

**Czech University of Life Sciences Prague**  
**Faculty of Economics and Management**  
**Department Of Economics and Management**



**Master's Thesis**

**Impact Of Renewable Energies on the Nigeria's Economy**

**Ganiyat Adebola JIMOH**

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# CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

## DIPLOMA THESIS ASSIGNMENT

Ganiyat Adebola Jimoh

Economics and Management

Thesis title

**The impact of renewable energies on the Nigeria's economies**

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### Objectives of thesis

- i. to identify the types of renewable energy used in the study area
- ii. To assess the effect of renewable energy utilization on economic growth
- iii. To examine the factors influencing the utilization of renewable energies in the study area
- iv. to reveal the challenges that affects the use of renewable energies

### Methodology

The well-being of the economy of a country is tide related to stable income resources. The power sector plays a vital role as an income resource, also as an operating factor for other income resources. Recently, renewable energy is substituting for petrol-based power. Winds power, waterfall power, etc. are employed to provide the required power for industries and homes as well. However, establishing this technique in developing countries is not yet completed because of the initial expenses that should be paid in advance. Therefore, decision-makers in developing countries are divided into two groups. The first group prefers to spend money on setting up renewable resources, while the second group believes that using non-renewable energy would save money for other projects that give better income than the power sector. Many factors are considered by the decision-makers to reach final regulations. Quantities of those factors along with each factor weight have to be investigated. The results of different case studies have to be reported and compared using a real-life, recent dataset.

**The proposed extent of the thesis**

50-60

**Keywords**

clean energy, consumption, developing countries, green economy, wellbeing

**Recommended information sources**

- Fu, Q.; Álvarez-Otero, S.; Sial, M.S.; Comite, U.; Zheng, P.; Samad, S.; Oláh, J. Impact of Renewable Energy on Economic Growth and CO2 Emissions—Evidence from BRICS Countries. *Processes* 2021, 9, 1281. <https://doi.org/10.3390/pr9081281>
- Oyedepo: Energy and sustainable development in Nigeria: the way forward. *Energy, Sustainability and Society* 2012 2:15. doi:10.1186/2192-0567-2-15
- P.K. Wesseh, B. Zoumara Causal independence between energy consumption and economic growth in Liberia: Evidence from a non-parametric bootstrapped causality test *Energy Policy*, 50 (2012), pp. 518-527
- T. Qi, X. Zhang, V.J. Karplus The energy and CO2 emissions impact of renewable energy development in China *Energy Policy*, 68 (2014), pp. 60-69

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### **Declaration**

I declare that I have worked on my master's thesis titled "The Impact of Renewable Energies on Nigeria's Economy" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 30<sup>th</sup> of March 2023

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**Ganiyat Adebola Jimoh**

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I fail to appreciate my darling husband, Kazeem Akanni Jimoh for his words of encouragement that made me pursue my master's degree in this prestigious University. I would like to say thank you to my son Jamal Akorede Jimoh who made the utmost sacrifice for me to be here today. And above all the lecturers and professors who have impacted their wealth of knowledge unto me. You all are my hero. Last but not the least to myself for being resilient and determined, I say the sky is my starting point.

# Impact of Renewable Energies on the Nigeria's Economy

## ABSTRACT

In order to close the gap between the 45–75% of Nigerians who lack access to environmentally friendly energy, the goal of this study is to investigate the potentials of renewable energy sources in Nigeria and how to support, promote, and empower the growth of renewable energy resources in Nigeria. Renewable energy solutions are fantastic and excellent since they are endless. We won't run out of them like we might with fossil fuels, which are Nigeria's main energy sources. Nigeria will adapt and move towards the usage of renewable energy sources as a result of a number of factors, not only the depletion of fossil resources. Climate change is a result of carbon emissions and environmental pollution.

The empirical portion of the study included two distinct research methodologies. The structured questionnaire survey was initially conducted. Moreover, interviews were conducted. Both study techniques were effective in examining Nigeria's energy status and yielding trustworthy data. The empirical findings show that there are serious energy issues.

The research's key finding is that Nigeria's renewable energy resources have an energy potential that is over 1.5 times greater than that of its fossil fuel resources. Solar energy is the best option for the crisis, followed by biomass and hydro. These three sources of renewable energy also have significant potential to improve and have an impact on Nigeria's low level of electricity, with a focus on rural areas, through adoption and use for sustainable development.

**Keywords:** Clean energy, Nigeria, wellbeing, Green economy, Consumption, Sustainability, Livelihood, Development, Power sector, Renewable energies.

# Dopad obnovitelných zdrojů energie na ekonomiku Nigérie

## Abstrakt

Cílem této studie je prozkoumat potenciál obnovitelných zdrojů energie v Nigérii a způsoby, jak podpořit, propagovat a posílit růst obnovitelných zdrojů energie v Nigérii, aby se odstranila propast mezi 45-75 % Nigerijců, kteří nemají přístup k energii šetrné k životnímu prostředí. Řešení obnovitelných zdrojů energie jsou fantastická a vynikající, protože jsou nevyčerpatelná. Nedojdou nám jako v případě fosilních paliv, která jsou hlavním zdrojem energie v Nigérii. Nigérie se přizpůsobí a přejde k využívání obnovitelných zdrojů energie v důsledku řady faktorů, nejen v důsledku vyčerpání fosilních zdrojů. Změna klimatu je důsledkem emisí uhlíku a znečištění životního prostředí.

Empirická část studie zahrnovala dvě odlišné výzkumné metodologie. Nejprve bylo provedeno strukturované dotazníkové šetření. Dále byly provedeny rozhovory. Obě studijní techniky byly účinné při zkoumání energetického stavu Nigérie a přinesly důvěryhodné údaje. Empirická zjištění ukazují, že v oblasti energetiky existují závažné problémy.

Klíčovým zjištěním výzkumu je, že nigerijské obnovitelné zdroje energie mají energetický potenciál, který je více než 1,5krát vyšší než potenciál zdrojů fosilních paliv. Nejlepším řešením krize je solární energie, následovaná biomasou a vodní energií. Tyto tři obnovitelné zdroje energie mají také značný potenciál zlepšit a ovlivnit nízkou úroveň elektrické energie v Nigérii, se zaměřením na venkovské oblasti, a to prostřednictvím přijetí a využití pro udržitelný rozvoj.

**Klíčová slova:** Čistá energie, Nigérie, blahobyt, Zelená ekonomika, Spotřeba, Udržitelnost, Živobytí, rozvoj, energetika, obnovitelné zdroje energie.

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# CHAPTER ONE

## 1.0 Introduction

### 1.1 Background of Study

#### 1.1.2 Overview of Nigeria

Nigeria is a country in western Africa, bordered to the east, north, and west by Cameroon, Niger, and the Republic of Benin, respectively, and to the south by the Gulf of Guinea. Nigeria is located between longitudes 50 and 150 to the east of the Greenwich Meridian and latitudes 50 to 150 to the north of the equator. The total area of land and sea in Nigeria is thought to be 924,000 km<sup>2</sup>. 36 administrative states make up the nation, with Abuja serving as the Federal Capital Territory (FCT) (Oladapo *et al.*, 2019).

Every economy's growth and development are significantly influenced by energy. Every aspect of economic activity on this planet requires energy, making it a key resource in the economy. In addition, rather than measuring the availability of products and services, it is employed as a measure of economic growth. Consequently, energy consumption and economic expansion are mutually exclusive (Chinedu, *et al.*, 2019). Energy is the essential force guiding all economic operations, according to Alam (2006).

Ojinnaka (2008) asserts that there is a direct correlation between national product and energy use. The need for energy has increased due to growing global production, yet the lack of available oil and natural gas supplies is a barrier to long-term economic expansion. Once more, the concerns associated with climate change and environmental degradation caused by the world's rising oil demand and carbon emissions have continued to influence the renewed attempts to harness renewable sources of energy (Uzokwe and Onyije, 2020; Iorember *et al.*, 2020). Slow economic growth and the growing need to decarbonize economies are two issues that developing nations like Nigeria must contend with (Uzokwe and Onyije, 2020).

Countries are searching for ways to boost their economies while reducing additional greenhouse gas emissions. Given this situation, renewable energy is emerging as a possible engine for economic growth and diversification as well as a way to meet rising energy demand while drastically cutting carbon emissions (IRENA, 2016).

Nigerian efforts to produce and use renewable energy are still in their infancy (Akorede *et al.*, 2017). According to Nigeria's Renewable Energy Master Plan (REMP), which was created by the energy commission in 2005, 90 percent of the country's population is expected to have access to energy by 2030, and 30 percent of their total generation will come from renewable sources (Gerretsen, 2018; Aliyu *et al.*, 2018). By 2030, 36% of all electricity will be generated from renewable sources, up from 13% in 2015, according to the Renewable Energy Master Plan (REMP). By 2025, 10% of the electricity consumed in Nigeria would be from renewable sources. Given the ratio of renewable electricity output to total national energy consumption, these goals are, however, very close to being achieved. Additionally, the literature for switching to renewable energy is not yet clear and supported, especially for nations like Nigeria that export a significant amount of conventional energy (Aliyu *et al.*, 2018).

## **1.2 Research Problem**

According to Painuly (2001), renewable energy has the potential to be crucial in delivering clean energy to the population of developing countries, where access to clean energy is now extremely limited. Furthermore, in many applications, renewable energy sources are not only cost-competitive with conventional energy, but also essential to establishing a sustainable shift (Painuly, 2001). Renewable energy may offer a remedy to the inefficiency in the energy sector, particularly in emerging nations. Environmental concerns are also driving initiatives in wealthy nations to increase the amount of renewable energy.

This study will look for the factors that prevent Nigeria from utilizing its potential for renewable energy. In reality, in coming parts, we'll examine and discuss Nigeria's potential for renewable energy as well as its present level of development before concentrating on the reasons for renewable energy investment in Nigeria.

## **1.3 Research Question**

What is the Impact of Renewable Energies on Nigeria's Economies?

### **1.3.1 Aim and Objective**

The aim of this research is to determine the impact of renewable energies on the Nigerian economies with the following objectives;

- To identify the types of renewable energy used in the study area.
- To assess the effect of renewable energy utilization on economic growth
- To estimate the factor influencing the utilization of renewable energies in the study area
- To reveal the challenges that affect the use of renewable energies.

### **1.4 Structure of the thesis**

The background information for the study, the research topic, the research question, and the study objectives are provided in Chapter 1. The second chapter describes and explains the research methodology employed and gives information about the public institutions. The third chapter reviews the literature, describes the energy process, and lists the five renewable energy sources along with information on how to produce energy from each. The findings and analysis of the thesis from the gathered data are presented in chapter four. The conclusion, recommendations, and summary in Chapter 5 will aid future research and the Nigerian people, institutions, and businesses with an interest in the effects of renewable energy on Nigeria's economy.

## CHAPTER TWO

### 2.0 RESEARCH METHODOLOGY

#### 2.1 METHODOLOGY

The methodological decisions the study took are covered in this chapter. Discussion of the research plan, research techniques, data collection technique, study methodology, public institutions, and case corporations.

#### 2.2 Description of Study Area

Geographically, Nigeria is situated close to the equatorial region and hence lies in the high sunshine belt which therefore increases its solar energy potential for the generation electrical power (Abdullahi, et al., 2017; Aderoju et al., 2017).

The average potential of energy within Nigeria have been embarked upon. It was reported that the aggregate of solar radiation incident on the land surface area of Nigeria is 12.6 MJ/m<sup>2</sup>day in the coastal regions and 25.2 MJ/m<sup>2</sup>day in the Northern part. A total of 17,459 billion MJ of solar energy was reported to be received on Nigeria's total land surface every day (Giwa et al., 2017). In a different study by (Ohunakin et al., 2014), the daily mean solar insolation in the coastal or southern region was estimated as 3.5 kWh/m<sup>2</sup>day and that of the northern region was estimated to be 7.0 kWh/m<sup>2</sup>day. Concisely, the quantity of sunshine hours across the country daily span from 7 to 9 hours on the average.

#### 2.3 Research Strategy

A comprehensive plan outlining how the researcher seeks to obtain answers to the study questions is known as a research strategy (Saunders *et al*, 2000). The primary types of research methods, according to Yin (1994), are surveys, experiments, histories, archival analyses, and case studies. In addition to these factors, it was noted that the selection of a research strategy is influenced by a number of factors, including the nature of the research question, the degree of the researcher's control over the actual behavioral events, and the degree of focus and attention given to current events as opposed to historical ones. The association between the three techniques and the condition was shown in Table 1 by Yin (1994).

**Table 1.** Relevant situation for different research strategies (Yin, p.6, 1994).

<b>Strategy</b>	<b>Form of Research Question</b>	<b>Requires Control Over Behavioral Events</b>	<b>Focus on Contemporary Events</b>
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how, many how much	Yes	Yes
Archival Analysis	Who, what, where, how, many how much	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes

#### **2.4 Data collection**

Both the qualitative and quantitative research methods were used to acquire the data. Triangulation, a concept that combines the two research methods, allows for the investigation and study of a single thesis topic using a number of methodologies. (Bogdan, Biklen, 2006). It is claimed that combining the two study approaches yields the greatest results because doing so is highly likely.

A questionnaire with 11 questions is drawn up (See appendix 1) and sent to the Nigerian public by email and using three contact persons in January 2023. A pilot test was conducted, 5 questionnaires were sent off, to test if the questions meet the objective of the study.

### **2.4.1 Qualitative Research Method**

Traditional applications of the qualitative research approach have been in the social sciences and marketing research, although it is now acceptable in a wide range of academic fields (Denzin, Yvonna, 2005). The goal of qualitative researchers is to learn as much as they can about human behaviors and the factors that influence it. The approach investigates the why and how of decision-making in addition to the what, where, and when.

The ways in which research is conducted, the results are reported, and the findings are analyzed varies between qualitative and quantitative research methods. Unlike quantitative research, the findings of qualitative research are not presented numerically. The objective of the qualitative research method is to gather more information rather than testing models and other hypotheses scientifically (Denzin, Yvonna, 2005). The results must be evaluated and categorized in accordance with the study and the situation. Here are some tips on how to create a qualitative research question because questions are crucial in qualitative research:

1. The research question's definition is of the utmost importance.
2. It's crucial to make the research question obvious to everyone.
3. It's crucial to talk a lot on a small subject rather than a little about a large one.

Sometimes, because of new insights or discoveries made throughout the course of doing the research, the original research strategy must be revised. Comparatively speaking, the qualitative research method is more adaptable. Additionally, quantitative research is typically less expensive than qualitative research. Due to the tiny sample size, each respondent provided a significant quantity of information, and conducting a successful interview needs the researcher to have specific interviewing skills. The qualitative technique uses exploratory research, and its analysis is interpretive and susceptible to personal opinion. Interviews and observation are the two ways that qualitative research methodologies obtain data.

Additionally, in unusual circumstances, official papers, articles, and photographs known as secondary data may be gathered to support the primary data acquired (McDaniel, Roger, 2009). Since social and behavioral science is where the qualitative research approach is most frequently utilized, it is appropriate for investigating people, groups, and organizations. Few observations are an issue with qualitative data, and data collection and analysis are also problematic because

they are frequently completed at the same time, raising questions about the validity and trustworthiness of a study.

#### **2.4.2 Quantitative Research Method**

The systematic empirical results of quantitative properties, phenomena, and their interactions are referred to as the quantitative research method. The objective is to create and use mathematical theories, models, and hypotheses that influence phenomena. The quantitative research technique relies heavily on the measuring process because it establishes a basic link between empirical observation and the mathematical expression of relationships.

In contrast to qualitative research, which is more subjective, quantitative research is more objective. The information gathered is more objective, the research topic is precisely specified, and the materials gathered are quantified. In contrast to the qualitative research approach, the objective of quantitative research is not to get a deeper understanding of phenomena. The quantitative research method's findings and conclusions are supported by statistical analysis (McDaniel, Roger, 2009).

