's (1960) formula to determine the sample size as shown below:

Population (N) =2864

Confidence level=95%

Margin of error (e) =0.05

Sample (n) =?

From the Solvin's formula

$$n = \frac{N}{1+Ns^2} = \frac{2864}{1+2864 \times 0.05^2}$$

$$n = \frac{2864}{1 + 2864 \times 0.0025} = \frac{2864}{8.16} = 350$$

$n = 350$  Hence sample size was 350 respondents.

## Categorization of Study population

**Table 1: Distribution of Sample from the Ministry of Water and Energy and three Villages**

SN	Departments / Villages	Target Population	Sample Size	Sampling Methods
1	Number of staff from the department of Energy and ZECO	957	120	Purposive Sampling
2	Matemwe Village	215	60	Stratified Sampling
3	Makunduchi Village	1377	100	Stratified Sampling
4	Bambi Village	315	70	Stratified Sampling
	<b>TOTAL</b>	<b>2864</b>	<b>350</b>	

### 3.6 Variables and Indicators

The dependent variable of the study was the adoption of solar energy system and the independent variables were financial barrier, government policy and infrastructure. The indicators were low or high level of income and attractive policy for investors, land space and networking infrastructure.

### 3.7 Procedure for Data Collection

After the proposal was approved by the research committee, an introduction letter from university introducing the Investigator to Zanzibar was secured. The Investigator then sought permission from the Second Vice President Office in Zanzibar to carry out this study. The Investigator after being permitted by the

Second Vice President Office then sought permission from the Office of Government Statistician to collect data relating to this study at the specified area. The Investigator carried on with the process of collecting data from the respondents after the consent being sought from the study participants.

### **3.8 Data Collection Instruments**

This part shows the instruments which were used in the data collection. This study employed questionnaires, interview and documentary review to collect data as explained below.

#### **3.8.1 Questionnaires**

In order to acquire information from the respondents for this investigation, the researcher created several questions with no room for response as they were called closed-ended questions. The respondents were responsible for completing the questionnaire on their own time. It included both villagers and laborers from the surrounding area. For the sake of this particular investigation, the Likert Scale was applied. Because it made it feasible to collect a tremendous amount of information in a very short amount of time from a huge pool of respondents, this method was vital to the research because it allowed for the research to be carried out. With the help of this instrument, the researcher was also able to allow the respondents freedom and provide them with ample time to fill out the questions. This was made possible by the instrument's open-ended nature. Because it helped with the management of time and resources and because it stopped the researcher from expressing any personal bias, this technique was very helpful for this study.



### **3.8.2 Interview**

This strategy was utilized on each and every respondent who could be contacted more easily and with whom it was possible to spend some time together. The attention was directed at the respondents who had indicated that they were interested in supplying the data in this format. People of average means who reside in rural areas and do not have a formal education for one reason or another were the focus of a lot of the attention that was paid to this issue

### **3.9 Pilot Study**

A pilot study is a small study of a full scale which is used to test research protocols, data collection methods and techniques in preparation of the larger study (Polit, Beck & Hungler, 2001). In other words, it is also a specific pre-testing of research instruments before the implementation during the complete study. The general goal of a pilot study is to provide information which can contribute to the success of the major study as a whole.

The pilot study was conducted with 20 participants from Maruhubi village in Urban West Region in Zanzibar who were invited to participate in the study, with adequate time given to consider whether they wished to participate. Out 20 participants, 8 participants were interviewed and 12 were given questionnaire. The villagers were demonstrated the consent by signing the consent form. Then they were handed questionnaires and interviewed in order to seek information on the extent to level of awareness, government policy and infrastructure as the hindering factors for the adoption of solar energy system in Zanzibar.

The measurement instruments (questionnaire and interviews) were also tested. An important factor was to determine the questions from questionnaires and interview guide accurately addressed the research questions. The pilot also tested

if the questions were comprehensible and appropriate, and that the questions were well defined, clearly understood and presented in consistent manner.

Data from the 12 respondents who were given questionnaire were entered into a computer and analyzed using Statistical Package for Social Sciences (SPSS) program version 21. The information obtained from 8 respondents who were interviewed was analyzed using content analysis. The analysis was mainly descriptive.

The findings from the pilot study helped the researcher to make several changes in the questionnaire and interview guide questions. Also, one specific objective concerning the factor of level of awareness has been changed to financial barriers, this was because the participants from pilot study were aware about solar energy system and the researcher saw that it does not make any sense to put it as hindering factor.

### 3.10 Quality/Error Control

In order to ensure the quality of the data, reliability and validity test of the instruments was conducted through Cronbach's Alpha and with the help of SPSS to measure the validity and reliability of such instruments. Upon conducting the test, if the value founded greater than 0.7, the items in the instruments was regarded as valid and reliable. Table 3 shows the reliability test of the 7 variables of this study

**Table 2: Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.742	.701	7

**Table 3: Item-Total Statistics**

	Cronbach's Alpha values
Income	.735
Land Scape	.720
Networking	.713
Tariffs	.853
Policy	.752
Solae energy	.738
Infrastructure	.806

### **3.11 Data Processing and Analysis**

Analysis refers to the computation of certain measures along with searching for patterns of relationship that exists among data-group (Kothari, 2004). Data analysis is necessary because it enables the researcher to summarize, categorize and organized the collected data in such a way that it is adequately answer the research questions or hypothesis. The quantitative data obtained from the field were statistically analysed using descriptive statistical techniques with aid of Statistical Package of Social Sciences (SPSS) for coding. The SPSS enabled researcher to generate charts, graphs and tables including frequencies of study responses from the categories of the respondents. The qualitative data were analysed using content method.

