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PUBLIC KNOWLEDGE, PERCEPTION, AND ATTITUDES TOWARDS BIOFUEL ENERGY TECHNOLOGIES IN LAGOS, NIGERIA

Master's Thesis in

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ABSTRACT:

This research aims to investigate the level of awareness and prevailing attitudes of the Lagos public towards renewable energy, with special focus on biofuel energy. Nigeria as a country is heavily reliant on fossil fuels despite having high RE (renewable energy) resources. The importance of this study stems from the need to better understand the role of education in cultivating awareness of RE, which is necessary for the public (especially the young population) to become responsible energy consumers. Additionally, this thesis aims to highlight the importance of implementing energy education as early as possible to encourage biofuel acceptance, which is necessary to alleviate the risk from fossil fuel-related environmental problems.

To answer the research questions, a combination of multiple choice and dichotomous web-based questionnaire was designed to ascertain the public's awareness, attitude, and willingness to invest in biofuel energy technologies. In total, 134 respondents completed the survey.

The results show that about 75% have are aware of biofuel energy. While a further 65% are willing to use the technology when it becomes available and an even greater number of respondents are willing to pay extra for their household to have biofuel energy. In general, this indicates a positive attitude towards new energy technology acceptance and use.

KEYWORDS: Biofuel, Public acceptance, Lagos, Renewable energy, awareness, Power

1 INTRODUCTION

The importance of energy and electricity in our daily life is of undisputable worth in modern civilisations. For many years, majority of power production methods in most countries were centred on environmental damaging, Thermal Power Stations. Each country generated energy mainly from petroleum, coal, and natural gas. And a country's energy consumption level is determined by its standard of living which in turn influences the decision on whether domestic or imported sources of energy should be used.

Nevertheless, there has been sweeping changes in the energy sector within the last 20 years. With ever increasing energy/ power demand, rising petroleum prices and uncertainty surrounding the future availability of resources for orthodox power production along with its well-documented negative effects on the environment and human health, attention of many countries has moved to sustainable energy possibilities. (Kaldelis, Kapsali, and Katsanou 2012: 37-38)

Efficacious energy development involves replacing the normal economic ideal with a more clear or see-through community hands-on model because people play a vital part in climate change reduction and renewable energy utilization. Such method entails enhancing communication with the public and allowing smooth transfer of easy to assimilate information to people in both strict and casual learning surroundings. (Zyadin et al. 2014).

A lot of scholarly research (Cloutier & Rowley 2011; Ohimain 2012; Fuwape et al. 1997) has been carried out on renewable energy in Nigeria with topics in this field ranging from the need to adopt alternative energy, energy policy formulation, to topics touching on its potential benefits for the country. But surprisingly, no research focused on the level of awareness, social acceptability, knowledge, and opinion of the Nigerian public towards renewable energy were found.

However, on the other hand, there are several researches in other countries touching this particular area of study with varying results. Moula et al. (2013) found in their study that knowledge, acceptability, and awareness of renewable energy technologies is positively related to social experience, educational level, and age group in Finland. On the contrary, a research carried out in Jordan by Zyadin et al. (2012), showed that gender and location plays a significant part in awareness and acceptability of renewable energy technologies.

1.1 Study Area: Lagos state

The area where this study focuses on is the city of Lagos in Nigeria. Lagos was formerly the federal capital of Nigeria until late 1991 when the capital was moved to Abuja. (Encyclopaedia Britannica 2013). The state is located in the south-western region of Nigeria sharing boundaries with Ogun state and Benin republic. In terms of landmass, Lagos is the smallest state in Nigeria occupying an area of 3,577 Square Kilometres of which a quarter of it is made up of Lagoons and small streams. (Lagos State Government 2014). However, it has the largest population in Nigeria with over 21 million inhabitants. Lagos state is often referred to as the commercial capital of Nigeria because over 60% of industrial activities in Nigeria are carried out in the state. (Adebodun-Toplonu & Ogunleye). The Murtala Muhammed International Airport located in Lagos is regarded as the busiest in the country serving over 10 million passengers yearly.

1.2 Objectives and research questions

This master's thesis aims to investigate the level of awareness and prevailing attitudes of The Lagos public towards renewable energy, with special focus on biofuel energy. Nigeria as a country is heavily reliant on fossil fuels despite having high RE resources. The importance of this study stems from the need to better understand the role of education in cultivating awareness of RE, which is necessary for the public (especially the young population) to become responsible energy consumers. Additionally, this thesis aims to highlight the importance of implementing RE education as early as possible to

encourage RE development, which is necessary to alleviate the risk from fossil fuel-related environmental problems. To achieve these goals, the following key research questions are going to be answered by this study

How aware is the Lagos public about biofuel energy technology?

How willing is the Lagos public to invest in biofuel energy technologies?

1.3 Methodology

A quantitative research approach was used in this thesis Project. This approach allows the comprehensive empirical examination of people's knowledge, through the utilization of a particular set of research approaches such as statistical, numerical data, or computational methods. The main distinctive feature of quantitative method is that it provides an essential relation between collected empirical data and the mathematical illustration of quantitative interactions. (Given 2008).

Furthermore, a survey-based study will be conducted, with collected questionnaires from the Lagos public aimed at investigating their awareness, views, and attitudes toward biofuel energy evolvement in the country. This methodology will help to include people from different ethnical backgrounds to enrich the sample space in order to make the research results more substantial, reliable and objective.

1.4 Definition of Key Concept

As the focus of this master's thesis is on biofuel energy which is a type of biomass energy, both key concepts are defined in this section. These two concepts are defined in order to shed more light into what they are about.

Renewable energy is referred to as the energy acquired from the perpetual or recurring flows of energy occurring in the environment (Twidell and Weir 2006: 3). Cleveland and Morris (2006: 371) defined RE as:

> *"any energy source that is naturally regenerated over a short-time scale and either derived directly from solar energy (solar thermal, photochemical, and photoelectric), indirectly from the sun (wind, hydropower, and photosynthetic energy stored in biomass), or from other natural energy flows (geothermal, tidal, wave, and current energy)"* (IPCC-WGIII 2007: 814)

Biomass is a viable renewable equivalent to traditional energy source. It is an indirect form of solar energy due to the photosynthesis process it arises from. Biomass is organic material made from plants and animals. Biomass can be used directly through combustion to produce electricity or heat, and it can be converted into biofuels such as ethanol, biodiesel, and biogas using conversion technologies such as fermentation, bacterial digestion, and gasification. (Rosillo-Calle, Bajay, & Rothman 2000: 2).

Biofuel is a sustainable energy source which is derived from living organisms, or the waste that living organisms produce. Biofuels comprises of ethanol (derived from corn or sugarcane), biodiesel (derived from animal fats), biogas (from animal manure), and green diesel (made from algae). (Investopedia 2014). Biofuels is widely seen as a potential catalyst for the major decrease of greenhouse gas emissions. However, some school of thoughts believe that there are environmental concerns surrounding the production of biofuels and other threats such as the disruption of world-wide food production. (Green Choices 2014).

1.5 Structure of the thesis

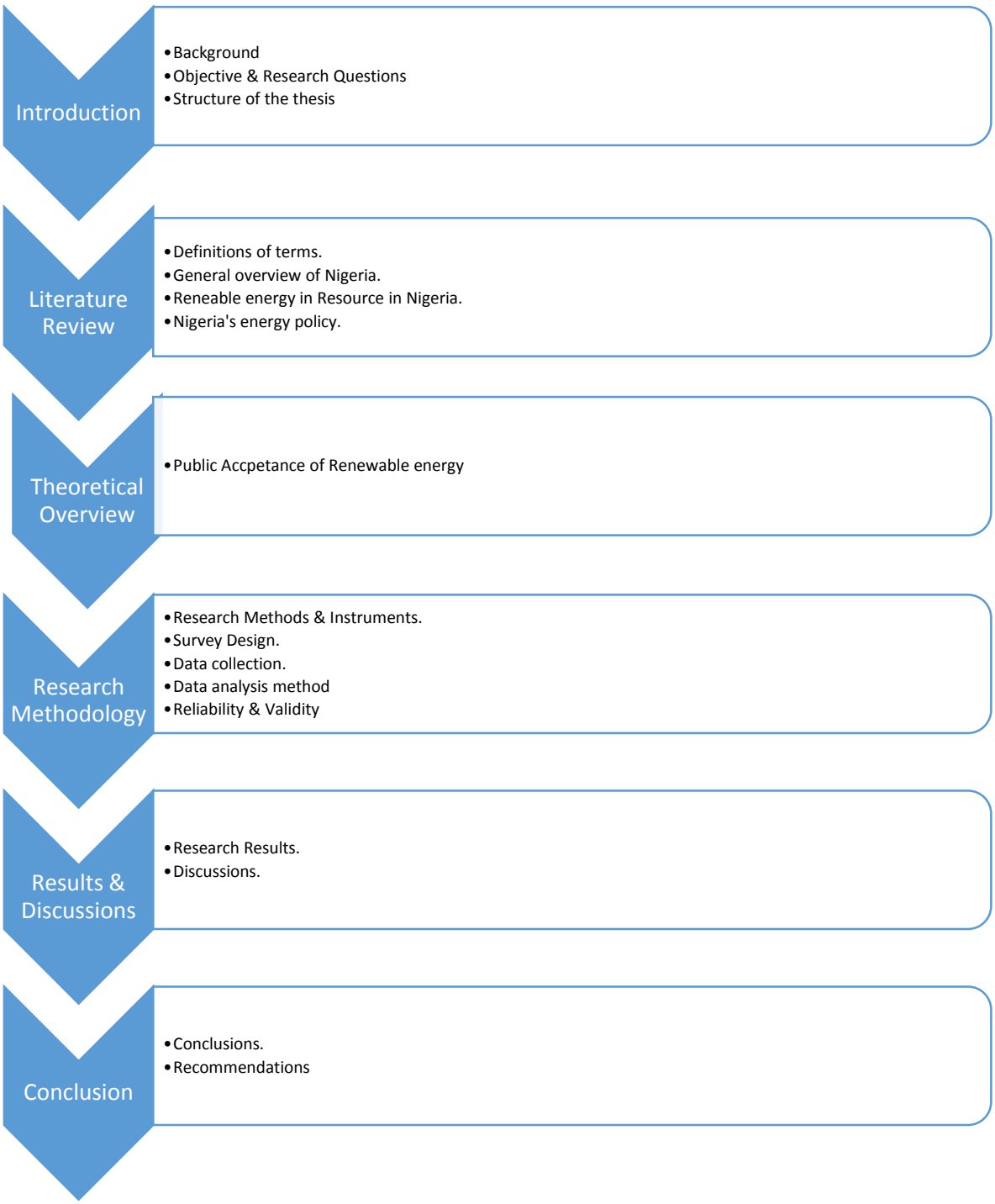

Figure 1. Thesis Structure.

2 LITERATURE REVIEW

2.1 General Overview of Nigeria

Nigeria is a Western African country which was created as a political entity in 1914 by Britain as part of the European partition of Africa that began towards the end of the 19th century (Falola 1999: 3). Nigeria is a federal democratic republic which is made up of 36 states scattered across the south, north, east, and western part of the country. The federal capital territory, Abuja is located in the central. It is a big country bordering the likes of Chad, Cameroon, Benin republic, and Niger, occupying 923,768 square kilometres. It is two times bigger than California and thrice the size of the United Kingdom. The geology is rich with natural gas, petroleum, tin, iron ore, coal, limestone, niobium, lead, zinc, salt, and copper. A quarter of the African population lives in Nigeria with a population of 174,507,539 (July 2013 estimate) and a growth rate of 2.54 %.(CIA fact book 2014). Nigeria has a multi-ethnic society comprising over 250 ethnicities which includes Hausa ,Yoruba, Igbo, and Fulani as the major and politically important ethnic groups. Furthermore, several indigenous languages are spoken alongside english, which is the official language. (Nigeria Business intelligence Report 2001).

Figure 2. the Map of Nigeria (CIA World Fact Book 2014).

2.1.1 Economic situation

Nigeria has a rapidly growing economy, with petroleum and oil riches playing a large role in the economy. The country is the 6th largest producer of petroleum in the world; it is the 8th largest exporter and has the 10th largest proven reserves. However, the country has become overly-dependent on its oil sector leading to the gradual decline of other areas of the economy such as agriculture, manufacturing, and solid materials. (UNICEF 2014). Although, the government is already taking steps to address this by stimulating the expanding the Nigerian economy away from the oil and gas sector. Also, It is tackling the lack of basic physical structures and facilities in the country and the improvement of the agricultural sector through modernization and the establishment of staple-crop processing zones, with the value chain model to provide linkages to the manufacturing sector. (African Economic Outlook 2014). Although the country has abundance of natural resources, its economy cannot yet meet the basic needs of the people. Such differences

between the growth of the gross domestic product (GDP) and the increasing poverty is indicative of a distorted distribution of Nigeria's wealth. (UNICEF 2014).