Finally, the data must be valid, trustworthy, and consistent with the study's objectives. Basically, the quantitative research method uses secondary sources of data and, in some situations, self-gathered data to collect data. The Statistical Program for Social Sciences software is used to portray the numerical results of the quantitative research approach in tables, graphs, percentages, and other statistical analyses (SPSS). The most popular methods for acquiring information for the quantitative research approach are listed below:

1. Interviews
2. Surveys
3. Observation
4. Experimental cases

Structured questionnaires are the most used tool for data collection. The questionnaire is made to make it simpler for the respondents to respond to the questions. The questionnaire's questions are planned, which streamlines the procedure. They also frequently offer other possible replies that



respondents can quickly mark (McDaniel, Roger, 2009). One benefit of employing a well-structured questionnaire is that it is simple to maintain, the data it collects is typically accurate, and it is simple to interpret and evaluate the results.

In contrast to qualitative research methods, the amount of information obtained from each respondent varies due to the huge sample size, and it also necessitates that the researcher has limited interviewing abilities. The quantitative method uses descriptive or causal research, and statistical and summarizing analysis (McDaniel, Roger, 2009). Depending on the research topic, different survey methodologies include in-person interviews, telephone interviews, teleconference interviews, and postal interviews. The timelines, money, respondent attitudes, and the information required for a study all have an impact on the research method selection.

Who, what, when, where, and how much are the research questions that are typically addressed by quantitative research methodologies (McDaniel, Roger, 2009). The drawback of the quantitative research approach is that the use of structured questionnaires may prevent obtaining deeper knowledge and comprehension of the issue. The sensitive or private questions regarding the respondents' wealth or religion are still another issue with the usage of questionnaires. The respondent might occasionally find no adequate answers to any questions in the structured surveys. Because he pays greater attention to the survey's form and also analyses its results, the researcher plays a different function in quantitative research methods compared to qualitative research methods.

## 2.5 Data Collection Structure

In general, six sources of evidence are often used to acquire data for case studies, however only four are shown in Table 2. (Yin, 1994). Archival documents, documentation, interviews, participant observation, firsthand accounts, and actual artefacts are some of the sources.

**Table 2.** Sources of Evidence Source: (Yin, p.80, 1994).

<b>Source of Evidence</b>	<b>Strengths</b>	<b>Weaknesses</b>
<b>Archival Records</b>	-Stable- is reviewed repeatedly.	-Access may be denied -Reporting bias which

	-Contain exact names, references, and details of an event.	may reflects the bias of the author
	-Broad coverage and long-time span	-Bias selectivity, if the collection is incomplete
	-Precise and quantitative	
<b>Documentation</b>	-Stable- is reviewed repeatedly.	-Access may be denied
	-Contain exact names, references, and details of an event.	-Reporting bias which may reflects the bias of the author
	-Broad coverage and long-time span	-Bias selectivity, if the collection is incomplete
<b>Interviews</b>	-Insightful, which provides causal references	-Response bias sometimes
	-Focused directly on case study topic	-inaccuracy because of poor recall
		-Sometimes the interviewee gives the interviewer what he wants to hear
<b>Participants</b>	-Insightful into interpersonal behavior and motives	-Bias as a result of manipulation by the investigator
<b>Observations</b>	-Contextual-covers context of the event	-Time consuming
	-Reality-covers the events in real time.	-Too much cost is involved
		-Selectivity- unless there is a broad coverage

Many of the above-mentioned sources of evidence will not be used in this study for a variety of reasons. The observations of participants are not necessary to include. The use of actual artefacts is also not intended because the research is not focused on technological or cultural operations. The only sources of evidence used in this study will be interviews; no other forms of documentation will be used.

Structured interviews, semi-structured interviews, and unstructured interviews are the three kinds of interviews based on formality. For the structured surveys, the questions are prepared and standardized. The questions are not standardized for semi-structured interviews, and a list of topics is utilized in place of a defined questionnaire. Finally, because unstructured interviews are typically done informally and without preset questions, the respondent is less free to speak candidly about the topic at hand (Saunders *et al*, 2000).

## **2.6 Methodology of the Studies**

The purpose of this thesis is to obtain a greater understanding of the potential of renewable energy and investigate ways to encourage, support, and develop the use of renewable energy sources in Nigeria in order to close the energy access gap faced by roughly 60–70% of Nigerians.

Both qualitative and quantitative research methodologies have been employed for the study due to its nature and purpose. Two people from Pamtronics Nigeria Limited and Sahcofields Energy Services, the chosen case companies, and three people from the Energy Commission of Nigeria, the chosen public institution, were interviewed over the phone and by email as part of the qualitative approach, which aims to address questions from the public institution and the case companies.

A systematic questionnaire was created for the quantitative method and distributed to the respondents by email and postal mail. The responses were then imported into the SPSS software for correct analysis of the study's findings. Because the respondents' samples are drawn from Nigeria, a questionnaire is a practical technique to carry out this study.

The benefit of using a structured questionnaire in this thesis research is that it is the least expensive method of conducting research, as well as being reasonably quick to get replies and allowing for the distribution of a big sample over a vast area to be surveyed.

For example, sending surveys by email and postal mail also helps to reduce prejudice that could emerge from face-to-face interviews. Since the interviewer and the respondent are not face to face, personal questions receive more responses.

Despite these benefits, there are also drawbacks to using questionnaires. The questions shouldn't be too difficult for everyone to grasp to respond. The responder may not be able to provide the researcher with spontaneous responses, and the respondent may not have the chance to discuss any questions with others before responding to the questionnaire. In other instances, it is also impossible to confirm whether the named respondent is the one who actually filled out the form. The aforementioned drawbacks adversely affect the validity and reliability of the research in one way or another (McDaniel, Roger, 2009).

## **2.7 About case companies**

Here is the brief description of the public institution and the four case companies.

### **2.7.1 Energy Commission of Nigeria**

The Nigerian Energy Commission (ECN) was founded in 1988 with the responsibility of planning and coordinating national energy policies and all their implications.

The commission is the highest government body with the authority to plan and implement policies for the entire energy sector, encourage resource diversification through the development and best use of all the alternative energy sources available in Nigeria, including solar, wind, biomass, hydropower, and nuclear energy. The commission's headquarters are in Abuja, Nigeria's Federal Capital.

The commission's mission and vision is to ensure the efficient and cost-effective assessment, development, and exploitation of the energy resources in a way that will serve Nigerian interests and the needs of the global community. This is done through effective coordination and monitoring of the energy sector policies, plans, programmes, and actions that are consistent with Nigeria's economic development objectives.

The basic guiding principles are the commitment to the following:

- professionalism in all energy-related concerns;
- dedication to serving Nigeria;
- to maintain the nation's services is to have integrity.

### **2.7.2 Smart City Innovation**

The Smart City innovation, founded in 2008 and incorporated, was created as a multifunctional technology solution that is affordable for businesses, non-profit organizations, interest groups, and parastatals of the government. The following are the company's primary competencies: Designing and installing solar power systems.

- Energy Hardware
- Renewable energy
- Mobile Devices
- Wireless Broadband

The business is dedicated to assisting clients' strategic growth and development by offering the best services possible. The company's basic values are high ethical standards and unwavering integrity, and its aim is to provide clients with new and unique information technology solutions without making any compromises. The business is situated in Plateau State's Jos. There are 12 technical employees and 18 non-technical employees working for the company.

### **2.7.3 Amergy Solar Services**

Amergy Solar Energy Services is a new business in Nigeria that provides architects and consumers with ideas for buildings as well as recommendations on how much energy to use. The business provides its services to architects establishing new enterprises as well as to owners of existing buildings and those looking for environmentally friendly energy source.

The business provides a wide range of energy-related services for both new and old constructions that are environmentally sensitive. Passive heating, grey water management, and renewable energy services are the company's three primary service segments.

The company's vision is to develop into a stable business organization that will serve many Nigerians with the best green energy solutions. The company's mission is to provide the best

renewable energy solutions through careful analysis, attentive customer support, and cost-effective solutions. The business is situated in Nigeria's Lagos State. Having nineteen staffs.

#### **2.7.4 Novel power System**

Novel Power Systems is a foremost company and one of the biggest solar energy companies in Nigeria with branches in Abuja, Lagos, Ibadan, Akure, Ilorin and so on. They focused on the technical side of the business while providing excellent customer service, ensuring that customers benefit from their solar system, save money, and have their solar investment protected. Having handled government solar projects and currently working on solar rural electrification projects in some Nigerian states. They install for households, firms and commercial businesses as well. Fascinatingly, they build solar systems and do power audits for individuals, businesses, or even communities, then suggest the ideal size solar system that will provide easy, cost-free power.

Solar panels, inverter batteries, solar water heaters, solar rechargeable fans, solar inverters, solar streetlights, solar water pumps, and solar home lighting kits are among the company's product lines. (good for students and homes).

#### **2.7.5 Solar Shop**

The energy firm, Solar Shop Limited specializes in engineering, procurement, and construction services for rooftop and ground-mounted PV systems, mini-grids, commercial and industrial solar power systems, solar water pumping systems, and backup power supply systems.

With their corporate headquarters in Lagos, Nigeria, and several commercial clients and project developers all over West Africa, they were established in 2012. They are a group of enthusiastic individuals whose mission is to make everyone's life better through power solutions. They create excellent products to address energy issues.

### **2.8 Data and Analysis**

160 questionnaires will be sent to the target population via email and posted to three contact persons who would help with the distributions of the questionnaires to the respondents. The contact persons have experience of research work. The first person is senior technical officer at ECN, the second person is a senior technical officer at smart city innovation. The last person is a

senior technical officer at Amergy solution. In addition, reminder emails will be sent after a week of the first email.

The questionnaire was adapted from earlier research projects carried out by the European School in Gladenbach, whose objective was to ascertain how individuals from various nations felt about renewable energy sources. The responders will find it simple to use because it is properly designed and organized. It appears that the respondents understood the questions well from going through the questionnaire forms that they had completed. The queries and responses will be imported into the Statistical Programme for Social Sciences to enable a thorough statistical analysis of the responses. (SPSS). The SPSS is a tool that enables the analysis and review of imported data using various tables and charts

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# CHAPTER THREE

## 3.0 LITERATURE REVIEW

### 3.1 Why is renewable energy important?

The relationship between energy consumption and economic growth has been carefully examined since the energy crisis of the 1970s, and research has indicated that there is a strong positive association between energy and economic growth (Zahid, 2008). Because energy is a necessary input in many manufacturing and consumption processes, the author claims that energy is the secret to economic progress. Energy accounts for only 10% of the costs associated with the modern economy, although driving at least half of its overall expansion (Zahid, 2008). The consumption of energy has a significant impact on people's wealth, health, nutrition, water, infrastructure, education, and even life expectancy, as demonstrated by the World Bank's development indices. During the past 50 years, energy development has made a positive impact on people's lives. The lives of billions of people have altered since the industrial revolution, and energy has allowed them to experience a level of comfort and mobility never before possible (Ahuja and Tatsutani, 2009).

Fossil fuels are primarily burned to produce today's energy. Fossil fuels are essential to the current economy because of them; compared to the early 19th century, the globe is essentially unrecognizable today (Ritchie and Roser, 2019). However, only a small portion of the world's population was lifted out of poverty by fossil fuels. According to Ritchie and Roser (2019), 13% of the world's population lacks access to energy, whereas highly industrialized nations have 100% power access. As a result, only a very small percentage of countries with low or middle-poor incomes get electrified. For instance, just 8.8% of people in Chad have access to electricity. This indicates that for certain nations, achieving such "modern world" economic progress will remain difficult for the foreseeable future (Ritchie and Roser, 2019).

In addition, numerous research conducted over many years have clarified the serious impacts of carbon and fossil fuel combustion on both humans and animals. Fossil fuel burning is one of the main causes of air pollution, according to Katsouyanni's (2003) study on "ambient air pollution and health." This issue is now expressly referred to as "anthropogenic air pollution," which derives from the ancient Greek and means caused by man. One finding from Katsouyanni's research is nitrogen dioxide (NO<sub>2</sub>), which is created by power plants, businesses that burn fossil



fuels, and car emissions. This material was found to increase the likelihood of respiratory disease symptoms and illnesses and decrease pulmonary function, both independently and in combination with other pollutants (Howarth, 2019)

However, given the current technological advancements that are making fossil fuel extraction cheaper and more effective, it is unlikely to imagine quitting exploitation of them any soon, unless a joint effort from all governments puts such high taxes on them to deter away from their use, as Covert *et al.* (2016) discussed in detail in their article. Despite the fact that it is desperately needed, that is once more very unlikely to happen in the near future. More so if we take into account the undeniably high energy density of oil, which means we can get more energy from it than from any other source -from the same volume of fuel. This is in addition to the restored affordability of fossil fuels. However, based on current usage rates and known reserves, a conventional prediction states that fossil fuels will run out by the year 2060. (Howarth, 2019).

However, given the current technological advancements that are making fossil fuel extraction cheaper and more effective, it is unlikely to imagine quitting exploitation of them any soon, unless a joint effort from all governments puts such high taxes on them to deter away from their use, as Covert *et al.* (2016) discussed in detail in their article. Despite the fact that it is desperately needed, that is once more very unlikely to happen in the near future. More so if we take into account the undeniably high energy density of oil, which means we can get more energy from it than from any other source -from the same volume of fuel. This is in addition to the restored affordability of fossil fuels. The political and power games that underlie that market are also too significant to be overlooked so quickly Covert *et al* (2016).

Even from an economic perspective, a heavy reliance on fossil fuels as the primary source of income might contribute to even more instability on both the political and economic fronts. This is a result of the industry's extreme volatility. Volatility can, of course, be seen both positively and negatively depending on the manner in which the price changes in relation to supply and demand, according to Covert *et al* (2016). However, some scholars contend that the impact of bad volatility is typically two to three times greater than that of positive volatility. According to Lyu *et al.* (2021), "economic uncertainty shocks induce considerably greater unfavorable volatility fluctuations. A combination of energy sources, with increasing importance placed on

renewables, could therefore aid emerging nations in achieving greater stability and sustainable future growth.