### **3.12 Ethical Consideration**

In order to maintain ethics, the study considered legal rights, privacy, and consent of respondents to safeguards their human rights. In this regard, during the data

collection, the researcher provided adequate and clear explanation on the purpose of the study to the respondents and their voluntary participation and sought consent from them. Moreover, the information obtained was confidential and solely used to inform this study not otherwise.

### **3.13 Methodological Constraints**

The researcher faced constraints from the participants withhold some information during collection of data, specifically staff from government ministry. The researcher assured the confidentiality and privacy of the respondents' information by told them that this research is solely for academic purpose.

The researcher was also faced a time constraint during the collection and analysis of data. The researcher tried her best to complete the research work on a specified time.

Indeed, the researcher faced constraints of language barrier to some of the respondents during the interview. The researcher translated the interview guide questions to Swahili language so as to make interview conducted easily.

### **3.14 Conclusion**

This chapter outlines the methodological framework that was used to conduct the study on the variables impeding the adoption of solar energy system in Zanzibar. The study was conducted on the variables that were found to be impeding the adoption of solar energy system. The purpose of this study was to investigate the variables that are preventing Zanzibar from adopting solar energy as a primary source of electricity. It describes the research design as well as the instruments that were used to collect data for the investigation that was being carried out. In addition to this, it indicates the sample procedures and the place where the

research was conducted. The chapter also discussed an analysis of the data that was acquired from the respondents, and it contained a depiction of the relative strengths and weaknesses of the method and instrument that was utilized. The chapter came to a close by describing an analysis of the data that was obtained.

## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

#### 4.0 Introduction

This chapter comprises the results, interpretation and analysis of findings which are basically based on the specific objectives of the study, where the main objective of this study was to the factors hindering the adoption of solar energy in Zanzibar. The organization of this chapter is arranged starting with the presentation of results which includes the response rate and demographic characteristics of the respondents. The next section analyses the findings and the last section presents the interpretation of the findings which were derived from the respondents.

#### 4.1 Response Rate

According to Fredrick and Wiseman (2003), response rate ought to be presented for purposes of ensuring validity and avoidance of doubt. The researcher issued 300 self-administered questionnaires whereby 280 questionnaires were returned which are equal to 93.3%. Also, 50 respondents were interviewed and all of them participated fully.

**Table 4: Response rate of respondents**

Questionnaire& Interview	Received questionnaire& Interviewed participants	Percentage response rate
300	280	93.3%
50	50	100%

*Source: field (2022)*

## 4.2 Demographic Information

Determining the characteristics of the particular respondents is very significant, as the respondents helped the researcher to understand the quality of the information obtained from the field. This part provides basic information about the respondent's characteristics, such information includes their gender, sex, education level and age. All these characteristics have been explained and presented below.

### 4.2.1 Gender of the respondents

Gender is an important variable in a given area which is variably affected by any social or economic phenomenon. Hence the variable gender was investigated for this study. Data related to gender of the respondents is presented in Table 5

**Table 5: Gender of the respondents**

Gender	Gender of Respondents	
	Frequency	Percent
Male	210	63.6
Female	120	36.4
Total	330	100.0

*Source: Survey data, (2022)*

Table 5 shows that 63.6% of respondents were male and 36.4% of respondents were female. The majority of respondents were male compared to female. The findings imply that both male and female were involved in the study and therefore avoiding bias based on gender to enrich the findings.

### 4.2.2 Age of the respondents

Age of the respondents is another important characteristic which has been examined in order to check whether it could have influence towards the response

collected. Since age indicates the level of maturity of individuals in the views and responses of particular issue, in that sense, age of the respondents has been examined in this study.

**Table 6: Age of the respondents**

		Age of Respondents	
		Frequency	Percent
	18-35	175	53.0
	36-45	125	37.9
	45 and above	30	9.1
	Total	330	100.0

*Source: Survey data, (2022).*

From Table 6 above it can be seen that on the basis of age criteria 53% of all respondents were between 18 and 35 years old, 37.9% of them were between 36-45 years of age, where 9.1% of respondents were above 45 years old. These findings imply that most of the respondents in the study area were young people.

#### **4.2.3 Education level of the respondents**

Person education background is directly linked to the study since education has more impact on adoption of solar energy system. In that way, the response of an individual is likely was determined by his educational status and therefore it becomes imperative to know the educational background of the respondents. Hence the variable 'Educational level' was investigated by the researcher and the data pertaining to education is presented in table: 7 below.



**Table 7: Education level of the respondents**

Education		Education level of Respondents	
		Frequency	Percent
	Secondary Education	255	77.3
	Bachelor Degree	60	18.2
	Master Degree	15	4.5
	Total	330	100.0

*Source: Survey data, (2022)*

The table 7 above shows that majority of the respondents 77.3% having secondary education, followed by 18.2% of the respondents having bachelor degree and only 4.5% of the respondents having master degree. Table 4.4 indicates that education level of the majority of the respondents (77.3%) was secondary education. This implies that the majority of the respondents in the areas of study understanding at least to read and write.

### **4.3 Finding of the Study**

The study aimed to examine the factors hindering the adoption of solar energy system in Zanzibar. Descriptive statistics was used to analyse the collected data from the respondents through SPSS. The researcher presented the findings by considering the specific objectives of the study as follow.

#### **4.3.1 Descriptive Statistics**

***Objective one: To assess the financial barriers as hindrance of the adoption of solar energy system in Zanzibar.***

**Table 8: Government capital is enough to adopt solar energy system**

		Government capital is enough to adopt solar energy system?	
		Frequency	Percent
Valid	Yes	30	10.7
	No	250	89.3
	Total	280	100

Source: Survey data, (2022)

Finding from the Table 8 indicated that 89.3% of respondents replied that the government capital is not enough to adopt solar energy while 10.7% of the respondents said the government capital can adopt solar energy. According to these findings, it implies that the government has not enough budgets to adopt solar energy system in the country. According to the findings that has been supplied, a survey may have been conducted in order to evaluate whether or not the government possesses the funds necessary to make the transition to solar energy. This evaluation may have been carried out in order to determine whether or not the government had the funds necessary to make this transition. As a result of this, one can get the conclusion that the government does not possess the necessary financial resources to set up an infrastructure for solar energy in the country. This might be the case because solar energy is still relatively new.