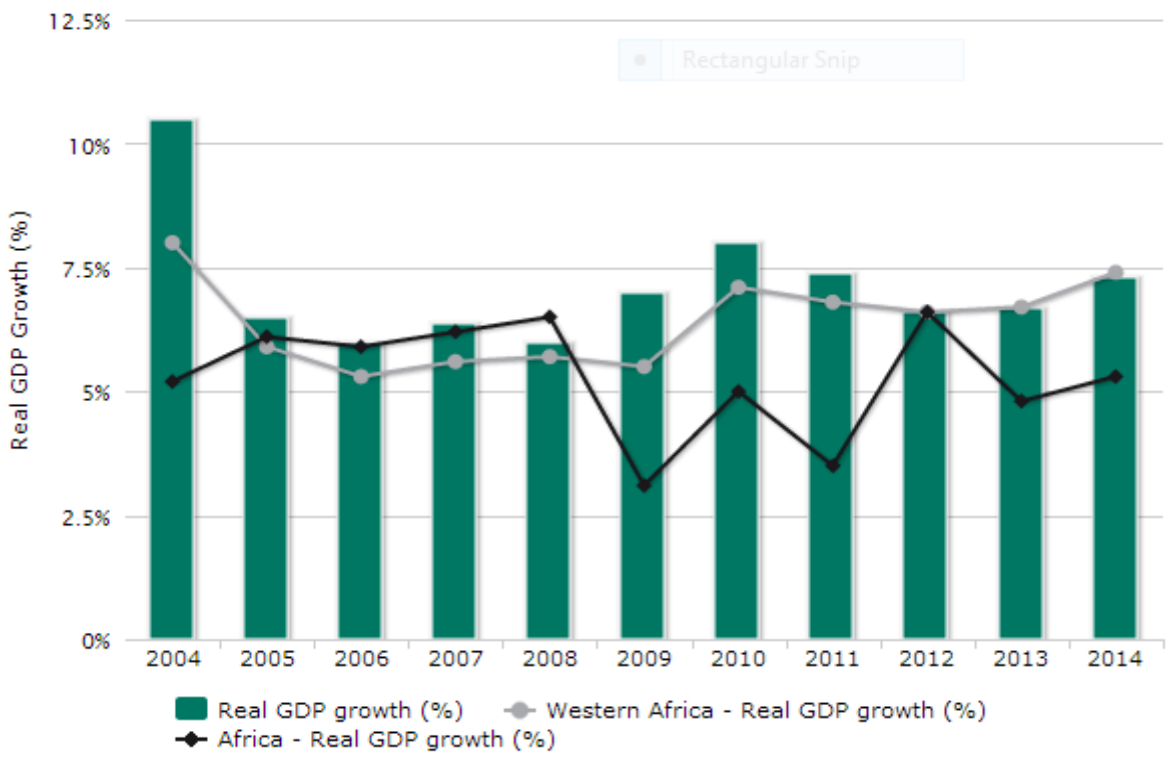

Figure 3. Real GDP growth 2013 (Adapted from: African Economic Outlook 2013).

Figure 2 above and table 1 below shows the real GDP growth and macroeconomic indicators respectively. In Figure 2, a comparison was made between the real GDP growth in West Africa and the whole of Africa. It shows that he real GDP growth has been relatively higher in West Africa since the year 2009 compared the whole of Africa. Although figures for 2013 and later are projections.

Table 1. Macroeconomic Indicators (Adapted from: African Economic Outlook 2013).

	2011	2012	2013	2014
Real GDP growth	7.4	6.6	6.7	7.3
Real GDP per capita growth	4.9	4.1	4.2	4.8
CPI inflation	10.9	12	9.7	9.5
Budget balance % GDP	-0.1	3.7	4.4	5.7
Current account % GDP	3.2	10.4	11.8	14.6

2.1.2 The Nigerian Energy Sector

Energy plays an important part in the country's economic advancement and expansion. It performs a big role in intercontinental mediation and acts as a means of getting national revenue used in funding government developmental projects (Oyedepo 2012: 2584). Nigeria has ample and diverse energy resources which includes 36 billion barrels worth crude oil deposit in reserve, in addition to an estimated 4 billion metric tons of coal and gas worth 187 trillion cubic feet. (Mohammed et al. 2013: 258; Oyedepo 2012; Ohimain 2013). It is a known fact that Nigeria has bountiful unsustainable and sustainable energy resources such as hydropower, biomass, solar, and wind energy. Both small and large hydropower resources are estimated as 3500MW and 11,135MW respectively, solar energy potential is estimated at 3,5 –7,5 kWh/m day, biomass energy potential at 144 million tonnes per year, and wind speed estimated at 2–4 m/s at 10m height. (Oseni 2012: 3968).

Source of energy	Estimated reserve
Crude oil	36.5 billion barrels
Natural gas	187.44 trillion cubic feet
Tar sands	30 billion barrels of oil equivalent
Coal and lignite	Over 40 billion tonnes
Large hydropower	11,235 MW
Small hydropower	3500 MW
Fuel wood	13,071,464 ha
Animal wastes	61 million tonnes/yr
Crop residues	83 million tonnes/yr
Solar radiation	3.5–7.5 kW h/m^2/day
Wind	2–4 m/s at 10 m height

Figure 4. Nigerian Energy reserve and capacity as at 2005 (Culled from: Mohammed et al 2013: 258).

Despite the existence of substantial energy resources, energy utilization and delivery level has always been modest. Low energy utilization is as a result of insufficient petroleum products and the long standing problem of persistent electricity failure which has led to the extreme dependence on self-produced power. Coupled with this, is the inadequate energy delivery infrastructure to handle the country's energy demand. With just 40% of homes in Nigeria having access to electricity, the country is in a deep energy predicament. (Oseni 2011; Mohammed et al. 2013; Oyedepo 2012).

Furthermore, the electricity sector is relatively small when compared to a country like Bangladesh, which has a slightly smaller population and with a smaller GDP. Bangladesh produces nearly twice as much electricity as Nigeria. The energy generation mix of Nigeria is dominated by thermal power derived from natural gas, accounting for 64% of the total power generation, thermal power derived from oil is 13%. This is followed by hydroelectricity, with a 23% power generation rate. Although, its input has lessened gradually from its peak of 8.2 billion kilowatt-hours KWh in 2002 to 4.5KWh in 2009. A rapidly growing population coupled with lack of investment in the electricity sector, inadequate maintenance, and an inadequate transmission network has resulted in power demand increases without any substantial increase in capacity. Businesses spend huge amounts of money in acquiring power generators to run their businesses and the majority

of households use old-fashioned means such as wood and charcoal to fulfil their energy requirements (Administration 2013). This is illustrated in figure 4 below.

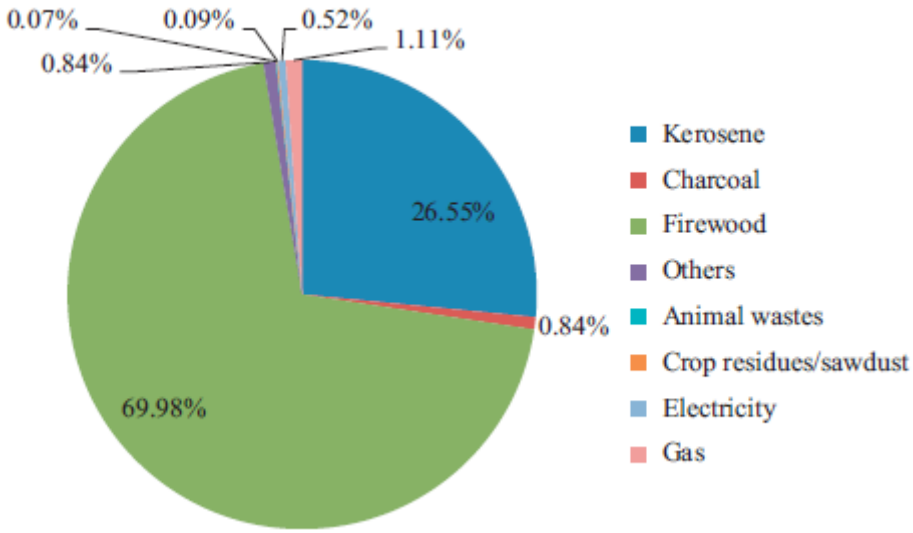

Figure 5. Energy consumption by source in Nigeria (Mohammed et al. 2013:258).

2.2 Renewable Energy Resource in Nigeria

Diminishing energy resources all over the world has impelled many countries to develop green energy systems to provide for development and growth. Renewable energy offers a non-toxic and viable option for the delivery of a clean and environment friendly energy. With world events involving developed countries reaching an agreement to embrace renewable energy resources as a better source of energy, coupled with demographic change, rapid population increase, and industrial growth in Nigeria, the Nigerian government is seriously looking into implementing the right policies which will result in renewable energy advancement. (Shaaban & Petinrin 2014; Oyedepo 2012).

In addition, the habit of gas flaring by oil companies such as Shell and Chevron in the south southern region of the country leads to the emission of large amount of greenhouse gases (GHG) into the atmosphere. This practice makes Nigeria among one of the highest producers of GHG emissions in the world. Environmental degradation, fluctuating petroleum prices in the global market, global warming, and militancy in the Southern region, where the majority of Nigeria's crude oil is extracted, have further highlighted the inevitability in adopting renewable energy. Thus, available renewable energy resources in Nigeria such as hydro, wind, biomass and solar have significant potential to improve and make a difference on the low level access of electricity in Nigeria. (Shaaban et al. 2014: 75).

2.2.1 Hydro power

Hydropower is the main source of electricity generation and supply in the country due to the abundance of rivers, dams, and waterfalls (Shaaban et al. 2014: 75). The country's hydropower potential stands at 14,750MegaWatts, from which just a meagre 1930MegaWatta is currently being tapped. This represents about 30% of the total installed grid connected electricity connection in Nigeria. (Ohunakin, Ojolo, & Ajayi 2011: 2009). In spite of Nigeria's hydropower capacity, potential and its important role in the provision of electricity in the country, it still remains vastly underdeveloped. The cause of this can be credited to the unearthing of petroleum and gas and the following power creation with the use of natural gas. (Mohammed et al. 2013: 264). Although large hydro power technology dominates the commercial renewable energy resources for electricity generation, small hydropower is being considered due to its cost effectiveness and reduced environmental impact (Oyedepo 2012: 2589). Despite being in existence in Nigeria since 1923, it still remains in its infancy (Ohunakin et al. 2011: 2009).

2.2.2 Solar Energy

Nigeria's location on the equator within a high sunshine belt allows for a fair distribution on solar radiation, with an estimated total daily average of about 3.5kWh/m2/day in the coastal region to about 7.0kWh/m2/day in the far north. However, in spite of the huge potential solar energy has in Nigeria, it is still conspicuous by its absence in the country's energy mix. This can be attributed to various barriers such as grid unreliability, operation and maintenance cost, lack of awareness and information, high initial investment cost, government policy and incentives, insecurity of solar plant infrastructure. (Ohunakin et al. 2014: 295–300).

2.2.3 Wind Energy

Wind energy in Nigeria is still at a developing stage as the government strives to implement policies that will aid the development. Mohammed et al. (2013: 264) observed that at present, wind energy is only limited to water pumping operations in the country with only one functional wind pump located in Sokoto (northern part of Nigeria).Wind speed in Nigeria is estimated at 4.0 to 5.12 m/s in the northern part to 1.4 to 3.0 m/s in the Southern area with peak wind speed generally occurring between April and August. In spite of these impressive values, the contribution of wind energy to the energy mix of the country is exactly zero. This can be attributed to technical ineptitude, lack of encouragement for wind technologies by governments and its agencies, and lack of finance. (Ajayi 2009: 751 – 752).

2.2.4 Biomass

Biomass or more specifically fuel wood is the most consumed source of energy in Nigeria. The country is blessed with numerous sustainable renewable biomass resources such as

wood, aquatic biomass, forage grasses, forestry wastes, municipal wastes, agricultural wastes, and wastes from industrial activities. There is an air of optimism in the development of biofuel in Nigeria owing to the rising amount of interested companies and the production capacity expansion plans of existing biofuel companies. Agricultural residue in the country is determined by environmental regions and local farming activities. In addition, the most common source of agricultural remnants in the country is cereal crop remnants, and other sources are namely jatropha, palm oil, soy beans, sugarcane, sweet sorghum, and cassava. Municipal waste like open dump and organized sanitary landfills can be found in major cities like Lagos, Abuja, Ibadan, Onitsha as shown in figure 5 below. (Mohammed et al. 2013: 260 – 261).