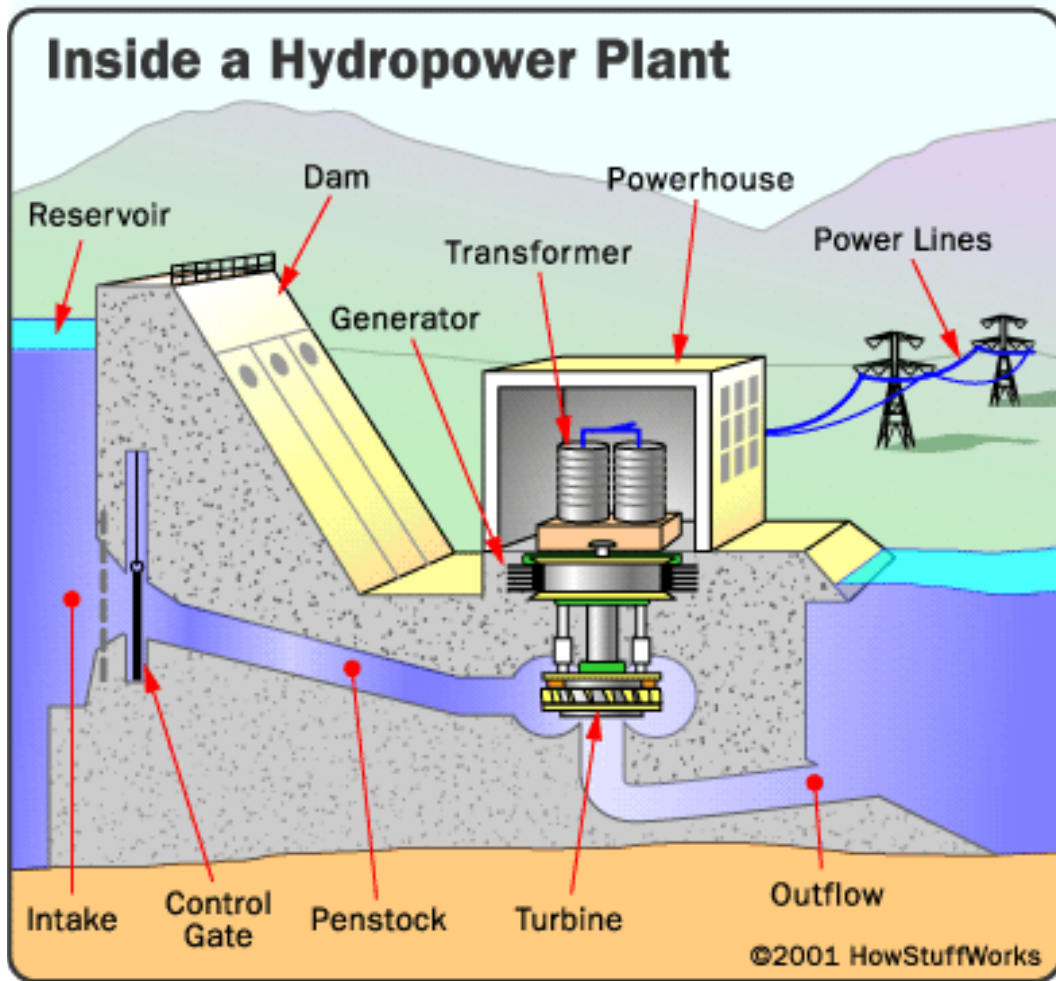
### **3.2 Renewable energy potentials in Nigeria**

In Nigeria, there are numerous renewable energy sources with bright futures. Although just a small portion of these energy sources have been used to generate electricity throughout the nation, there are several prospects for their effective use.

#### ***3.2.1. Hydropower.***

Using turbines and generators, water's potential energy is transformed into electrical power to produce hydropower (Esan 2018). One of the biggest sources of renewable energy in the world, hydropower accounts for over one-fifth of all electrical power produced globally and more than four-fifths of all electricity produced from renewable sources (Aderoju *et al.*, 2017). Given Nigeria's present level of power supply diversity, hydropower accounts for the biggest share (20%) of all renewable energy sources (Akinwale and Ogundari 2017). One of the reasons hydropower in Nigeria isn't getting enough attention is that thermal hydro facilities use fossil fuels to generate electricity.

Shiroro dam, Jebba dam, and Kainji dam are the three largest dams in the country as of now, each with a capacity of 500 MW to 800 MW (Mohammed *et al.*, 2017; Ezugwu, 2015; Sbaaban and petinrin 2014). However, it was highlighted that, in addition to the three dams listed, Nigeria possesses many additional dams of various sizes and scales that may be planned, built, and developed for hydroelectric purposes (Wole-osho *et al.*, 2016). Nigeria has the capacity to produce more than 18 GW of energy from its hydro resources, but it only uses 20% of them to do so, according to Emodi and Boo (2015); Aderoju *et al.* (2017). Each of these reports demonstrate that Nigeria's hydropower potential has not been fully realized, harnessed, or developed for the purpose of generating electricity.



**Figure 1.** Generation of energy from hydro (EMT, 2009).

### 3.2.2. Wind energy.

Wind turbines or windmills must be used to generate wind energy (Abam and Ohunakin 2017; Noorollahi *et al.*, 2016). Wind blows both during the day and at night, although its direction depends on the region and/or time of year. It is quite sporadic in character, ranging in strength and regularity. Since wind energy has been mostly used for irrigation, there is currently relatively little wind usage in Nigeria.

Fagbenle *et al.*, (2011) reported an assessment of the potential for wind energy in Maiduguri and Pokiskum (North-Eastern Nigeria). Ayodele *et al.*, (2018) provides an assessment of the wind resources in Nigeria and estimates the amount of land that can be used to harvest wind energy. Their findings demonstrated that the two locations are appropriate to produce wind energy. A detailed discussion of a research of the wind power potential in Kano, Nigeria (North-Western), where there is typically a lot of wind blowing, was found elsewhere (Shehu *et al.*, 2017). They came to the conclusion that Kano's average monthly wind power density is in the highest category at a height of 10 meters, making it suitable for applications linked to wind power energy generation. A prime location for the deployment of efforts aimed at harnessing wind to produce power has typically been recognized as the Northern area of Nigeria. A number of North-Western regions of the nation, including the Jos highlands in Plateau State, have also been highlighted as potential locations for the production of wind energy that can be connected to the national grid. The same idea was put out by Aderoju *et al.* (2017).

Nigeria has not yet made any attempts to use wind energy to generate electricity. A significant effort to integrate wind power into the electrical grid, in the opinion of many researchers, is justified (Ayodele *et al.*, 2016; Okeniyi *et al.*, 2015).

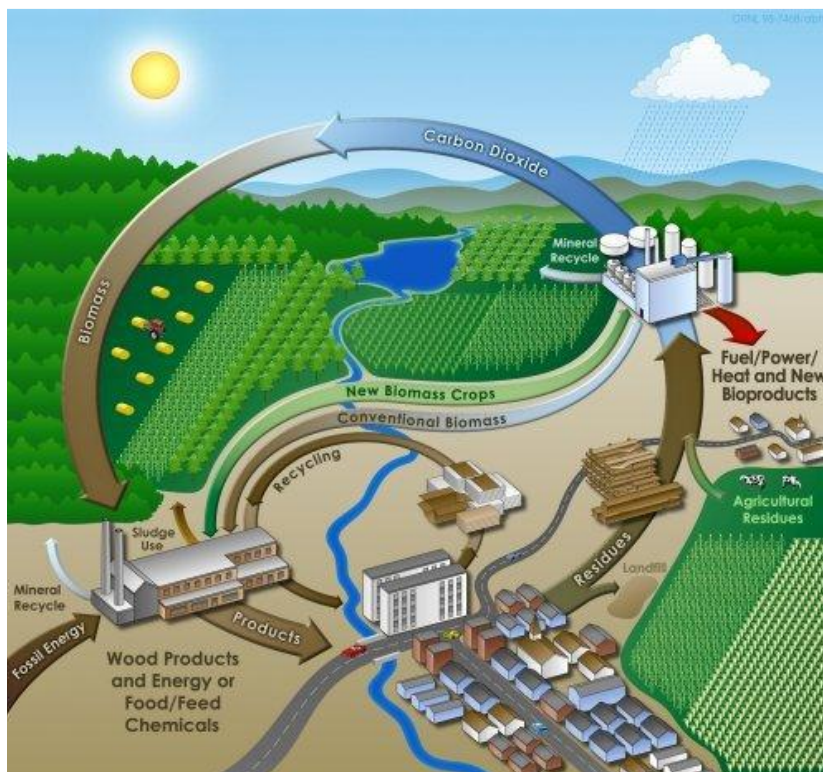


**Figure 2.** Wind turbine (Christian, 2006).

### 3.2.3. Biomass.

The term "biomass energy" describes the kind of energy used in power generation that comes from food crops and their wastes, agricultural by-products, farm residues, municipal solid wastes, and other organic materials. Despite being present in large numbers in Nigeria, biomass has not yet been developed for use in the creation of electricity through the use of bioelectric power generation.

A published piece of literature (Nomanbhay *et al.*, 2017) explained how pyrolysis, an effective thermochemical process for energy applications, can be utilized to manufacture biofuel and how oil palm residues in Nigeria can be used to generate 500 MW of electrical power. Another study (Somorin and Kolios 2017) proposed that *Jatropha* biodiesel-fired plants might be a very good substitute for natural gas, which is typically used in industrial gas turbines, as well as for the generation of electricity in Nigeria, taking into account that it can reduce annual greenhouse gas emissions from individually generated electricity by 76%.



**Figure 3.** Generation of energy from biomass (REPP, 2009).

#### **3.2.4. Solar energy.**

Most other renewable resources (including wind, hydro, and biomass) are dependent on this one, making it the most significant renewable energy source. Nigeria undoubtedly offers the best circumstances for using solar energy to generate power given that it receives abundant of sunlight throughout the year. The Energy Commission of Nigeria (ECN), with assistance from the National Agency for Science and Engineering Infrastructure (NASENI) through the following research institutes: National Centre for Energy Research and Development (NCERD), Sokoto Energy Research Centre (SERC), and NASENI Solar Energy Ltd., oversees the country's efforts to harvest and use solar energy. A few scientific accomplishments of SERC have involved the use of solar energy for water pumping, drying, and heating (Mas'ud *et al.*, 2017). Therefore, it is necessary to consider the potential of solar energy technologies in meeting Nigeria's rising need for electricity.

Through a variety of applications, including photovoltaics (PV) and concentrated solar power (CSP) technologies for electricity, the development of solar energy technologies tends to provide the nation with a significant amount of social and economic benefits. In general, it is generally known that solar energy increases fairness by lowering electricity costs in cities and villages without connection to the grid (Bondio *et al.*, 2018). Therefore, it has been determined that solar energy is the greatest and most efficient way to address energy poverty in emerging nations like Nigeria (Shahsavari and Akbari 2018). Aside from power generation, the advancement and application of solar power technology will lead to the creation of jobs across a range of industries, hence boosting the country's economy.

Geographically, Nigeria is close to the equator and is therefore located in the high sunlight belt, which improves its potential for using solar energy to produce electricity (Abdullahi *et al.*, 2017; Aderoju *et al.*, 2017)].

According to reports, Nigeria's entire land surface receives 17,459 billion MJ of solar energy daily (Giwa *et al.*, 2017). In a different study by Ohunakin *et al.* (2014), the daily mean solar insolation was calculated to be 3.5 kWh/m<sup>2</sup>day in the coastal or southern region and 7.0 kWh/m<sup>2</sup>day in the northern region. In a nutshell, the average number of hours of sunshine per day in the nation is between 7 and 9.

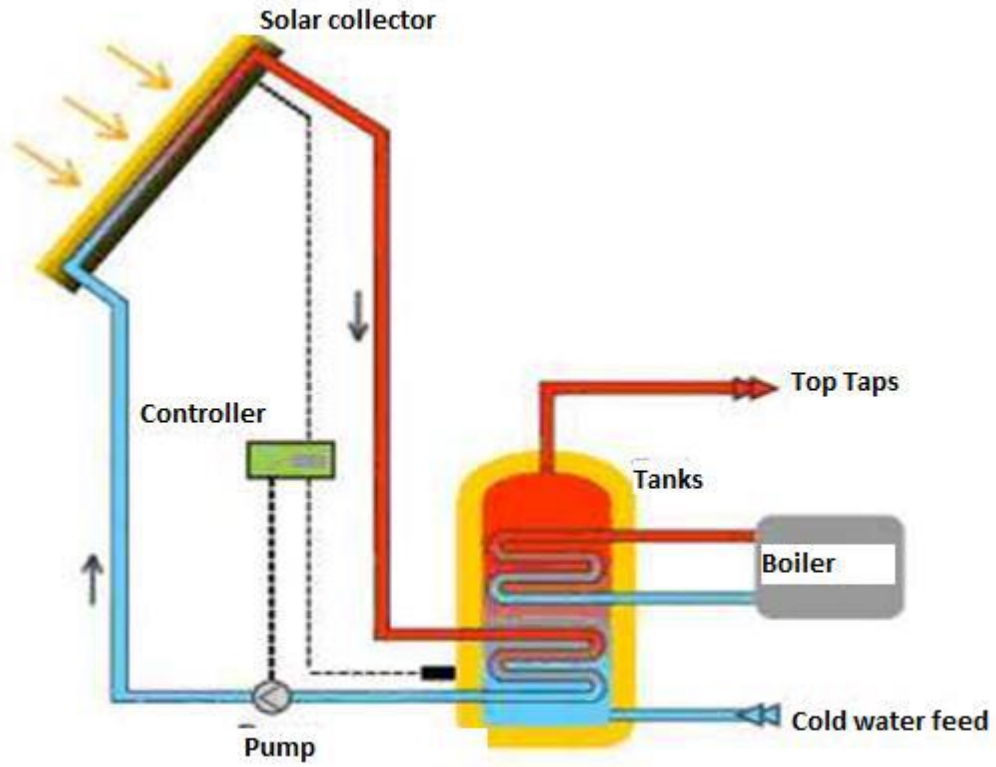
Riti and Shu (2016) Claimed that if solar panels were put to cover just 1% of Nigeria's land area, 1.85 10<sup>6</sup> GWh of electrical energy could be generated from solar energy virtually every year.

This is anticipated to produce a production that is greater than a hundred times the nation's current electrical supply system. Similar to this, Giwa *et al.* (2017) suggested that just 3.7% of the nation's area might be used for solar farms, producing enough solar energy to meet the country's electrical needs.

The potential for solar energy in Nigeria was also evaluated by (Okoye *et al.*, 2016). The cities of Lagos, Onitsha, and Kano were taken into consideration for the assessment because of the cities' substantial economic activity and dense population. According to the assessment's findings, Kano City, which is located in the North-West geopolitical region, has the highest mean daily global solar resource (6.08 kWh/m<sup>2</sup>), while the solar resources in Lagos, which is in the South-West, and Onitsha, which is in the South-East, are nearly equal, with values of 4.42 kWh/m<sup>2</sup> and 4.43 kWh/m<sup>2</sup>, respectively.

Nigeria receives fairly even distribution of solar radiation. A review of the solar energy potentials over the vastness of Nigeria was conducted and reported in Olatomiwa *et al.* (2016). All six of the country's geopolitical zones were taken into account, and it was determined that each one has very real potential suitable for a range of uses, including solar power. While the amount of solar radiation varies from place to place, it is often greater in the country's north. The best locations for large-scale solar ranches are in the northern region, particularly in the geopolitical North-East and North-West. These areas have a very high potential for using solar energy to produce electricity (Olatomiwa *et al.* 2016).





**Figure 4.** Generation of energy from the solar thermal method (Pwkits, 2009).

### **3.3 Obstacles to the development of Renewable Energy**

#### **3.3.1 General Obstacle theory**

Renewable energy technologies (RET) may hold the key to enhancing the quality of life in those nations without access to energy in addition to being the solution to an important environmental challenge. According to a clear statement made by Painuly (2001), "Renewable energy has the potential to play a major role in supplying energy with sustainability to the huge masses in developing nations who as of yet have no access to clean energy. Renewable energy hasn't been able to reach its full potential despite being economically viable for a variety of applications due to a number of obstacles.

According to Painuly (2001), it is impossible to build an analysis of a particular area's potential in the field of renewable energy without taking the obstacles to such development into account. A specific strategy to deal with them can only be established when those have been identified. In addition to his analysis, a number of authors attempted to explain the reasoning behind the failure to deploy these effective technology. According to Painuly, a nation's potential for developing renewable energy can be broken down into technological, economic, and techno-economical potential.

##### ***3.3.1.1 Market Failure and Market Imperfection***

The first part of Painuly's framework introduces the obstacles associated to market failures. The economic condition known as "market failure" is characterized by an ineffective allocation of commodities and services in the open market (Boyle, 2020).

There are many obstacles in Painuly's work that are connected to this subject, including the tightly regulated energy sector, the high transaction costs and investments necessary, the lack of knowledge and awareness, and the absence of competition. It is a fairly broad category that touches on a number subjects that we will further analyze in more detail in following parts like financial and technological, such as the costs and investments necessary, as well as the limited access to technology. Due to the complex relationships between market actors in every industry, the author acknowledges that obstacles' categories can overlap. Some of these obstacles are present simultaneously in multiple categories. Here, we'll concentrate on market flaws that have a direct impact on the energy industry.

To start, it is important to consider how a market is set up, including if there is established free competition or if one (or a few) enterprises are in control. Due to the significant expense of maintaining and operating such a system, state institutions have historically had a strong hold over the energy sector.