**Table 9: Statements from strongly agree to strongly disagree**

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The level of income of most Zanzibaris are low to afford installation of solar energy system	195(69.6%)	47(16.8%)	38(13.6%)		
Solar energy system is cheap to install in a house		15(5.3%)	10(3.6%)	44(15.7%)	211(75.4%)
The solar energy equipment is very expensive	115(41.1%)	35(12.5%)	40(14.3%)	55(19.6%)	35(12.5%)

*Source: Survey data, (2022)*

Findings from Table 9 on the responses of the level of income of most Zanzibaris are low to afford installation of solar energy system revealed that 69.9% of all respondents strongly agreed, followed by 16.8% of them who agreed and 13.6% of them reported to be neutral. The findings have an implication that majority of the

respondents strongly agreed that most of Zanzibar have lower income that make them not to afford installing solar energy in their houses.

On other hand, the responses of the solar energy are cheap to install in a house revealed that 75.4% of all respondents strongly disagreed, followed by 15.7% of them who disagreed whereas 3.6% of them reported to be neutral and the remaining 5.3% were agreed. The findings implied that installing solar energy is not cheap that anyone can afford.

Moreover, the responses of the solar energy equipment are very expensive revealed that 41.1% of all respondents strongly agreed, followed by 19.6% of them who disagreed while 14.3% of them reported to be neutral. On the other hand, 12.5% agreed and the remaining 12.5% were strongly disagreed. The results implied that buying solar energy equipment needs to have enough money because they are expensive.

According to the findings, an overwhelming majority of respondents were in complete agreement with the statement that the majority of people in Zanzibar have low salaries, which makes it financially impossible for them to install solar energy systems in their houses. This conclusion was supported by (La Rovere, 2018) the fact that a large number of respondents indicated that they were completely in agreement with the statement. The feedback received was entirely consistent in expressing agreement with this notion. Because of the high cost of solar energy equipment, the findings of the study indicate that in order to make a purchase of this kind, a person needs to have a sizeable quantity of available financial resources. This is due to the growing demand for devices that can produce solar energy.

**Objective 2: To determine the extent government policy hinder adoption of solar energy system in Zanzibar**

**Table 10: Is any policy related to renewable energy in Zanzibar?**

		Is any policy related to renewable energy in Zanzibar	
		Frequency	Percent
Valid	Yes	280	100
	Total	280	100

*Source: Survey data, (2022)*

Finding from the 10 revealed that all respondents (100%) answered that there is policy which related to renewable energy in Zanzibar. The findings implied that Zanzibar has a policy related to renewable energy. It would infered that, on the basis of the evidence that is now at hand, that Zanzibar has implemented some kind of policy regarding renewable energy sources.

**Table 11: Does the policy allow the installation of solar energy system in Zanzibar?**

		Does the policy allow the installation of solar energy system in Zanzibar?	
		Frequency	Percent
Valid	Yes	280	100
	Total	280	100

*Source: Survey data, (2022)*

Findings from Table 11 indicated that all respondents (100%) said that the policy all allowed installation of a solar energy system in Zanzibar.

**Table 12: Does the policy provide friendly tariffs to solar energy corporation to invest in Zanzibar?**

		Does the policy provide friendly tariffs to solar energy corporation to invest in Zanzibar?	
		Frequency	Percent
Valid	Yes	65	23.2
	No	215	76.8
	Total	280	100

*Source: Survey data, (2022)*

Findings from Table 12 indicated that 76.8% of respondents replied that the policy does not provide friendly tariffs to solar energy corporations to invest in Zanzibar, while 23.2% of the respondents said the policy provides friendly tariffs.

**Table 13: Does the government policy provide attraction to the investors who have willing on solar energy investment?**

	Does the government policy provide attraction to the investors who have willing on solar energy investment?	
	Frequency	Percent
Yes	71	25.4
No	209	74.6
Total	280	100

*Source: Survey data, (2022)*

Finding from the Table 13 indicated that 74.6% of respondents replied that the policy does not make attractiveness to investors or solar energy corporation to invest in Zanzibar while 25.4% of the respondents said the policy provides attraction to investors.

**Table 14: Statements from strongly agree to strongly disagree**

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The policy allows investors to distribute electricity direct to the citizens	56(20%)	15(5.3%)	25(8.9%)	57(20.4%)	127 (45.4%)
The policy allows investors to distribute electricity to National grid	220(78.5%)	40(14.3%)	10(3.6%)	10(3.6%)	
The policy considers the management of waste produced by PV			110(39.3%)	40(14.3%)	130 (46.4%)

*Source: Survey data, (2022)*

Findings from Table 14 on the responses of the policy allow investors to distribute electricity direct to the citizens revealed that 45.4% of all respondents strongly disagreed followed by 20.4% of them who disagreed whereby 20% of them strongly agreed and 8.9% were reported to be neutral and the remaining 5.3% were agreed.

On other hand, the responses of the policy allow investors to distribute electricity to National grid revealed that 78.5% of all respondents strongly agreed followed by 14.3% of them agreed whereas 3.6% of the respondents were reported to be neutral and the remaining 3.6% disagreed.

Moreover, the responses of the policy consider the management of waste produced by PV revealed that 46.4% of all respondents strongly disagreed followed by 39.3% of them reported to be neutral while 14.3% disagreed.