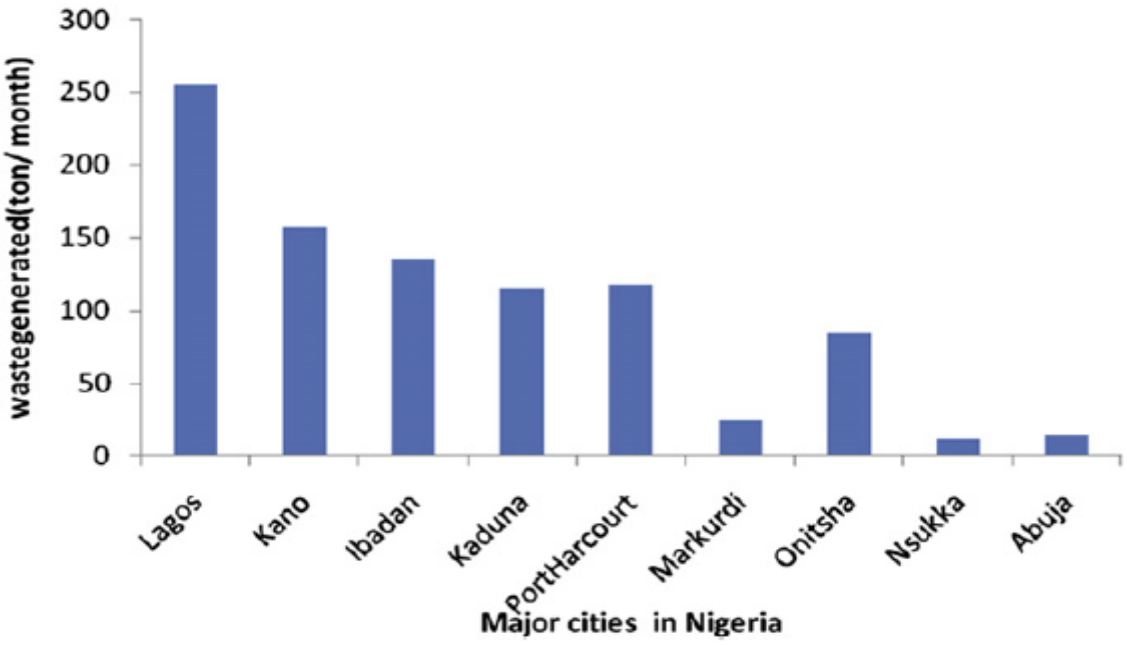

Figure 6. Monthly generated public waste in some States (Ishola et al. 2013: 558).

2.3 Nigeria's Energy Policy

The Nigerian Energy Policy was ratified in 2003, some 11 years after a draft National Energy Policy was produced by the Energy Commission of Nigeria —a body charged with energy formulation and coordination. This Energy Policy approval was preceded by two separate draft policy reviews in 1996 and 2001 by an eleven-man inter-ministerial committee (Nigeria Energy Study Report 2005). This policy was intended to be a facilitator to an improved future for energy in Nigeria. In the year 2005, this policy led to the development of what is called Renewable Energy Master Plan (REMP) by a collaboration involving the ECN and the United Nation Development Programme (UNDP). The idea behind the REMP was to assess the state of Nigeria's energy and suggest ways to improve the energy policy. The policy proposed a road map that should ensure the country increases its energy production capability from 5000MegaWatts to 16000MegaWatta by next year (2015) via the exploration of sustainable energy means. (Ajayi & Ajayi 2013: 62 – 63).

In a bid to take on the Brazilian way of making and using ethanol, in 2005 a government directive was given to the Nigerian National Petroleum Corporation (NNPC) for the exploration of renewable energy as a source of energy. This directive was given with the view of gradually reducing the Nigeria's reliance on supply of gasoline from abroad while transforming into a biofuel economy. (Ohimain 2013: 354). Furthermore, this mandated policy from the government led to the establishment of the Renewable Energy Division (RED) of the NNPC which operates according to the dictates of the Kyoto protocol. (NNPC 2010).

More importantly, in July 2013, the European Commission in Brussels announced their support for renewable energy policy in Nigeria by providing 27 million euros to aid the advancement of renewable energy policy in the country. They created an initiative called Energising Access to Sustainable Energy (EASE) which goals is to improve the necessary structure environments for sustainable energy and energy productivity in Nigeria. Other

aims of this initiative includes the outline of energy evaluation and approaches to expand access to energy, provision of vital education, and the design of business proposals to show profitability of small-scale gas resources. (European Commission 2013).

Overall, renewable energy technologies in Nigeria is developing at a slow pace. However, with the solutions recommended in REMP, there is a collective believe in the continued growth of the energy sector in the country. The enactment of a judicial agenda for the sector, with respect to the utilization of sustainable energy technologies and their diffusion, would empower the growth of Nigeria's renewable energy resources. (Reegle 2014).

3 THEORETICAL OVERVIEW

3.1 Public Acceptance of Renewable energy

Social acceptance is viewed as the intention to use a technology and quantify it through willingness to pay or through better environmental consciousness and the outcome of long-term energy utilization (Mallett 2007: 2). Public resistance to the implementation of renewable energy technologies and public unwillingness to invest in these energy technologies are main impediments in the realization of energy policy targets in several countries. In other words, the feasible implementation of renewable energy technologies is dependent on a positive public attitude or acceptance. Wustenhagen et al. (2007), conceptualized social acceptance in their article— which is a collection of best papers from an international research conference in Switzerland—by presenting three facets of social acceptance, namely socio-political, market, and community acceptance. They laid the groundwork for a theoretical combination of research results from diverse social science fields on public acceptance of renewable energy technologies. Also, Brohmann et al. (2007) discussed the factors influencing the social acceptance of renewable energy innovation in terms of technology-specific, context, and shareholder involvement. Niiniluoto's (1996) article (as cited in Makipelto 2010: 44) touched on the use of the six Es formula to evaluate the acceptance of technology and its qualities. The formula used is (Efficiency x Economy x Ergonomics x Ecology x Esthetics x Ethics) + social consequences. The essence of the formula is to determine the factors that must be considered when a new technology is being introduced.

Many research works focused on the measurement of social acceptance have utilized several pointers or indicators in accordance with a particular context (Devine-Wright 2011; Mallett 2007; Musall and Kuik 2011; West, Bailey, and Winter 2010; Liu, Wang, and Mol 2013). Among these are socio-political background, location, age, gender, Educational level, awareness and attitude. Furthermore, political views, perceived risk and benefits, socio-demographic background, income, cost, intention to use, perceived

ease of use and perceived effectiveness all perform key functions when measuring social acceptance. It is paramount to note here that this thesis work has used some of these indicators to measure people's awareness, attitude, and perception about renewable energy technologies in Lagos, Nigeria. Other public acceptance assessable indicators like, perceived flexibility, perceived behavioural control, relative advantage, perceived pleasure, nervousness, time, culture, peer pressure, perceived social trust, and cultural identities were not used in this study. Also, it is important to mention that despite several researches on public awareness, attitude, and perceptions towards sustainable energy technologies, it is still hard to pin down the subtleties of public acceptance. According to Brohmann et al. (2007), this obscureness is due to the fact that public acceptance is conceptualized poorly and as a result is rarely studied in broad terms, taking into account contextual, technological, and shareholder involvement factors.

Zyadin et al. (2014) discussed a method for measuring public acceptance indicators for renewable energy technologies development amongst secondary school teachers in Jordan. The study was in the form of a case study and was conducted in several different geographical regions in Jordan, so as to cover various municipality types. Knowledge, perception, and attitude were the indicators measured with the aid of a questionnaire. Findings from the questionnaire showed that teachers have inadequate knowledge of renewable energy technologies and indistinct perceptions concerning its use. This was observed to hold back the integration of renewable energy education into the schooling process and capability of policy makers to plan for the future. However, teachers showed a positive attitude towards renewable energy technologies.

A host of likely reasons are found in various publications for contradictions in rate of public support for various green energy sources (Dalton, Lockington, and Baldock 2008; Karlstrom and Ryghaug 2013; Moula et al. 2013). Devine-wright (2007) gave a comprehensive assessment of possible reasons for this variations in his analysis. He mentioned personal (class, gender, income, age), social-psychological (environmental

and political views, place attachment, knowledge and direct experience), and contextual (technology type and scale, institutional structure and spatial context).

A London survey showed that older respondents had a higher knowledge of renewable energy (Somerset County Council 2004). Parallel deductions were drawn from a Turkish survey (Erbil 2011). In comparison, however, a nation-wide survey found that older and younger respondents had more knowledge of renewable energy and were more like to oppose it in comparison to middle-aged respondents (Populus 2005). In relation to gender, Dalton et al. (2008: 2177) referred to a Scottish survey (DTI Scottish Executive 2003) which showed that 85% of men had more awareness of renewable energy technologies as compared to 67% of women. However, in a contradictory fashion, they mentioned that in the same survey, men were more opposed to renewable energy technologies than women.

Observations from Norway suggest that political party preferences has a huge influence on renewable energy public acceptance. Environmental issues have been prominent in Norwegian politics since the 1980s. Therefore, environmental values has been a huge factor for Norwegian voters when considering which party to vote for. (Karlstrom and Rughaug 2013). Figure 7 below shows the correlation for various renewable energy and party preferences.

	Ap	FrP	H	KrF	Sp	SV	V
Onshore wind	−.03	−.04	.09**	.01	−.00	−.01	.03
Offshore wind	−.00	−.05	.06	−.00	.03	.03	.02
Hydro	−.01	.02	.09**	.04	−.07**	−.03	−.02
Gas w/CCS	.07*	.02	.10**	−.05	.01	−.03	.03
Bio-energy	.03	−.04	−.04	−.02	−.02	.06	.02
Coal w/o CCS	.01	.06	−.01	−.04	−.01	−.12**	−.08*
Gas w/o CCS	−.01	.10**	.11**	−.07*	−.02	−.14**	−.10**

[i] Denotes significance below the.05 and.01 level, respectively.
* Denotes significance below the.05 and.01 level, respectively.
** Denotes significance below the.05 and.01 level, respectively.

Figure 7 Correlation for various renewables and specific party preferences (Culled from Karlstrom and Rughaug 2013).

Devine-Wright (2007) mentioned that emotional attachment to a particular place can also influence the level of support or resistance people have towards development of renewable energy projects in a locality. He noted that rarely do researches on public acceptance take into consideration the influence of people-place and/or people-technology relations. However, Devine-wright (2011) carried out a study on public acceptance of a tidal energy converter between two villages in Northern Ireland. The study revealed a predominantly positive responses to the development of renewable energy projects. The findings helped to put to rest the negative relationship between place attachment and social acceptance of alternative energy sources that were observed in previous empirical studies (Stedman 2002; Vorkinn and Riesse 2001; Devine-wright and Howes 2010).

Furthermore, Hidalgo and Hernandez (2001) observed that restriction to spatial range of neighbourhood is one huge limitation in the study of place attachment. They argued that there is a gap regarding other spatial environments with the exception of studies analysing

attachment to house. Their argument stems from the fact that the extent to which people can be attached to a spatial environment is unknown. The three main findings from their study shows that in terms of spatial ranges (city, neighbourhood, and house), attachment to neighbourhood is the weakest, social attachment is stronger than physical attachment, and the degree of attachment varies with age and gender.

Some number of researchers have shown the relationship between public acceptance of renewable energy technologies and perceived fairness and trust. Gross (2007) used a pilot survey to study the perspectives of a community in Australia towards wind energy, drawing upon procedural justice principles to evaluate fairness. The results show that perceptions of fairness does impact on how the community see the wind energy project legitimacy, and that an unbiased procedure will lead to an upsurge in the acceptance of the technology. An important observation from the study was that different facets of justice influenced different sections of the community. These facets of justice are namely, outcome favourability, outcome fairness and process fairness. Similarly, Huijts, Midden, and Meijnders (2007) researching public acceptance of carbon dioxide storage, found that Non-governmental Organizations (NGOs) were trusted more than industry by the public. Trust tend to depend on perceived competence and intentions. Trust in shareholders (owners or regulators) who are responsible for the technology have been found to influence public's perception of the dangers and gains of the relevant technology (Huijts, Molin, and Steg 2011: 528). Several literatures have stated that the secret to receiving public acceptance is by providing monetary or other type of compensation to amend disparities in the allocation of gains and losses.