Skytte (1999) argues that a few decades ago, even the industrialized nations of northern Europe started liberalizing their energy markets. Regional monopolies, like energy in most countries, generally offer clients pricey, ineffective services as a result of a lack of competition and R&D expenditures. The author contends that even after market liberalization, there are still some additional market defects present, such as the dominant supplier's abuse of the market.

In any situation, when considering the development of renewable sources, the hazards are significantly greater. If the technology must switch to RETs, the expensive adjustment procedure may be considerably more difficult to accomplish, disincentivizing the introduction of more competitors and raising customer costs. Monopolies pose a market failure that impedes the advancement of renewable energy technology (Painuly, 2001). According to Sen and Ganguly (2017), this failure occurs because the system becomes very centralized when there are fewer participating organizations, making it impossible for smaller supply technologies to proliferate. There are still numerous nations where the energy industry is not privately owned, which is a major deterrent to investment.

The degree to which the government controls the energy sector is another element that could indirectly impede the growth of RETs. Energy systems in many developing nations today are mostly based on oil and coal (Laumanns *et al.* 2004). The authority of proponents of renewable energy is limited due to the substantial reserves of fossil fuels and the subsequent necessity of their utilization for their national economies.

The state of the infrastructure is particularly crucial because its absence or underdevelopment could severely impede the growth of investments. It will significantly raise the price of the goods for consumers. In this instance, we are talking to both the entire system of electricity transmission to users as well as the power plants used to produce electricity.

### **3.3.1.2      *Market Distortions***

According to Painuly (2001), encompass everything that can impede the growth of the industry under consideration. As a result, the question is whether the market in the area under investigation is unfavourable, making the new technology affordable (Painuly and Reddy, 2004). The nations over reliance on a conventional energy source can cause distortions in the market for renewable energy (Painuly, 2001). According to the BP Statistical Review of World Energy 2019, coal is a key component of the industrial sector and generates around 64.8% of the world's electricity. In addition, it is thought that making the necessary infrastructure upgrades would be prohibitively expensive and time-consuming, especially for poorer nations (Kariuki, 2018).

Why is it so difficult to stop using fossil fuels, as Gross questions in 2020, is an intriguing subject. The author makes the argument that the widespread criticism of fossil fuel businesses that has been going on for years was insufficient to convince policymakers to implement laws requiring major reforms. The practicality of fossil fuels is the cause of this. In fact, compared to fossil fuels, renewable energy technologies demand high initial investment costs and even higher market prices that are occasionally out of consumers' financial range, particularly in poor nations (Kariuki, 2018). As a result, because most of the time people would choose the cheapest choice, fossil fuel technologies unfairly compete with renewable energy sources in the market. In addition, fossil fuels are more desirable than other resources of energy due to their higher energy density (Gross, 2020).

However, ease and energy density are not the key justifications for why fossil fuels are still the dominant source of energy in the modern world. Politics, according to Gross (2020), is the main obstacle to the development of renewable energy. Making the switch to renewable energy entails overhauling a multi-trillion-dollar industry that is essential to both our economy and daily existence. Government investments are necessary. The author contends that because these investments are risky and only provide returns over the long run, politicians are more likely to prioritize short-term gains that voters can immediately see.

Public subsidies have an impact on investments and may skew their cost judgments (Beck, 2016). These government subsidies can come in a variety of forms, including tax incentives, R&D funding, liability insurance, and leases. Given the competitive disadvantage they pose, one of the main obstacles to the development of renewable energy today is the widespread use of fossil fuel subsidies (Beck, 2016).

The government should provide financial, institutional, or instructional assistance for the renewable energy sector (White *et al.*, 2012). Positive externalities brought about by financial and institutional assistance, such as the efficient growth of a new market, can pave the way for private investors to enter the market (White *et al.*, 2012).

While governments should act in favor of social welfare, private companies' responses are largely motivated by profitability (White *et al.*, 2012). Examples include the EEG (Erneuerbare-Energien-Gesetz), which boosted the overall share of renewable energy, and the feed-in tariffs supported by the governments of the UK and Germany. However, if the market failure continues, government intervention is ineffective (White *et al.*, 2012). Governments must produce the positive externalities or the negative externalities that threaten RETs would prevent their development. Negative externalities, according to Painuly, can include high initial capital costs, high tax rates, and trade restrictions. Compared to conventional energy sources, RETs offer less installed capacity for every dollar invested because of their higher initial capital expenditures. Furthermore, these investments may be subject to significant import taxes and other fees, which might make the high initial costs of sustainable technology and fuels even more problematic (Beck, 2016).

### **3.3.1.3            *Economical and Financial***

According to Lee (2019), funding is an essential component of creating a functional renewable energy system. One of the greatest obstacles to a wider adoption of RES, according to the author, is its price. Painuly (2001) lists several potential obstacles among the financial variables that could affect this game, including economic feasibility, a high cost of capital, high up-front capital costs for investors, a lack of financial institutions to support RETs, and more. However, the greater risk associated with projects in emerging economies has a significant impact on investors' choices. The private sector must be mobilized due to the lack of state investment for power facilities in most African nations (Baumli and Jamasb, 2020).

It is crucial to develop policies that distinguish between financial and non-financial factors to draw in private investment. In their study of the difficulties in financing RETs, Owusu-Manu *et al.* (2021) list "intrinsic economic obstacles" as one of the major causes. This depends on the risk-reward ratio, the length of the RE payback time, and the high initial capital expenses.

The first indicates that the perceived dangers associated with investing in RES are excessively high when compared to the possible payoff anticipated; this phenomenon is even more crucial when deciding where to place RE investments in underdeveloped nations. According to Firelake Capital (2012), which Owusu-Manu *et al.* (2021) cite, "countries on the low-income spectrum exhibit returns on investments that are heavily influenced by socio-economic factors," which furthers investors' lack of interest in those regions. The development of RES is more recent than that of conventional energy sources (such as coal, oil, and others), and its full potential has not yet been realized (Lee, 2019). Another thing that prevents their deployment is the relative newness of these investments. "Investors typically look for investment vehicles that have a track record of generating the needed returns and compensation." (Owusu-Manu *et al.*, 2021). Investors therefore tend to take a more cautious and conservative stance when there is a dearth of historical knowledge regarding the dependability and reward that can be obtained from these ventures. Higher perceived risks and expected compensation are a result of this. As an illustration, Aly *et al.* (2018) used firsthand data gathered from interviews with both private and public investors in their study on the hurdles to large-scale solar power in Tanzania to analyse these constraints. Many private investors acknowledged negotiating 20% or lower debt interest rates for solar power project funding. On the other hand, government-supported projects can obtain favorable terms from development finance institutions, including loans with interest rates of 3-7%. The issue is that these initiatives typically involve fossil fuel-fired power plants. Secondly, the return certainty is also reduced by the long span of time in which the investment unfolds and generates income to reward the investors, which is longer than the projects in traditional energy resources.

Moreover, because the investment takes longer to develop and start paying off investors financially than traditional energy projects, there is less assurance about the returns.

Owusu-Manu *et al.* (2021) quote Pueyo *et al.* (2017), who claimed that higher costs for REs projects do not just occur at the start-up phase but "cut across planning, procuring, and contracting," to discuss the high upfront capital required. Investments in the field are heavily focused on R and D because of how quickly RETs are emerging. Instead, while considering public investors, we consider not just the government of the nation in question but also governments from other nations and international organizations. Let's consider Ghana's hydroelectric dam finance as an illustration of this. The World Bank, the UK, the USA, and the

government of Ghana each contributed 50% of the funding for these projects (Owusu-Manu *et al.*, 2021).

Laumanns *et al.* (2004) assert that Morocco has found it necessary to rely on international investors. The rural electrification programme is supported by the German KfW Bank. A 200 MW solar thermal power plant in An Beni Mathar will be built at the same time with the help of a loan from the Global Environment Facility.

Internally, RET development is hampered by the absence of government backing or, more precisely, the glaring inequality between the various energy resources. IRENA's forecasts of energy sector subsidies for 2020 are based on data from 2017.

#### **3.3.1.4 Institutional**

According to Painuly, a country's institutional setting can either strongly encourage investors to invest there or fast drive them away. The political and institutional factors that can generally thwart investments as well as how they affect other barriers were the subject of investigation by several authors (Painuly, 2001).

Painuly identified several institutional obstacles to the development of renewable energy, including a macroeconomic climate that is uncertain, political instability, corruption and conflicts of interest, political commitment, and a lack of openness. The aforementioned circumstances hinder the development of renewable energy technology because they make it difficult for information to reach prospective investors and customers (Painuly, 2001). Also, managing political risk has been very difficult when evaluating investments.

Starting from a financial standpoint, political risk is difficult to measure and is also challenging to include in a quantitative investment analysis due to its high subjectivity (Shimbar and Ebrahimi, 2020). Thus, political risk has an impact on most foreign direct investments, particularly those made in developing nations. Additionally, many economists define corruption as the "selling of government property for private benefit" (Venard, 2013), which may logically lead one to believe that corruption is detrimental to a nation's overall development. Accordingly, Venard (2013) contends that it is improbable that judgments made by civil workers that are only motivated by their own interests will be advantageous to society. Political unrest and corruption have been called "sand in the wheel" of development because they could indicate insufficient

resource allocation, a lack of investments, or an increase in economic constraints, which would lead to a decrease in the economy (Venard, 2013).

Investments in renewable energy demand good coordination, expertise, infrastructure, and experience, according to a study by Uzar that examined the relationship between RE and institutional attributes in 38 nations from 1995 to 2015. Politicians in nations with high levels of political instability and corruption often fail to consider public opinion, which results in a decline in investment (Uzar, 2020).

As a result, high-risk ventures such as those involving high costs and political instability are prevalent in nations with high levels of corruption (Uzar, 2020). A professional relationship between investors and policymakers would be challenging in the absence of established professional institutions (Painuly, 2001).

### **3.3.1.5        *Social, Cultural and Behavioral***

According to Painuly (2011), this category is among the largest in the entire world. However, a number of authors have examined the social constraints on the growth of renewable energy from various angles.

In 2011, Pasqualetti made the argument that people, not technology, are to blame for the issues. He criticised the industry for making the frequent error of underestimating social obstacles and completely disregarding public opinion. Government decisions and economic and financial considerations are simply one factor because public rejection can also have a significant impact (Painuly, 2001).

In contrast, with each advance, more people start to think about what a future powered by renewable energy means for their own lives. As indicated by Pasqualetti (2011), barriers might be site-specific, based on the local ecological and cultural sensitivities, or they can be general, such the rejection of the presence of wind turbines on the land. To research the unacceptance of renewable energy technologies degrading the beauty of the landscapes, the author really studied the citizen response to the development of renewable energy in certain American states over a period of two decades. His findings are intriguing in that despite improvements in electric circumstances brought about by investments in renewable energy that allowed a million people to fulfil their average demands, protests against it were sharply rising (Pasqualetti, 2011).



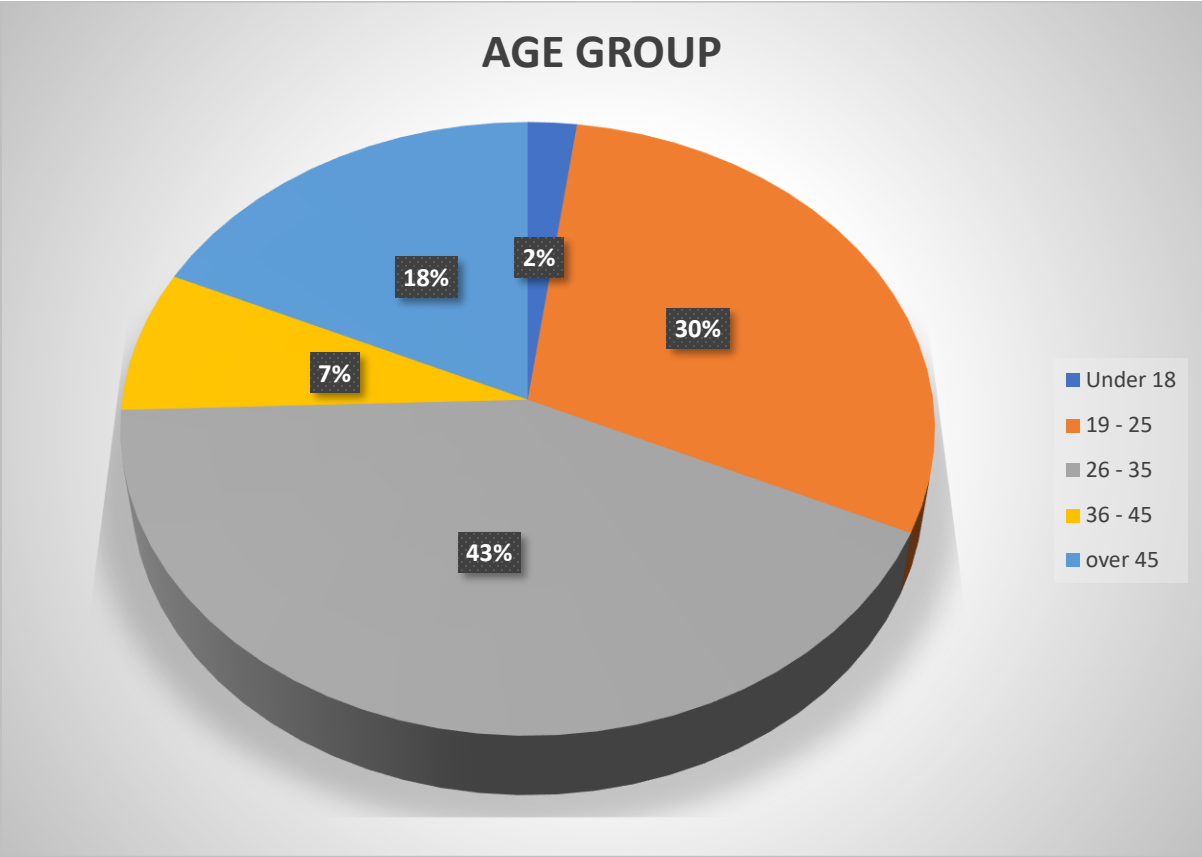
Sen and Ganguly (2017) described the RETs as a phenomenon that may obstruct various land uses, and as a result, the population of farmers may demand compensation for their land if it is exploited for energy purposes. The fact that each social barrier varies from time to time, from group to group, and from terrain to landscape must be considered (Pasqualetti, 2011). Furthermore, the high level of customer reliance on traditional electricity sources hinders the development of RETs. In actuality, consumers of energy would be the new technologies' customers, and it is essential that they embrace them. The market size will be too small to generate a profit if consumers are not interested in the product, either because there are so many alternatives or because the technology is viewed as being too different (Painuly, 2001).

## **CHAPTER FOUR**

### **4.0 RESULTS**

#### **4.1 Research Observations**

The questionnaire was distributed to 150 Nigerians, and 94 of them completed and returned it, yielding a response percentage of 58.6%. Convenience sampling was used because the study's objective was to investigate rather than predict the factors influencing the use and growth of renewable energy sources in Nigeria. The convenience sample technique was used to select the respondents based on their availability. The age span of the respondents, which made up the majority (43%), was 26 to 35 years. The first two questions of the questionnaire were designed to collect some background information. The first question focused on the respondents' ages, while the second asked about their familiarity with different green energy sources. The percentages are displayed and explained on a chart diagram for each of the question. A few observations that resulted from the analysis of the complete questionnaire were also provided.