**Objective 3: To analyse the extent infrastructure hinder adoption of solar energy system in Zanzibar**

**Table 15: Does Zanzibar have solar resources that allow operation of solar energy system?**

		Does Zanzibar have solar resources that allow operation of solar energy system?	
		Frequency	Percent
Valid	Yes	252	90.0
	No	28	10.0
	Total	280	100

Source: Survey data, (2022)

Finding from the Table 15 indicated that 90% of respondents said that Zanzibar has solar resources that allow operation of solar energy system whereas while 10% of the respondents said that there have not.

**Table 16: The availability of land space and infrastructure is friendly to invest solar energy system in Zanzibar?**

		The availability of land space and infrastructure is friendly to invest solar energy system in Zanzibar?	
		Frequency	Percent
Valid	Yes	15	5.4
	No	265	94.6
	Total	280	100

Source: Survey data, (2022)



Finding from Table 16 revealed that 94.6% of respondents said that the availability of land space and infrastructure is not friendly to invest solar energy system in Zanzibar whereas 5.4% of the respondents said that the availability of land space and infrastructure is friendly to invest solar energy system in Zanzibar. The findings of the study indicate that the majority of respondents do not believe that the current state of affairs in Zanzibar, in terms of the availability of land space and infrastructure, is suitable for financial investments in solar energy systems. However, only a minority of respondents are of the opinion that there is sufficient land space and infrastructure in Zanzibar to support the installation of solar energy installations. The findings are similar to study done by Ahmad et al., (2017), it can be inferred that the study was conducted to assess the opinions of respondents regarding the suitability of Zanzibar's current state of affairs for investing in solar energy systems. The findings suggest that most respondents do not consider the availability of land space and infrastructure in Zanzibar to be favorable for financial investments in solar energy systems. However, a small number of respondents have a different opinion and believe that there is enough land space and infrastructure to support the installation of solar energy systems.

**Table 17: Does ZECO networking infrastructure is promising to connect solar energy system into National grid?**

		Does ZECO networking infrastructure is promising to connect solar energy system into National grid?	
		Frequency	Percent
Valid	Yes	92	32.9
	No	188	67.1
	Total	280	100

*Source: Survey data, (2022).*

Finding from the Table 17 revealed that 32.9% of respondents agreed that ZECO networking infrastructure is promising to connect solar energy system into National grid whereas 67.1% of the respondents said that ZECO networking infrastructure is not promising to connect solar energy system into National grid.

**Table 18: The climate infrastructure in Zanzibar is promising for solar energy investment?**

		The climate infrastructure in Zanzibar is promising for solar energy investment?	
		Frequency	Percent
Valid	Yes	198	70.7
	No	82	29.3
	Total	280	100

*Source: Survey data, (2022)*

Finding from the Table 18 showed that 70.7% of respondents agreed that climate infrastructure in Zanzibar is promising for solar energy investment while 29.3% of the respondents said that climate infrastructure in Zanzibar is not promising for solar energy investment.

#### **4.4 Qualitative data obtained from interview method and analyzed by Content analysis**

The content analysis was done for the data obtained from conducted interviews with participants. Therefore, results which are directly related to the specific objective of this study were presented since the results reflect the opinions of participants from the selected areas of this study, though it sheds light for the general population on the adoption of solar energy system in Zanzibar. The following were the views of participants during the interview as elaborated on the bases of the interview guided questions:

##### **Financial barriers**

After conducting an in-depth interview from the various respondents, there were a resembling number of comments about the financial aspect that hinder the adoption of solar energy. Most of the respondents commented on the low level of income for many Zanzibaris which could hinder them installing solar power in their homes. One respondent commented that *'to put solar in the house is not simple thing considering most of Zanzibaris are poor, in other countries like France, for example, if you want to put solar in your house, you just go to the bank to get an interest free loan to cover it. But here the banks provide loans with high interest rates that is difficult for a poor person to return it back.* Another respondent highlighted that *government itself is not able to adopt solar energy because of its capital is low, however currently, the government has got loan from World Bank to start adoption of solar energy in some of the areas within Zanzibar.*

Different respondents highlighted that, most of the villagers are poor, some of them cannot afford to connect electricity and still candles to their houses, how

come they can afford to install solar power. This is evident in the following quote of the respondents *'We who speak to you in our house still we are not connect electricity from the grid and we are using local lamps, it does not mean that we do not want an electricity but we don't have the money to connect in our house and to pay monthly tariffs. Therefore, telling us to install solar power is like you telling us to carry a packet of stones at our heads'*. Another respondent explained that *'I am eating once in a day with my family because I don't have enough money to make sure that we are eating three times a day, so, if I don't have money to eat how could I be capable to install solar power?*

Indeed, some of the respondents have different views on the adoption of solar energy as an independent source of electricity by reckoning the three months blackouts and frequency power outages happening in Zanzibar are troublesome to their fishing activities, *'I agree that solar is expensive but once you install it there is no need to pay for electricity, but the electricity that we use now once the units are over you buy again, both are expensive and to me solar is cheap than that we have now'*. *If you recall in 2010, we stayed three months without electricity in all over the country, the situation was very difficult to us because we were not able to store our fishes in the refrigerators and end of the day they were destroyed'*.

### **Environment**

On the hand of the impact of solar energy to the environment, during the interviews the respondents were fairly uniform in their opinion about the impact of solar energy to the environment. One respondent highlighted that solar energy is one of the clean sources of energy due to the fact that it does not produce pollution to the environment during its use. *'Solar energy is a clean source of energy and environmentally friendly'*. Another respondent went on to highlight the

benefits of solar energy, he urged that *'solar energy does not produce carbon dioxide gases to our environment; it encourages the preservation, conservation and sustainable utilization of forest resources.* Though some of the respondents have different opinions on the environment and mentioned that installing high amount of solar technology could destruct environment.