Devine-Wright (2007: 9) stated that there is a widely held assumption that people staying close to renewable energy technology installations are most likely to oppose it even though they support the adoption of such technology in general. This assumption was also noted by Wolsink (2000: 51) in his literature on wind power that people's positive attitude towards wind turbine changes due to a perceived visual quality of wind turbines in the landscape. Several explanations have been provided for this assumption but one

explanation especially stands out; not in my back yard (NIMBY) phenomenon. Ribeiro et al. (2013: 43) described NIMBY as an attitude of generally supporting a technology implementation project only to oppose the idea when it is being implemented in one's own backyard.

Some academics and researchers alike have been critical about the various way in which NIMBY phenomenon is being applied. There is a feeling that the NIMBY phenomenon might be a myth as there is too little empirical evidence to back it up, given that most researches have shown a huge amount of public support for technology in their locality (Bidwell 2013). This view was further buttressed by Wolsink (2007: 52) that supporters of NIMBY phenomenon do not separate the concerns of the opposing public and their aims, and they largely neglect the opposing public's perception of risk. In support of this view, Van der horst (2007: 2706) stated that some researchers measure NIMBY without consideration for the stage of the technological project, even though it is known that public opposition is strongest at the planning stage and weakest when the technology has become operational.

Finally, Devine-Wright (2007) noted that researches focused on ascertainment of the rate of people's knowledge and perception of various types of renewable energy sources and its effects has resulted in the establishment of varied observations, partly because of the diverse questions being asked. Additionally, although people are aware of different renewable energy technologies, findings indicate that deep understanding of these technologies vary or is lacking, and the public are not always conversant with some of the technical or subject-specific terms used by researchers to talk about various renewable energy resources.

4 METHODOLOGY

Following the examination of literatures regarding biofuel energy and the theoretical underpinnings in the public acceptance of renewable energy technologies, an empirical study has been carried out to fulfil the objectives of this research. It is essential to present the design of the survey and the research techniques used, so as to ensure a high quality study. This study is a quantitative research that studies the Lagos public's acceptance, knowledge, and willing to invest in biofuel energy. Efforts were made to see if attitudes depended on age group, gender, educational level and so forth. Hoy (2010: 1) mentioned that quantitative research focuses on measurement and statistics because they provide links between empirical observations and mathematical illustration of interactions. Newman and Benz (1998: 10) stated that the control of variables, randomization, and valid and reliable measures are required in quantitative research in order to draw generalizations from the sample to the population. This chapter begins with explaining the survey design, followed by data collection and analysis. Finally, the validity and reliability of the study was discussed.

4.1 Survey Design

A survey questionnaire methodology was preferred in measuring people's knowledge and acceptability of biofuel energy in Lagos, Nigeria. In order to capture respondents from different background to strengthen the reliability of the study, the survey was designed on Survey Monkey website (www.surveymonkey.com). In addition, the survey questionnaire designed for this study had two types of questions: multiple choice and dichotomous questions. The survey began with questions concerning age and gender. Respondents had only two choices (yes or no) in the dichotomous questions. These questions (dichotomous types) were used to determine how important the respondents regard biofuel energy and their willingness to pay extra for it.

The multiple choice questions in the survey were used to assess respondent's knowledge of renewable energy and especially biofuel energy, profession and educational background. For example the choices for educational background were: (a) primary education (b) high school (c) University (d) Don't know. Appendix 1 shows the survey structure in detail. Additionally, technical terms were mostly left out of the survey in order to avoid confusing the respondents. Also, all questions were closed-ended in order to ascertain the frequency and percentage of choices for each question.

4.2 Data Collection

Empirical data for this study was collected by means of online survey via surveymonkey.com. The links to the survey was sent via email, Facebook, and LinkedIn pages to respondents in the Lagos region. Survey monkey is the world's leading provider of web-based survey solution. This medium was chosen because it aids to gather the insights needed to make better generalization. The web-based survey is very cost effective way of collecting data from a sample and it eliminates the problem of handling huge amount of paper form questionnaires.

A survey is the most commonly used method in quantitative research and this usually achieved by collecting information from only a fraction of the population rather than from the whole population. The collected information or data is used afterwards to produce statistics or numerical inscriptions which will form as the basis to make inferences about the whole population (Fowler 2009: 1). To achieve this, some sampling work on the population needs to be carried out. Simple random sampling method was chosen for this study in order to give every member of the population a fair chance of being selected.

Simple random sampling is the most basic and easiest sampling selection process. This is an unbiased surveying technique which gives every member of a population an equal chance of being selected at any stage during the sampling process (Wikipedia). However,

other types of probability samples are more common as simple random sampling requires a list of possible cases and can be more expensive. But simple random sample is possible in web-based surveys as sampling from e-mail addresses is feasible. (Weisberg 2009: 238).

4.3 Data Analysis

In order to generate results from collected empirical data, it needs to be analysed. After all data has been collected, a good understanding of the variables (dependent and independent) aids in determining suitable descriptive and inferential methods to apply in data analysis (Wetcher-Hendricks 2011: 11). Data analysis can be in the form of simple descriptive statistics or more complex inferential statistics such as factor analysis, regression, central tendency and dispersion, and numerous tests of association and significance (Detmar, Gefen and Boudreau 2004). Descriptive statistics describes the relationship among variables and inferential statistics is used to estimate the degree of confidence with which generalizations made from a sample is representative of the whole population from which the sample was selected (Chambliss and Schutt 2013: 155).

Data collected from the survey was inputted into the PSPP statistical analysis software, after which appropriate quantitative analysis was conducted using some of the techniques briefly mentioned in the previous paragraph. Also, data summary and percentage calculation was carried out in order to determine the frequency of choices for each question. In addition, care was taken during the analysis to remove any form of subjectivism and subsequently appropriate tables and graphs were used to present the result of the analysis.

4.4 Validity and Reliability

Improving the accuracy of a survey result is very crucial in research, and this is certainly true for this particular study. Research results are increasingly being used as a basis for making huge decisions in large organizations and in the society today. Therefore, the assessment and interpretation of the quality of survey data by thoroughly examining the survey instrument being used goes a long way in making research results accurate. This is why it is good practice to account for validity and reliability when carrying out a research. These two concepts are discussed in this section.

Validity is vital to a successful research because an invalid research work is worthless. Therefore, validity is a necessity in quantitative (and qualitative) research. It is impossible for a research to be perfectly valid. However, the validity of a research can be improved upon by thoroughly sampling and assigning proper statistical approach to collected data. There are several types of validity but only three of them will be briefly discussed. These are: External validity, content validity, and construct validity. External validity refers to how far generalizations can be made to a population based on sample taken from it. Construct validity refers to the degree to which a measure for data collection fits the hypothetical framework in which it is sited. Content validity concerns the fair representation of questionnaire contents on the wider subject under investigation. (Cohen, Manion, and Morrison 2013: 179, 186, 188).

Data that can be evaluated, documented, and believed can be termed as reliable. The absence of any one of these factors in a data can reduce the reliability and confidence of the decisions that are based on the data. (Taylor and Cihon 2004: 5) A reliable research must demonstrate some level of consistency. This means that if a previously conducted research is carried out on a comparable sample in a comparable setting, then similar findings will be produced. There are three main kinds of reliability; equivalence, internal consistency, and stability. Stability is a form of reliability that takes consistency into account over a period of time and over like samples. Furthermore, if a twin form of an

instrument is applied and produces similar results, then equivalence form of reliability has been achieved. Thirdly, internal consistency follows the assumption that administered test can be divided into two equal halves. (Cohen et al. 2013: 199- 201).

5 RESULTS

The general findings of the study are presented in this chapter followed by discussions of each findings. Respondents' background information was first presented followed by the presentation of graphs and tables that more closely answered the objectives of this research.

5.1 Background of Respondents

A total number of 134 people completed or partially completed the survey. The number of male respondents was 97, while the number of female respondents was 35. This means that about 73.48% of respondents were male while 26.52 of the respondents were female (Figure 8). However, two respondents declined to give up their gender, hence, the missing value depicted in table 2. The most common age group of respondents were ages 21-29 and 30-39. These two age groups made up 43.61% each. The least represented age groups of respondents were 50-59 and 60 or older. This was probably due to the mode of data collection-- web-based survey-- as the older population are less computer savvy. Majority of the respondents were employed (54.20%) as depicted in Figure 10 below, whereas the second largest group of respondents were students (32.82%). The percentage of unemployed respondents were 12.21%, while the only 0.76% was retired. The majority of respondents had university of education (96.24) while only 3.1% had high school education (Figure 11 and Table 5).

Table 2 Gender of Respondents.

Gender

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Male	1.00	97	72.39	73.48	73.48
Female	2.00	35	26.12	26.52	100.00
	99.00	2	1.49	Missing	
	Total	134	100.0	100.0	

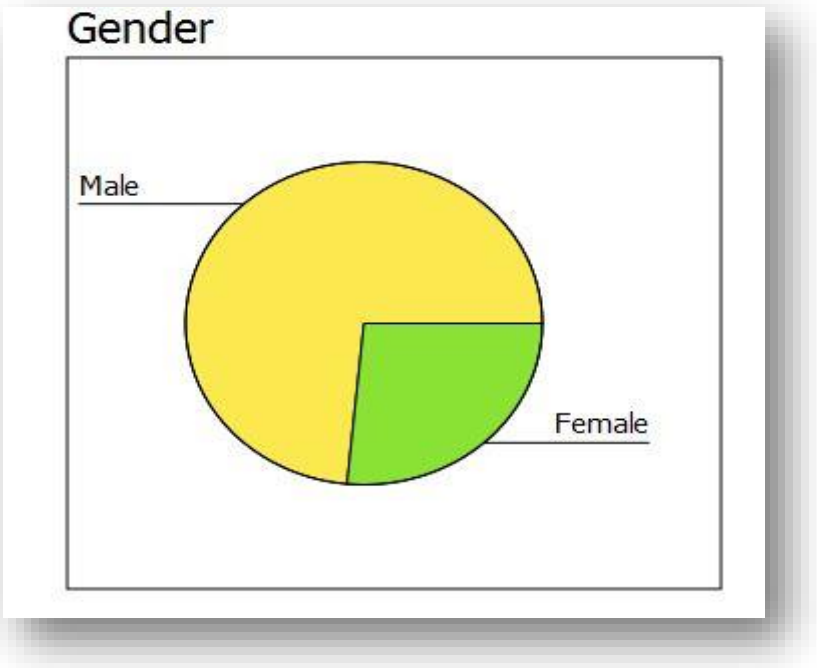

Figure 8 Pie Chart Depicting Gender of Respondents.

Table 3 Respondent's age.

Age

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
18-20	6.00	5	3.73	3.76	3.76
21-29	7.00	58	43.28	43.61	47.37
30-39	8.00	58	43.28	43.61	90.98
40-49	9.00	10	7.46	7.52	98.50
50-59	10.00	1	.75	.75	99.25
60 or older	11.00	1	.75	.75	100.00
	999.00	1	.75	Missing	
	Total	134	100.0	100.0	

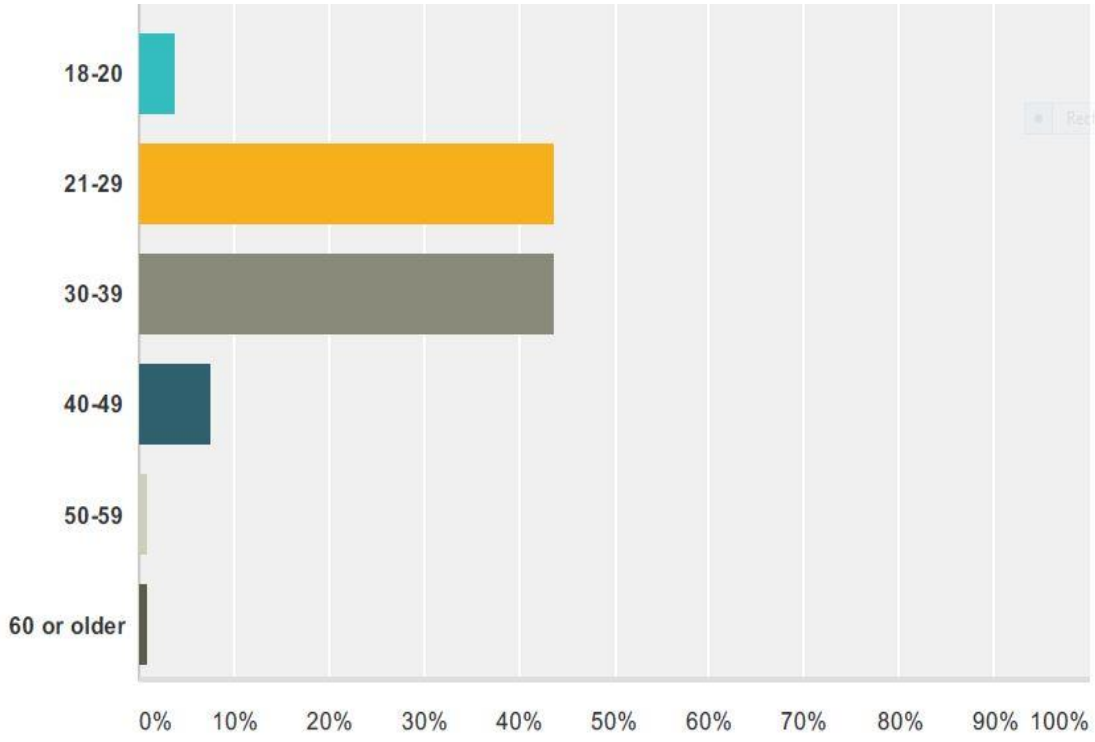

Figure 9 Bar chart of Respondents' age group.