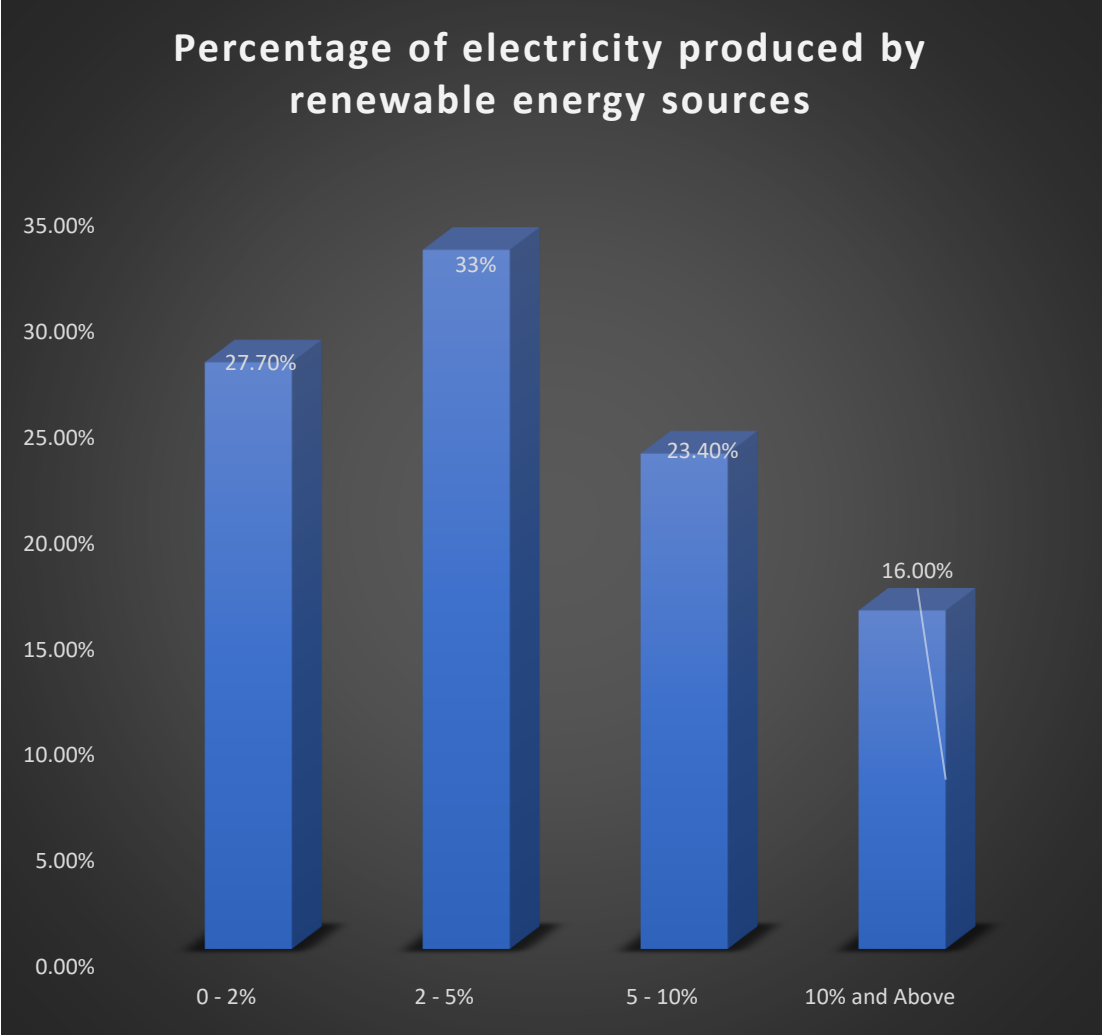


**Figure 5.** Age of the respondents (Appendix III).

The respondents' ages are depicted in Figure 5 above, which helps us comprehend how the respondents' attitudes and knowledge change with age. The majority of respondents—40 in total, or 42.55% of the 94 completed questionnaires—were between the ages of 25 and 36. The age group under 18 had the fewest respondents, filling out just 2 of the surveys and making up just 2.12% of all respondents, followed by the 19 to 25 age group. Due to collective global efforts to promote the use of renewable energy to replace conventional, especially in developed world, while at the same time paying more attention to developing ones, the respondents' age reveals that more youth in the country are paying more attention to issues that are related to renewable energy usage in the country.

The second study inquiry, "Can you name three renewable energy resources," aids in our comprehension of the fact that the respondents' attitudes are informed rather than prejudicial. When you compare the first questions to the second questions, which complement the respondents' attitudes based on their knowledge and age, 87 responded "yes," which reflects 92.55%, showing that the attitudes of the respondents are based on knowledge and not prejudice.

Comparing the findings of this research to those of earlier studies, it is clear that people are becoming more aware of various alternative energy sources. Additionally, there is need for advocacy in educating the public about renewable energy and its different sources when you take into account the 7.45% of respondents who were unable to name three sources of renewable energy. Since the majority of the respondents reside in cities, it's possible that they have a fundamental level of literacy.



**Figure 6.** Percentage of electricity produced by renewable energy sources (Appendix III)

For the percentage of electricity generated in Nigeria by renewable energy sources, the respondents had a variety of choices to choose from. The responses to this topic are extremely diverse. The majority of respondents, or 33.00%, indicated that the rate is between 2-5%, while some respondents believed it to be between 0-2%, and 23.40% indicated that the rate is between 5-10%, although some respondents believed it to be over 10%. The majority of respondents think Nigeria has an abundance of conventional energy resources, and recently the government has continued to invest in conventional energy sectors in an effort to improve the country's dwindling electricity situation, which is why there is such a wide disparity in their responses and no absolute majority between the percentages.

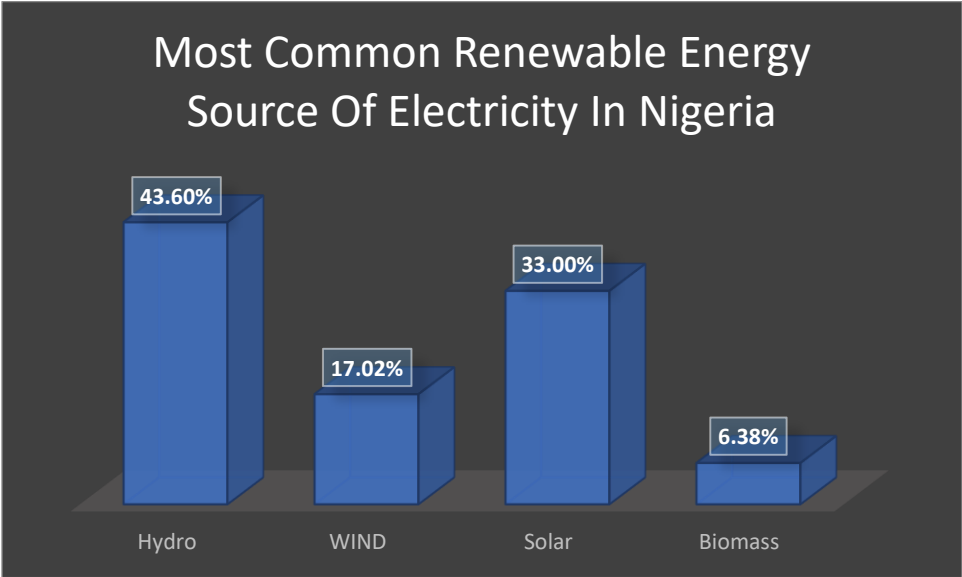


Figure 7: Most common renewable energy source of electricity in Nigeria (Appendix III)

The graph shows the prevalence of each of Nigeria's four renewable energy sources among survey respondents. This inquiry enables us to determine whether the respondents were able to identify the most prevalent green energy source in Nigeria as well as the differences between them. The majority of respondents, or 43.60%, chose water as the most prevalent source out of the four, followed by 3.98% who chose solar because of the country's high levels of sunshine, 17.02% who selected wind, and 6.38% who chose biomass.

The most popular green energy source in Nigeria is hydro, which received the most favorable responses from all the survey participants.

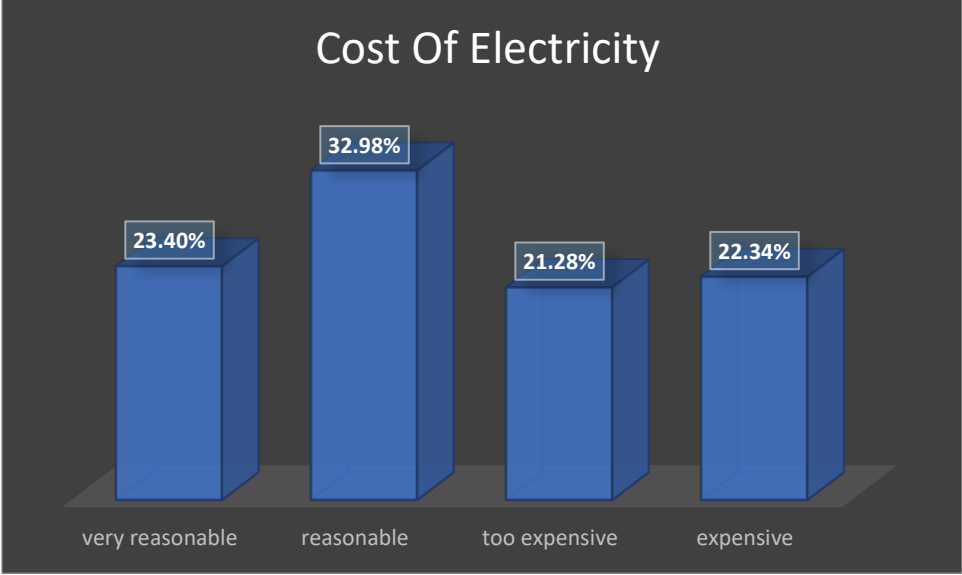


Figure 8: A viewpoint on the cost of electricity (Appendix III).

In order to encourage the use of renewable electricity energy sources in the nation, it is important to understand how respondents feel about the cost of their current electricity bill. This information will help researchers determine whether the population will be able to accept an increase in the cost of their electricity. According to 32.98% of the respondents, Nigeria's current energy billing system is reasonable when compared to other Sub-Saharan African countries. In comparison to the appallingly unstable state of the electricity supply, 21.28% of respondents said it is too expensive, 22.34% said it is expensive, and 23.40% said the cost of electricity is extremely fair.

Nigeria is one of the nations where the government provides subsidies for all of the nation's energy needs. The promotion and use of renewable energy sources in Nigeria is thus greatly influenced by the power price and billing system. This question, "Do you pay for your energy bill," was added to the survey to gauge respondents' attitudes toward using and abusing public

utilities. More than half of the respondents (71.27%) indicated that they pay their electricity expenses, while 28.72% indicated that they do not.

When the price of electricity from generation to distribution is considered, the percentage of respondents who do not pay their bills is quite significant. The respondents who don't pay their electricity bills might not have a steady source of electricity. Prior to the majority of the population paying their energy bills, it appears that efficiency and stability are essential to Nigerians.

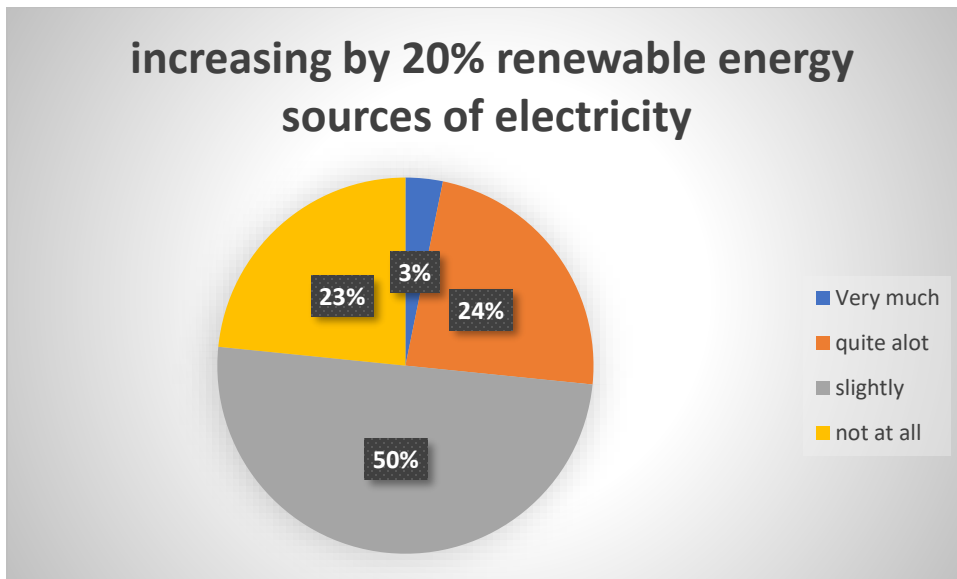


Figure 9: A viewpoint of payment to increase renewable energy sources (Appendix III).

This is an open-ended question intended to gauge how much the respondent understands about the effectiveness of using renewable energy sources. Fifty percent of respondents said it will "slightly" improve the country's electricity situation, followed by 24.0% who said it will "quite a lot" improve the country's appalling electricity situation, and 23.00% who said "Not at all." 3.0% of respondents are very passionate about the increase in the use of renewable energy sources because they think it will greatly improve the electricity situation in Nigeria. It appears that the majority of respondents are aware that increasing the country's use of renewable energy sources will improve the country's electricity situation and clear the way for achieving energy efficiency in the shortest amount of time.



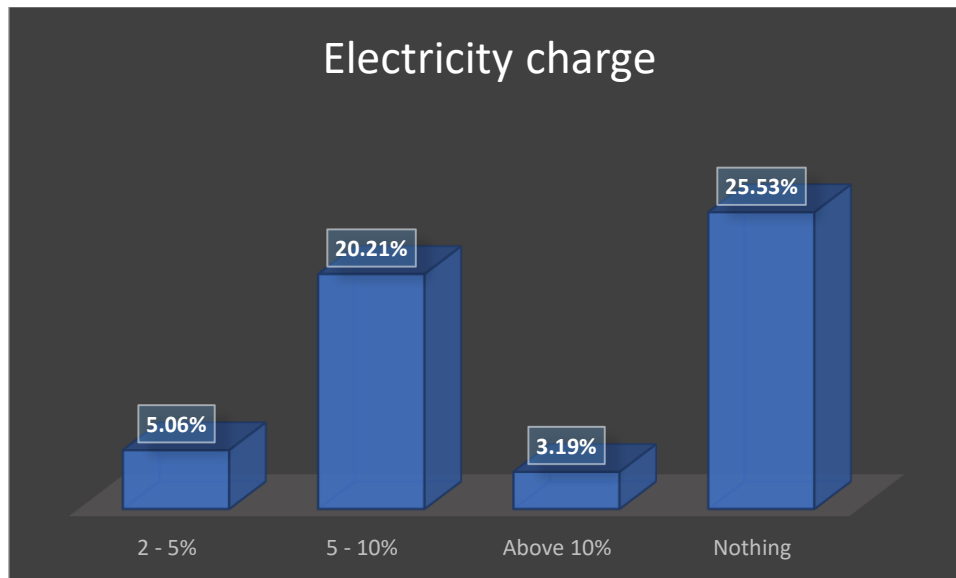


Figure 9: A viewpoint of payment to increase renewable energy sources (Appendix III).

It was crucial to know in this question whether the respondents would be ready to pay any future increases in order to advance the use of renewable energy sources in the nation. A plurality of respondents, 20.21%, indicated that 5–10% increments are reasonable, which appears to be within most respondents' means. Conversely, 25.53% believed that no increases should be made, while 5.06% indicated that 2-5% increments are significant and 3.19% indicated over 10% increments. The most important finding in this case is that the majority of respondents concurred that an increase should be made, but one that will be affordable to the Nigerian population in light of the country's present economic conditions.