### **Government policy**

On another hand of responses from interview concerning with government policy, the respondents had same views concerning with the government policy to allow solar energy corporation to invest in Zanzibar, most of their comments sited an example on the current electricity, only government institution is responsible to supply electricity within Zanzibar. The comments based on this fact. *'Madam, I don't think that government is ready to allow other company to invest in Zanzibar on the electricity issues, because even now only ZECO is one and only institution that provide electricity.* Further, he cited section from ZECO Act, 2006, under section 4 (e) and (f) which stated that *"to enter into contracts with any public, local authority or any person for the purchase and supply of electricity or for any other purpose; and "to enter into agreements for purchase of electricity in bulk from independent power producers within or outside Zanzibar for resale to consumers"*.

On the other hand, one respondent from Zanzibar Electricity Corporation highlighted main points concerning with the current status of adopting of solar energy in Zanzibar. He commented that *solar can be connected in a national grid however in a very small amount because the networking infrastructure is not able to receive high amount of solar energy.* He continued to clarify about the issue of investors if there were any who came to invest solar power in Zanzibar, He said that *there are so many investors who came to invest on solar power, though the*

*government scrutinizes all petition finally and until now did not accept any of the investor, currently there is a project sponsored by World Bank which is going to be installed in Makunduchi area which will be directly connected in national grid. Among the area of this project is to improve infrastructure including transmission lines of ZECO which will be constructed after 2 up to 3 years from Welezo to Makunduchi,*

*Another participant has explained that current status of national grid cannot afford to receive even 50 Mgwatt, this will be able after the completion of the project.*

## CHAPTER FIVE

### RESULTS AND DISCUSSION

#### 5.0 Introduction

This chapter presents the discussion of the results as followed in consideration to the specific objects of the study.

#### 5.1. To examine the level of financial barriers, hinder the adoption of solar energy system in Zanzibar

The descriptive statistics results of this study revealed that the financial barriers affect the adoption of solar energy in Zanzibar. This is findings were supported from the Leach's (1992) hypothesis who assumed that a household's energy source choice depends on the level of income of the community. When the income raises, community changes from using traditional energy to modern ones as seen for example, the community changes from using kerosene candle and use electricity from the grid (Leach 1992). The study revealed that most of the residents in Zanzibar had low income which contributed to the high number of residents resisted to adopt solar energy system. Majority of the respondents did not have loans in the banks or in any microfinance institutions. The findings show that majority of the respondents did not have enough money to purchase and install solar energy due non regular income. On the other hand, the resembled with the Kessy (2018) study findings revealed that 90% of respondents agreed that income affects the adoption of technology. The findings of Ng'eno (2014) in his study supported the current results that the community has not adopted much into solar technology with only 32% using solar in the region because of the level of income of households which negative impact on adoption of solar technology. Whereas

Peimani et al (2018) on their study concluded that government reluctance to finance has been the major barrier to the expansion of solar energy in Asia.

### **5.2 To examine the extent to which government policy hinder the adoption of solar energy system**

The findings from the descriptive statistics of this study showed that the government policy affect the adoption of solar energy in Zanzibar. The findings revealed that policy is not attractive to energy Corporations to invest because of tariffs and there is not opportunity for the Corporations to distribute solar power to residents. The findings were supported with the study conducted by Karakaya & Sriwannawit (2015) which revealed that there is no sufficient and effective policy that support stakeholders who are willing to invest on the solar energy industry. These findings have been supported by other authors in their studies such as Vasseur, Kamp, & Negro, (2013) who conducted their study in Netherlands and Zhai, (2013) conducted in U.SA.

### **5.3 To examine the extent to which infrastructure hinder the adoption of solar energy system**

The findings from the descriptive statistics of this study revealed that the infrastructure affects the adoption of solar energy in Zanzibar. Majority of the respondents showed that the climate infrastructure in Zanzibar is promising for solar energy investment though networking infrastructure could be a barrier for the adoption of solar energy system in Zanzibar. These results were supported by Samoita et al., (2020) in their study of “Barriers and solutions for increasing the integration of solar photovoltaic in Kenya’s electricity mix” addressed the barriers for increasing the integration of solar photovoltaic are technological barriers, economic barriers including costs and infrastructure, institutional barriers and political barriers.



## CHAPTER SIX

### CONCLUSIONS AND RECOMMENDATIONS

#### 6.0 Introduction

This chapter is divided into three sections. The first part describes the conclusion of the study; the second part presents the recommendations of the study based on the findings and the final part presents suggestions of area for further study.

#### 6.1 Conclusion

Using solar energy as an independent source of electricity has paramount importance to reduce frequency happening blackouts and power outages especially for semi-autonomous countries like Zanzibar. It is vital to understand the factors hindering the adoption of solar energy system. Previous studies on the factors hindering the adoption of solar energy system overlooked key variables and did not look at the situation in the study area. To fill this gap, the study gathered data from three villages and staff from government institutions collected from 350 respondents to examine factors hindering the adoption of solar energy system in Zanzibar.

In the study area, many villagers have an inclination not to adopt solar energy system. Out of the total sample, 69.6% of the respondents were not ready to adopt solar energy system because of the low level of their income and 41.1% said that solar equipment is very expensive. Based on the finding, respondents are varied in many demographic and socioeconomic variables.

## **6.2 Recommendations**

- i. Revolutionary Government of Zanzibar should improve rural households' income level by giving them free interest loans, this improvement will grow not only their willingness to adopt solar energy system but also improves the overall wellbeing of the family.
- ii. Also, in order to ensure the adoption of solar energy system in Zanzibar, a government should produce equipment and experts in the solar industry through efficiency and innovation.
- iii. Indeed, the Revolutionary Government of Zanzibar should design and develop policies that would allow Energy Companies to own the supply of the electricity to the customers in a positive manner to a healthier environment.