Table 4 Profession of Respondents.

Profession

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Student	1.00	43	32.09	32.82	32.82
Employed	2.00	71	52.99	54.20	87.02
Unemployed	3.00	16	11.94	12.21	99.24
Retired	4.00	1	.75	.76	100.00
	9999.00	3	2.24	Missing	
	Total	134	100.0	100.0	

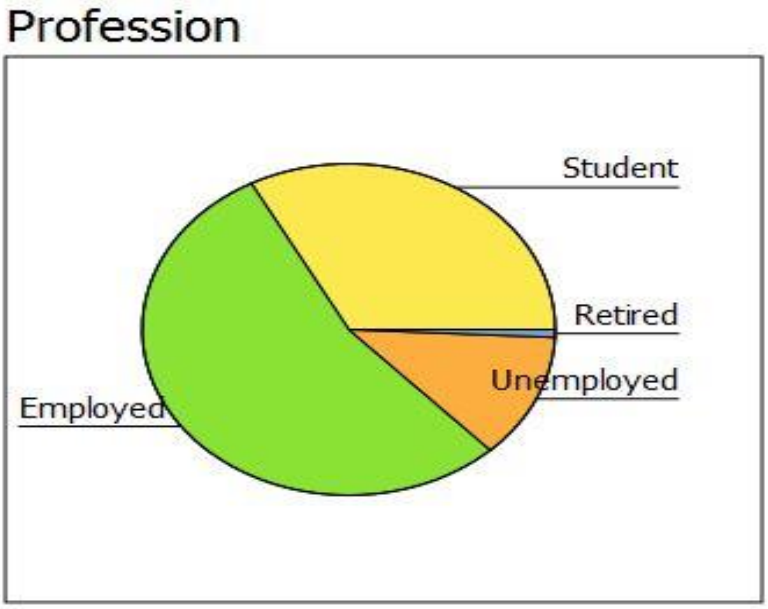

Figure 10 Respondents' Profession.

Table 5 Respondents' level of education.

Education

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Medium (High school)	2.00	4	2.99	3.01	3.01
High (University)	3.00	128	95.52	96.24	99.25
Don't know	4.00	1	.75	.75	100.00
	99.00	1	.75	Missing	
	Total	134	100.0	100.0	

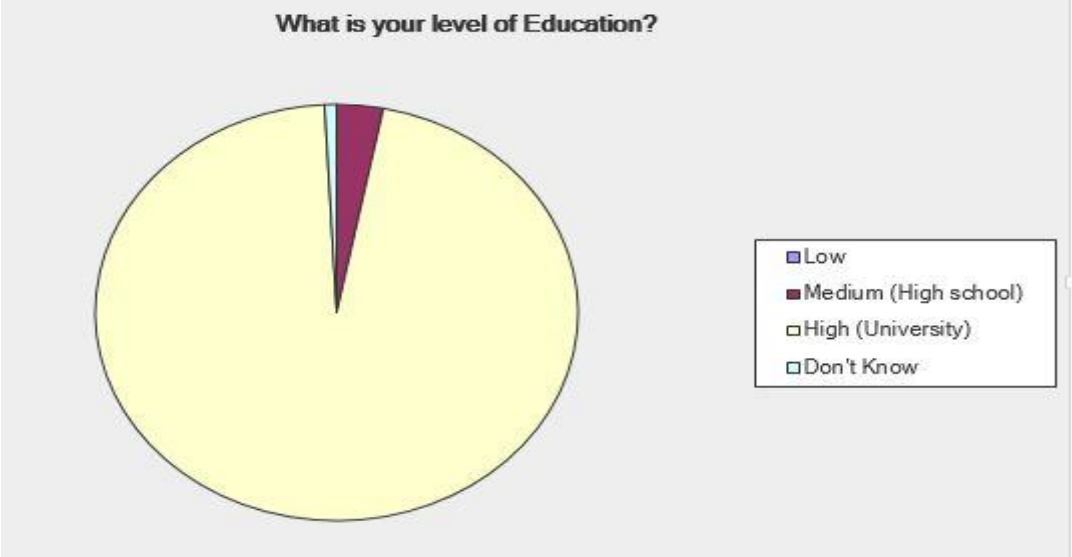

Figure 11 Respondents' educational background.

5.2 Respondents' Knowledge and Awareness of Renewable Energy/ Biofuel Energy

Firstly, question 5 (appendix 1) in the survey aims to test respondents' knowledge of biofuel energy by simply asking the respondents what they know about biofuel energy. A multi choice question was used to test this with five options provided and the first option is the only true option. Overall, 74.81% respondents got the answer right, while 12.97% of respondents chose the wrong answer. However, 12.21% of respondents chose "I do not know" while three other respondents skipped the question as depicted in table 6. This result indcates that majority of the respondents have prior knowledge of what biofuel energy is and how it is derived.

Table 6 Knowledge of Biofuel Energy.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
it is obtained from living organisms	1.00	98	73.13	74.81	74.81
it is used in the solar heaters	2.00	7	5.22	5.34	80.15
it is obtained from nuclear plants	3.00	10	7.46	7.63	87.79
I do not know	5.00	16	11.94	12.21	100.00
	99.00	3	2.24	Missing	
	Total	134	100.0	100.0	

N	Valid	131
	Missing	3
Mean		1.69
Std Dev		1.36
Minimum		1.00
Maximum		5.00

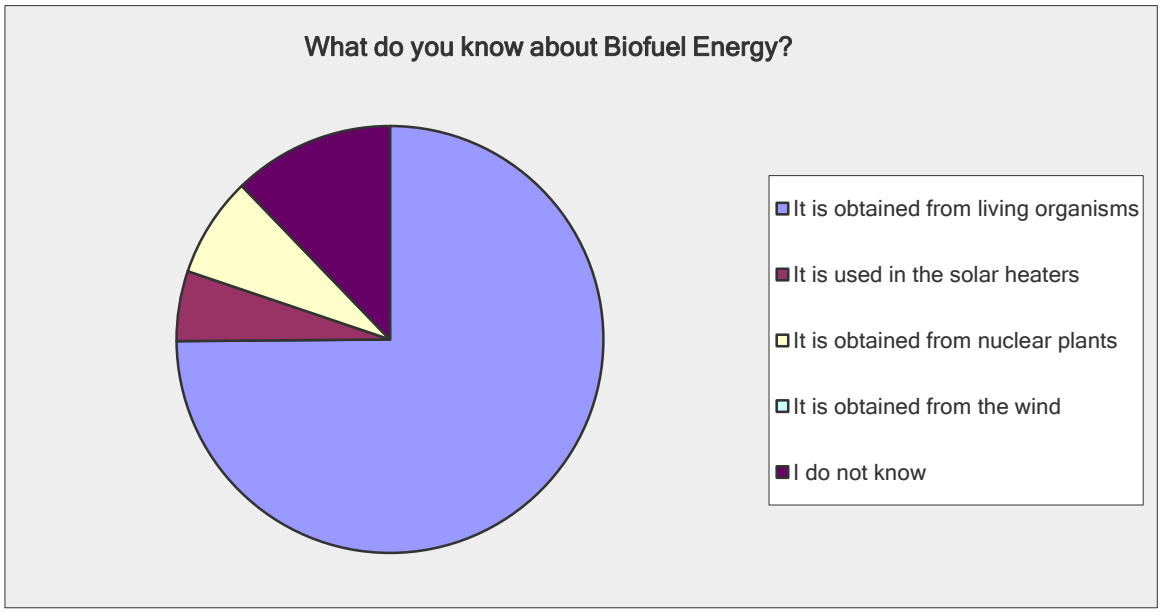

Figure 12 Respondents' Biofuel Energy Knowledge.

Secondly, question 6 observes respondents' knowledge of other kinds of renewable energy technologies that they are aware of. This question also takes the form of a multi-choice question with five different options provided namely; Solar, wind, geothermal, hydropower, and don't know. About 97.75% of respondents were aware of atleast one

other type of renewable energy technology. The most identified renewable energy type was solar energy (62.41%). This is probably due to the various discussions concerning the installation of solar panels by the Nigerian government. The second most identified alternative energy source was hydro power(20.30%). This can be attributed to the fact that hydro power is the major source of electricity in the country as Shaaban et al (2014:75) pointed out in his research literature. However, this question was not properly constructed to find out the depth of each respondent's knowledge of the kind of renewable energy source they have identified.

Table 7 Knowledge of other types of renewable energy technologies.

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
solar	1.00	83	61.94	62.41	62.41
wind	2.00	11	8.21	8.27	70.68
Geothermal	3.00	9	6.72	6.77	77.44
Hydro power	4.00	27	20.15	20.30	97.74
Don't know	5.00	3	2.24	2.26	100.00
	999.00	1	.75	Missing	
	Total	134	100.0	100.0	

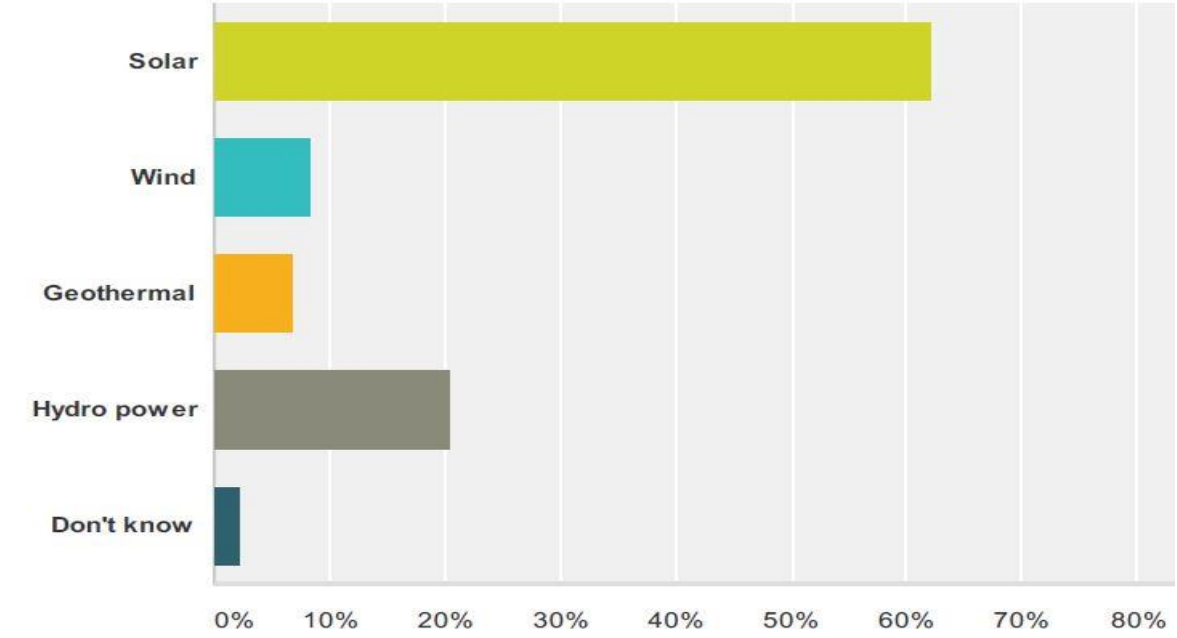

Figure 13 Other types of Renewable energy technologies.