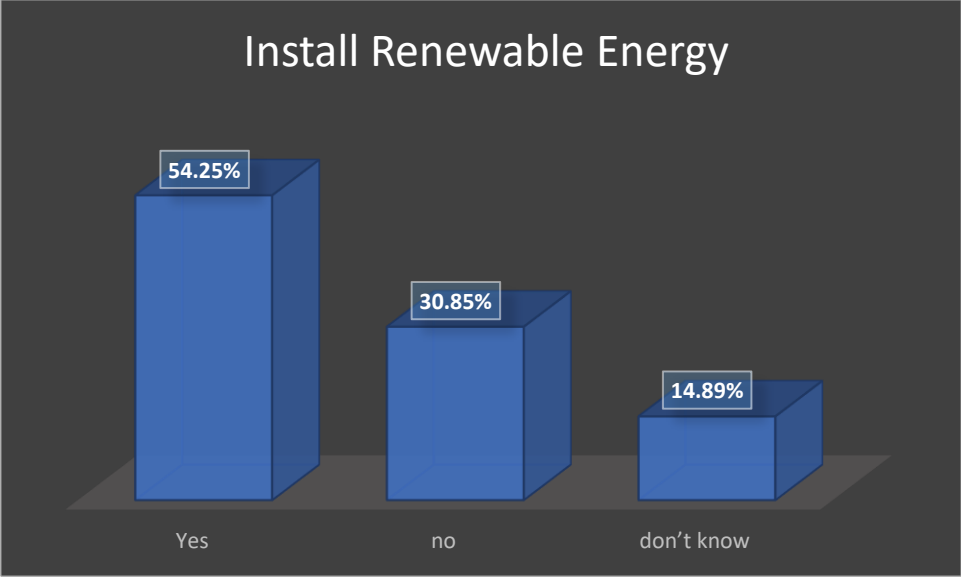
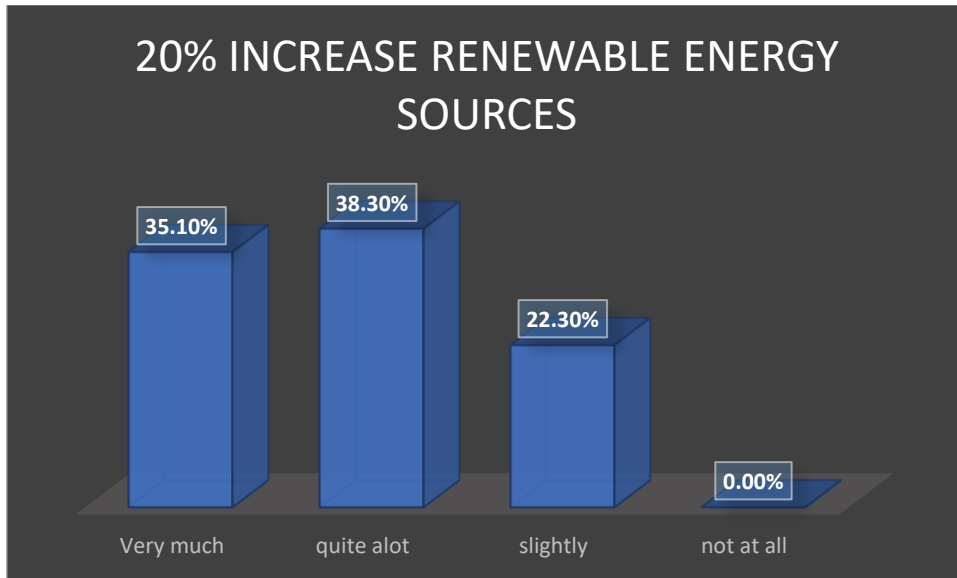


Figure 10: Household preference for renewable energy sources (Appendix III).

This question allows us to directly approach respondents without necessarily waiting for the governmental or public system, which helps us better understand their views toward and preparedness for the use of renewable energy. The respondents had several choices, with 54.25% of them choosing "Yes," 30.85% remaining unsure, and 14.89% refusing to purchase a home with any renewable energy installations. The majority of respondents are likely to purchase homes with renewable energy installations, which is an intriguing finding that will aid businesses that provide renewable energy sources in making investment decisions.

Are there any funds available to support the installation of efficient or renewable energy technologies? If so, please elaborate. This inquiry aims to determine whether the respondent is aware of any government grants or other forms of assistance that might motivate people to install various alternative energy sources. 'No' was the response given by all respondents.

The fact that the government did not provide any assistance to households for the installation of alternative energy sources is an intriguing finding.



**Figure 11.** Viewpoint regarding the effects of renewable energy sources on the environment (Appendix III).

This open-ended query was added to see how much the respondents knew about how renewable energy sources affected the environment. The bulk of respondents said, "Be more quiet; it will help the environment." 38.30% of respondents believe it will "quite a lot" improve environmental conditions, 22.30% said it will "slightly" improve conditions, and 0.00% said it will have no positive impacts at all.

The fact that the majority of respondents are environmentally conscious is notable and intriguing and suggests that there is a better chance of increasing the country's use of environmentally friendly energy sources in the near future.

## **4.2 Results from the Interviews**

The majority of the interviewees' responses did not differ significantly, according to an analysis of the interview findings. Below is a discussion of the interviewees' responses.

### **4.2.1 How demanding is renewable energy?**

Five of the respondents said that the country's demand for renewable energy is average, while two claimed that it is low given the size of the population and the country's power crisis. They contend that a high desire for renewable electricity sources is necessary given the nation's current energy crisis.

### **4.2.2 What kind of technical problems are companies facing in building renewable energy sources?**

The technical issues that companies and businesses are facing when providing and developing renewable energy electricity sources were almost universally addressed and recognized by all respondents.

Following are the issues:

- a. High funding costs
- b. insufficient technological expertise
- c. inadequate rewards
- d. Low Physical Capacity/Competency Level
- e. Local production capacity is lacking

These are nearly the same elements that A.S. Sambo identified earlier in the theoretical section as the most important problems limiting the development of renewable energy in the nation and calling for the government to take decisive action to encourage the industry and the use of renewable electricity in the nation.

The interviewees' responses to questions three and four, in which they all said there is "No" sufficient infrastructure and government incentives that will help the sector expand, are strengthened by all the factors mentioned above.

### **4.2.3 What incentives do you expect from the government to provide that will enhance the growth and the penetration of renewable energy in the country? Briefly explain**

Since the country depends on importation for both the technical know-how and the components, two of the interviewees stated that the most significant incentives they expected from the government to increase the penetration of renewable energy in the nation should be waivers on import duties for renewable energy components. Tax holidays for domestic manufacturing and improved policies aimed at promoting renewable energy in the nation were the views of three respondents. According to the two other interviews, the government's support for the adoption of renewable energy technology should take precedence as this will promote both public and private involvement and the adoption of renewable energy sources across the nation.

### **4.2.4 Do you think the government policies will contribute to the success of renewable energy in the country? If yes, in what ways?**

The government should emphasize policies that will significantly aid in the success of renewable energy in the nation, according to the majority of interviewees. They recommended that the government set up a framework that could be used to promote and encourage investment in the industry. The market will be opened up, made more affordable, and more accessible if the government can create an effective policy structure that attracts more willing foreign investors.

There is a need for government financial incentives or to support local manufacturers so that the cost of renewable energy electricity in the country will be reasonable and affordable for both the high, middle, and lower income earners in the country. Three of the interviewees stated that the cost of renewable energy electricity in the country is "too expensive," and four stated that it is expensive when you consider the average income of households in the country.

## **CHAPTER FIVE**

### **5.0 CONCLUSION AND RECOMMENDATION**

#### **5.1 Conclusion**

Nigeria has an abundance of conventional and non-conventional energy resources (fossil and renewable). It is necessary to encourage the creation of an energy mix that includes will place a greater emphasis on the need for fossil fuel conservation to sustain exports for the foreseeable future. Natural gas and petroleum consumption will decrease as a consequence of the adoption of renewable energy. The primary advantages of alternative energy solutions (renewable energy solutions) over conventional energy solutions energy systems include ease of maintenance, technological simplicity, and environmental friendliness.

This investigation revealed that Nigeria has an exceptionally high demand for electricity but insufficient and inconsistent supply, leaving many Nigerians with few options. According to estimates, the energy potential of Nigeria's renewable energy resources exceeds 1.5 times the amount of its fossil fuel reserves. By adopting and utilizing these renewable energy sources, it has the potentials to improve and make a difference in Nigeria's inadequate access to electricity, with an emphasis on rural areas.

#### **5.2 Recommendation**

The findings of the study led to the following recommendations; Current renewable energy usage sources in the nation are fairly evident. Nevertheless, promoting and utilizing renewable energy sources is crucial and necessary, especially in rural development. In light of this, significant funding is required from the public and private sectors for new research and development facilities into renewable energy.

While the extension centers for energy charged with dissemination and demonstration responsibilities for the renewable energy infrastructure, the existing research and development centers should be supported and bolstered to conduct quality research. More emphasis must be placed on training local artisans in construction, design, operation, and maintenance, owing to the fact that local manufacturers are responsible for the upkeep of the various renewable energy technologies in use. With these, the maintenance costs for these devices are reduced.

Entrepreneurs are hesitant to embrace the widespread production and commercialization of renewable energy sources and infrastructure. Consequently, it is necessary to establish a Renewable Energy Fund that will function as a mechanism for providing financial incentives to renewable energy suppliers, regional producers, and end-users. It is essential to develop a comprehensive national energy master plan that promotes sustainable energy, policies and extensive public education campaigns concerning environmental sustainability.

All of the aforementioned recommendations, actions, and implementation techniques that are meant to encourage the development and use of renewable energy systems and practises can only be fulfilled through the strengthening of the institutions in charge of such promotions. In this regard, the federal government should endorse and publish a thorough National Energy Policy for the nation as well as designate agencies at the state and municipal government levels that will be tasked with overseeing the implementation of projects and programs for renewable energy electricity.

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## APPENDIX I

Dear Respondent,

I am writing my thesis that seeks to survey your opinion on how to support, promote and courage the impact of renewable energy sources in Nigeria to close the gap of almost 60-70% of Nigerians that did not have access to energy not only energy, but the energy that is environmentally friendly. I hope you will have few minutes to contribute to this study. I am very grateful for your time and effort when answering this questionnaire.

1. Please indicate your age grouping

Under 18  19 - 25  26 - 35  36 - 45  over 46

2. Can you list 3 renewable energy resources?

Yes  No

3. What percentage of electricity in our country do you think is produced by renewable energy sources?

Under 2%  2% - 5%  5% - 10%  over 10%

4. What is the most common renewable energy source of electricity in this country?

Hydro  Solar  Wind  Biomass

5. How do you rate the cost of electricity in your state?

Very reasonable  reasonable  expensive  too expensive

6. Do you pay for your electricity bill at home?

Yes  No

7. How much more would be reasonable to pay in electricity bills to increase by 10% renewable energy sources of electricity in this country?

Nothing  2% - 5%  5% - 10%  over 10%

8. Do you believe that increasing by 20% renewable energy sources of electricity in this country may improve the electricity supply?

Very much  quite alot  slightly  not at all

9. When buying a home would you be more likely to buy one with renewable energy installations?

Yes  No  don't know

10 Are you aware of any grants available to help you install renewable energy or energy efficient technologies? Please give details

Yes  No

.....  
.....  
.....  
.....  
.....

11 Do you believe that increasing by 20% renewable energy sources of electricity in this country your local environment would improve?

Very much  quite a lot  slightly  not at all

Thank you very much for taking part in this survey

APPENDIX II

Interview questions:

1. How demanding is renewable energy?

Low      Average      High

2. Which kinds of technical problems companies are facing in building renewable energy sources?

.....  
.....  
.....  
.....  
.....

3. Would say the government has provided adequate infrastructure to support the growth of renewable energy in Nigeria?

Yes      No

4. Do you feel that the government incentives is been enough to encourage investment in renewable energy?

Yes      No

5. What incentives do you expect from the government to provide that will enhance the growth and the penetration of renewable energy in the country? Briefly explain

.....  
.....



.....  
.....  
.....

6. Did you think the government policies will contributed to the success of renewable energy in the country? If yes, in what ways?

Yes       No

.....  
.....  
.....  
.....  
.....

7. How would you rate the cost of renewable energy in the country?

Very reasonable     reasonable     expensive     too expensive

Please feel free to add comments beyond the scope of the questions given above.

Thank you very much for taking part in this survey!!!

## APPENDIX III

### Frequencies

Statistics

	Please indicate your age grouping	Gender	What percentage of electricity in our country do you think is produced by renewable energy sources	What is the most common renewable energy source of electricity in this country?	How do you rate the cost of electricity in your state	Do you pay for your electricity bill at home	How much more would be reasonable to pay in electricity bills to increase by 10% renewable energy sources of electricity in this country?	Do you believe that increasing by 20% renewable energy sources of electricity in this country may improve the electricity supply	When buying a home would you be more likely to buy one with renewable energy installations?	Do you believe that increasing by 20% renewable energy sources of electricity in this country your local environment would improve?
N	Valid	94	94	94	94	94	94	94	94	94
	Missing	0	0	0	0	0	0	0	0	0

### Frequency Table

Please indicate your age grouping

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Under 18	2	2.1	2.1	2.1
	19 - 25	28	29.8	29.8	31.9
	26 - 35	40	42.6	42.6	74.5
	36 - 45	7	7.4	7.4	81.9
	over 45	17	18.1	18.1	100.0
	Total	94	100.0	100.0	

#### Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	85	90.4	90.4
	Female	9	9.6	100.0
	Total	94	100.0	100.0

#### What percentage of electricity in our country do you think is produced by renewable energy sources

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 2%	26	27.7	27.7
	2 - 5%	31	33.0	60.6
	5 - 10%	22	23.4	84.0
	10% and Above	15	16.0	100.0
	Total	94	100.0	100.0

**What is the most common renewable energy source of electricity in this country?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Hydro	41	43.6	43.6	43.6
Wind	16	17.0	17.0	60.6
Valid Solar	31	33.0	33.0	93.6
Biomass	6	6.4	6.4	100.0
Total	94	100.0	100.0	

**How do you rate the cost of electricity in your state**

	Frequency	Percent	Valid Percent	Cumulative Percent
Very reasonable	22	23.4	23.4	23.4
reasonable	31	33.0	33.0	56.4
Valid Too expensive	20	21.3	21.3	77.7
expensive	21	22.3	22.3	100.0
Total	94	100.0	100.0	

**Do you pay for your electricity bill at home**

	Frequency	Percent	Valid Percent	Cumulative Percent
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	Yes	67	71.3	71.3	71.3
Valid	No	27	28.7	28.7	100.0
	Total	94	100.0	100.0	

**How much more would be reasonable to pay in electricity bills to increase by 10% renewable energy sources of electricity in this country?**

	Frequency	Percent	Valid Percent	Cumulative Percent
	2 - 5%	48	51.1	51.1
	5 - 10%	19	20.2	71.3
Valid	Above 10%	3	3.2	74.5
	Nothing	24	25.5	100.0
	Total	94	100.0	100.0

**Do you believe that increasing by 20% renewable energy sources of electricity in this country may improve the electricity supply**

	Frequency	Percent	Valid Percent	Cumulative Percent
	Very much	33	35.1	35.1
	quite alot	36	38.3	73.4
Valid	Slightly	21	22.3	95.7
	not at all	4	4.3	100.0
	Total	94	100.0	100.0