## **6.3 Recommendations for further study**

Other study can be conducted in examining the effectiveness in implementation of solar energy project in Zanzibar. This study will base on checking how solar energy project is effective implemented in Zanzibar.

Also, other study can be conducted on the sustainability of solar energy system in Zanzibar. The aim of this study will be to oversee the future of the government institution to the solar energy system.

## REFERENCES

- Abdullahi, D., Suresh, S., Renukappa S. and Oloke D. (2017) Key Barriers to the Implementation of Solar Energy in Nigeria: A Critical Analysis, 2nd International Conference on Green Energy Technology (ICGET 2017) IOP Conf. Series: Earth and Environmental Science 83 (2017) 012015 doi :10.1088/1755-1315/83/1/012015
- Ahmad S. Razman M.T, Jack K. C and Liu Y. (2017). Public acceptance of residential solar photovoltaic technology in Malaysia. Emerald Publishing Limited, Malaysia.
- Alam, S. S., Ahmad, M., Othman, A. S., Shaari, Z. B. H., & Masukujjaman, M. (2021). Factors Affecting Photovoltaic Solar Technology Usage Intention among Households in Malaysia: Model Integration and Empirical Validation. *Sustainability*, 13(4), 1773.
- Amini K., Fatihya M., Sam W. and Djouna M. (2017) Feasibility Study on Solar lighting for Poverty Alleviation in Rural Communities in Southern Tanzania Sokoine University of Agriculture, Morogoro, Tanzania International Child Support, Meatu, Tanzania.
- Aziz N, Wahid N, Sallam M. (2017). Factors influencing Malaysians consumers intention to purchase green energy: the case of solar panel. *Global Business and Management Research* 328-346

- Bhuiyan M. A., Zhang Q., Khare V., Mikhaylov A., Pinter G., Huang X. (2022). Renewable energy consumption and economic growth nexus-a systematic literature review. *Front. Environ. Sci.* 10. doi: 10.3389/fenvs.2022.878394
- Burlando, A. (2010). The impact of electricity on work and health: evidence from a blackout in Zanzibar. *SSRN Electronic Journal*, 1-44.
- Daly H., Walton M.A. (2017) Energy access outlook 2017: from poverty to prosperityWorld energy outlook 2017, special report, International Energy Agency (IEA), Paris, France
- D'Agostino AL, Sovacool BK and Bambawale MJ. (2011). A retrospective appraisal of China Renewable Energy Development Project (REDP). *Renew Energy* 36:3154-65
- Dean, E. (2020). Uneasy Entanglements: Solar Energy Development in Zanzibar. *The Cambridge Journal of Anthropology*, 38(2), 53-70.
- Dennis Asante, Zheng He, Nana Osaе Adjei, Bismark Asante. (2020) Exploring the barriers to renewable energy adoption utilising MULTIMOORA- EDAS method, *Energy Policy*, Volume 142, 111479, ISSN 0301-4215
- Ezugwu, C. (2015). Renewable energy resources in Nigeria: Sources, problems and prospects. *Journal of Clean Energy Technologies*, 3(1), 68-71.
- Fellows, R. and Liu, A. (2008). *Research Methods for Construction*. 3<sup>rd</sup>Edition, Blackwell Publishing Limited, Hoboken.
- George, L. (2019). Challenges face small scale industries in adoption of solar energy in Tanzania: Case study in Mbeya City. Mzumbe University.

- Grothoff J.M. (2014) Estimating the Renewable Energy Potential in Africa  
International Renewable Energy Agency (IRENA)
- Gerhard Z & Amanda C. (2012). Zanzibar renewable energy assessment.
- Itai M. (2006). Solar power: Cheap energy source for Africa. Africa Renewal. A  
Podcast from the United Nations.
- Jamila W. O., Essah, E., and Ofetoste, E. (2018) Barriers of solar energy uptake  
and the potential for mitigating solutions in Barbados. *Renewable and  
Sustainable Energy Reviews*, 91. Pp. 934-949
- Kåberger T. (2018). Progress of renewable electricity replacing fossil fuels. *Global  
Energy Interconnection*. 1, 48-52. doi: 10.14171/j.2096-  
5117.gei.2018.01.006
- Karakaya, E., & Sriwannawit, P. (2015). Barriers to the adoption of photovoltaic  
systems: The state of the art. *Renewable and Sustainable Energy Reviews*,  
49, 60-66.
- Kardoon R, Yosuff SB and Kari FB. (2016). Renewable Energy Technology  
Acceptance in Penusular Malaysia. *Energy Policy*, 88:1-10
- Karekezi, S., and Ranja, T. (1997) *Renewable Energy Technologies in Africa* ZED  
Books and AFREPREN. Oxford U.K
- Karekezi, S. and Kithyoma, W., (2002) *Renewable Energy Strategies for Rural  
Africa: is a PV-led renewable energy strategy the right approach for  
providing modern energy to the rural poor of sub-Saharan Africa?* *Energy  
Policy*, Vol. 30 Nos. 11-12, Special Issue - Africa: Improving Modern Energy  
Services for the Poor. Oxford: Elsevier Science Limited