Finally, two-tailed correlation analysis was run to determine the association between respondents' background and their knowledge of biofuel/ renewable energy. The result according to Table 8 below shows that there seems to be a weak positive correlation r = .02 between gender of respondents and their knowledge of biofuel energy. In contrast, there is no relationship r= 0.00 between gender and knowledge of other types of renewable energy technologies. There seems to be a negligible relationship between respondent's age and their knowledge of biofuel/ renewable energy with a pearson's correlation result of r = -.03 and r = .13. The same could be said for repondents' profession and their knowledge/ awareness of biofuel energy with a correlation of r= .12, indicating a negligible relationship. In summary, while there is a high level of knowledge and awareness regarding biofuel and other renewable energy technologies, there seems to be little or no relationship between this awareness and respondents' background; age, gender, profession.

Table 8 Correlation Matrix between respondents' background and knowledge of biofuel/ renewable energy.

Correlations

		Gender	Age	Profession	Knowledge of Biofuel energy	Other types of energy Sources
Gender	Pearson Correlation	1.00	-.40	.04	.20	.00
	Sig. (2-tailed)		.000	.622	.025	.958
	N	132	132	131	130	132
Age	Pearson Correlation	-.40	1.00	.14	-.03	.13
	Sig. (2-tailed)	.000		.120	.731	.133
	N	132	133	131	131	133
Profession	Pearson Correlation	.04	.14	1.00	.12	.03
	Sig. (2-tailed)	.622	.120		.192	.745
	N	131	131	131	129	131
Knowledge of Biofuel energy	Pearson Correlation	.20	-.03	.12	1.00	-.02
	Sig. (2-tailed)	.025	.731	.192		.779
	N	130	131	129	131	131
Other types of energy Sources	Pearson Correlation	.00	.13	.03	-.02	1.00
	Sig. (2-tailed)	.958	.133	.745	.779	
	N	132	133	131	131	133

5.3 Respondents' Perceptions and Attitudes towards Biofuel Energy

The seventh question in the survey was aimed to test how much importance respondents place on green energy. 64.39% of the respondents felt renewable energy is very important to them. However, opinions varied as 28.79% of the respondents think it is not absolutely important and 6.82% believe renewable energy does not matter to them. As majority of the respondents think green energy is very important to them, this might point to the fact that there is a really good awareness regarding renewable energy and its benefits. Hence, the overwhelming response that renewable energy is very important.

Table 9 Perceived importance of renewable energy.

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Very important	1.00	85	63.43	64.39	64.39
Average	2.00	38	28.36	28.79	93.18
Doesn't matter	3.00	9	6.72	6.82	100.00
	99.00	2	1.49	Missing	
	Total	134	100.0	100.0	

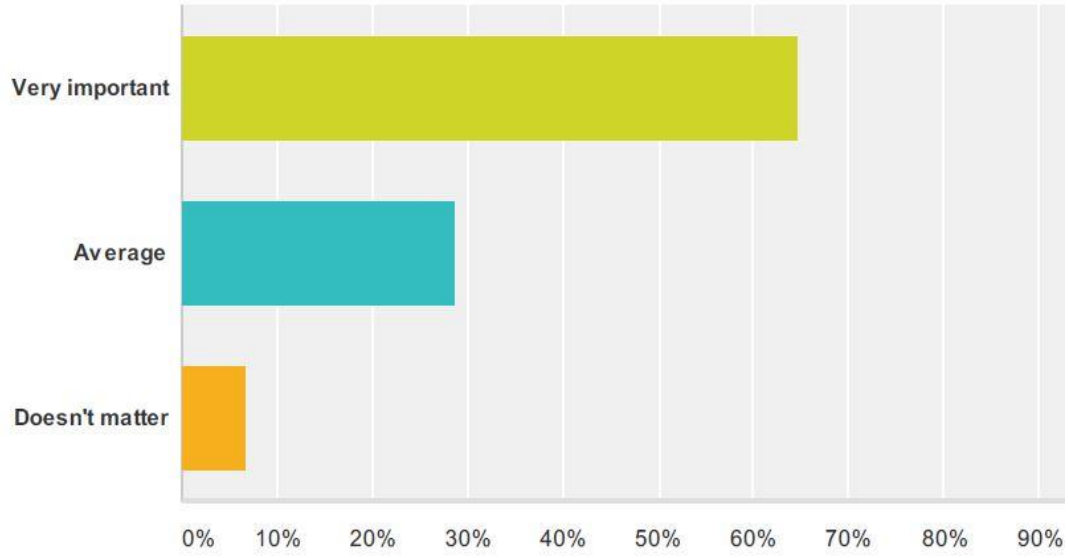

Figure 14 Importance of green energy to respondents.

The eighth question was further used to test the importance of implementing biofuel energy technologies to households. A dichotomous; yes or no type of question was used to achieved this aim. This is slightly similar to the question seven, but the only difference is that respondents have been asked if they would consider it Important for households in general. 89.31% of the respondents responded with a "yes" while 10.69% think it is not important for households to have biofuel energy. In addition, table 11 shows that more female respondents (91.18%) think that it is important for households to have biofuel energy than male respondents (88.66%).

Table 10 Importance of Biofuel energy for Household.

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Yes	1.00	117	87.31	89.31	89.31
No	2.00	14	10.45	10.69	100.00
	99.00	3	2.24	Missing	
	Total	134	100.0	100.0	

Table 11 Importance of having biofuel in household according to gender.

	Importance of having biofuel		
Gender	Yes	No	Total
Male	86.00	11.00	97.00
	88.66%	11.34%	100.00%
	73.50%	78.57%	74.05%
	65.65%	8.40%	74.05%
Female	31.00	3.00	34.00
	91.18%	8.82%	100.00%
	26.50%	21.43%	25.95%
	23.66%	2.29%	25.95%
Total	117.00	14.00	131.00
	89.31%	10.69%	100.00%
	100.00%	100.00%	100.00%
	89.31%	10.69%	100.00%

The ninth question takes a similar form as the previous question, but this time the respondents are asked to consider if biofuel will be a reliable source of energy for their

home. This is a more specific question in comparison to the previous question. The results show that 89.39% of the respondents have total trust in the ability of biofuel energy as a source of energy for their homes. Whereas, only 10.61% gave a negative reply. This result is indicative of respondents willingness to try alternative energy and their trust in it. Results also show that female respondents were more receptive of biofuel to their homes than male respondents.

Table 12 Biofuel as a reliable source of energy.

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
yes	3.00	118	88.06	89.39	89.39
No	4.00	14	10.45	10.61	100.00
	99.00	2	1.49	Missing	
	Total	134	100.0	100.0	

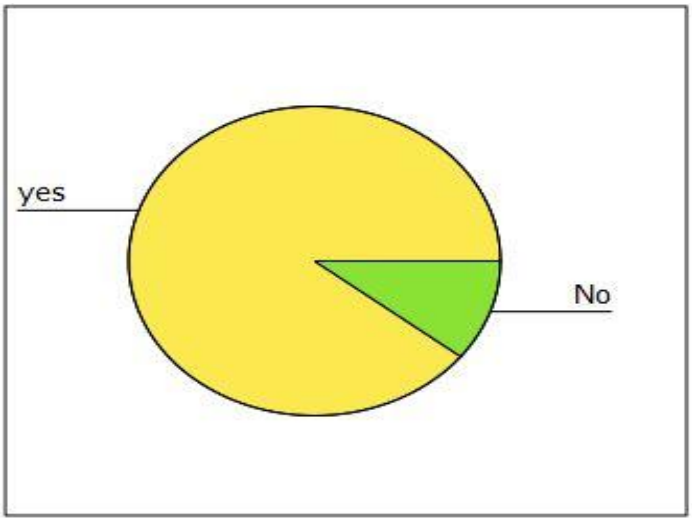

Figure 15 Biofuel as a reliable form of energy for the home.

The tenth question was asked due to the fact that the current energy capacity generated in Nigeria as at present is very low in comparison to what is actually needed. This is one of the reasons why power “black outs” is a common occurrence in the country. As biofuel and indeed renewable energy technologies are generally expected not to fail in addition to being environmentally friendly, it was interesting to test respondents’ attitude towards

such unexpected failure in their accomodation supposing they are being used. The results shows a difference of opinion amongst respondents where 57.25% of respondents would be more sympathetic towards the failure of biofuel energy and 42.75% would not. This conflict of opinions can be attribued to the kind of confusion such unexpected failure will cause. In addition, male repondents (58.95%) were more likely to be sympathetic towards the failure of biofuel in their homes than female respondents (50%). However, amongst the female respondents there seems to be an even split (50%) between those who will be sympathetic towards biofuel failure and those who will not.

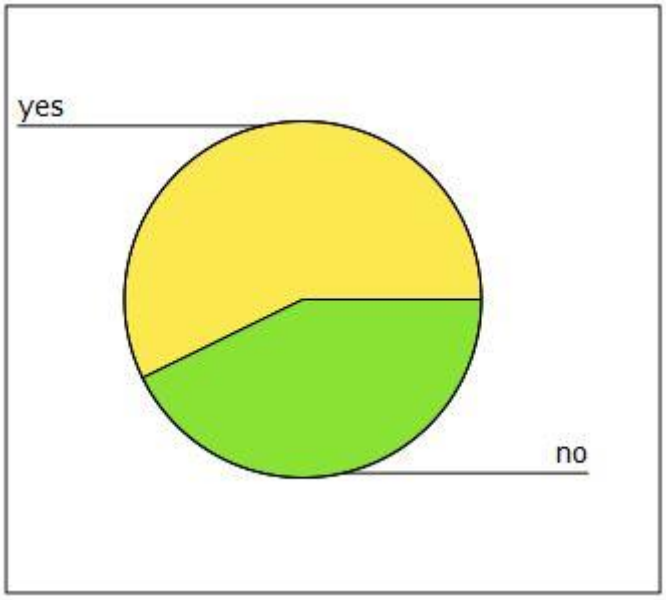

Figure 16 Attitude towards biofuel failure at home.

Table 13 Respondents' sympathy towards biofuel failure.

Gender	Sympathy towards biofuel failure		Total
	yes	no	
Male	56.00	39.00	95.00
	58.95%	41.05%	100.00%
	76.71%	69.64%	73.64%
	43.41%	30.23%	73.64%
Female	17.00	17.00	34.00
	50.00%	50.00%	100.00%
	23.29%	30.36%	26.36%
	13.18%	13.18%	26.36%

5.4 Respondents' Willingness to Pay for Biofuel Energy

Given the difficult economic situation which means low level of income, less jobs and the epileptic power supply in the country, it became paramount to ask people if they would pay extra for an accomodation fully powered by biofuel energy. Therefore, with the eleventh question, respondents were asked to answer "yes" or "no". The answers show that approximately 64% of respondents were willing to pay extra for an accomodation with biofuel energy and about 36% were not willing to pay extra. The respondents that are not willing to pay extra might have hindrances due to their current life situations such as being unemployed, a student, retired, or low level income workers. Table 15 indicates that those most unwilling to pay extra were the "employed" category (39.13%). These negative responses could be due to low income level as previously mentioned. Students were the second category showing most unwillingness (34.88%). This could be basicaly due to financial constraints.

Table 14 Willingness to pay extra.

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
yes	1.00	84	62.69	64.12	64.12
no	2.00	47	35.07	35.88	100.00
	99.00	3	2.24	Missing	
	Total	134	100.0	100.0	

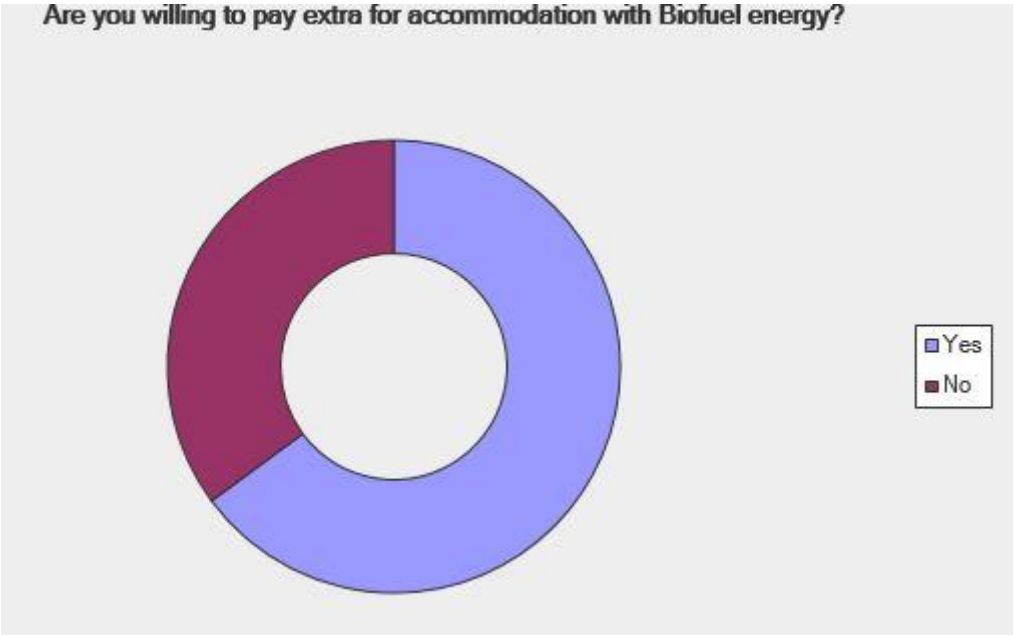

Figure 17 Willingness to pay extra for biofuel.