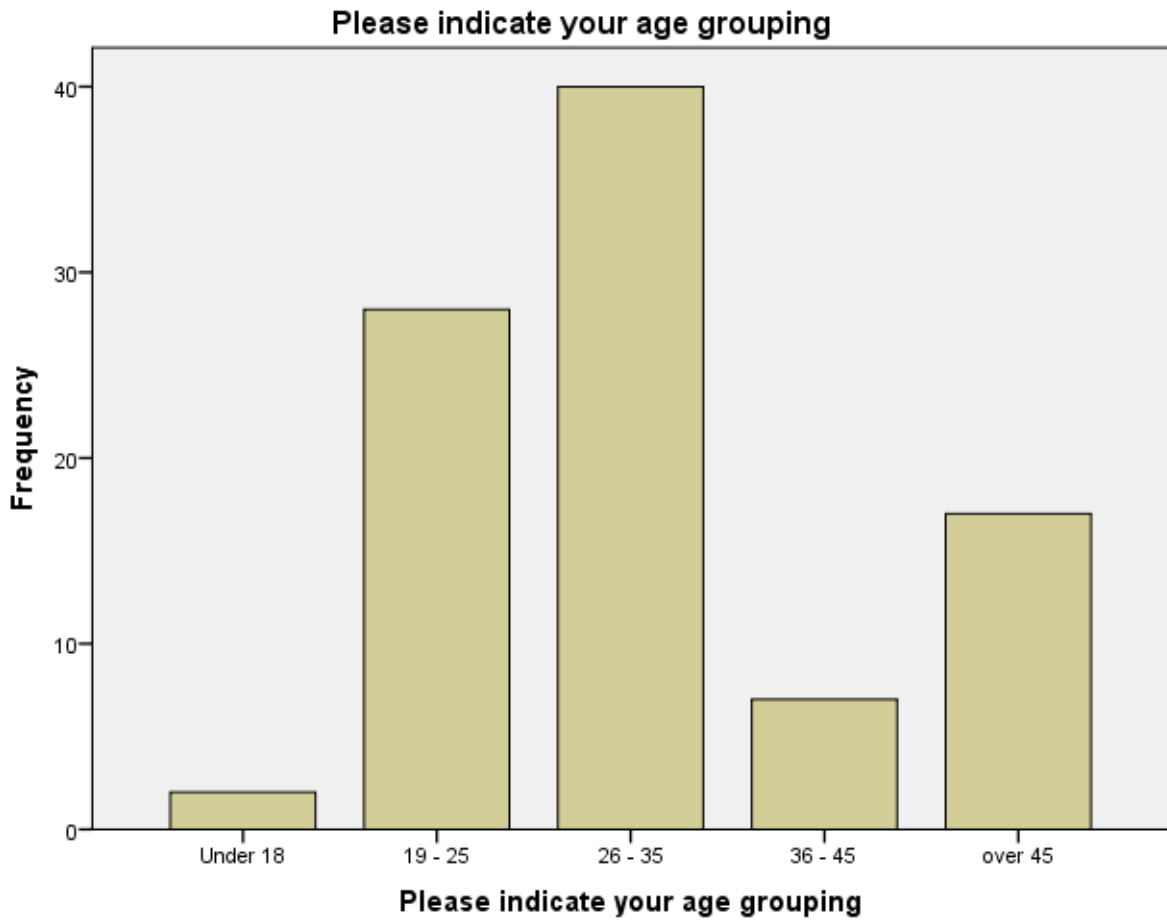
**When buying a home would you be more likely to buy one with renewable energy installations?**

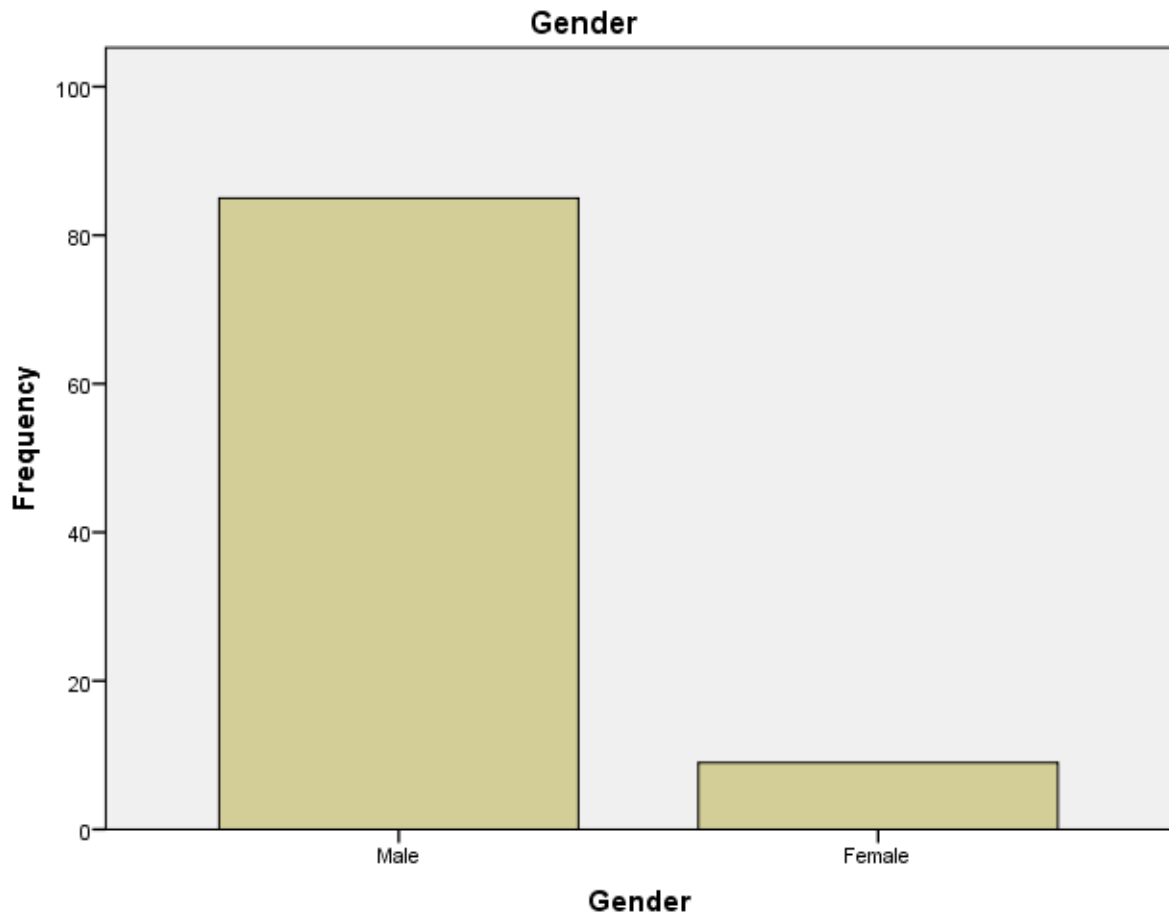
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	51	54.3	54.3	54.3
No	29	30.9	30.9	85.1
Don't know	14	14.9	14.9	100.0
Total	94	100.0	100.0	

**Do you believe that increasing by 20% renewable energy sources of electricity in this country your local environment would improve?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Very much	33	35.1	35.1	35.1
quite alot	36	38.3	38.3	73.4
Slightly	21	22.3	22.3	95.7
not at all	4	4.3	4.3	100.0
Total	94	100.0	100.0	

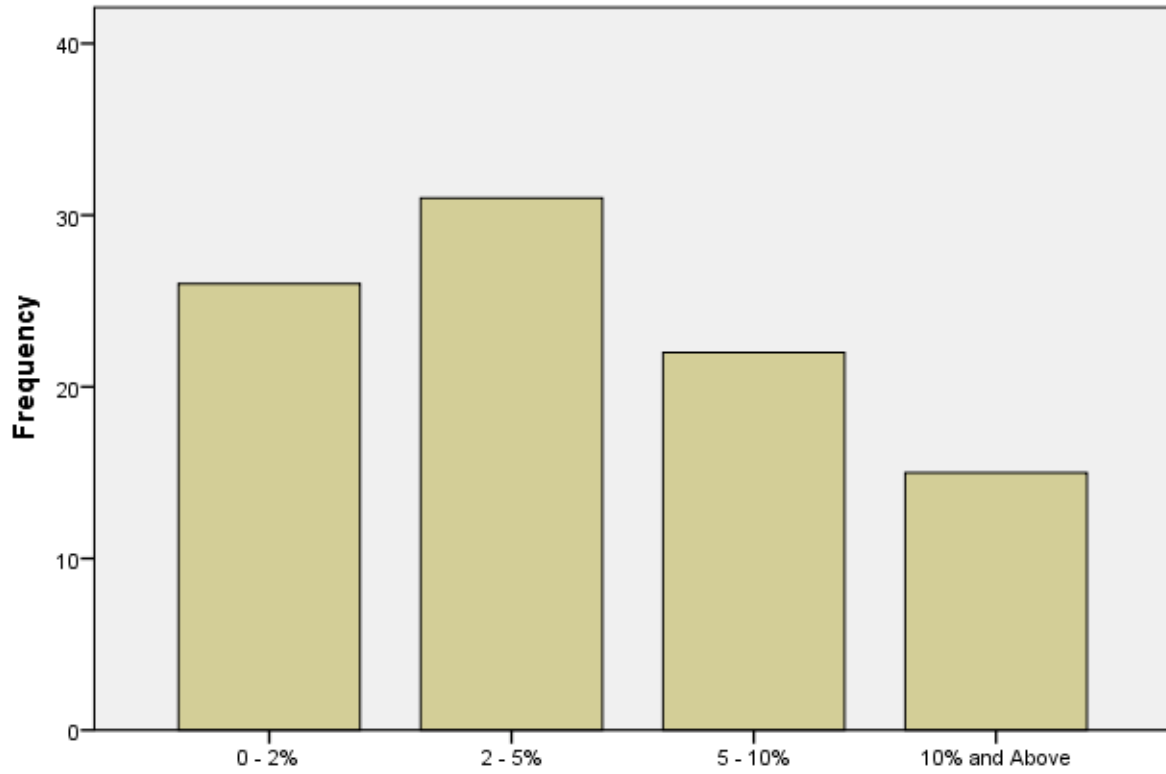
**Bar Chart**





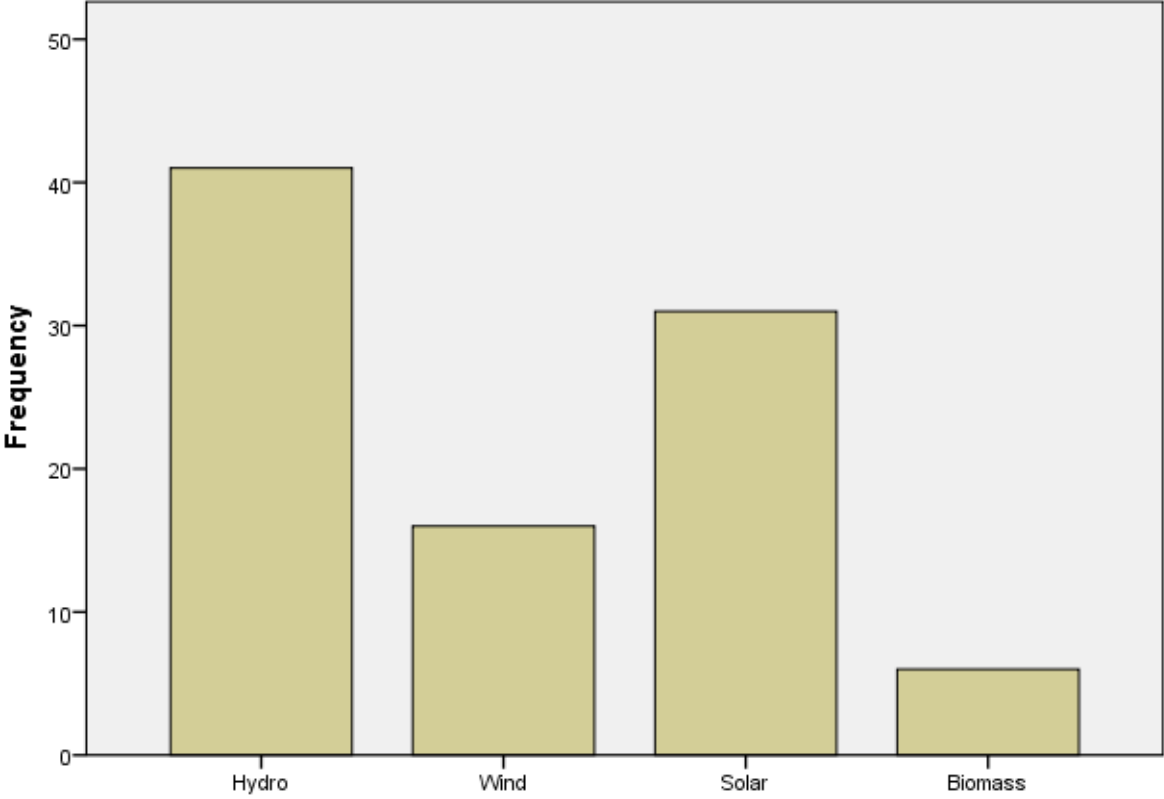


**What percentage of electricity in our country do you think is produced by renewable energy sources**



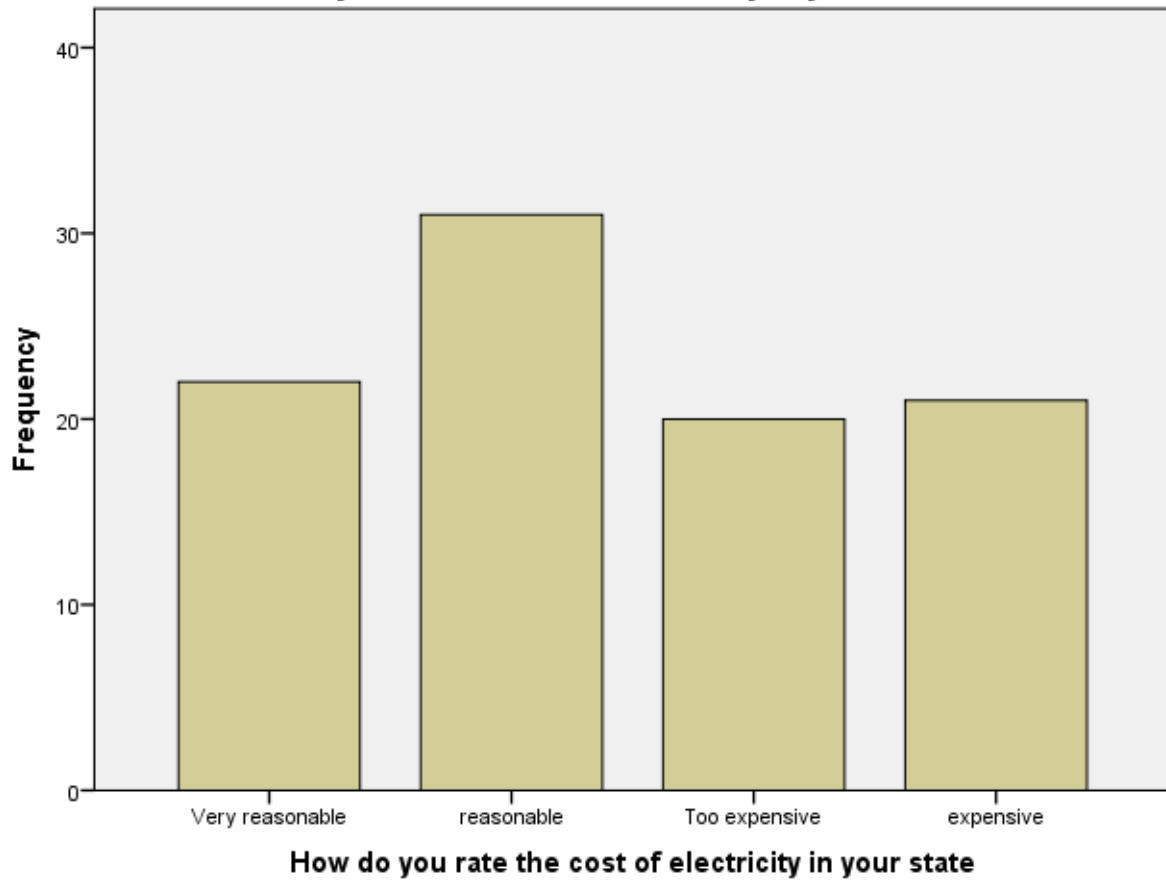
**What percentage of electricity in our country do you think is produced by renewable energy sources**