- Kessy S. S. (2018) Factors influencing adoption of solar technology in Tanzania  
International Journal of Science and Research (IJSR) ISSN: 2319-7064
- Kothari, C. R. (2004). Research methodology: Methods and techniques: New Age International.
- Kulkarni S. S., Edwards D. J. (2022). A bibliometric review on the implications of renewable offshore marine energy development on marine species. *Aquaculture Fisheries* 7, 211-222. doi: 10.1016/j.aaf.2021.10.005
- La Rovere, E. L., Grottera, C., & Wills, W. (2018). Overcoming the financial barrier to a low emission development strategy in Brazil. *International Economics*, 155, 61-68.
- Laura F., and Ghazali N. N. (2020) Barriers to implementing solar energy systems in buildings: The resident's perspective in Malaysia. In Tommelin, L.D and Daniel E. (eds). *Proc 28<sup>th</sup> Annual Conference of the International Group for Lean Construction (IGLC28)*, Berkeley, California, USA
- Leach, G. (1992), The Energy Transition, in: *Energy Policy* , 20, 2, 116-123.
- Liu Z. (2015). *Global Energy Interconnections*. Elsevier Science p.30 ISBN 9780128044063.
- Margolis, R., & Zuboy, J. (2006). Nontechnical barriers to solar energy use: review of recent literature.
- Manish K. H., Sajal G. (2017). 100GW solar power in India by 2022 - A critical review, *Renewable and Sustainable Energy Reviews*, Volume 73, Pages 1041-1050, ISSN 1364-0321

Maarita, N. O., (2002) The Impact of Large-Scale Energy Development on the Poor: Environmental and Social Economic Impact of a Geothermal Power Plant on a poor Rural Community in Kenya. Energy Policy, Elsevier Science, Oxford. U.K.

Ng'eno C. (2014) Factors affecting adoption of solar power for domestic usage in Kajiado county Kenya. Master thesis University of Nairobi Kenya

Peimani, H. (2018). Financial Barriers to Development of Renewable and Green Energy Projects in Asia ADBI Working Paper 862. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/financial-barriers-development>

Power System Master Plan, 2016 Ministry of Energy and Minerals, the United Republic of Tanzania, Dar es Salaam

Qazi A. Hussain F, and Rahim NA. (2019). Towards Sustainable Energy: A systematic Review of Renewable Energy Sources, Technologies and Public Opinion, IEEE Access.

Sampaio, P. G. V., & González, M. O. A. (2017). Photovoltaic solar energy: Conceptual framework. *Renewable and Sustainable Energy Reviews*, 74, 590-601.

Samoita, D., Nzila, C., Østergaard, P. A., & Remmen, A. (2020). Barriers and solutions for increasing the integration of solar photovoltaic in Kenya's electricity mix. *Energies*, 13(20), 5502.

- Siddharth S., Sunila S. K. (2018) Solar 'power': Socio-political dynamics of infrastructural development in two Western Indian states, *Energy Research & Social Science*, Volume 41, Pages 270-278, ISSN 2214-6296
- Steinbuks J. and Foster V. (2009). In House Generation of Electricity by Firms in Africa World Bank Open Knowledge.
- Vasseur, V., Kamp, L. M., & Negro, S. O. (2013). A comparative analysis of Photovoltaic Technological Innovation Systems including international dimensions: the cases of Japan and The Netherlands. *Journal of cleaner production*, 48, 200-210.
- World Bank (2018) Electricity access and economic development: options for accelerating progress in sub- Saharan Africa Washington DC.
- Bank, T. W. (2022). Tracking SDG7: The energy progress report 2022. IEA Report.
- Wyllie, J. O., Essah, E. A., & Ofetotse, E. L. (2018). Barriers of solar energy uptake and the potential for mitigation solutions in Barbados. *Renewable and Sustainable Energy Reviews*, 91, 935-949.
- Zebra, E. I. C., van der Windt, H. J., Nhumaio, G., & Faaij, A. P. (2021). A review of hybrid renewable energy systems in mini-grids for off-grid electrification in developing countries. *Renewable and Sustainable Energy Reviews*, 144, 111036.
- Zhai, P. (2013). Analyzing solar energy policies using a three-tier model: A case study of photovoltaics adoption in Arizona, United States. *Renewable energy*, 57, 317-322.



Zluu S, Zulu E and Mwansa C. (2021). Factors Influencing Intention to Adopt Solar Energy Solutions in Households in Zambia: Insights from the Theory of Planned Behavior. *Smart and Sustainable Environment*.

## APPENDECIES 1 QUESTIONNAIRE

I am, Raya Issa Mwadini, student of MBA Oil and Gas Management at Uganda Christian University. I am conducting academic research titled “*Factor hindering the adoption of solar energy system in Zanzibar*”. The research is academic one whose purpose is to complete the requirements for being awarded the above said master program. The information which will be provided in this questionnaire is confidential and will be used for the above-mentioned purpose only. Thank you for receiving this questionnaire and please help me to get the answers for the questions below.

### PART A: DEMOGRAPHIC INFORMATION

1. Gender:

a. Male

b. Female

2. Education Level

a. Primary Education

b. Secondary Education

c. Bachelor Degree

d. Master Degree

3. Age

a. 18-35

b. 36-45

c. 45 and above

4. Which area are you coming from?

- a. Ministry of Water and Energy
- b. Bambi
- c. Matemwe
- d. Makunduchi

**PART B:** This part is intended to assess the financial barriers regarding the hindrance of the adoption of solar energy system in Zanzibar.

5) Government capital is enough to adopt solar energy system?

- a) Yes
- b) No

6) There are FIVE possible responses to each statement ranging from “strongly disagree” (no 1) to “strongly agree” (no 5). Strongly Disagree (SD), Disagree (D), Neutral (N) Agree (A), Strongly Agree (SA), please TICK ON ONLY ONE NUMBER (1,2,3,4,5) that correspond to your opinion.

S.N	Statements	SD	D	N	A	SA
1	The level of income of most Zanzibaris are low to afford installation of solar energy system	1	2	3	4	5
2	Solar energy is cheap to install in a house	1	2	3	4	5
3	The solar energy equipment is very expensive	1	2	3	4	5

**PART C: This part is intended to determine the extent government policy hinder adoption of solar energy system in Zanzibar**

7) Is there any policy related to renewable energy in Zanzibar?

- a) YES    b) NO

8) Does the policy allow the installation of solar energy system in Zanzibar?