Table 15 respondents' life situation and willingness to pay.

	Willingness to pay extra		
Profession	yes	no	Total
Student	28.00	15.00	43.00
	65.12%	34.88%	100.00%
	34.15%	31.91%	33.33%
	21.71%	11.63%	33.33%
Employed	42.00	27.00	69.00
	60.87%	39.13%	100.00%
	51.22%	57.45%	53.49%
	32.56%	20.93%	53.49%
Unemployed	12.00	4.00	16.00
	75.00%	25.00%	100.00%
	14.63%	8.51%	12.40%
	9.30%	3.10%	12.40%

5.5 How Much Extra are Respondents Willing to Pay for Biofuel

This is a follow up question to the previous question where respondents were tested for their willingness to pay extra for accomodation with biofuel. The twelfth question was based on how much extra the respondents were willing to pay for their home to have biofuel energy. The question was in a multiple choice style with options ranging from 0%, 1-5%, 5-10%, 10- 20%, 20 -30%, 30- 40%, 50%, and 100% respectively. The results varied as 27.69% of the respondents were willing to pay between 1-5% extra for their home to have biofuel energy. Whereas, 26.92% of respondents were not willing to pay extra. However, 20% of the total respondents were willing to pay 5-10% extra and 10% were willing to pay 10-20% extra. Even about 7% of respondents were willing to pay as high as 50% extra for biofuel energy as illustrated in figure 18 below. The findings point to the fact that in general, there are more people willing to pay extra for biofuel energy based on the perceived reliability of its output.

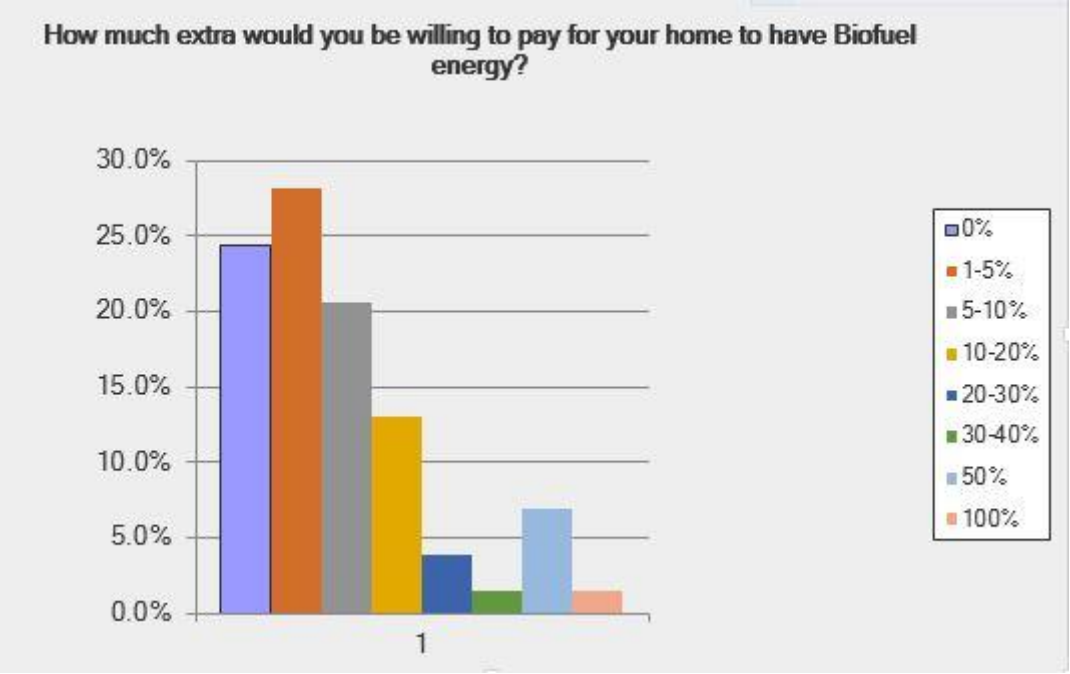

Figure 18 How much Extra for Biofuel.

6 LIMITATIONS OF THE RESEARCH AND SUGGESTIONS FOR FURTHER STUDIES

This chapter discusses the limitations of the study research design, data collection and analysis techniques. This was followed by recommendations for future research in this particular field. It is worth noting that although the bulk of suggestions for future research was discussed in section 6.2, some of the suggestions are already obvious in the initial discussions in section 6.1. This chapter is necessary because it helps to identify those limitations which had the strongest possible effect on (1) the validity of the findings and (2) the ability to make generalizations based on these findings.

6.1 Research Limitations

A limitation of this study is the lack of variability in sample measured. For example, a large proportion of the survey respondents turned out to have university education (despite the fact that there are equally huge amount of people without university education in Lagos). This is probably due to the fact that simple random sampling technique used in this study was only used to sample available lists of e-mail addresses of residents of Lagos. But this was not effective as there are so many residents who do not own an e-mail address. The web-based survey was subsequently sent randomly to the available list of e-mail addresses. Therefore, it was impossible to get an e-mail list of all Lagos residents.

Another limitation is the external validity of the study. There were only 134 survey respondents and this responses has been used to make statistical inferences representing a population of 21 million people. In addition, the sample did not fully cover the aged population in city as older people rarely use the internet and are unlikely to answer the web-based survey. Therefore, the sample was not representative of the older population.

Any attempt to try and reach the older population would have incurred huge costs which the researcher could not afford. Hence, the choice of the web-based survey method.

Finally, a limitation related to the survey design is the close-ended structure. While this survey was made closed-ended in order to facilitate the ease of coding the responses, there is also the danger of being structurally biased. This is because, the close-ended nature of the survey might ensure that the real views of the respondents might not be properly reflected and their choices are just a close match. However, despite this limitation the close-ended survey is still preferred in quantitative research as it makes coding and running statistical analysis easier.

6.2 Suggestions for Further Studies

This study has tested the level of knowledge, awareness, and acceptance or willingness of the Lagos public to invest in renewable energy technologies using the conceptual framework established earlier in this thesis. The indicators that were tested are gender, age, educational background, and profession. However, for future studies it would be interesting to know if other indicators like culture, location, perceived socila trust, and political views have any kind of influence on people's acceptance of renewable energy technologies. In addition, due to financial restrictions, the sample size for this study was a bit small. For the purpose of future studies, there is a need to test a larger sample size in order to see if the same findings still hold. If possible a nationwide research should be carried out and it should include participants under the age of 18 years.

7 VALIDITY AND RELIABILITY EVALUATION OF THE RESEARCH

The concepts of external, construct, and content validity introduced in the methodology chapter of this thesis is valid for quantitative research, as well as internal validity. The subsequent section of this chapter aims to evaluate the dependability, authenticity, transferability, conformance, and generizability of the empirical data and the findings generated from performing various statistical analysis on it.

7.1 External Validity

This refers to the extent generalizations can be made about a population based on the sample taken from it. The conformance of the study results to generalizability is in no doubt. This is due to the fact that the survey respondents were highly representatives of their various categories. In other words, the sample for each category was good enough to make some sort of inference about the whole population. Another argument in the favour of the external validity of this study is the fact that survey respondents had been selected from a certain region in the country where people's social experiences are very similar and there is little difference in the way of cultural background as people have got a very similar way of life. This ensures that should the same kind of research be carried out with different set of respondents, there will be a high chance of having similar results.

7.2 Internal Validity

Just like the external validity of this study, the internal validity or credibility of this study is in no doubt. This is due to the fact that at no particular point was data used in analysis or respondents' answers manipulated. In other words, there was no sort of bias as the data collected were coded and analyzed. Also, appropriate experimental procedure was

applied and there was no indication of systematic error that threatens the research's ability to draw correct inferences from the data experiment.

7.3 Construct Validity

This research has fulfilled the construct validity criteria of measuring what it aimed to measure. In other words, it has measured publics' knowledge, awareness, and attitude towards biofuel energy that aimed to measure. The empirical data and the theoretical evidences favour the fairness and acceptability of inferences based on the research results.

7.4 Reliability

The Cronbach's Alpha was acceptable at about 0.9 (90%) when checking the consistency and dependability of the variables. That figure proves that the data demonstrates a certain level of consistency. In reliability analysis, the reputation of a data source is critical. The research measures used in this study are consistent and repeatable if used in a similar context for a separate research.

8 CONCLUSION

The main aim of this study is to investigate the Lagos public knowledge of biofuel energy and their willingness to invest in it. The public is generally aware of the nature of renewable energy technologies like hydropower and solar. This could be due to the fact that the majority of the survey respondents had atleast a university education. However, the public lack the ability to identify some other renewable energy technology such as geothermal due to its lack of popularity in the country. Also, it became pretty obvious while studying the data that the answers provided were mostly influenced by individual respondent's curent life situation as well as socio-economic and demographic background. For example, respondents who are students were not willing to pay extra for an accomodation with biofuel energy because they can not afford it. But this does not affect the fact that 90% of the students believe that biofuel energy is important for households.

However, it is worth noting that one of the reasons why the scope of this study was on Lagos is because urban population are usually conversant with environmental issues and they seldom lack basic social amenities, whereas rural areas are not usually environmentally cautious because their immediate focus is on livestock feeding. Also, the Lagos state government have taken several steps over the last few years to implement its own renewable energy power plan with a strong focus of biomass/ biofuel energy sources as it aims to fight the crippling power supply in the state. Although biofuel energy is at its infancy in the country, the Lagos state government are doing their possible best to create necessary awareness.

Results suggest that gender had no significant influence in the knowledge and awareness of biofuel energy. However, the female respondents see biofuel energy more important to their households than male respondents. Curiosly, there was a bit of a conflict of opinions amongst respondents when they were asked if they would be sympathetic in respect of power failure if they new that it was biofuel that failed. Opinions were almost

split into half as 56% said they would be sympathetic and 44% said they would not be sympathetic. This points to the fact that one of the elements of public acceptance of renewable energy; trust and reliability which the public has in biofuel must have been broken the moment there is a failure.

The results also show that the majority of respondents are willing to pay extra for biofuel energy. This shows that knowledge, level of trust, perception, and awareness plays a vital role in the public acceptance of biofuel energy and the consequent willingness to pay extra for it. But according to the results, students and low income earners were among the most categories that would not pay extra obviously due to their socio-economic situation. The Lagos state government has a vital role to play in continuing to create awarness and providing biofuel solutions that is subsidized and accessible to all.

In summary, the Lagos public has a fairly good knowledge of biofuel energy and some other renewable energy sources. Also, there is a huge amount of willingness to adopt, pay for and use biofuel energy. Therefore, the government need to speeden up its various energy initiatives and also provide more awareness to the public about the importance and benefits of using green energy.

LIST OF REFERENCES

Adebodun- Toplonu, Sewanu & Ogunleye, James. Recent Developments on Green Growth in Nigeria [online]. [Cited on 05 May 2014]. Available from World Wide Web: <URL: http://www.oecd.org/dac/environment-development/James%20Ogunleye_Sewanu%20Adebodun%20Toplonu_Nigeria%20Recent%20Developments%20on%20Green%20Growth.pdf >.

Administration, E. (2013). *Energy profile of Nigeria* [online]. [Cited on 31 Jan. 2014]. Available from World Wide Web: <URL: http://www.eoearth.org/view/article/152513 >.

African Economic Outlook (2013). *Nigeria Economic Outlook* [online]. [Cited 29 Jan. 2014]. Available from World Wide Web: <URL: http://www.africaneconomicoutlook.org/en/countries/west-africa/nigeria/>.

Ajayi, Oluseyi O. (2009). Assessment of utilization of wind energy resources in Nigeria. *Energy Policy* 37, 750 – 753.

Ajayi, Oluseyi O. & Ajayi, Oluwatoyin O. (2013). Nigeria's energy policy: Inferences, analysis and legal ethics toward RE development. *Energy Policy* 60, 61– 67.