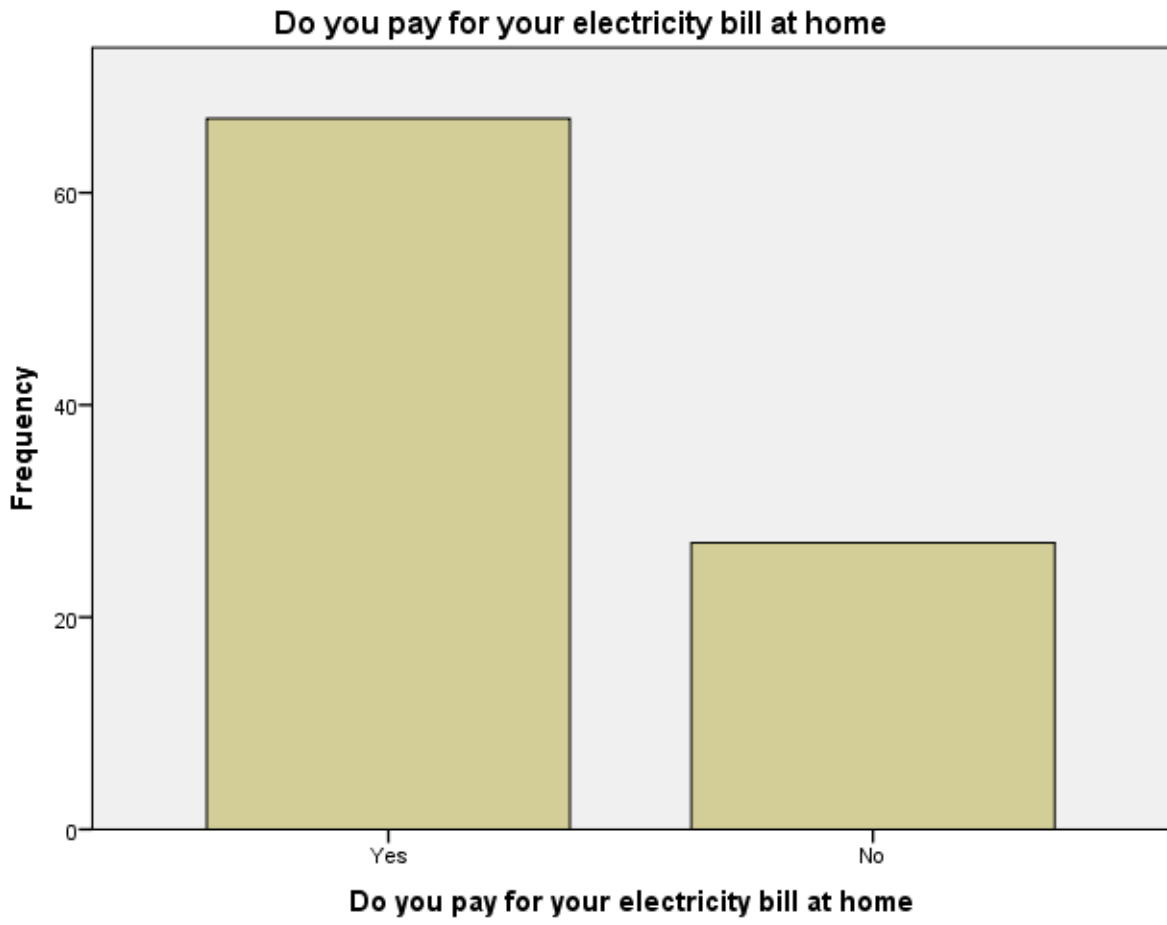
What is the most common renewable energy source of electricity in this country?



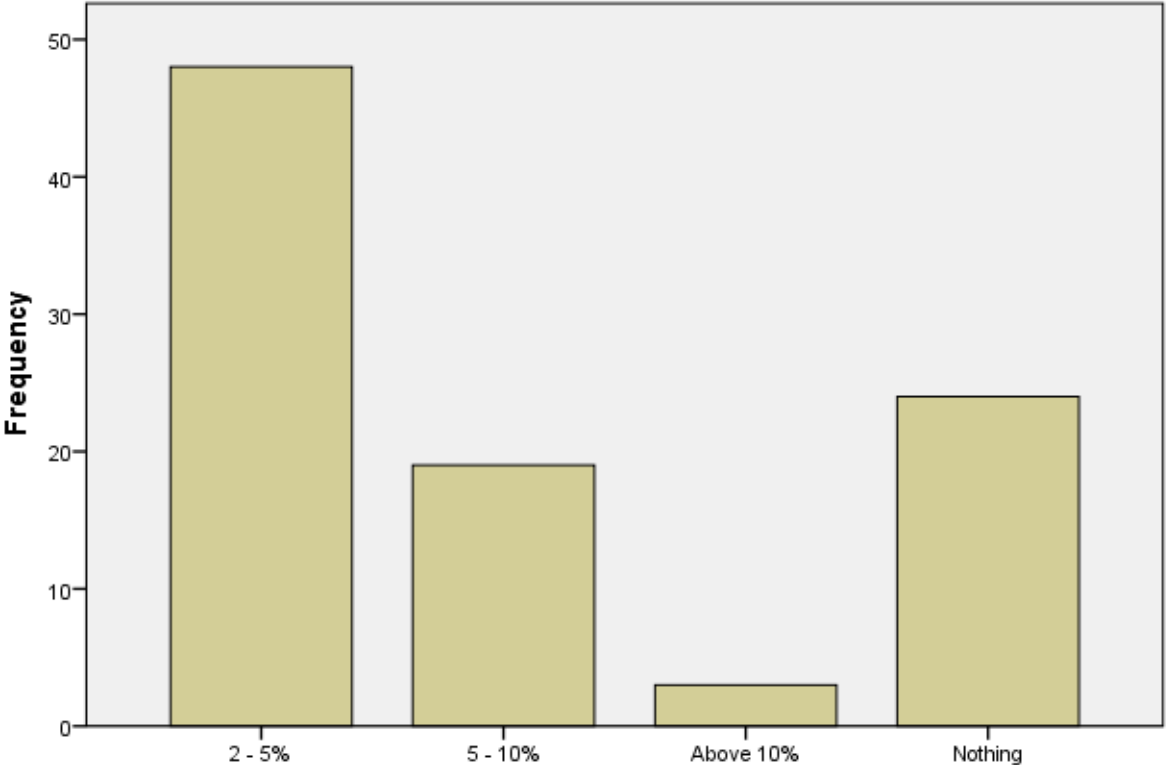
What is the most common renewable energy source of electricity in this country?

### How do you rate the cost of electricity in your state



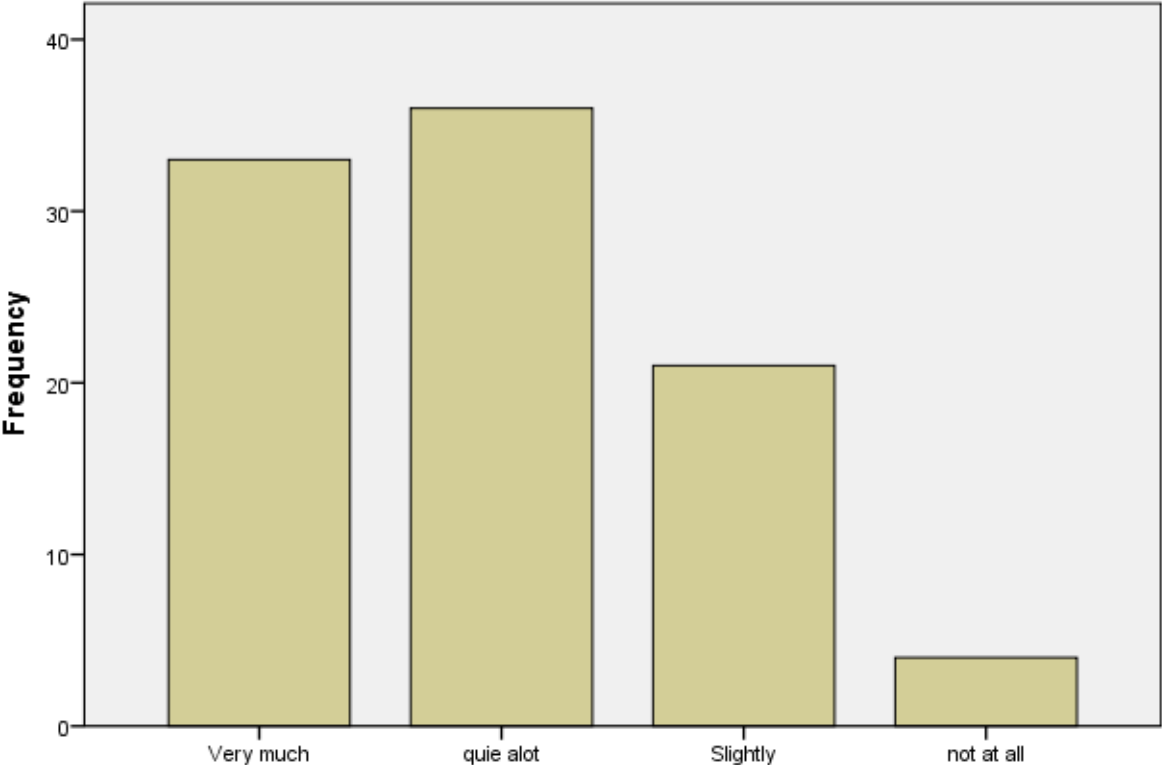


**How much more would be reasonable to pay in electricity bills to increase by 10% renewable energy sources of electricity in this country?**



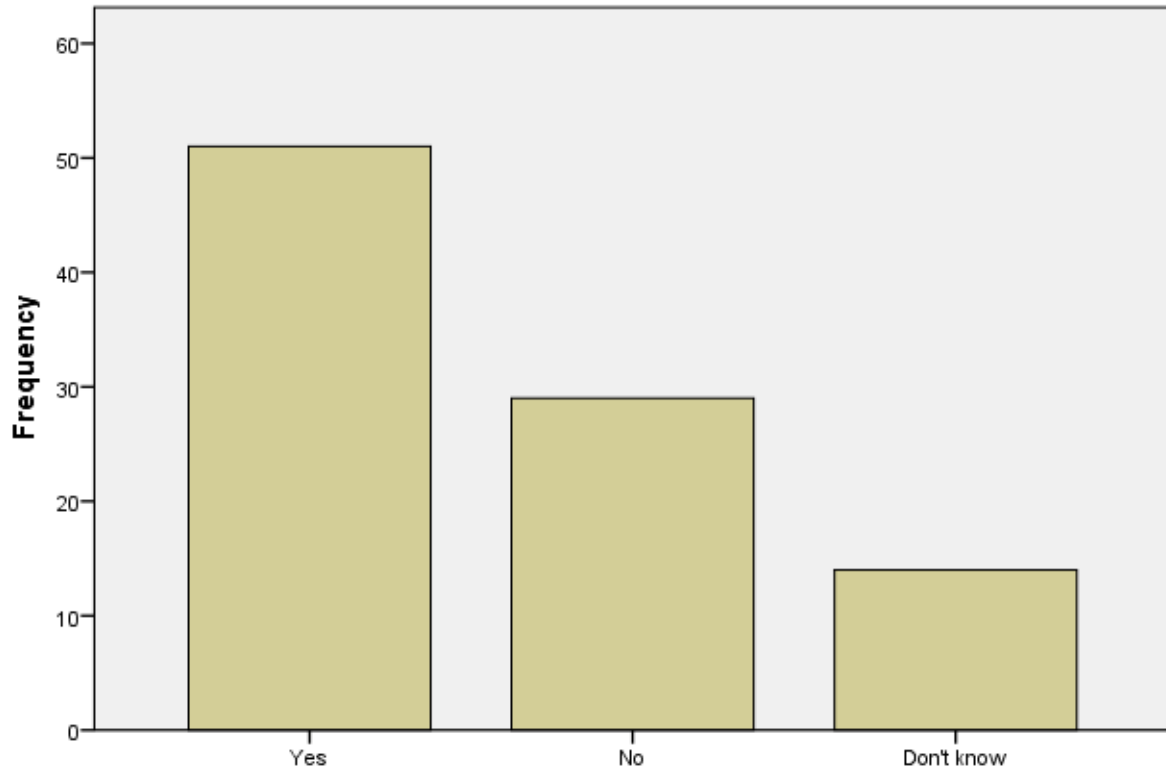
**How much more would be reasonable to pay in electricity bills to increase by 10% renewable energy sources of electricity in this country?**

**Do you believe that increasing by 20% renewable energy sources of electricity in this country may improve the electricity supply**



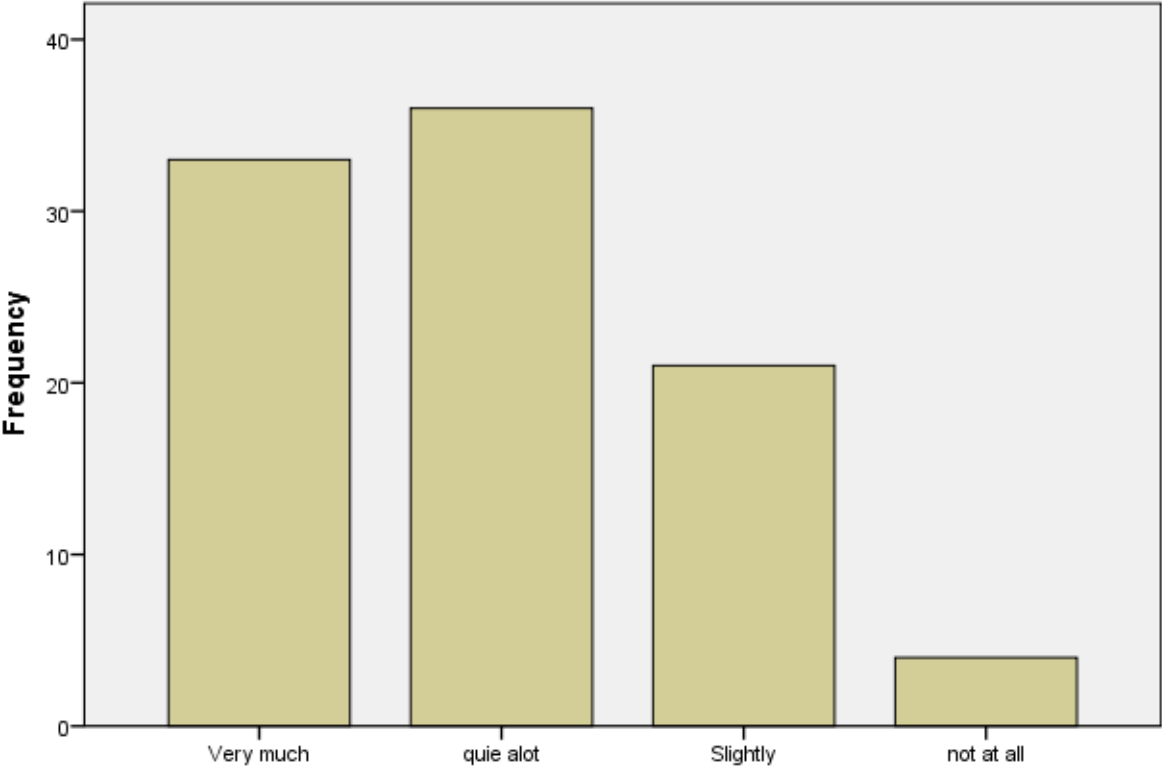
**Do you believe that increasing by 20% renewable energy sources of electricity in this country may improve the electricity supply**

**When buying a home would you be more likely to buy one with renewable energy installations?**



**When buying a home would you be more likely to buy one with renewable energy installations?**

**Do you believe that increasing by 20% renewable energy sources of electricity in this country your local environment would improve?**



**Do you believe that increasing by 20% renewable energy sources of electricity in this country your local environment would improve?**