- a) YES    b) NO

9) Does the policy provide friendly tariffs to solar energy corporation to invest in Zanzibar?

- a) YES    b) NO

10) Does the government policy provide attraction to the investors who have willing on solar energy investment?

- a) YES    b) NO

11) There are FIVE possible responses to each statement ranging from “strongly disagree” (no 1) to “strongly agree” (no 5). Strongly Disagree (SD), Disagree (D), Neutral (N) Agree (A), Strongly Agree (SA), please TICK ON ONLY ONE NUMBER (1,2,3,4,5) that correspond to your opinion.

S.N	Statements	SD	D	N	A	SA
1	The policy allows investors to distribute electricity direct to the citizens	1	2	3	4	5
2	The policy allows investors to generate and transmit electricity to National grid	1	2	3	4	5
3	The policy considers the best treatment management of waste produced by used solar PV during the decommissioning	1	2	3	4	5

**PART D: This part is intended to analyse the extent infrastructure hinder adoption of solar energy system in Zanzibar**

12) Does Zanzibar have adequate solar resources that allow operation of solar energy system?

- a) YES      b) NO

13) The availability of land space and infrastructure is friendly to invest solar energy system in Zanzibar?

- a) YES      b) NO

14) Does the ZECO networking infrastructure is promising to connect solar energy system into National grid?

- a) YES      b) NO

15) The climate infrastructure in Zanzibar is promising for solar energy investment?

- a) YES      b) NO

## APPENDECIES 2

### INTERVIEW GUIDE

I am, Raya Issa Mwadini, student of MBA Oil and Gas Management at Uganda Christian University. I am conducting academic research titled “*Factor hindering the adoption of solar energy system in Zanzibar*”. The research is academic one whose purpose is to complete the requirements for being awarded the above said master program. The information which will be provided in this interview is confidential and will be used for the above-mentioned purpose only. Thank you for sparing sometimes with me and please help me to get the answers for the questions below.

1. Are there any financial obstacles that make you hinder adoption of solar energy system?
2. Dou think adoption of solar energy will lead to the environmental destruction at your area and Zanzibar at large?
3. Do you think that government policy allows solar energy Investment Company to invest in Zanzibar? If yes, why there is no investment which has been made?

APPENDECIES 3

LETTER OF PERMISSION FROM THE OFFICE OF GOVERNMENT STATISTICIAN



REVOLUTIONARY GOVERNMENT OF ZANZIBAR

SECRETARY  
ZANZIBAR RESEARCH COMMITTEE  
P.O Box 2321, Mazizini, Zanzibar  
Tel: 024 2231869  
Fax: 024 2231742



RESEARCH/FILMING PERMIT  
(This Permit is only Applicable in Zanzibar for duration specified)



SECTION

Reference No#: 62AB209C72FA6

Name	RAYA ISSA MWADINI
Gender	F
Date and Place of Birth	1989-04-08, MPENDAE-ZANZIBAR
Nationality	Tanzanian
Data Collection Duration	6 Month(s)
Research Tittle	Factor hindering the adoption of solar energy system in zanzibar
Date of Issue	17-06-2022
Valid until	17-12-2022



Full Address of Sponsor

Name of the authorizing officer

ABDHYA M. DENGGE

Signature and seal

Institution

Office of the Chief Government Statistician  
P.O. Box 2321, ZANZIBAR

Address



Printed Date

17-06-2022

APPENDECIES 4

LETTER OF PERMISSION FROM THE SECOND VICE PRESIDENT OFFICE



SERIKALI YA MAPINDUZI YA ZANZIBAR  
AFISI YA MAKAMU WA PILI WA RAIS,

Simu : 0242231826  
Nukushi: 0242231826  
Barua pepe: [info@ompr.go.tz](mailto:info@ompr.go.tz)  
Tovuti : [www.ompr.go.tz](http://www.ompr.go.tz)

S.L.P 239,  
Mtaa wa Vuga,  
Zanzibar, Tanzania

OMPR/M.95/C.6/3/VOL.IV/ 104

21/06/2022.

KATIBU MKUU,  
WIZARA YA MAJI, NISHATI NA MADINI,  
ZANZIBAR.

MKURUGENZI MTENDAJI,  
SHIRIKA LA UMEME (ZECO),  
ZANZIBAR.

**KUH: RUHUSA YA KUFANYA UTAFITI**

Kwa heshima, naomba uhusike na mada ya hapo juu.

Serikali ya Mapinduzi ya Zanzibar imemruhusu Ndg. Raya Issa Mwadini mwanafunzi kutoka Chuo Kikuu cha Christian, Taasisi ya Masomo ya PetroliKampala anaosomea Shahada ya Uzamili katika fani ya Mafuta na Gesi kufanya utafiti katika mada inayohusiana na "Factors Hindering the Adoption of Solar Energy System in Zanzibar: Case Study Unguja Island". Utafiti huo utafanyika Wizara ya Maji, Nishati na Madini pamoja na Shirika la Umeme kuanzia tarehe 20/06/2022 mpaka 17/12/2022. Tunaomba asaidiwe ili aweze kukamilisha utafiti huo.

Kwa nakala ya barua hii mara baada ya kumaliza utafiti, mtafiti anatakiwa kuwasilisha nakala (copy) 3 za ripoti ya utafiti huo, Afisi ya Makamu wa Pili wa Rais - Zanzibar.

Naambatanisha na kivuli cha kibali cha kufanyia utafiti.

Wako mtiifu,

*Khamis H. Juma*

**KHAMIS H. JUMA,**  
**/KATIBU MKUU,**  
**AFISI YA MAKAMU WA PILI WA RAIS,**  
**ZANZIBAR.**



*Jumlaa kuhesabiwa siku ya Jumatane tarehe 23 Agosti, 2022.*

NAKALA: Ndg. Raya Issa Mwadini (0774 243535).