Bidwell David (2013). The Role of Values in Public Beliefs and Attitudes towards Commercial Wind Energy. *Energy Policy* 58, 189-199.

Brohmann, B., Feenstra, Y., Heiskanen, E., Hodson, M., Mourik, R., Prasad, G., & Raven, R. (2007). *Factors influencing the societal acceptance of new, renewable and energy efficiency technologies: Meta-analysis of recent European projects*. European Roundtable for Sustainable Consumption and Production.

Cohen Louis, Manion Lawrence, & Morrison Keith (2013). *Research Methods in Education*. New York: Routledge. ISBN: 9780415583350.

Chambliss Daniel F. & Schutt Russell K. (2013). *Making Sense of the Social World: methods of investigation*. Sage Publications Inc. ISBN: 9781452217710.

Cleveland, C.J., & Morris, C. (2006). *Dictionary of Energy*. Oxford, UK: Elsevier.

Cloutier, Michael & Rowley, Paul (2011). The feasibility of renewable energy sources for pumping clean water in sub-Saharan Africa: A case study for Central Nigeria. *Renewable Energy* vol. 36: 8, 2220 – 2226.

Devine-Wright, Patrick. (2007). *Reconsidering Public Attitudes and Public Acceptance of Renewable Energy Technologies: a critical review*. School of Environment and Development, University of Manchester. Oxford Road, Manchester. Available from the World Wide Web <URL: http://www.sed.manchester.ac.uk/research/beyond_nimbyism/ >.

Detmar Straub, Gefen David, & Boudreau Marie-Claude (2004). The IS World Quantitative, Positivist Research Methods [online]. [Cited on 07 Jul. 2014]. Available from World Wide Web <URL: http://www.dstraub.cis.gsu.edu:88/quant/>.

Devine-Wright, Patrick. (2011). Place attachment and public acceptance of renewable energy: A tidal energy case study. *Journal of Environmental Psychology* 31, 336 – 343.

Encyclopaedia Britannica. (2013). Lagos [online]. [Cited on 05 May 2014]. Available from World Wide Web <URL: http://global.britannica.com/EBchecked/topic/327849/Lagos >.

European Commission. (2013). *Press Release* [online]. [Cited on 21 Feb. 2014]. Available from World Wide Web <URL: http://europa.eu/rapid/press-release_IP-13-649_en.htm>.

Falola, Toyin. (1999). *History of Nigeria*. Westport, USA: Greenwood Press. ISBN: 9780313032400.

Fowler, Floyd J. (2009). *Survey Research Methods*. London, UK: Sage Publications Inc. ISBN: 9781412958417.

Fuwape, Joseph A., & Akindele, Shadrach O. (1997). Biomass Yield and Energy Value of Some Fast-growing Multipurpose Trees in Nigeria. *Biomass and Bioenergy* vol. 12: 2, 101– 106.

Given, Lisa M. (2008). *The Sage encyclopedia of qualitative research methods*. California: Sage Publications. ISBN: 1412941636.

Green Choices. (2014). *Biofuels* [online]. [Cited on 23 Apr. 2014]. Available from World Wide Web <URL: http://www.greenchoices.cornell.edu/energy/biofuels/ >.

Hennink, M., Hutter, I., & Bailey, A. (2010). *Qualitative Research Methods*. California: Sage Publications Inc. ISBN: 978-1-4129-2225-8.

Hidalgo, Carmen M., & Hernandez, Bernardo (2001). Place Attachment: Conceptual and empirical questions. *Journal of Environmental Psychology* 21, 273-281.

Hoy, Wayne .K. (2010). *Quantitative Research in Education*. London: Sage Publications Ltd. ISBN: 9781412973267.

Huijts, Nicole M. A., Midden Cees, J. H., & Meijnders Anneloes L. (2007). Social Acceptance of Carbon Dioxide Storage. *Energy Policy* 35: 5, 2780 – 2789.

Investopedia (2014). Biofuel [online]. [Cited on 23 Apr. 2014]. Available from World Wide Web <URL: http://www.investopedia.com/terms/b/biofuel.asp >.

IPCC-WGIII, 2007. Climate Change (2007). *Mitigation of Climate Change*. Cambridge University Press.

Ishola, Mofoluwake M., Brandberga Tomas, Sanni Sikiru A., & Taherzadeh, Mohammad J. (2013). Biofuels in Nigeria: A critical and strategic evaluation. *Renewable Energy* 55, 554 –560.

Kaldellis J. K., Kapsali M., & Katsanou Ev. (2012). Renewable energy applications in Greece—What is the public attitude? *Energy Policy* 42, 37 – 48.

Karlstrøm Henrik & Ryghaug Marianne. (2013). Public attitudes towards renewable energy technologies in Norway. The role of party preferences. *Energy Policy*.

Lagos State Government. (2014). *Lagos Overview* [online]. [Cited on 05 May 2014]. Available from World Wide Web:<URL: http://www.lagosstate.gov.ng/ >.

Liu, W., Wang, C., & Mol, A. P. J. (2013). Rural public acceptance of renewable energy deployment: The case of Shandong in China. *Applied Energy* 102, 1187 – 1196.

Mäkipelto, Tomi. (2010). *The Competitive Priorities Affecting Energy Production Investments: Wind power in Finland as a special issue*. Acta Wasaensia 231. ISBN: 9789524763219.

Mallett Alexandra .(2007). Social acceptance of renewable energy innovations: The role of
technology cooperation in urban Mexico. *Energy Policy* 35, 2790 – 2798.

Mohammed Y. S., Mustafa M. W., Bashir N., & Mokhtar A. S. (2013). Renewable energy resources for distributed power generation in Nigeria: A review of the potential. *Renewable and Sustainable Energy Reviews* 22, 257 – 268.

Moula, Munjur E., Maula Johanna, Hamdy Mohamed, Fang Tingting, Jung Nusrat, & Lahdelma Risto. (2013). Researching social acceptability of renewable energy technologies in Finland. *International Journal of Sustainable Built Environment*.

Musall, F. D., & Kuik, O. (2011). Local acceptance of renewable energy —a case study from southeast Germany. Energy Policy 39, 3252 – 3260.

Newman, Isadore & Benz, Carolyn, R. (1998). *Qualitative-quantitative Research Methodology: exploring the interactive continuum*. USA: SIU Press. ISBN: 0809321505.

Nigeria Business Intelligence Report (2001). Essex, UK: Walden publishing Ltd.

Nigeria Energy Study Report (2005). *Enabling Urban Poor Livelihood Policy Making: understanding the role of energy services*. Twente Centre for Studies in Technology and Sustainable Development.

Niiniluoto, Ilkka (1996). Teknologiapolitiikka, arvot ja kansalaiset. Tiedepolitiikka vol. 4, 37 – 44.

NNPC Group (2010). *Renewable Energy* [online]. [Cited on 21 Feb. 2014]. Available from World Wide Web:< URL:http://www.nnpcgroup.com/NNPCBusiness/MidstreamVentures/RenewableEnergy.aspx >.

Ohimain, Elijah I. (2013). Can the Nigerian biofuel policy and incentives (2007) transform Nigeria into a biofuel economy? *Energy Policy* 54, 352– 359.

Ohimain, Elijah I. (2013). A review of the Nigerian biofuel policy and incentives (2007). *Renewable and Sustainable Energy Reviews* 22, 246 – 256.

Ohimain, Elijah I. (2012). The benefits and potential impacts of household cooking fuel substitution with bio-ethanol produced from cassava feedstock in Nigeria. *Energy for Sustainable Development* vol. 16: 3, 352 –362.

Ohunakin, Olayinka S., Ojolo, Sunday J., & Ajayi Oluseyi O. (2011). Small hydropower (SHP) development in Nigeria: An assessment. *Renewable and Sustainable Energy Reviews* 15, 2006–2013.

Ohunakin, Olayinka S., Adaramola, Muyiwa S., Oyewola, Olanrewaju M., & Fagbenle, Richard O. (2014). Solar energy applications and development in Nigeria: Drivers and barriers. *Renewable and Sustainable Energy Reviews* 32, 294 – 301.

Oseni, Musiliu O. (2012). Improving households' access to electricity and energy consumption pattern in Nigeria: Renewable energy alternative. *Renewable and Sustainable Energy Reviews* 16, 3967– 3974.

Oseni, Musiliu O. (2011). An analysis of the power sector performance in Nigeria. *Renewable and Sustainable Energy Reviews* 15, 4765 – 4774.

Oyedepo, Sunday O. (2012). On energy for sustainable development in Nigeria. *Renewable and Sustainable Energy Reviews* vol. 16: 8, 2583 – 2598.

Reegle 2014. *Nigeria- Policy and regulatory overview* [online]. [Cited on 21 Feb. 2014]. Available from World Wide Web: <URL: http://www.reegle.info/profiles/NG>.

Ribeiro Fernando, Ferreira Paula, Araujo Madalena, & Braga Ana, C. (2014). Public Opinion on Renewable Energy Technologies in Portugal. *Energy* 69, 39 –50.

Rosillo-Calle Francisco, Bajay Sergio V., & Rothman Harry. (2000). Industrial Uses of Bioenergy. London: CRC Press. ISBN: 9780203194034. Pages: 304.

Shaaban, Mohammed & Petinrin, J. O. (2014). Renewable energy potentials in Nigeria: Meeting rural energy needs. *Renewable and Sustainable Energy Reviews* 29, 72– 84.

Taylor John K. & Cihon Cheryl. (2004). *Statistical Techniques for Data Analysis*. Florida: CRC Press. ISBN: 1584883855.

Twidell, J., & Weir, T., (2006). *Renewable Energy Resources*. London: Taylor & Francis.

UNICEF 2014. *The Nigerian Situation* [online]. [Cited on 29 Jan. 2014]. Available from World Wide Web: <URL: http://www.unicef.org/nigeria/1971_2199.html>.

Van der Horst, D. (2007). NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy* 35, 2705 – 2714.

Weisberg, Herbert F. (2009). *The Total Survey Error Approach: a guide to the new science of survey research*. USA: University of Chicago Press. ISBN: 0226891283.

Wetcher-Hendricks, Debra. (2011). *Analyzing Quantitative Data: an introduction for social researchers*. New Jersey: John Wiley & Sons Inc. ISBN: 9780470526835.

West, J., Bailey, I., & Winter, M. (2010). Renewable energy policy and public perceptions of renewable energy: A cultural theory approach. Energy Policy 38, 5739 – 5748.

Wolsink Maarten. (2000). Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. *Renewable Energy* 21, 49 – 64.

Wustenhagen, R., Wolsinki, M., & Burer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy* 35, 2683 – 2691.

Zyadin Anas, Puhakka Antero, Ahponen Pirkkoliisa, Cronberg Tarja, & Pelkonen Paavo. (2012). School Students' Knowledge, Perceptions, and Attitudes toward Renewable Energy in Jordan. *Renewable Energy* 45, 78 – 85.

Zyadin Anas, Puhakka Antero, Ahponen Pirkkoliisa, & Pelkonen Paavo. (2014). School Teachers' Knowledge, Perceptions, and Attitudes toward Renewable Energy in Jordan. *Renewable Energy* 62, 341 – 348.

APPENDICES

APPENDIX 1. Survey Questions

1. Which category below includes your age?

- 17 or younger
- 18-20
- 21-29
- 30-39
- 40-49
- 50-59
- 60 or older

Other (please specify)

2. What is your gender?

- Female
- Male

3. What is your Profession?

- Student
- Employed
- Unemployed
- Retired

4. What is your level of Education?

- Low
- Medium (High school)
- High (University)
- Don't Know

5. What do you know about Biomass Energy?

- It is obtained from organic material made from plants and animals
- It is used in the solar heaters
- It is obtained from nuclear plants
- It is obtained from the wind
- I do not know

6. What other kind of renewable energy sources/ technologies do you know?

- Solar
- Wind
- Geothermal
- Hydro power
- Don't know

7. How Important is green/ renewable energy for you?

- Very important
- Average
- Doesn't matter

8. Do you think it is important for households to have biomass energy?

- Yes
- No

9. Would you consider Biomass a reliable source of energy for your home?

- Yes
- No

10. Would you be more sympathetic in respect of power "black outs" in your accommodation if you knew it was Biomass that failed?

- Yes
- No

11. Are you willing to pay extra for accommodation with Biomass energy?

- Yes
- No

12. How much extra would you be willing to pay for your home to have Biomass energy?

- 0%
- 1-5%
- 5-10%
- 10-20%
- 20-30%
- 30-40%
- 50%
- 100%